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974	78	3794	241	6839	128	9277	149	11,991	635	14,869	443	17,192	806
720	96	3807	268	6840	128	9323	436	12,001	512	14,947	836	17,218	723
729	79	3826	281	6848	194	9341	616	12,145	342	14,955	689	17,274	1314
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7372	83	3981	98	6860	324	9384	279	12,253	320	14,961	510	17,318	693
7515	44	3998	140	6863	277	9455	331	12,347	736	14,970	668	17,320	887
7587	149	4028	105	6898	196	9456	346	12,388	744	14,972	614	17,330	1309
7666	37	4058	139	6898	196	9456	346	12,417	746	14,980	677	17,407	1053
7763	98	4059	139	6920	339	9482	501	12,440	455	15,010	663	17,435	1063
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7968	101	4134	124	6922	339	9516	453	12,512	448	15,053	814	17,497	77
8031	79	4217	28	6946	39	9608	793	12,540	791	15,088	666	17,528	725
8087	45	4249	146	6957	323	9622	429	12,606	663	15,219	676	17,563	803
8262	144	4271	722	6959	882	9635	123	12,632	671	15,220	736	17,589	791
8296	144	4295	142	6959A	721	9638	283	12,634	545	15,223	614	17,624	810
8297	144	4377	127	6987	444	9668	490	12,659	611	15,269	882	17,625	1309
8491	137	4391	133	7010	235	9674	448	12,707	243	15,294	626	17,651	811
8506	127	4415	141	7041	427	9675	493	12,785	549	15,298	626	17,660	1025
8590	93	4433	136	7042	237	9680	499	12,816	803	15,418	669	17,690	971
8594	77	4462	277	7043	237	9703	341	12,847	676	15,435	686	17,736	1025
8595	77	4506	235	7044	201	9769	443	12,940	674	15,440	685	17,749	985
8602	138	4552	129	7056	201	9776	498	12,962	681	15,577	893	17,775	908
8611	102	4557	136	7061	244	9776	498	13,012	679	15,624	669	17,794	1238
8617	37	4560	146	7074	90	9787	437	13,121	804	15,693	727	17,816	937
8667	132	4580	124	7079	269	9836	625	13,161	539	15,709	900	17,818	841
8711	37	4589	288	7139	234	9861	448	13,223	550	15,729	887	17,822	674
8736	138	4651	146	7256	274	9893	209	13,227	811	15,733	489	17,870	986
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		4708	124	7347	490	9953	345	13,253	836	15,776	893	17,908	811
		4742	44	7397	493	9962	248	13,266	452	15,792	731	17,920	626
25	36	4787	194	7397	493	10,005	436	13,285	559	15,793	929	17,965	811
199	30	4793	241	7397	132	10,066	676	13,316	666	15,829	747	17,984	1066
295	32	4796	28	7397	128	10,094	537	13,377	747	15,846	793	17,994	811
456	90	4907	273	7452	332	10,105	449	13,436	791	15,866	29	18,019	1025
579	79	4941	151	7478	501	10,156	437	13,481	791	15,885	904	18,052	806
686	445	4994	151	7511	348	10,170	334	13,484	543	15,930	689	18,047	815
700	322	4996	119	7534	289	10,211	446	13,517	666	15,934	683	18,056	965
966	36	4997	433	7592	490	10,235	433	13,565	832	15,935	669	18,083	342
1144	198	5041	241	7602	501	10,272	671	13,578	804	15,943	616	18,096	842
1339	79	5041	241	7602	501	10,272	671	13,579	811	15,944	616	18,144	251
1393	136	5170	235	7631	622	10,344	269	13,588	703	15,982	724	18,147	557
1400	28	5218	189	7658	290	10,350	244	13,638	510	16,008	918	18,194	1011
1452	203	5247	273	7668	269	10,361	451	13,651	203	16,028	893	18,214	986
1477	199	5263	344	7692	23	10,422	489	13,664	632	16,069	918	18,269	836
1556	23	5280	149	7725	537	10,466	506	13,715	665	16,070	810	18,305	1032
1581	189	5286	149	7739	437	10,466A	557	13,765	616	16,105	544	18,356	210
1628	20	5303	127	7745	323	10,539	685	13,773	836	16,119	669	18,382	846
1694	490	5445	508	7767	435	10,663	690	13,822	543	16,120	669	18,403	846
1738	198	5467	101	7790	429	10,664	808	13,867	548	16,185	678	18,437	1006
1776	124	5479	324	7793	493	10,670	673	13,875	548	16,245	855	18,456	901
1826	40	5535	190	7863	150	10,677	665	13,877	666	16,262	808	18,484	982
1857	22	5540	276	7875	291	10,682	502	13,892	273	16,268	795	18,488	1003
1881	85	5549	208	7882	291	10,701	632	13,895	23	16,269	725	18,512	682
1930	91	5574	144	7893	244	10,733	490	13,941	550	16,276	623	18,514	744
1933	235	5603	197	7953	345	10,767	330	13,952	727	16,281	40	18,514A	1019
2001	101	5648	445	7954	345	10,794	678	13,955	541	16,313	886	18,602	132
2065	140	5688	201	8041	348	10,797	613	13,956	845	16,351	147	18,600	798
2152	36	5711	198	8282	271	10,867	453	13,981	851	16,353	925	18,710	886
2167	91	5712	443	8298	273	10,873	446	13,983	749	16,354	925	18,720	240
2211	189	5730	149	8302	289	10,881	503	14,014	1291	16,412	549	18,742	813
2268	40	5789	341	8304	289	10,885	506	14,042	740	16,422	850	18,825	806
2323	35	5853	443	8377	240	10,898	346	14,058	852	16,425	836	18,840	1006
2376	38	5948	512	8400	129	10,902	335	14,128	625	16,427	539	18,858	891
2398	190	6018	290	8492	539	10,926	491	14,130	627	16,503	965	18,909	443
2456	23	6101	203	8504	278	11,105	79	14,157	665	16,504	731	18,920	850
2468	83	6143	441	8544	345	11,113	147	14,183	278	16,538	669	18,922	973
2469	90	6216	194	8545	340	11,123	801	14,196	611	16,543	838	18,937	976
2470	85	6217	203	8550	543	11,158	1006	14,203	627	16,546	744	18,937	882
2573	269	6225	127	8570	537	11,174	684	14,213	679	16,546A	744	18,975	
2578				8602	197	11,256	441	12,214					

No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.
1904.		1904.		1904.		1904.		1904.		1905.		1905.	
18,978	916	21,888	1010	24,238	1023	26,255	321	28,062	1230	13,142	455	14,841	685
19,001	893	22,062	1292	24,288	1249	26,262	241	28,126	322	13,377	1248	14,947	887
19,053	501	22,084	197	24,290	1190	26,270	198	28,128	1230	13,607	965	14,958	1254
19,067	91	22,090	39	24,293	79	26,278	196	28,129	1239	13,608	1061	14,959	1188
19,092	880	22,050	1007	24,308	1218	26,345	1167	28,149	1254	14,116	1084	14,968	1256
19,141	204	22,056	971	24,333	189	26,381	1167	28,150	1117	14,577	848	14,971	887
19,142	200	22,064	43	24,336	1103	26,383	852	28,152	429	14,999	1000	15,147	834
19,165	796	22,065	29	24,363	1103	26,456	1084	28,239	342	15,011	670	15,200	737
19,178	982	22,098	1064	24,386	1113	26,457	1075	28,243	1294	15,033	984	15,244	965
19,187	882	22,114	1118	24,430	1080	26,477	1105	28,250	1249	15,077	1057	15,245	965
19,222	1006	22,126	689	24,440	977	26,487	104	28,256	1126	15,300	1250	15,353	1332
19,234	835	22,127	689	24,445	1019	26,516	1018	28,259	1243	15,572	448	15,367	1300
19,237	130	22,128	689	24,446	1003	26,532	331	28,294	553	15,587	980	15,377	804
19,263	440	22,129	689	24,451	892	26,554	206	28,295	1164	15,555	1080	15,378	804
19,269	1020	22,169	1067	24,456	1299	26,602	1178	28,297	1072	15,711	1058	15,379	804
19,411	982	22,245	855	24,467	1056	26,623	288	28,368	674	15,755	963	15,380	804
19,444	982	22,323	908	24,482	129	26,654	1122	28,376	457	15,866	921	15,458	1199
19,464	974	22,381	1028	24,505	129	26,659	1171	28,396	1216	15,745	1320	15,481	1006
19,474	746	22,422	1179	24,554	625	26,698	1183	28,424	537	15,760	1054	15,564	541
19,565	002	22,423	92	24,585	241	26,770	324	28,434	738	15,776	811	15,572	1167
19,568	002	22,540	968	24,669	1061	26,779	1181	28,442	1243	15,816	904	15,687	1256
19,653	974	22,547	70	24,670	1072	26,779	1188	28,456	1201	15,817	919	15,748	1291
19,737	813	22,614	1010	24,672	602	26,790	332	28,490	335	15,818	963	15,761	720
19,744	1006	22,628	96	24,686	269	26,840	1242	28,593	1167	15,843	1293	15,861	541
19,774	1245	22,688	1019	24,712	278	26,881	1175	28,596	328	15,917	1058	15,930	1025
19,779	1245	22,704	1317	24,733	978	26,905	288	28,601	550	15,975	1006	15,932	633
19,780	1245	22,724	685	24,774	878	26,909	1010	28,613	619	16,001	1116	15,983	1238
19,785	25	22,732	448	24,781	244	26,909	1010	28,614	619	16,031	1029	15,988	603
19,827	1006	22,735	963	24,782	205	26,915	269	28,619	553	16,139	432	16,045	1196
19,853	1010	22,753	21	24,785	1293	26,916	270	28,646	1249	16,166	632	16,055	937
19,874	1006	22,815	22	24,869	1009	26,917	129	28,729	547	16,192	841	16,073	1004
19,889	889	22,817	1161	24,870	123	26,918	270	28,733	1249	16,210	663	16,102	685
20,003	34	22,917	889	24,885	132	26,919	270	28,734	1105	16,228	964	16,158	836
20,012	925	22,927	207	24,903	133	26,920	190	28,755	491	16,213	806	16,276	751
20,031	287	22,940	28	24,904	1312	26,921	491	28,808	690	16,228	895	16,273	746
20,108	1012	22,952	39	24,966	1181	26,922	429	28,811	1102	16,243	1067	16,356	1066
20,138	960	22,968	97	24,980	142	26,947	201	28,930	1306	16,246	1108	16,363	633
20,160	93	22,988	104	24,990	902	26,948	280	28,951	1250	16,248	1290	16,371	682
20,166	936	22,990	1110	24,994	146	26,949	202	28,966	324	16,241	1076	16,388	958
20,178	799	23,016	98	25,010	1312	27,005	1084	28,967	290	16,255	1245	16,391	926
20,195	857	23,036	1066	25,077	1122	27,034	893	29,039	321	16,267	892	16,437	1075
20,241	968	23,045	979	25,092	1301	27,037	200	29,056	250	16,266	1254	16,457	1319
20,243	43	23,066	100	25,128	136	27,073	200	29,065	1240	16,275	1244	16,485	543
20,276	1053	23,070	1053	25,165	194	27,090	842	29,094	437	16,265	934	16,585	891
20,292	101	23,072	885	25,208	330	27,091	1167	29,130	1106	16,270	1293	16,601	1118
20,309	973	23,081	20	25,213	539	27,092	1180	29,136	720	16,274	1251	16,617	811
20,339	981	23,100	247	25,216	489	27,093	1180	29,137	1225	16,277	749	16,650	932
20,340	981	23,183	427	25,222	1259	27,094	1180	29,141	283	16,283	1175	16,651	814
20,444	29	23,187	897	25,284	1011	27,105	857	29,170	611	16,284	1294	16,693	976
20,474	283	23,193	1225	25,296	1063	27,162	250	29,179	720	16,287	799	16,726	798
20,527	840	23,198	963	25,307	123	27,167	250	29,330	1254	16,248	811	16,759	1108
20,534	100	23,245	149	25,310	123	27,167	207	29,364	893	16,315	1054	16,762	1004
20,543	1113	23,277	1248	25,331	1240	27,222	1227	29,374	1216	16,302	1242	16,839	1027
20,627	447	23,292	1067	25,394	132	27,222	1227	29,392	324	16,307	806	16,902	1027
20,630	550	23,331	93	25,404	235	27,266	207	29,474	1008	16,308	725	16,905	671
20,637	330	23,336	1190	25,414	133	27,267	210	29,479	330	16,309	1126	16,920	1021
20,665	965	23,364	1110	25,505	198	27,268	235	29,546	666	16,314	793	16,932	1187
20,757	886	23,366	1084	25,506	1010	27,272	1167	29,564	322	16,316	963	16,932	968
20,809	976	23,379	81	25,507	1258	27,292	1061	29,573	321	16,317	1066	16,934	850
20,815	932	23,380	140	25,514	147	27,373	1061	29,618	437	16,318	964	16,934	663
20,842	973	23,473	441	25,563	1249	27,374	1061	29,633	887	16,315	1069	16,939	1181
20,845	269	23,492	92	25,571	1163	27,396	1248			16,319	894	16,941	974
20,857	37	23,515	845	25,624	207	27,425	1181			16,325	1309	16,940	965
20,870	1103	23,569	103	25,683	338	27,449	282			16,348	960	16,941	1006
20,877	1116	23,576	1026	25,702	136	27,459	1256			16,348	666	16,948	792
20,885	39	23,578	209	25,703	495	27,460	1256			16,349	494	16,949	1291
20,952	496	23,597	1025	25,704	405	27,465	210			16,352	895	16,949	1056
20,984	342	23,616	1080	25,718	152	27,466	249			16,359	804	16,952	1299
21,047	43	23,619	1076	25,726	149	27,496	1243			16,369	1233	16,959	1054
21,062	978	23,622	94	25,728	129	27,497	1297			16,371	974	16,961	1066
21,208	966	23,640	1080	25,774	1121	27,498	1167			16,379	973	16,968	917
21,210	1190	23,651	1168	25,787	734	27,499	1222			16,380	691	16,968	807
21,211	1072	23,675	1163	25,788	734	27,510	269			16,381	550	16,968	1309
21,233	1307	23,680	492	25,796	335	27,533	887			16,382	1251	16,968	1064
21,317	324	23,727	1166	25,797	152	27,565	543			16,382	1086	16,968	1027
21,322	594	23,729	513	25,832	1161	27,571	1163			16,386	996	16,968	885
21,380	340	23,765	1178	25,837	1110	27,579	1216			16,397	808	16,968	796
21,387	197	23,766	635	25,858	1238	27,596	191			16,403	1163	16,968	1298
21,393	1109	23,809	837	25,882	1238	27,606	986			16,452	1238	16,968	1298
21,397	24	23,806	241	25,884	1233	27,707	1057			16,455	1030	16,968	1027
21,398	44	23,909	681	25,889	1166	27,713	190			16,455	925	16,968	1293
21,402	1102	23,942	77	25,889	1064	27,753	1172			16,455	882	16,968	848
21,408	332	23,973	250	25,897	291	27,757	552			16,455	792	16,968	966
21,488	965	23,974	1082	25,901	919	27,820	1163			16,455	1012	16,968	1163
21,502	1180	23,984	1165	25,948	243	27,834	136			16,455	1009	16,968	1216
21,558	982	24,023	1074	25,966	189	27,843	1105			16,455	1081	16,968	857
21,568	976	24,045	1069	25,965	1297	27,861	503			16,455	886	16,968	982
21,569	1179	24,064	611	26,008	273	27,857	240			16,455	1188	16,968	807
21,634	963	24,08											



No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.
1905.		1905.		1905.		1905.		1905.		1905.		1905.	
642	1302	9656	1188	10,758B	1082	11,620	926	13,180	1075	14,211	976	16,478	1318
662	1066	9698	1122	10,862	958	11,670	1068	13,184	1320	14,239	1110	16,643	1309
696	1022	9774	1069	10,873	958	11,680	1066	13,247	1055	14,316	1125	16,744	1325
746	986	9832	1319	10,927	1312	11,751	1163	13,263	1293	14,333	1022	17,242	1298
808	1069	9875	805	10,947	958	11,780	1100	13,347	1030	14,334	1163	17,393	1189
816	673	9885	1163	10,976	813	11,784	917	13,350	1070	14,369	1302	17,383	1250
808	1119	9998	855	10,993	1164	11,861	1115	13,351	1113	14,546	1084	17,741	1256
984	1055	10,198	1079	11,063	1075	11,957	1003	13,381	1102	14,681	1244	17,945	1220
1114	984	10,201	939	11,073	929	12,059	1056	13,455	978	14,687	1007	17,946	1161
1115	1904	10,273	1315	11,077	1031	12,105	1312	13,553	1085	14,851	1319	18,267	935
1138	1298	10,319	1028	11,147	1183	12,169	966	13,613	1070	14,855	1319	18,275	1324
1130	1167	10,326	1075	11,180	939	12,266	1076	13,788	1306	15,250	1318	18,674	1188
1190	1113	10,372	1083	11,205	840	12,291	897	13,886	971	15,296	1309	19,200	1298
1211	926	10,404	1293	11,231	1250	12,300	1309	13,952	1225	15,311	1027	19,375	1323
1221	892	10,448	887	11,237	1217	12,320	1309	14,061	1292	15,398	1243	19,539	1293
1246	903	10,538	1161	11,300	805	12,460	934	14,090	1163	15,808	1217	21,018	1109
1457	1122	10,706	1163	11,353	1072	12,533	1055	14,103	1318	16,918	1218	21,746	1298
1547	725	10,758	1082	11,452	1255	12,854	885	14,119	974	16,316	1964		
1550	902	10,758A	1082	11,512	855	13,022	1025	14,161	1188	16,392	1115		

## ERRATA, 1905.

VOL. XXV	Page.	Column	Line from Top.	Line from Bottom.	Corrigenda.
No. 1—Jan. 16	39	1	2	..	<i>In title, for " Caspra " read " Caspar."</i>
No. 2—Jan. 31	87	..	..	16	} <i>Delete the word " monohydrate."</i>
" "	..	..	..	29	
" "	..	2	..	32	
" "	101	2	..	22	<i>Name omitted in title. " M. and A. Campagne."</i>
No. 4—Feb. 15	125	2	..	9	<i>Name in title. For " Michand " read " Michaud."</i>
" "	137	2	..	6	<i>For " FRENCH PATENTS " read " ENGLISH PATENTS."</i>
No. 4—Feb. 28	192	1	..	11	<i>Delete the words " of the."</i>
No. 9—May 15	491	1	..	16	<i>Title. For " Marschal " read " Maréchal."</i>
" "	..	2	..	6	<i>Title. For " Larondie " read " Laroudie."</i>
No. 11—June 15	615	2	..	26	<i>Patent number. For " 188,662 " read " 158,662."</i>
" "	623	2	..	22	<i>Title. For " Uthemann " read " Uthmann."</i>
" "	629	1	..	4	<i>Title. For " Ulhand " read " Uhland."</i>
No. 12—June 30	692	2	..	24	<i>For " green " read " yellow."</i>
No. 15—Aug. 15	837	1	..	9	<i>Title. For " Necken " read " Nacken."</i>
No. 19—Oct. 16	1024	1	12	..	<i>Title. For " Scheidner " read " Schneider."</i>
No. 21—Nov. 15	1107	2	8, 9, 10	..	<i>Read title as follows:—" Wool; Process and Apparatus for Degreasing "—A. H. Burl, H. Jackson and C. A. Finch. Fr. Pat. 354,667, May 26, 1905.</i>
" "	1102	2	31	..	<i>In title, for " 554,598 " read " 354,598."</i>
" "	1116	2	..	11	<i>Add name of patentee " H. M. Chance, Pa., U.S."</i>
No. 22—Nov. 30	1173	1	27	..	<i>In title, for " J. H. Hint " read " J. H. Hirt."</i>
" "	1178	2	..	5	<i>In title, for " Sahlstöm " read " Sahlström."</i>
" "	1181	1	19 and 20	..	<i>Read thus:—" for example, No. 4. 13 and 15 which are improved in viscosity by extractions, contain resins which, &amp;c "</i>
" "	..	..	37	..	<i>For " n=c.p' " read " n=c.p' "</i>
No. 23—Dec. 15	1223	1	11	..	<i>For " 355,326 " read " 355,331."</i>
" "	1250	2	..	15	<i>For " Hofman " read " Hofmann."</i>
" "	1256	2	18	..	<i>In title for " Michrochemical " read " Microchemical."</i>
No. 24—Dec. 31	1302	2	..	18	<i>For " W. Wedge " read " U. Wedge."</i>
" "	..	..	..	8	<i>For " W. Wedge " read " U. Wedge."</i>
" "	1303	1	5	..	<i>For " W. Wedge " read " U. Wedge."</i>



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## ERRATUM.

LIST OF MEMBERS ELECTED Dec. 22nd, 1904.—*For* Kennedy *read* Kenney, Fred. J., 493, Lexington Avenue, New York City, U.S.A.



## Deaths.

Allen, Wm. Evenley Hall, Brackley. Jan. 10.  
 Bowtell, N. E., Hazeldene, Heath Road, Runcorn. Dec. 3.  
 Dodd, T. H., 6, Granville Park, Blackheath, S.E.  
 Dunn, John, Northern Assurance Buildings, Manchester.  
 Dec. 21.  
 Kent, Wm. J., Parterre, Sandown, Isle of Wight. Dec. 29.  
 McArthur, J. G., 98, Dobbie's Loan, Glasgow.  
 Shaw, Geo., 35, Temple Row, Birmingham.

## Liverpool Section.

*Meeting held at the University, Liverpool, on Wednesday,  
 30th November, 1904.*

MR. EUSTACE CAREY IN THE CHAIR.

### CHAIRMAN'S ADDRESS.

#### CHEMICAL INDUSTRIES OF THE UNITED STATES.

You will naturally expect that I shall have a great deal to say about what was to be seen in the United States during our recent memorable visit, a visit that was made most pleasant to all the members of the Society who took part in it. We all have, and shall always retain, a very lively recollection of the great hospitality with which we were received, and the unvarying kindness which was shewn to us by the office-bearers and by many of the members of the New York and other American Sections. I cannot speak too highly of their generous treatment of us, and of the immense labour which they must have bestowed upon the preparation and the carrying out of their plans for our benefit.

Of course, in a visit of this kind, we were not by any means exclusively occupied in studying technical processes. Our hosts were naturally desirous of showing us and we were naturally desirous of seeing their country and their institutions, and in the few remarks which I shall venture to make to you this evening, I shall not confine myself to an account of technical matters, but shall endeavour also to touch upon some subjects of general interest. But I must confine myself to matters which were brought under my own notice, and not attempt to give anything like a general account of the whole of the proceedings.

In fact, I may say here, that if there is one thing more than another in which the Americans appear to be interested, it is in the subject of education. Their Universities are numerous. Their professors are strongly alive to modern requirements, and thoroughly up-to-date in their methods; in fact, more than one University is attracting students from Europe and from all parts of the civilised world. I don't mean to affirm that education is all that the American citizen cares for, for it goes without saying that he has a great appreciation of the almighty dollar, but the accumulation of a pile does not satisfy even their millionaires, who love their country, labour almost night and day to develop its resources, and are keenly alive to educational requirements, and give like princes to educational establishments, in order that their young men and young women may be well equipped for the struggle of life. This feeling is not only that of the well-to-do, but it is shared by the working people, who are eager to take advantage of any schools within their reach, and they have one immense advantage over the majority of people in this country—that if poor they are not ashamed to be poor, they are not ashamed to take any opportunity of earning their living and improving their position at occupations which many of our young students would despise. In this connection

I may mention the case of a young man with whom I came in contact at the St. Louis Exposition. He was a Canadian (and I may here say, that my remarks apply to Canada as well as the United States), and during his summer vacation he was presiding over a cigar stall, selling cigars for a living, with the expectation of putting a little money by to help him in his university career in the winter. This kind of thing has been done in Scotland, we know, but one does not see many such cases in England. Americans often boast that their land is the land of freedom. It is so in some respects, and especially so in the freedom with which the poor mingle with the well-to-do and well educated on terms of apparently perfect equality. In short, I may sum up the situation by saying that the celebrated and all-powerful Mrs. Grundy has but little influence in America.

In connection with education I may mention the wonderful library at Washington. The building is stated to have cost \$6,343,000, the land on which the building stands \$585,000. At the present time there are over 40 miles of bookshelves filled, and there is provision made for extension up to 150 miles of bookshelves. The reading room is large, and the mechanical arrangements are very complete for carrying the books from the shelves to the reading room and back from the reading room to the shelves. The reading room is open on Sundays from 2 to 10, and my informant told me that it was always well filled, in fact, he said every seat was taken, people waiting to come in some time before it was opened. There are 300 officials connected with the working of the library. The decoration of the building is extremely beautiful and artistic, and indicates the delight with which the American people have erected and are maintaining that building in the interest of education.

At New York we had a very considerable list of works to visit, viz.:—The Nichols Chemical Co., the New York Edison Co., Westinghouse, Church, Kerr and Co.'s Power-House for the Pennsylvania R.R., the Ravenswood Works of the Consolidated Gas Co. of New York, New Jersey Zinc Co., the Balbach Smelting and Refining Co., the Murphy Varnish Co., George Ehret's Brewery, Carl Schultze Mineral Water Factory, paint works of the F. W. Devoe and C. T. Reynolds Co., and of J. W. Masury and Sons.

This list gives an idea of what was provided for us, more or less, in all the cities we visited. It was impossible for any one individual to visit a quarter of the works that were open for inspection, therefore individual members notified the particular works to which they wished to go.

In addition to the works, of course there were places of interest in New York and the neighbourhood—such as the Columbia University, Metropolitan Museum of Art, American Museum of Natural History, and special collections of jade, porcelain and jewellery.

Personally, I was only able to visit the New York Edison Co., Westinghouse, Church, Kerr and Co.'s Power House, and the Ravenswood Works of the Consolidated Gas Co.

The Edison works is an enormous and impressive place. They use 200,000 h.p., and claim to obtain 1 i.h.p. per 12½ lbs. of dry steam.

At the works of the Consolidated Gas Co., the boiler fuel gases we were told contain 14 per cent. of carbon dioxide, and the gases leave the boilers at a temperature of only 400° F.; from 8 to 8½ lbs. of water are evaporated per lb. of fuel. They use anthracite smalls with no dust, what they call "corn size" as received from the colliery. I was very much struck by the uniformity of the coal delivered to the various works. The collieries in the United States separate their coal into various sizes to meet customers, all sizes without smalls. I was told that they used up their small or dust in coke ovens. They make various sizes of coal, some the size of walnuts, some larger, but all beautifully clean and free from dust. With absolute uniformity of size, it is of course easier to fire with regularity and obtain uniform results.

The Westinghouse Works at Pittsburg are most interesting. At the time of our visit they were very busy in steam turbines, and had hardly any orders for large steam engines. They make turbines up to 3000 h.p., and work them with a vacuum of 27-28 inches of mercury,

and they informed us that the turbine has an advantage over the steam engine in that it can work at 30 to 40 per cent. over-load or under-load with the same economy of steam, whereas steam engines must run at about the power for which they are constructed, or their valves are set.

Many hundreds of women and men are employed in winding the dynamos, an operation over which great care is taken: in fact, I was told by the manager of a works that had suffered from the floods last spring that he had several of the Westinghouse motors under water for a considerable time, but that they were so well wound that, as soon as they were dry, they worked as well as before. The care also that they took with the balancing of their armatures is well repaid by the steady, smooth working of their dynamos. The Westinghouse firm were constructing a dynamo for the Manhattan R.R., 5000 h.p., with a fly-wheel weighing 100 tons or over; in fact, the machines are so large that the machine tools for planing, drilling and so on have to be moved to the work, and not the work to the machine tools. Large tracts of floor are laid with thick plates, planed a dead level, so that a piece of plank can be fastened down to any part of the surface, and then and there it is level, and a machine tool can be brought to it and can operate upon it without delay.

Perhaps the most striking sight that we saw at Pittsburgh was the Homestead Works of the Carnegie Steel Co. The smelting works are on one side of the river, and the rolling mills on the other. We visited the rolling mills. The liquid cast-iron from the smelters is conveyed in fire-clay lined ladles of very large size in trucks from the iron works over a bridge to the rolling mills, taking about 45 minutes for the journey. The iron, however, is in such a large mass that it will remain liquid for four hours, and the cooling during the 45 minutes' transit is no hindrance to the subsequent operations of bessemerising puddling, and rolling.

We began at an open hearth from which a "bloom," about 5 to 6 feet long, about 4 feet wide, and about 15 inches thick, was taken, and run backwards and forwards through several sets of rolls, until it became a thin sheet of about 45 or 50 feet long. All this was done before the heat acquired in the smelting furnace has disappeared.

Water was thrown in plenty on the rolls, but the heat continued sufficient until the iron was rolled to its required size and shape. The water thrown upon the rolls, of course, to a great extent, fell upon the iron which was passing through the rolls on which it ran about in a spheroidal condition. The men by the side of the rolls frequently spread a shovel or two of coarse salt over the iron close to the rolls, when the pellicles of gas interposed between the spheroids of water and the iron were broken, and the water brought into direct contact with the iron, causing a series of deafening explosions. This perpetually recurring noise, coupled with the noise and rattle of the rolling mills themselves, rendered it almost impossible to ask an audible question or to hear a reply—conversation was, therefore, difficult.

There were several sets of rolls occupying more than 100 feet each of the shed, some for sheets, some for rods, some for girders, &c. In some cases a mass of iron has to go through two or more separate machines. These machines work together like clockwork. Not an instant seems to be lost. In fact, the machines work together with the precision of soldiers at parade. The men who drive these enormous machines seem to have no respite. They work two shifts in the 24 hours in dust, great heat, and overpowering noise. They earn from \$4 to \$5 a day.

The Homestead Works were fully employed, but we were given to understand that some of the other works belonging to the Company were not working full; but their policy is to work those works full which work most cheaply, and, as the Homestead Works is one of their cheapest, they naturally continue it in full operation. The excellent organisation of the labour in this works, the extent to which power is used, and the supreme effort all concerned in those rolling mills have to make in order to avoid the loss of a moment of time, is the great secret of their success. Labour, as everyone knows, is expensive, power is comparatively cheap, and the intelligent manage-

ment of labour-saving contrivances all through the United States is the one thing needful for success, and that one thing being of prime and ever present necessity, accounts for the extraordinary extent to which brain-work in connection with the management of large industrial processes has been cultivated, more perhaps than in any other manufacturing country in the world.

I saw the same kind of organisation in a large zinc-smelting and zinc-rolling works near Chicago. The men who have the responsibility of rolling the zinc receive up to \$6 a day of eight hours, but they are kept at work in such a way by subsidiary appliances for the furnishing with due speed and punctuality of the material to be rolled, that the sheets of zinc appeared to follow one another through the rolls almost as quickly as you could turn over the pages of a book. At this works they had a most beautiful quality of zinc blende to treat; their colliery formed a part of the premises, and the coal at the pit mouth was not farther from the furnaces than the receiving siding is from the furnaces in an ordinary English works, and far less distant than in many with which we are familiar. Coal costs them 90 cents for run of mine.

I have a few words now to say about St. Louis and the wonderful "Louisiana Purchase Exposition," as it is called.

An American historian says "that the annexation of Louisiana was an event which gave a new phase to politics, and ranks in historical importance next to the Declaration of Independence and the adoption of the Constitution." The Exhibition is intended to commemorate the centenary of this great event. For many years the region of the Mississippi valley was coveted by both Great Britain and France, and in 1801 there was great fear that the army of 40,000 sent by Napoleon Bonaparte to suppress the insurrection in San Domingo was really intended to take military possession of Louisiana and the Floridas. Fortunately, Napoleon's attention was, of necessity, taken up with European complications, and a peaceful termination of a very critical situation was effected by Mr. Jefferson when he took office as President in 1801, and the treaty for the transfer was concluded on April 30, 1803, by Napoleon and by Thomas Jefferson, author of the "Declaration of Independence," and third President of the United States. The American people have thought it desirable to celebrate this very important event, and they have celebrated it in a right royal manner. The great area covered by the Exhibition was 1240 acres; the Chicago Exhibition covered 633 acres; the Paris Exhibition in 1900 covered 336 acres; the Buffalo Exhibition 300 acres; and the Centenary Exhibition at Philadelphia 236 acres.

In the St. Louis Exhibition 128 acres were covered by the various buildings required for the Exhibition, and this Exhibition is remarkable also in the fact that no charge was made to exhibitors for space or power.

The amount of money spent by some exhibitors was no doubt very great. Platt Bros., of Oldham, had a very fine exhibit of their cotton machinery, the Westinghouse firm also of theirs, and one of their people told me that their exhibit had cost them £40,000. They had the contract for supplying power to the Exhibition.

The great buildings, although temporary and made of lath and plaster, were most artistically designed, and were as beautiful in proportion, in outline, and in detail as if they had been built to last for centuries. In fact, the design and decoration of the outside of these buildings must have cost the architect or architects as much time and study as if the buildings were required to be permanent.

I am glad to be able to say, and I am sure those members of the Society who saw the Exhibition will agree with me, that the British Chemical exhibit was, thanks to the sub-committee of the Royal Commission for the St. Louis Exhibition, consisting of Dr. Boverton Redwood (Chairman), Mr. Thomas Tyrer, Mr. Gordon Salamon and Mr. Wightman, acknowledged by all to be an excellent exhibit and worthy of British enterprise. As a Society and as British Exhibitors, we are much indebted to those gentlemen for the excellent work which they did, and for the successful result.



Everyone has heard of the wonderful deposit of sulphur in Louisiana and the still more remarkable manner in which that sulphur is extracted, and placed on the surface ready for the market. An excellent exhibition of this sulphur was shown in the St. Louis Exhibition. The specimens are remarkably fine, beautiful in colour and evidently of great purity. The owners claim that the sulphur tests 99.9 per cent., and so far as the appearance goes I have no doubt that that is correct.

Mr. Higgins, Dr. Conroy and myself, who were together on that occasion, were introduced to Dr. William C. Stubbs, the Commissioner for Louisiana, also the State geologist, who received us with great courtesy and gave us much interesting information. It appears that the sulphur mines were discovered by accident, and a very large sum of money is said to have been spent and lost in endeavouring to get at the sulphur by sinking shafts, but the quicksand and the water therein prevented any success by that method. Subsequently, however, Mr. Frasch, of the Standard Oil Co., devised the method of melting the sulphur *in situ*, and forcing it up to the surface in a melted condition. At first the sulphur was melted by superheated steam; it now is melted by superheated water, and it is stated that the borings made by the Company, now working this mine, show that at least 40 million tons of sulphur lie underneath their land. The deposit occurs at about 400 feet below the surface, and for the upper 120 feet the sulphur is of a pure crystalline character. There is a further thickness of about 300 feet more or less mixed with gypsum.

When we were there it was reported that the mine was raising about 1,000 tons of sulphur per day. Reports, however, vary upon this point, but it appears that at all events not less than 500 tons a day are being raised, and the owners of the mines expect to raise a very much larger quantity before long. The expense of labour and fuel in getting the sulphur to the surface is comparatively small, and is stated to be about \$3½ per ton, but how long the borings will last, or, in other words, how many borings it will be necessary to sink for a given quantity of sulphur I believe no one as yet knows. Therefore, the total cost of the sulphur over a long period is at present a matter of conjecture. I see, however, that a cargo of this sulphur has arrived at Marseilles, and I believe several quantities have been shipped to Europe; at all events, there seems to be no doubt that the supply from this mine will quite satisfy the domestic demand. In fact, statistics already show that whereas over 29,000 tons of sulphur were imported into America in October, 1903, only between 2000 and 3000 were imported during October, 1904.

It is an interesting question when and how this sulphur has been deposited. Dr. Stubbs informed us that in this region the sulphur and the oil occur together, and they occur in the lowest tertiary or the upper cretaceous formation. Geologists are not decided upon this point, but they are agreed as to the origin of the sulphur, and the theory is as follows:—Gypsum, limestone and lignite occur together, and it is believed that the sulphur has been formed by the reduction of the gypsum by the underlying lignite, which is also the source of the oil.

Chicago is now a city of two million inhabitants, and celebrated all the world over for its enormous establishments for the killing of cattle and pigs and the preparation of their carcasses for food and for food products. In 1833, the inhabitants of Chicago did not number more than 150. The souvenir of Chicago, which was furnished to us as visitors, contained a great number of most astonishing figures; for instance, 26 railways centre in the city, and the mileage of these, which is about one-third the total in the States, or 84,000 miles, handles 41 per cent. of the total freight tonnage of the country, and the railway mileage of Great Britain, Germany, Ireland and France about equals the mileage centring in Chicago.

An area of about 500 acres is covered by the stock-yards, and upon this space are handled daily 75,000 cattle, 300,000 hogs, 125,000 sheep and 6000 horses; the number of people dependent upon this industry is about 450,000.

One of the most vivid impressions which I have brought

home from America is that ceaseless and superabundant energy of the inhabitants. Exhibitions of force seemed to give them more satisfaction than mere force does to the people of other countries. I remember one Sunday morning, whilst walking along the principal road—a beautifully wide one—of Chicago, noticing how every driver of a motor car seemed intently anxious to get the utmost possible out of his machine. It did not appear to be their object to enjoy the air or see the country, but their one idea seemed to be to go as hard as they could, and this seems to apply to them in every relation of life.

At Detroit, we went through the enormous pharmaceutical manufacturing establishment of Messrs. Parke, Davis & Co. The visitors were the guests of this firm for the day. We were shown the laboratories and we received a very interesting lecture from one of the principal men in the laboratory, on the subject of the preparation of drugs, the efficacy of which could not at present be tested by any chemical method, but only by practical trial. For instance, drugs acting upon the heart. The lecturer claimed that his firm produced absolutely uniform results in drugs of this description, by the only method at present possible, that is, the experimental method upon living animals. These experiments apparently are carried out with all the humanity possible, dogs are usually chosen for the purpose and are put under an anæsthetic, and are continually under an anæsthetic during the whole of the experiment, which sometimes lasts for two or three days. The animal is not allowed to return to consciousness, but its life is terminated when the experiment is finished, and without the slightest suffering to the animal. Messrs. Parke, Davis & Co., of course, have a large quantity of beautifully designed machinery for the manufacture of their various preparations, essences, pills, capsules, and the labour-saving machinery is as conspicuous in the manufacture of these preparations, as in any industrial operation that we had the pleasure of seeing in the United States.

At Detroit I was obliged to sever my connection with the Society of Chemical Industry party, owing to some business calls in other directions. The party afterwards went to Buffalo, Niagara and Boston, and so round to New York and home.

#### DISCUSSION.

Mr. MAX MUSPRATT said that what interested chemists most were those processes which centred round the great water powers of America. At Niagara, of the many industries worth mentioning, in the first place was the carbide industry. Calcium carbide was industrially discovered in America, an exceptionally good country for the development of that industry, because it had so many isolated towns and villages without coal-pits or water power, but wanted a cheap illuminant. At present something like 40,000 tons of carbide were manufactured annually at Niagara, where they had an extremely efficient staff both of engineers and chemists, who were always improving their methods and discovering new variations, both in the manufacture and application of carbide of calcium. The power used was about 30,000 h.p. per annum. Carborundum was an extremely interesting product; but carborundum, though important and interesting, was not an epoch-making substance in the evolution of chemistry. Among the processes which would have been of great interest to him, if he could have obtained details, were the caustic and bleach works. One had an idea that the American and English works had drifted apart in their method of manufacture, but nothing definite was known. Chlorate of potash was also manufactured at Niagara, and one had reason to think it was working satisfactorily from the point of view of the owners of the works there. But apart from Niagara, although there were other powers in the United States, he thought that the electro-chemical processes were not making any great headway. In the hands of the particular companies situated at Niagara, the processes seemed successful; but attempts made in Massachusetts and in Michigan to establish chemical works for the production of alkalis and bleach were apparently not very successful. There

were two factors that were making the American industries extremely complicated from the technical point of view. First of these was the great power of combination that Americans had. It did not at all follow because a process was being worked satisfactorily in the States, that it was a true technical success; it might mean that the people who financed it were so powerful that they ran anyone else off the ground. In England and Germany a good process generally came to the front. In the States he was not quite sure that the best processes were always arrived at, because of this enormous power which the first in the field kept in such a country. The second factor, closely connected with the question of combination, was the question of protection, which also complicated things very much. Products that had a 25 per cent. protection could be manufactured by a 10 per cent. worse process successfully, so, unless one had an opportunity of examining the books and the processes very minutely, it was impossible to conclude that because a thing was a commercial success in the States it was a real technical success. The States had not adopted the contact process for sulphuric acid manufacture, but they had developed the ordinary lead chamber process to a very good point, and they certainly had good vitriol plants, well managed. In alkali, the ammonia-soda process at Syracuse was supreme; and in Michigan there were also ably conducted ammonia-soda works. In Canada the natural resources were very great, at any rate for the primary industries, but the power of capital was so great that he was inclined to think that technical development might have been checked in even greater degree than in the States. In Canada they had exactly the American spirit of force and energy, and expected quick and rapid returns, and when a man was making 40 per cent. he did not perhaps bother about the fine details of manufacture to the same extent as he had to do in an old country. One of the interesting industries in Canada was wood distillation, for which he believed there was a great future. Certainly it was in very energetic hands, and although the technical side of it was nothing like so well developed as in Germany, where they had not the same natural advantages, the industry was an important one, and a very growing one.

Dr. CONROY also gave a short account of his visit to America. In the various works they visited, he said there was noticeable a great deal of organisation—a great deal of method even in works of small size, and in which in this country comparatively little method would be observed. As regarded the efficiency of the staff, a great deal was due to the way in which they were trained. They went from the universities into business, and started at the bottom. Thus in engineering works they began by oiling the engines; if they were smart they rose gradually, and the result was that when they did come to the top they had, in addition to their scientific training, a thorough practical knowledge from start to finish. They were thus capable of leading and managing. Another point which struck him was the way in which the larger concerns encouraged research. Messrs. Parke, Davis and Co., for example, had a chemical laboratory in which were employed 26 chemists, 15 of whom, highly educated men, were doing independent research. Each had a room to himself, and was able to pursue his researches uninterrupted, reporting when he had results to give. America was undoubtedly a very great country. It had great resources, which one could not help but feel on walking through two or three of the halls of the St. Louis Exhibition. Going through the agricultural hall there was a wealth of agricultural produce all round. Similarly in the building devoted to metallurgy there was an equal wealth of minerals. They were told that the mineral resources of the States had only been scratched at up to the present. In the Exhibition they were shown a mineral which was stated to contain almost every known element, including 9 ozs. of platinum to the ton. The chemical processes, however, which they were permitted to view, were not in the new branches. With regard to the processes he had the privilege of seeing he did not think the Americans were ahead of us in their methods of

manufacture, or that they could produce more cheaply; but they seemed to carry more method into the thing. Niagara was, of course, the point which they thought would be the most interesting to them, and was the industrial centre they wished to have the opportunity of seeing in some detail. Unfortunately, they were only allowed to go into one of the chemical works, viz., that of the Acheson Graphite Co. Mr. Muspratt had made some remarks as to the American methods in electro-chemistry, having perhaps grown apart from English methods. From conversations on the spot he could say that had taken place to some extent; in fact, in one of the electrolytic processes a large share of success was due to the very considerable modification in the construction of the cell.

## Manchester Section.

*Meeting held at Manchester, on Friday, December 2nd, 1904.*

MR. J. CARTER BELL IN THE CHAIR.

### NOTE ON THE ACCURACY OF THE DRY ASSAY OF GALENA IN AN IRON CRUCIBLE.

BY W. F. LOWE, A.R.S.M., F.I.C.

Although the dry assay of galena in an iron crucible is so largely used in the buying and selling of lead ores, its accuracy is often questioned: success with it is, however, a matter requiring experience, and to those who have had some practice with it, it will yield very good results indeed. The method is so well known, that a description is not required; it may be mentioned, however, that it is advisable to remove the assay from the furnace as soon as it appears to be reduced, and, in my own practice, I do not keep it in longer than 5 to 10 minutes.

In Percy's Metallurgy, Vol. Lead, it is stated that the purest galena by this method yields from 84½ per cent. to 85½ per cent., whilst the theoretical amount of lead in lead sulphide is 86.58 per cent. Phillips states that the method with pure galena yields 84 per cent. My own experience, which is a fairly large one, is that better results than these can be obtained, for samples of dressed ore as sold at the mines, and in which a little blende and calcite can be seen with the eye, yield from 83 per cent. to 84 per cent. of lead.

Recently, a sample of very pure galena sold as Potter's Lead (*i.e.*, hand-picked ore for use in the Potteries), when assayed in the usual way, yielded 85.86 per cent. of lead. In order to see that it had not been assayed under specially favourable conditions, it was assayed again a few days later, and then yielded 85.87 per cent. As this sample represented 18 tons of ore, it was not likely to be absolutely pure, and it seemed of sufficient interest to estimate the amount of impurity present. This was done, and the only foreign matters found were 0.22 per cent. of  $F_2O_3$ , and 0.3 per cent. of  $CaO$ . As the lime was present as carbonate, and 0.3 per cent. of  $CaO$  equal 0.53 per cent. of  $CaCO_3$ , the total amount of impurity was 0.75 per cent. After taking this into account, it will be seen that the yield of lead, by dry assay, differs from the theoretical by only + 0.02 per cent. to + 0.03 per cent.

### DISCUSSION.

Mr. H. L. TERRY regretted that Mr. Lowe was unable to be present to reply to the discussion. The accuracy of the dry assay was often called into question, and there were plenty of instances on record where considerable discrepancies existed between the figures yielded by the dry and wet assay. It was the common practice in the North of England for the dry assay to be used; the lead smelters preferred it to the wet because it showed the results they might expect in practice. At the same time, the mine owners were often inclined to grumble, because they knew that the method favoured the smelter rather



than themselves. His own experience bore this out, though he might say that the error in the case of galena dressed up to 77 or 80 per cent. was but trifling; it was rather in assays of the bouse or crude ore that the error became significant. In the case of low-grade ore, indeed, he had known the error to be as much as 25 per cent.—a fact of importance where the valuation of a mining sett was in question. Mr. Lowe certainly seemed to have obtained some very accurate results, though he was rather doubtful whether the smelters would extend a complete welcome to the improved method if it came into general use.

Mr. F. SCUDDER endorsed Mr. Terry's remarks. Some years ago he (Mr. Scudder) had extensive practice in analysing galena by the Flintshire method, and it was most difficult to obtain results within  $2\frac{1}{2}$  per cent. There was a great difference between the dry and wet methods, and Mr. Lowe should have given the exact fluxing mixture for the dry assay of galena. It was well known that Welsh galenas were obtained from good ores. The paper was deficient with regard to the exact methods adopted in conducting these analyses, and he hoped Mr. Lowe could see his way to furnish the details of his process. Galenas contained about 2 to 2.5 per cent. of oxygen, and it would be of great interest if the author of the paper could throw some light on the form which the oxygen assumed in these ores.

Mr. W. F. LOWE has furnished the following reply:—

My object in writing this paper was simply to point out that the dry assay of lead is much more accurate than is generally supposed, and for rich ores will give very good results, whilst the time occupied is very short. As there is nothing new in the method I use, it is fully described in Percy's Metallurgy, and is the one usually employed, I did not think it necessary to go into details, but I will do so as there is a request for them.

32.666 grms. of ore (one assay ton), 3 grms. of argol, and 30 grms. of carbonate of soda are mixed and placed in a bright copper scoop, the charge occupying the front portion of the scoop, and behind it is placed about 10 grms. of borax; the charge is then shot into a red hot iron crucible which has been removed from the furnace for the purpose. The crucible is replaced and kept in the furnace until the charge has run down and is quiet and clear on the surface; the crucible is then given a shake with the tongs, so as to clean the sides with the molten flux, and the assay is then poured into a conical iron mould, and the hot crucible tapped on the top of the furnace to collect any shots of lead which are poured into another mould, and weighed with the large button. As soon as the flux has set, the lead button is knocked off, hammered into a cube, marked, washed, dried and weighed. The crucibles must be of wrought iron, as cast iron pots are useless. The crucibles I use are made for me by the Sandycroft Foundry Co. They usually stand from 20 to 30 melts; they are scraped out with an iron scraper between each assay, and before the first assay, a charge of borax is melted down and run out, except in the case of a new crucible. The chief point of all is to remove the assay as soon as reduction has taken place, for if it is left in the furnace, even for a very few minutes after this, a loss will take place; the temperature, also, must not be too high. I prefer ordinary borax to the anhydrous, as it swells up and cleans down the sides of the crucible. When the silver is not required, 30 grms. of ore are taken, but if the silver also has to be estimated, as is usually the case, the assay ton is more convenient, as it gives the silver direct, without calculation or the use of tables, for each mg. of silver is equal to an ounce per ton of 2240 lbs.

I quite agree with Mr. Terry that the method is not suitable for poor ores, and for such I use a wet method, but it can be used for most samples of dressed ore. A plan adopted by an American assayer for poor lead ores would, I think, very likely make the method applicable. He adds a known weight of litharge sufficient to bring up the lead to about 80 per cent., and then assays the ore in the dry way. The method generally known as the Flintshire Assay is one in which about 1 lb. of galena is melted in a wrought iron bowl without any flux.

The oxygen referred to by Mr. Scudder as being present in galena was most likely due, I should say, to a little cerussite, as this mineral, carbonate of lead, very frequently occurs with galena.

## Newcastle Section.

Meeting held at Armstrong College, on Thursday,  
December 15th, 1904.

DR. J. T. DUNN IN THE CHAIR.

### DETERMINATION OF SULPHUR IN PYRITES. BY LUNGE'S METHOD.

Communicated from J. and H. S. Pattinson's Laboratory,  
Newcastle-on-Tyne, BY THE LATE H. SALVIN PATTINSON,  
PH.D., F.I.C.

The experiments in the paper were undertaken with a view to comparing Lunge's method of determining sulphur in pyrites with that published by Silberberger (this J., 1903, 1149). The details of the comparison of the two methods were communicated to Prof. Lunge for embodiment in a report to the International Committee on Analytical Methods, and need not be given here; it is enough to say that Silberberger's method was found to give accurate results when carefully carried out, but that it is very much more troublesome to work than Lunge's and is also expensive, from the large quantities of alcohol required. During the inquiry, however, several points arose requiring investigation, and it seems desirable to place on record the experiments that were made to decide them, and the results obtained.

The sources of error in the determination of sulphur in pyrites by barium chloride are due to (1) retention of iron by the barium sulphate precipitate. (2) Solubility of barium sulphate in the filtrate and wash waters. (3) Co-precipitation of barium chloride with the barium sulphate. To avoid (1) Lunge precipitates the iron as ferric hydroxide by means of ammonia, and filters off this precipitate before precipitating with barium chloride; but by so doing he introduces (4), the possibility of carrying down with the iron some of the sulphuric acid in the form of basic ferric sulphate.

The analyses of pyrites mentioned in this paper were carried out by Lunge's method, as described in his "Chemisch-Technische Untersuchungs-Methoden," 1899, Band I., 245, with certain slight differences or more exact details, the reasons for which will appear in the sequel.

The two details which it appeared to me were not given with sufficient explicitness, in the published descriptions of Lunge's method, are the following, viz.: The quantity of ammonia to be added in excess when precipitating the ferric hydroxide, and the excess of HCl to be added to the solution previous to precipitating with BaCl<sub>2</sub>. I have made a number of experiments upon these two points, and I will first deal with those relating to the excess of HCl. The effect of adding a very slight or a greater excess of HCl is seen in two ways—its influence upon the physical character of the BaSO<sub>4</sub> precipitate and upon the retention of BaCl<sub>2</sub> by this precipitate. The rate of addition of the BaCl<sub>2</sub> has also possibly something to do with the retention of BaCl<sub>2</sub>, but this point I have not fully gone into. Suffice it to say that whether the BaCl<sub>2</sub> solution (about 20 c.c.) be added over 2 minutes or over 5 minutes, there is no evidence of these different rates affecting the results.

Table I. shows the influence on these two points of the variable acidity of the solution in which the BaSO<sub>4</sub> was precipitated. Some of the precipitates were formed from solutions of normal H<sub>2</sub>SO<sub>4</sub> neutralised with ammonia, and in some cases excess of ammonia added and then HCl in excess, others from solutions obtained in the course

of the analysis of pyrites. In each case, the precipitate of  $\text{BaSO}_4$  weighed about 1.75 grm., and was fused in a muffle-furnace with 1 grm. of sodium carbonate. From the

amount of chlorine found in each case was subtracted that found by a blank experiment with the sodium carbonate alone.

TABLE I.

Showing influence of the acidity of the solutions upon the nature of the  $\text{BaSO}_4$  precipitate and the retention of  $\text{BaCl}_2$ .

No. of Expt.	Volume of liquid.	Excess of $\text{NH}_4\text{HO}$ neutralised by HCl.	Excess of HCl.	Excess of HCl per 100 cc of liquid.	Rate of adding 20-23 cc $\text{BaCl}_2$ solution.	$\text{BaCl}_2$ in $\text{BaSO}_4$ ppt. calculated from AgCl obtained	Nature of $\text{BaSO}_4$ ppt.
17	300 cc	7.5 cc	3 drops	Abt. 0.1 cc	5 min.	Grms. 0.0049	Fine; settled slowly, not quite clear in 30 min.
21	300 ..	Nil	3 ..	.. 0.1	do.	0.0037	Do. do.
18	350 ..	8.5 cc	3 ..	.. 0.1 (—)	do.	0.0049	Do. do.
22	300 ..	10.0 ..	3 ..	.. 0.1	do.	0.0025	Do. do.
26	325 ..	5.0 ..	3 ..	.. 0.1 (—)	2 min.	0.0029	Do. do.
23	300 ..	Nil.	0.5 cc	.. 0.17	do.	0.0020	Denser; settled more quickly; nearly clear 20 min.
25	300 ..	Nil.	2.0 ..	0.67	do.	0.0020	Do. do.
24	300 ..	Nil.	1.0 ..	0.33	do.	0.0012	Nearly clear in 10 min.
27	365 ..	Nil.	1.0 ..	0.27	do.	0.0016	Dense; settled clear in 2 min.
28	420 ..	5.0 cc	1.0 ..	0.24	do.	Nil.	Fine; settled badly.
later. Samp.	340 ..	5.0 ..	1.0 ..	0.29	4 min.	0.0008	Dense; settled clear in 2 min.
later. ..	340 ..	5.0 ..	1.0 ..	0.29	3½ min.	0.0004	Do. do.

From this table it may be seen that the presence or absence of ammonium chloride within the limits used has apparently no influence upon the retention of chlorides or upon the character of the precipitate of  $\text{BaSO}_4$ . The degree of acidity, however, has a very important effect. If there be less than 0.17 c.c. of HCl per 100 c.c. of liquid, the precipitate of  $\text{BaSO}_4$  retains  $\text{BaCl}_2$  in objectionable amount, and is usually fine and settles slowly. When the acidity is increased to about 0.3 c.c. per 100 c.c. of solution, the retention of  $\text{BaCl}_2$  is insignificant, and the precipitate is usually dense and settles almost immediately. Experiment 25, in which the excess of HCl was 0.7 c.c. per 100 c.c. caused a precipitate which was not quite so free from  $\text{BaCl}_2$  as when about 0.3 c.c. per 100 c.c. of solution was used, but which settled fairly rapidly. Only one experiment was made with an excess of 0.7 c.c. per 100 c.c.

The other detail to which I have directed attention is the excess of ammonia necessary to be added to precipitate the ferric hydroxide. The experiments which I have made on this point have also been directed to clear up two other points, viz., the best temperature at which to effect the precipitation of the ferric hydroxide so as to obtain a precipitate free from sulphuric acid, and the conditions which influence the bulk of liquid necessary to wash the ferric hydroxide precipitate thoroughly. Lunge, and his pupils at the Zurich Polytechnic, have no difficulty in obtaining the ferric hydroxide precipitate free from basic ferric sulphate; nor has Treadwell, although his procedure differs somewhat from Lunge's in that he precipitates in the cold, and, whilst stirring continually, brings the solution to the boiling point, but does not continue to boil, while Lunge precipitates in the cold, heats to 60–70° C., and allows to stand 15 minutes. Neither Lunge nor Treadwell is explicit about the excess of ammonia to be added. Lunge, in the *Alkali-Makers' Hand Book* (Lunge and Hurter, 2nd Eng. Ed., 1891, p. 93), says, "The filtrate and washings (i.e., from the insoluble residue) are saturated with ammonia, avoiding much excess of it and keeping the hot liquid about 10 or 15 minutes before filtration, but not boiling till all the ammonia is expelled (in which case the precipitate contains some basic sulphate)." In his work on Sulphuric Acid and Alkali (2nd Eng. Ed., Vol. I., p. 56), he says, "The filtrate and washings are saturated with ammonia, avoiding much excess of it; the mixture is kept at a moderately warm temperature for about 10 minutes (at the expiration of which time it ought still to smell of ammonia very distinctly, not merely faintly), and the precipitated ferric hydrate is filtered off while the liquid is still hot;" and in his *Chemisch-Technische Untersuchungs-Methoden* (Ger. Ed., 1899, Vol. I., p. 245), the following is a translation of his description of this part of his process: "The filtrate,

together with the washings, is saturated with ammonia in not too great excess, and the liquid warmed at 60–70° for 10–15 minutes, but not heated to boiling; it must always still smell strongly of ammonia (otherwise the precipitate may contain some basic ferric sulphate)."

Treadwell, in his "Analytical Chemistry" (Eng. Ed., 1904, Vol. II., Quantitative Anal., p. 282), says:—"To separate the iron, the cold solution is treated with an excess of ammonia in the cold (*sic*) (to prevent the formation of a basic ferric sulphate), and afterwards heated to boiling point, with constant stirring"; and to this there is a foot-note as follows:—"After the solution is made alkaline with ammonia, it can be heated to boiling without any danger of forming a basic ferric sulphate. The latter would be formed if the weakly acid solution were boiled. Except (the English Edition says 'even,' but this is a mistranslation of the German 'ausser,' which stands in the German Edition) when the pyrites contained considerable copper, the author has never found sulphuric acid in the ammonia precipitate when the above directions are followed."

But, notwithstanding the fact that Lunge and Treadwell and their pupils are successful in precipitating the ferric hydroxide free from basic ferric sulphate, it is an undoubted fact that other chemists find this a difficulty. Not only have we found it so in our own laboratory, but I have private information from other and well-known laboratories that the same difficulty exists.

It occurred to me that the solution of the difficulty might be found in the addition of at least a minimum excess of ammonia. I found that an excess of 0.5 c.c. of ammonia made the solution smell quite distinctly of ammonia, and the solution might even be considered by a person sensitive to ammonia fumes to smell strongly of ammonia after it had stood at 60–70° for 15 minutes in a covered beaker. I began by adding this excess, and increased it in other experiments up to 10 c.c. under the conditions of temperature given in Table II.

The solution used was in all cases 15 c.c. of normal  $\text{H}_2\text{SO}_4$ , containing ferric chloride equivalent to 0.21 grm. of iron (these being the amounts of sulphuric acid and iron in the solution of 0.5 grm. of a pyrites containing about 48 per cent. of sulphur). To this was added 1 c.c. of HCl and 150 c.c. of water, so that the total volume of the solution was about that obtained after oxidising 0.5 grm. of pyrites, and filtering and washing the insoluble residue according to Lunge's method. The ferric hydroxide precipitates were tested for barium sulphate by fusing with 4 grms. of sodium carbonate in a muffle-furnace, deducting from the weight found in each case that obtained from 4 grms. of the sodium carbonate itself by precipitation with barium chloride.



TABLE II.

No of Expt.		BaSO <sub>4</sub> from Ferric Hydroxide ppt. with undermentioned excess NH <sub>4</sub> HO.						Volume of liquid after washing.						No. of washes required.					
								Excess of ammonia used.						Excess of ammonia used.					
		cc 0.5	cc 1.0	cc 2.0	cc 3.0	cc 5.0	cc 10.0	cc 0.5	cc 1.0	cc 2.0	cc 3.0	cc 5.0	cc 10.0	cc 0.5	cc 1.0	cc 2.0	cc 3.0	cc 5.0	cc 10.0
		g	g	g	g	g	g	cc	cc	cc	cc	cc	cc						
36	Precipitated cold, filtered at once, without standing .....	0.0045		0.0015		nil		500		500		480		27		27		23	
37	Precipitated cold, filtered after standing cold 15 minutes ...	0.0035		0.0005		nil		420		350		300		20		14		11	
34	Precipitated cold, brought to boiling point with continuous stirring and filtered (Treadwell) ...	0.0030		0.0015		0.0015		420		440		280		18		20		10	
35	Precipitated cold, warmed to 60-70° allowed to stand 60-70° 15 min., then filtered (Lunge)	0.0045		0.0015		0.0015		540		400		430		31		22		23	
38	Precipitated at 60-70° filtered at once without standing .....	0.0180		0.0015		0.0015		380		380		320		17		17		13	
39	Precipitated at 60-70° kept at 60-70° for 15 min. and filtered ...	0.0175		0.0015		nil		380		360		300		18		15		10	
40	Brought to boiling point, removed from gas, precipitated and filtered at once	0.0195			0.0040	0.0020		400		310		310		17			11	11	
41	Brought to boiling point, removed from gas, precipitated, allowed to stand 15 min. and filtered ...	0.0085			0.0020	0.0020		310		290		280		11			9	8	
42	Brought to boiling point, removed from gas, precipitated, boiled 5 min. and filtered .....	0.0105				0.0015	nil	370				310	290	15				12	8
43	Brought to boiling point, removed from gas, precipitated, boiled till ammonia expelled (40 min.), boiled 5 min. longer and filtered .....						0.0235						400						15

I do not wish to draw too sweeping conclusions from the results shown in this table; but, as far as they go, they indicate that:—

- (1) With a distinct excess of ammonia, even when precipitation is effected in the cold, the precipitate may contain very considerable quantities of basic sulphate.
- (2) The tendency to the formation of basic sulphate increases with the temperature, so that at the boiling point with 3 c.c. excess of ammonia, the precipitate may contain as much as when precipitated in the cold with only 0.5 c.c.
- (3) The amount of basic sulphate in the precipitate diminishes as the excess of ammonia increases. With 5 c.c. excess in the cold the precipitate is free from it, and even when precipitated at the boiling temperature, the amount is only equivalent to 0.05 per cent. of sulphur in a pyrites when 0.5 grm. is operated upon.
- (4) It is shown by experiment 43 that at the boiling point ferric hydroxide will react upon ammonium sulphate, with production of basic ferric sulphate. Speaking generally, therefore, it is inadvisable to boil the solution,

lest, through expulsion of the excess of ammonia, this reaction should occur.

(5) Having regard, not only to obtaining a precipitate free from sulphate, but also to the rapidity of filtration and washing, and to minimising the bulk of fluid for subsequent operations, it seems advisable to precipitate with not less than 5 c.c. excess of ammonia, at whatever temperature the precipitation and the filtration be carried out.

With regard to the influence of ammonium salts in increasing the solubility of barium sulphate, the following experiments (Table III.) show that the presence of ammonium chloride, in quite considerable amount, has but little influence in increasing the solubility of BaSO<sub>4</sub> under the conditions of its precipitation by Lunge's method, and that an excess of from 1.2 c.c. of HCl in 300 c.c. of liquid is also quite permissible.

I may remark that usually all the soluble BaSO<sub>4</sub> is obtained by evaporating the filtrate to dryness on a water bath, and that it is quite exceptional to find any still remaining in solution, so that the expulsion of the ammonia salts from the dry residue is unnecessary.

TABLE III.

*Showing  $\text{BaSO}_4$  in Solution in Filtrates from about 1.75 grm. of  $\text{BaSO}_4$  Precipitate, when Varying Amounts of  $\text{NH}_4\text{Cl}$  and  $\text{HCl}$  are Present.*

No. of Expt	Volume of liquid from which $\text{BaSO}_4$ was precipitated.	Excess of $\text{NH}_4\text{HO}$ neutralised by $\text{HCl}$ and forming $\text{NH}_4\text{Cl}$	Excess of $\text{HCl}$ added	A $\text{BaSO}_4$ in solution obtained on evaporating filtrate to dryness	B $\text{BaSO}_4$ still in solution obtained by evaporating filtrate from A to dryness, and expelling $\text{NH}_4\text{Cl}$
21	About 300 cc	Nil.	Ammonia boiled off.	3 drops	0.0030
23	" 300 cc	do.	do.	0.5 cc	0.0010
24	" 300 cc	do.	do.	1.0 cc	0.0010
25	" 300 cc	do.	do.	2.0 cc	0.0010
27	" 365 cc	do.	do.	1.0 cc	Not tested
29	" 300 cc	10 cc	do.	0.0030	0.0010 (total in solution A + B).
26	" 325 cc	5 cc	do.	3 drops	Not tested.
28	" 420 cc	5 cc	do.	3 drops	0.0010 (total in solution A + B).
				1 cc	Not tested
					0.0010 (total in solution A + B).

The modifications in Lunge's method, then, mentioned above, are as follows:—

(1) The ferric hydroxide was precipitated at a temperature of 70° C. and allowed to stand 10 minutes at this temperature instead of precipitating in the cold and then warming to 60–70° and keeping at that temperature for 10–15 minutes.

(2) The excess of ammonia added was 5 c.c. of ammonia sp. gr. 0.88. The necessary excess is not stated by Lunge.

(3) The volume of solution after washing the precipitate of ferric hydroxide was found to be 340 c.c. The volume was not reduced by evaporation, but the solution was exactly neutralised at once (using methyl orange as indicator), with  $\text{HCl}$ , an excess of  $\text{HCl}$  added and the  $\text{BaSO}_4$  thrown down by  $\text{BaCl}_2$  in the boiling hot solution.

(4) The excess of  $\text{HCl}$  added was 1 c.c. of  $\text{HCl}$  sp. gr. 1.17. The amount of excess most desirable is not stated by Lunge.

The statement is made by Lunge and also by Treadwell that the volume of liquid after washing the ferric hydroxide precipitate can be easily kept as low as 300 c.c., and that, if it be more, it should be concentrated before precipitating with  $\text{BaCl}_2$ . I find it not very easy to keep the bulk of liquid as low as 300 c.c., though, with care, it can be done. But even should the volume reach 400–450 c.c., I have found it quite unnecessary to concentrate the liquid.

I find the time required to wash the ferric hydroxide precipitate properly is, as stated by Lunge, from  $\frac{1}{2}$ –1 hour.

In the analyses of the samples of pyrites the amount of barium sulphate carried away in solution in the filtrates and wash-waters was determined and allowed for; the amount contained in these usually amounted to 0.003 grms. under the conditions of the experiment. It is clear that if the re-agents employed were absolutely free from sulphur, this amount would always have to be determined (or a constant allowance made). If, however, as is usually the case, the reagents used contain more than this amount, then not only the filtrate from the main barium sulphate precipitate, but also the filtrate in the "blank," carries away this amount of barium sulphate. Each of these precipitates, then, being below the truth by the same amount, the difference between them is the same as though both were accurate, and there is no need to evaporate the filtrates and determine the barium sulphate they contain. It is thus an advantage that the reagents should contain sulphur to this extent.

Finally, it may be mentioned that the figures obtained for the sample of pyrites tested, which was sent to me direct from Dr. Lunge, and three determinations of the sulphur in which were made, agreed among themselves within 0.02 per cent., and differed from two determinations of Dr. Lunge's on the same pyrites by less than 0.1 per cent.

Dr. Lunge was good enough, at Dr. Pattinson's request, to make a number of experiments on the three points of (1) temperature of precipitation of the ferric hydroxide, (2) amount of excess of ammonia advisable in precipitating the ferric hydroxide, (3) amount of excess of hydrochloric

acid advisable before precipitating with barium chloride. The results of these experiments, and Dr. Lunge's general conclusions, are as follows:—

(1) The temperature of precipitation of the ferric hydroxide is of no consequence, so far as the freedom of the precipitate from basic sulphate is concerned; but precipitation at 70° C. has the advantage over precipitation in the cold and subsequent heating that the ferric hydroxide can be more quickly washed. (2) An excess of ammonia of 2 c.c. (sp. gr. 0.915) is sufficient to avoid any sensible contamination of the ferric hydroxide with sulphate. This excess may be increased without disadvantage to 7 c.c. (equivalent to 5 c.c. of solution of sp. gr. 0.880); but with larger excess, say, 15 c.c., the ammonium chloride formed keeps sensible quantities of barium chloride in solution. (3) If the excess of hydrochloric acid is greater than 1 c.c. (say, 3–6 c.c.), sensible quantities of barium chloride are precipitated with the sulphate.

Accurate results are obtained by following Dr. Pattinson's recommendations (5 c.c. of ammonia and 1 c.c. of hydrochloric acid beyond the quantities required for precipitation or neutralisation), and it is quite unnecessary to determine the quantities kept back in solution or in the precipitates, as the errors in question are balanced by the sulphuric acid contained in "chemically pure" reagents, obtained from first-class dealers.

#### SOME SOURCES OF ERROR IN SULPHUR DETERMINATIONS.

*Communicated from J. and H. S. Pattinson's Laboratory, Newcastle-on-Tyne, by JOHN PATTINSON, F.I.C., AND J. T. DUNN, D.S.C., F.I.C.*

Two sources of error in sulphur determinations, both of which may assume considerable importance where small amounts of sulphur have to be determined, have recently come under our notice.

Some of the red india-rubber corks commonly used for wash bottles are acted on by boiling water or steam, and give up sulphuric acid to the water. This is probably due to the oxidation of sulphur used for vulcanising or of metallic sulphides (such as antimony sulphide) which have been added to the rubber. If such a bung be boiled for a few minutes with water and the water be then tested with barium chloride it will be found to contain an amount of sulphur sufficient to introduce serious error into the determination of sulphur in, say, an iron or steel.

The other source of error lies in the presence of soluble sulphur compounds in commercial barium chloride. We find that many samples of barium chloride when dissolved in water, and oxidised with a drop of nitric acid or bromine and boiled, yield a precipitate of barium sulphate. This is no doubt due to the barium chloride having been manufactured from heavy spar by reduction to sulphide and subsequent treatment with hydrochloric acid, some soluble unoxidised sulphur compound being retained in the crystals of barium chloride. We have



found, in a sample of chloride of barium sold as pure, a quantity of sulphur which would, in testing an iron or steel, have increased the sulphur result by 0.02 per cent.

## New York Section.

*Meeting held at the Chemists' Club, on Friday,  
November 25, 1904.*

DR. RUSSELL W. MOORE IN THE CHAIR.

### THE USE OF TANNIC ACID IN DETERMINING ALUMINA.

BY ROBERT E. DIVINE.

In carrying out a series of complete analyses of clay, considerable difficulty was experienced by the writer in accomplishing a sufficiently rapid and accurate determination of alumina. It is well known to those who are familiar with this determination that to filter alumina and wash it free from chlorides is a difficult matter. The use of tannic acid has afforded the writer such valuable results that it seemed desirable to invite general attention to its value in effecting the precipitation of alumina in a form which admits of satisfactory and easy filtration and washing. In this connection it is assumed that it is always necessary to make a double precipitation of alumina if it is associated in solution with any considerable quantities of other salts.

If to a solution containing approximately 0.1 gram. of alumina there be added 2 c.c. of a 2½ per cent. solution of tannic acid, then ammonia in slight excess, and the solution boiled until the odour of ammonia has almost disappeared, alumina is precipitated in a form which filters very readily with the aid of a "suction tube," and permits of washing free from chlorine. Some doubt was at first entertained as to whether, in presence of considerable quantities of lime and magnesia, the presence of tannic acid would interfere with their separation, and the subjoined experiments were carried out to decide this point. The results are in every way satisfactory.

Solutions were made up as follows:—

1. Standard aluminium chloride solution, made by dissolving metallic aluminium in hydrochloric acid, and containing 0.095 gram. alumina in 25 c.c.
2. Standard lime solution containing approximately 0.1 gram. CaO in 25 cc.
3. Standard magnesia solution, containing approximately 0.1 gram. MgO in 25 c.c.
4. A solution containing 40 grms., each of potassium and sodium chlorides (80 grms. of salts) per litre.

These solutions were carefully standardised, and a blank determination of alumina and magnesia made on the mixed solutions, leaving out in each case the standard aluminium and magnesia solutions respectively. Then 25 c.c. each of the aluminium chloride, lime and magnesia solutions, and 50 c.c. of the salt solution were measured into a platinum dish, alumina precipitated with aid of tannic acid as above, filtered and washed with hot water three times, then washed back into the platinum dish and redissolved in hydrochloric acid, reprecipitated with ammonia and washed practically free from chlorine.

The filtrates from alumina were concentrated in a platinum vessel, made alkaline with ammonia, and the slight trace of alumina so obtained filtered off and added to the main precipitate; then the lime was precipitated with ammonium oxalate and weighed as CaO. It was found necessary, in presence of so much magnesia, to make a second precipitation of lime in order to completely free it from magnesia. Accordingly the ignited calcium oxalate was dissolved in dilute hydrochloric acid and reprecipitated with ammonium oxalate and ammonia.

In standardising the aluminium chloride solution tannic acid was used with this modification: the filtrates from alumina were evaporated with addition of a little

sulphuric acid, and finally ignited until sulphuric was expelled and all tannic acid removed; the residual trace in the platinum dish was treated with concentrated hydrochloric acid and finally with ammonia, and the trace of alumina filtered off and added to the main precipitate. Results follow:—

Standards.		Found in mixture.	Blank.	Corrected.
Alumina $Al_2O_3$		$Al_2O_3$	$Al_2O_3$	$Al_2O_3$
1	0.0950	0.0953	0.0002	0.0951
2	0.0945	0.0952	0.0002	0.0950
3	0.0950	0.0952	0.0002	0.0950

### LIME, CaO.

Standard.		1st precipitation.	2nd precipitation.
1	0.1030	0.1072	0.1030
2	0.1024	0.1057	0.1023
3	0.1027	0.1063	0.1019

### MAGNESIA AS $Mg_2P_2O_7$ .

Standard.		Found in mixture.	Blank.	Corrected.
1	0.2750	0.2805	0.0015	0.2790
2	0.2757	0.2799	0.0015	0.2784
3	0.2764	0.2817	0.0015	0.2802

The results on magnesia calculated to MgO are:—

Standard.		Found in mixture (corrected).	
1	0.0998 MgO	0.1010	MgO
2	0.0998 "	0.1008	"
3	0.1001 "	0.1014	"

In the above alumina determinations, the trace of alumina found in the filtrates was ignited and weighed with the main precipitate. It was thought of interest to make a few determinations without recovering the alumina in filtrates, and to make a few with addition of ammonium chloride to the aluminium solution before precipitating. In the first six of the following determinations 25 c.c. of aluminium solution was taken, in the remainder double this amount:—

1	0.0939	Without ammonium chloride.
2	0.0938	
3	0.0943	
4	0.0937	With 1 gram. ammonium chloride.
5	0.0940	
6	0.0950	
7	0.1895	Alumina in filtrate not recovered.
8	0.1894	

Four determinations were now made to ascertain how much alumina passed into the filtrate. Ammonium chloride was added in each case.

Main precipitate.		Residual in filtrate.	Total.
$Al_2O_3$		$Al_2O_3$	$Al_2O_3$
9	0.1897	0.0002	0.1899
10	0.1892	0.0002	0.1894
11	0.1902	0.0002	0.1904
12	..	0.0002	..

Small amounts of iron precipitated with alumina do not interfere with filtration. It is the writer's belief that large quantities of ferric hydroxide mixed with alumina would filter readily. Pure ferric hydroxide in presence of tannic acid does not filter satisfactorily.

## THE DETERMINATION OF ROSIN IN SHELLAC.

By A. C. LANGMUIR.

The presence of rosin in shellac has long been suspected and complained of. Always a serious question, conditions of late have become little short of scandalous. This has been due to the scarcity of shellac and the marked increase in its price. Tempted by the profit to be made in selling rosin costing 2 or 3 cents in the form of shellac at 50 cents, and undeterred by any fear of a complaint fortified by incontestable chemical evidence as to the percentage of rosin present, adulteration has gone on unchecked. Objections that a shellac has given trouble in bleaching, or worked badly in a varnish or cement, are met by the statement that in colour and general appearance the sample is up to the standard. As long as these points are the only ones considered between sellers and buyers the condition of the trade will remain as it is, and little improvement in quality can be looked for. It is only by a systematic chemical examination of shellac that progress can be made. Against this, in the past, has stood the lack of an accessible method described in detail, so that concordant results could be obtained by different chemists. I trust that the method to be described will prove of service in this respect.

The literature on the testing of shellac is meagre. Schmidt and Erban (*Zeits. angew. Chem.*, 1889, 35), in a study of the iodine absorption of resins, find, in the case of brown shellac, an absorption of 8.3 and 6.0 per cent. Curiously, with an orange shellac they found no absorption. Williams (*Chem. News*, 58, 224) obtained iodine figures for various grades of shellac ranging from 17.5 to 28.7. Some of these were unquestionably impure. Parry (*Chemist and Druggist*, Jan. 31, 1903) finds that pure lacs give iodine numbers varying between 7.5 and 11. Rudling (*Chem. Rev. Fett u. Harz Ind.*, 1903, 51) found values between 3.6 and 7.5, button lacs 19.0 to 23.3. Tschirch ("Harz und Harz behälter") and Dieterich ("Analyse der Harze" and various papers) urge the uselessness of iodine absorption tests in the valuation of rosins. In so far as this applies to shellac they are mistaken. Worstall (*J. Amer. Chem. Soc.*, 1903, 860) draws the same conclusion in regard to copals. The variation between iodine values, as obtained by different observers, cannot be urged as an objection against the method, for (1) Their samples may not have been pure. (2) It will be shown that conflicting results are obtained by variation in the details of the method.

Mangold (*Zeits. anal. Chem.*, 1894, 477) proposes the use of the Hübl method in determining the proportion of rosin and shellac in sealing wax, forgetting that the presence of turpentine would render the method useless. Ulzer and Defris (*Zeits. anal. Chem.*, 1897, 36) base a separation on the difference of behaviour of the rosin and shellac acids in Gladding's and Twitchell's methods. There are many sources of error, however, and the method is only a rough approximation, although Parry, in a modification of his own, obtains fair results. Dieterich (*Chem. Rev. Fett u. Harz Ind.*, 1901, 223), after trying to solve the problem by determinations of the acid, ester and saponification numbers, concludes that such determinations are worthless, on the ground "dass die Grenzzahlen der Handelsorten sich in erschreckend weiten Bahnen bewegen." He falls back on the action of solvents as offering the only method leading to quantitative results. Tests quoted by him, however, are far from encouraging.

**Petroleum Ether Extraction.**—Rosin is almost completely soluble in petroleum ether, shellac only sparingly. A separation of a fused mixture of the two is practically impossible, however, as the insoluble shellac protects the rosin from solution. This error is the greater the coarser the particles extracted. Shellac wax, which is always present, is soluble in petroleum ether, and is a disturbing factor. It may be removed and the shellac obtained at the same time in a finely-divided state by dissolving the shellac in warm dilute sodium carbonate solution, cooling and filtering off the wax. The shellac is thrown out of the filtrate by acid, filtered on a Buchner funnel, washed and dried. In this condition it is wax-free and in a very finely divided state, offering the most

favourable chances for a successful extraction of rosin.

A button lac of poor quality, known to contain rosin, was finely ground. 5 grms. were extracted in a Soxhlet apparatus for 5 hours. 5.07 per cent. of soluble matter was obtained, largely, wax. An additional treatment of 5 hours gave a further 0.48 per cent. The same button, purified as above and extracted for the same time, gave 1.55 per cent. to the ether. A pure button freed from wax and extracted with petroleum ether gave 0.38 per cent. soluble matter.

Seven bleached shellacs of American make were finely pulverised and passed through an 80-mesh sieve; 10 grms. was extracted for 5 hours. The samples showed respectively, 1.05, 1.08, 1.84, 1.75, 2.43, 4.23, and 4.30 per cent. soluble in petroleum ether. A pure bleached ralli sample gave 3.35 per cent. soluble. The residues from the evaporation of the ether were of a waxy character and showed no indications of rosin.

A poor quality of TX, finely ground and extracted for 5 hours, gave an extract of but 1.6 per cent. A good TX gave 0.6 per cent. The wax was not removed in these tests. Better results were obtained with freshly-prepared artificial mixtures of rosin and shellac, but they were far from the truth.

No safe inferences can be drawn from the results of a petroleum ether extraction, either in the original shellac or the shellac freed from wax.

A published test for rosin is to shake the petroleum ether extract with a little water containing some copper acetate. The ether layer will be coloured emerald green if rosin is present. In our hands artificial mixtures of shellac and rosin failed to show the latter, if less than 15 per cent. were present.

**Iodine Absorption.**—The most valuable paper yet published on testing shellac is one by Parry (*Chemist and Druggist*, Jan. 31, 1903). The author evidently had access to a great variety of grades, pure and impure, and gives the results of his tests by the iodine method, together with some check analyses on artificial mixtures of rosin and shellac. The latter showed a very satisfactory agreement with the theory. Unfortunately, Parry gives no details whatever as to the kind of solution used, excess of reagent, time of reaction or temperature. It will be shown that these points are of vital importance if the method is to give the same results in different hands.

Parry sets the maximum absorption of a pure shellac at 9 per cent. For rosin, he takes the iodine value at 125. Unless all the conditions of Parry's experiments are known, it would be unsafe for other chemists to adopt these values in their work. Schmidt and Erban, using Hübl's solution, find a value for rosin after 24 hours of 116.8. Worstall obtains a value of 170, using a large excess of Hübl's solution, and standing 18 hours. Ingle (this J., 1904, 425), using Wijs' solution, time  $\frac{1}{2}$  to 1 hour, gets 150.

If Wijs' solution, rather than Hübl's, be used in the test for rosin, there is the great advantage that a qualitative reaction is furnished, simultaneously with the quantitative determination. Furthermore, if the details to be given are followed, a higher number for rosin is obtained than heretofore, and the difference between the absorption of rosin and that of shellac is so great, that a very satisfactory basis for calculation is furnished, and the method gains greatly in sensitiveness and accuracy. Shellac stands alone among the rosins in its low iodine absorption. Rosin has an uncommonly high absorption.

Ingle (this J., 1902, 587) states that "all ordinary oils merely reduce the intensity of shade of Wijs' solution by absorption of iodine chloride. Boiled and blown oils colour Wijs' solution red-brown." Shellac has no effect on the colour of Wijs' solution (except after long standing); rosin, even when mixed with shellac in small amount, speedily produces a characteristic red-brown coloration in proportion to the quantity present. By comparison with artificial samples, containing known proportions of shellac and rosin, a fair colorimetric estimation can be made.

There is no trouble whatever in preparing the Wijs' solution. It is more active than the Hanns solution, and a smaller excess is required. The use of the latter should be discouraged as tending to a troublesome duplication of data. Four litres at a time is prepared.



Glacial acetic acid was used. The acid should always be tested for reducing impurities; 51 grms. of finely divided iodine is dissolved at a gentle heat. A portion of about 250 c.c. is set aside; 20 c.c. is taken for titration. Suppose 20.7 c.c. of sodium thiosulphate solution are required. Pure chlorine is passed into the remaining solution until the characteristic colour change takes place; 20 c.c. of this are titrated. Suppose the amount required to be 41.7 c.c. The unchlorinated portion is now added until the titer is reduced to 0.1 or 0.2 c.c. less than  $2 \times 20.7$  c.c. or 41.4 c.c.

The deci-normal sodium thiosulphate solution is best standardised directly against iodine, sublimed from a tube containing a mixture of iodine with 20 per cent. of potassium iodide, into a weighing bottle 6.5 x 1.5 cm. diameter. The first vapours are rejected. After weighing the iodine is dissolved in strong potassium iodide solution, and shaken up in the weighing bottle.

*The Method.*—0.2 gm. of ground shellac is introduced into a 250 c.c. bottle with ground stopper; 20 c.c. of glacial acetic acid is added, and the mixture warmed gently until solution is complete (except for the wax). A pure shellac is rather difficultly soluble. Solution is quicker according to the proportion of rosin present; 10 c.c. of chloroform is added and the solution is cooled to 21° to 24° C. The temperature should be held between these limits during the test. The colour at this stage is a light yellow. Little difference is noticeable between shellacs, the lac dye having little effect; 20 c.c. of Wijs' solution is added from a pipette, the end of which has been heated to somewhat diminish the size of the orifice. The bottle is closed and the time noted. The solution is stood in a dark place. Pure shellacs will scarcely alter the colour of the Wijs' solution. If in small amount, rosin will produce a slowly appearing red-brown colour. In large amount, rosin causes an immediate coloration, increasing in intensity as time passes. After 1 hour, 10 c.c. of 10 per cent. potassium iodide solution is added. The solution is immediately titrated with  $N_{10}$  thiosulphate solution; 25 c.c. or 30 c.c. may be run in immediately, unless the shellac is very impure, and the remainder gradually, with vigorous shaking. Just before the end, a little starch solution is added. The end point is sharp, as the reaction products of shellac remain dissolved in the chloroform. Any colour remaining after a half minute or so is disregarded.

A blank determination should be run with 20 c.c. of Wijs' solution, 20 c.c. of acetic acid and 10 c.c. of chloroform. The blank is necessary on account of the well-known effect of temperature changes on the volume.

Example:—

Ralli shellac 0.2 gram.  
Blank 20 c.c. Wijs' solution 41.1 c.c. hypo. 1 c.c. = 0.123 I  
Required in test .... 35.6 " "

Equivalent to iodine absorbed 5.5 "  
 $5.5 \times 100 \div 0.123 \div 2 = 33.9$  per cent. iodine absorbed.

In testing rosin, 0.15 gm. with 20 c.c. acetic acid, 10 c.c. chloroform and 40 c.c. Wijs' solution is used, the other conditions as to time and temperature remaining exactly as with shellac. With bleached shellacs 0.4 gm. is taken, other conditions remaining unchanged.

*Effect of Dirt, Orpiment, Wood, &c.*—The only effect noticed was due to the lowering of the iodine absorption by the presence of extraneous matter, less shellac being present to absorb iodine. Except in very dirty samples this error is negligible.

*Influence of Time.*—This is an important factor, as the following experiments show. Conditions were precisely as given in the method above, except for the variation in time.

Iodine Absorption.			
Time.	Pure Button Lac.	Light Rosin "M"	"WW" Rosin.
Hour.	Per Cent.	Per Cent.	Per Cent.
$\frac{1}{4}$	8.3	222.3	—
$\frac{1}{2}$	16.0	233.4	250
1	17.2	253.0	—
2	18.5	252.0	279.1

*Influence of Temperature.*—Other factors remaining unchanged, the temperature was varied; time one hour.

Iodine Absorption.		
Temperature.	Pure Button Lac.	Light Rosin "M."
°C.	Per Cent.	Per Cent.
12	10.8	209.5
22	16.6	235.0
33	22.4	265.6

The shellac and rosin used in each series are the same. The agreement between the respective rosin and shellac values is noteworthy in the two series where the conditions are identical, i.e., shellac 16.0 and 16.6; rosin, 233.4 and 235.0.

*Excess of Wijs' Solution.*—No experiments were made, a liberal excess being used in all tests.

*Effect of Light.*—No experiments were made in direct sunlight. Comparative tests on shellac and rosin showed no differences between darkness and moderate light lying outside of experimental errors.

*Effect of Shellac Wax.*—The wax has an absorption of only 4.5 per cent., and can be disregarded.

An examination of the above results is convincing as to the necessity for keeping the time and temperature constant. If these conditions are observed, concordant results can invariably be obtained on well-mixed samples. Duplicates will not agree as closely as those obtained with non-drying oils, but on account of the enormous difference in iodine absorption between shellac and rosin, a slight variation in the iodine value between duplicates is of little consequence.

*Iodine Absorption of Shellac.*—A series of standard samples of shellac obtained from a well-known firm gave iodine absorption values of 16.0, 15.4, 16.0, 13.5, 15.1, 19.7, 21.5, 14.8, 17.2, 18.5, 16.0, 31.4, 15.4, 15.4, and 26.5.

The following samples of pure shellac were drawn from cases or large lots:—

Shellac.	Iodine Absorption—Per Cent.
DC .....	15.9
Good Ralli .....	16.0
" TN .....	17.7
" Button (year 1897) .....	15.8

Many other analyses of shellacs, which have bleached well and gave no evidence of rosin in any way, gave iodine values of 18 or less.

After a consideration of the iodine values of the better grades of standards and the others given, it must be admitted that it is perfectly fair to take as the iodine number of a shellac free from rosin the number 18. If anything, this value favours the dealer, for an absolutely rosin-free shellac undoubtedly has a value below this. Roughly speaking, it could be said that a shellac with a value 18 or less would be a good shellac. Such a shellac will give good results when used; 18 to 23 would be a fair shellac. At 23, various qualitative tests for rosin begin to reveal its presence; 23 to 28 would indicate a poor shellac; 28 to 33 bad. A shellac above 33 is grossly adulterated.

*Iodine Absorption of Rosin.*—Various rosins show considerable differences in their ability to absorb iodine. The samples are of American origin only:

Iodine Absorption—Per Cent.	
Rosin.	235
" M "	262.5
W.W. 1	228.4
" 2	244.6
" 3	224.3
" 4	217.5
" 5	233
H 1	225.6
" 2	175.7
Dark 1	178
" 2	

The light coloured, soft varieties of rosin would probably have the highest iodine values, as they contain more residual turpentine after the distillation of the latter.

*Calculation of the percentage of Rosin.*—In all probability, light rosins are used in the adulteration of button lac. A small piece of rosin found in a case of button was of the light variety, and had an iodine absorption of 202. In another case, part of a stave from a rosin barrel which

had contained light rosin was found. In determining the rosin in button lac, a value for rosin well above 200 should be taken. The average of a number of tests on light rosins was 228, and we have taken this figure as representing a fair average absorption for rosin.

The darker coloured shellacs, Ralli and TN, are probably adulterated with the cheaper dark rosins. The Agricultural Ledger, No. 9, 1901, states that a common grade of American rosin is used in adulterating shellac. The average absorption of such rosins would probably be below 200. On account of the uncertainty, we have preferred to use as a basis in calculating the per cent. of rosin the value 228 for all shellacs, low or high grades. The results are probably closer to the truth in button lacs than in Ralli and TN. By taking the number as high as 228, however, no injustice can be done to the dealer, as any error would be in the direction of low results for rosin.

The use of fmetallic resinsates, ester gums, glycerin-rosin compounds, &c., is very unlikely on account of their expense. Metallic compounds would reveal themselves in the ash of the shellac. Analyses of ash from various crude shellacs reveal nothing of this nature. Furthermore, no rosin preparation can be used in which the rosin has lost its solubility in alcohol. Such preparations have a lower iodine value than rosin itself. Any manipulation of the rosin, such as long exposure, heating, &c., would result in a lowering of the iodine absorption due to oxidation. A "W.G." rosin, iodine absorption 226, was pulverized and spread out on glazed paper. After three weeks the iodine value had dropped to 193.

If Y = per cent. rosin, M = iodine number of shellac, N = iodine number of rosin, A = iodine number of mixture

$$\text{Then } Y = \frac{100(A - M)}{N - M}.$$

Taking the iodine numbers of shellac and rosin at 18 and 228, respectively, we have in the case of a TN shellac giving a number of 33.9.

$$\text{Per cent. rosin} = \frac{100(33.9 - 18)}{228 - 18} = 7.6.$$

If a rosin of 190 value had been used we should have 9.2 per cent. rosin. It is safe to say, therefore, that in the above case we are certain that there is at least 7.6 per cent. rosin present.

The following tables, based on the values shellac 18, rosin 228, will give an idea of the relation between iodine absorption and per cent. rosin.

Iodine Number.	Per cent. Rosin.	Iodine Number.	Per cent. Rosin.
18.00	—	65.25	22.5
23.25	2.5	70.50	25.0
28.50	5.0	75.75	27.5
33.75	7.5	81.00	30.0
39.00	10.0	86.25	32.5
44.25	12.5	91.50	35.0
49.50	15.0	96.75	37.5
54.75	17.5	102.00	40.0
60.00	20.0		

*Extent of Adulteration.*—The following results were obtained on samples taken from large lots of TN and Ralli shellac landed at New York during the past year:—

Shellac.	Iodine Number	Per cent. Rosin
Ralli, free..	26.5	4.0
" " " "	31.4	6.4
" " " "	28.7	5.1
TN " " "	35.7	8.4
" blocked " " "	40.1	10.5
" " " "	42.7	11.8
" " " "	30.6	6.0
TN, matted " " "	45.9	14.7
" blocked " " "	63.0	21.4
" free " " "	22.9	2.3
" blocked " " "	27.3	4.4
Ralli, free..	19.7	0.8
" " " "	15.0	—
TN, " " "	17.2	—
" " " "	16.6	—
" " " "	15.4	—
Ralli, blocked	33.8	7.5

The tests given were taken at random from a large number. The rosin-free shellacs are in a decided minority and the extent of adulteration shown is deplorable.

Any shellac will block if the temperature is high enough, and a blocked article is not necessarily adulterated. Rosin, however, facilitates blocking by lowering the melting point, and there is no doubt of the increase in blocked goods of late.

The adulteration practiced with TN and Ralli is far surpassed in the case of button lacs. With the exception of one brand, not a single sample of genuine button has been met with in the past year.

Button Lac.	Iodine Number.	Per cent. Rosin.
Ruby .. ..	73.6	26.5
Sapphire .. ..	70.4	25.0
Amethyst .. ..	77.4	28.3
Turquoise .. ..	68.5	24.0
Special .. ..	85.5	32.2

The average of thirty samples of button gave 57.8 iodine absorption corresponding to 18.9 per cent. rosin.

*Accuracy of the method.*—As a check on the method, a series of melts of shellac and rosin were made. Button lac was used on account of its ready fusibility; 100 grm. portions were cautiously melted on the sand bath. The loss was 1.25 to 1.50 per cent. The very fair agreement between results and theory shows that melting rosin and shellac together at moderate temperatures has no effect on the iodine absorption.

#### SERIES I.—Button Lac 22.9. Dark Rosin 178.

	Iodine Number.	Per cent. Rosin Found.
10 per cent. rosin ..	40.8	11.5
20 " " " " ..	56.7	21.8
30 " " " " ..	69.8	30.0

#### SERIES II.—Button Lac 20.7. Light Rosin 264.3.

	Iodine Number.	Per cent. Rosin Found.
10 per cent. rosin ..	45.1	10.0
20 " " " " ..	65.8	18.5
20 " " " " ..	66.6	18.8

#### Series III.—Button Lac 16.2. Light Rosin 223.9.

	Iodine Number.	Per cent. Rosin Found.
3 per cent. rosin ..	23.7	3.6
5 " " " " ..	26.2	4.8
10 " " " " ..	38.65	10.8
15 " " " " ..	48.0	15.3

It will be seen that the addition of even 3 per cent. rosin has a marked effect on the iodine value, increasing it from 16.2 to 23.7.

*Physical properties.*—In the case of the superior grades, SS, VSO, &c., the colour is of some assistance as a guide to purity. When we come to the lower grades, Ralli and TN, it is of uncertain value. With button lacs the colour is no indication whatever of purity. Strength and fracture are also tests of doubtful character. The powdered sample in some grossly adulterated shellacs (about 20 per cent. rosin) will sometimes give evidence of rosin in the odour and stickiness when rubbed between the fingers.

If the sample is prepared for analysis by grinding in a coffee mill, some indications as to purity are obtained in the strong electrical properties shown by the pure shellac, the powder obstinately adhering to the grinding plates and receiver.

*Bleaching test.*—This is a practical test which may be used as a confirmation of the determination of rosin by



the iodine absorption. There is a close connection between the latter and the quantity of bleach required to bleach a shellac properly.

1 oz. (28.35 grms.) of the ground shellac is transferred to a large beaker, and 350 c.c. of water and 5 grms. dry sodium carbonate added. The open beaker is heated on the water bath with frequent stirring until solution of the shellac is complete. For comparative purposes a standard sample of pure shellac (*i.e.*, one with an iodine value of 18 or less) is treated in the same way. The beaker is removed from the bath and the odour of the contents noted. The characteristic smell of rosin is noticeable to most observers with shellacs carrying 10 per cent. rosin or more. With experience as little as 5 per cent. can be detected in this way.

Shellacs containing 10 per cent. or over generally show a flocculent separation. On continued heating this will often collect on the surface in a sticky mass enclosing some shellac. This shows unmistakable properties of rosin. Such a separation from a poor TN showed an absorption of 80 per cent. With pure shellacs the solution is clear, except for the semi-transparent minute particles of undissolved shellac wax.

The solution is allowed to stand for fifteen minutes and decanted through a fine sieve from the sediment of sand, orpiment, &c. The amount of residue in the beaker will give a fair idea of the quantity of mineral matter present. It may be washed by decantation, rinsed into a platinum dish, dried and weighed for a rough determination.

The shellac solution is allowed to cool to about 40° C., and 150 c.c. of sodium hypochlorite solution is added. This should be of such strength that 10 c.c. are equivalent to 32 c.c. of  $N_{10}$  sodium arsenite solution. If not of this strength, a volume equivalent to 150 c.c. is used.

The colour due to lac dye is rapidly bleached. A yellowish colour remaining will persist several hours before the final cream colour is obtained; 150 to 175 c.c. will suffice for the bleaching of a pure shellac. Greater amounts of bleach running up to 250 and 300 c.c. will be required if rosin is present. Rosin will absorb much more bleach than shellac and will not bleach as white even with large quantities, a persistent yellow colour remaining with badly adulterated samples.

The solution should be tested for chlorine from time to time with potassium iodide-starch paper. With pure shellac the solution will react for hours, often over night. If much rosin is present, the excess of bleach is rapidly destroyed, sometimes within twenty minutes and additional bleach should be added. It is, of course, important, especially for those lacking experience, to run a test side by side with a shellac of known purity.

After bleaching is complete, the shellac is precipitated with dilute acid, filtered, washed, dried and dissolved in alcohol in the proportion of four pounds to the gallon (20 grms. to 42 c.c.). The colour of the varnish is compared with that prepared from the standard or a good grade of bleached shellac.

**Storch-Morawski Reaction.**—This well-known test for rosin in fats and oils, depending on the red-violet colour produced on adding a drop of strong sulphuric acid to the solution in acetic anhydride, may be applied successfully to shellac.

A little shellac is dissolved by gently warming with acetic anhydride, and a drop of sulphuric acid added to the cooled solution. A distinct reaction is obtained with 10 per cent. rosin, a doubtful test with 5 per cent.

The following modification renders the test more sensitive. One gram of the sample is treated with 15 c.c. of acetic anhydride. The mixture is gently warmed on the water bath until solution is complete, and cooled by standing in cold water. Rosin remains in solution. The greater part of the shellac separates as a gelatinous mass, which is filtered off. In this way the rosin is concentrated in the filtrate. The test-tube is inclined, and a couple of drops of strong sulphuric acid allowed to flow down the side, agitating the liquid a little as the acid meets it. A coloration, which soon disappears, is obtained with as little as 2 or 3 per cent. of rosin. A pure shellac gives no coloration if care has been taken to avoid charring.

**Bleached Shellac.**—As is to be expected, bleached shellac will absorb less iodine than the crude. It is less easy to detect intentional adulteration here, as it is generally beyond the power of the bleacher to procure a rosin-free shellac to begin with. Rosin carried through the bleaching process loses materially in iodine value. A light rosin with an iodine number of 230 bleached in the laboratory showed a reduction to 121. Nevertheless, an addition of rosin to the final product may be detected without great difficulty in the higher iodine number and colour reaction with Wijs' solution. A series of American bleached shellacs gave iodine numbers of 9.6, 7.3, 8.9, 9.9, 7.6, 7.0, 6.0, 8.3, 9.6, 19.8, 21.4, 16.3. An extra white sample gave 4.1.

The three samples with high iodine values are either adulterated by the bleacher or made from a crude shellac high in rosin.

A bleached shellac of good colour will generally run about 8. Anything much over 10 would point to sophistication. The determination of the proportion of added rosin could be made by substituting in the formula the values 10 and 228.

**Shellac Varnish.**—Starting out with an adulterated shellac, the varnish maker, secure in his belief that rosin cannot be detected in the solution, proceeds to add still more rosin. What has been said in regard to adulteration of shellac fades into insignificance in comparison with that practiced in the manufacture of shellac varnishes. Shellac varnishes are sold containing no shellac. "Pure" shellac varnishes, grain alcohol, may be purchased at less than the cost of the alcohol. It is, however, easy to detect adulteration. Those who have ever seen a genuine white shellac varnish freshly prepared (and many users have never seen it) should be able to recognise the presence of rosin by the yellow colour of the false article. The characteristic waxy, streaky appearance on the bottle above the level of the liquid is an evidence of shellac wax, which becomes less and less apparent as the varnish is adulterated with wax-free materials.

Adulterated orange shellac varnishes are not readily identified by the colour. Some substitutes are nothing but a solution of Kauri chips in a mixture of wood alcohol and benzene. Alcohol added to such a mixture produces a precipitate.

**Determination of the Strength or Body of Varnishes.**—0.75 to 1 gm. of the varnish is weighed into a weighed platinum dish and evaporated on the water bath to constant weight (for about 5 hours). The result is calculated in pounds per gallon. Taking the weight of a gallon (231 cu. in.) of wood alcohol at 60° F. as 6.75 lb., we have:—

Pounds per Gallon corresponding to	Per Cent. Dry Resin.
3	30.77
3.5	34.15
4.0	37.20
4.5	40.00
5.0	42.55
5.5	44.90
6.0	47.06
6.5	49.05
7.0	50.91
7.5	52.63
8.0	54.23

**Examination of the Solvent.**—100 grms. of the varnish is distilled until incipient decomposition, and the distillate again distilled. The boiling point will differentiate between grain and wood alcohol. A test for acetone will distinguish between wood alcohol and Columbian spirit. On dilution with three or four volumes of water, benzene will separate if present.

**Detection of Adulterants.**—The commonest one met with is rosin. The residue, after drying the varnish in the determination of strength, may be used directly for this test, by solution in 20 c.c. glacial acetic acid. If much rosin is present solution will be easy and rapid. The iodine number is then determined as described.

The residue in the case of white shellac varnishes will, if pure, lie between 10 and 15. With pure orange shellac varnish it should run 20 or under, provided a good grade of crude shellac has been used. If not, it may run as high as 30. Anything much higher than 30 would point to adulteration by the varnish maker.

In calculating the per cent. of rosin in the residue, the values 228 for rosin, 18 for crude, and 10 for bleached shellac may be used. Here, again, it is more likely to be a hard rosin of lower iodine absorption which has been used. We are also confronted by the difficulty that other alcohol-soluble resins, such as Manila copal, gum sandarac, &c., may have been used alone or together with the rosin. We can only figure the adulteration in terms of rosin. Express the result in pounds per gallon.

Gum	Iodine Absorption.
Sandarac	160.6
"	174.8
Spirit Copal	118.0
Kauri	119.5
Acaroides	119.3

These values were determined by the standard method described. Their absorptions are less than that of rosin. They all colour Wijs' solution red-brown, and in some cases produce a turbidity, and, after standing, a precipitate. A study of the iodine absorption of these resins, together with an examination of the precipitate as to melting point, &c., might lead to useful results.

It will be seen that here, as well as in the crude shellac, any error will be in the direction of low results. I analysis shows a varnish to consist of 4 lb. of shellac and 1 of some other gum (assumed to be rosin) to the gallon we are certain that there is at least 1 lb. of foreign gum present. A knowledge of the market conditions will generally show whether the analysis is far out of the way.

If much rosin is present, it is not safe to take the residue after evaporation for analysis. A little rosin (iodine value 224.3) was dissolved in alcohol, evaporated on the water bath and heated 5 hours. It then showed a value of 148.2. Similarly, a dark rosin 175.7 fell to 131.

Wood alcohol has some effect on Wijs' solution. 20 c.c. Wijs' solution, which required 41.4 c.c. of hypo., fell to 41.0 c.c. after standing for an hour with 1 gm. of wood alcohol, 20 c.c. of acetic acid and 10 c.c. of chloroform. If sufficient varnish be taken to yield 0.2 gm. of residue and enough alcohol is evaporated to leave a pasty residue, this may be dissolved in acetic acid for analysis, and the error due to alcohol will be negligible.

#### AMERICAN SHELLAC VARNISHES.

Varnish.	Pounds per Gallon.	Iodine Number of Residue.	Solvent.
Substitute	3.75	136.1	Benzine and Wood Alcohol.
1 white	6.00	44.6	Wood Alcohol.
2 orange	7.00	48.3	" "
3	7.50	72.5	" "
4 white	7.00	57.0	" "
5 orange	7.50	33.0	" "
6 "	7.25	36.8	" "
7 "	7.50	70.0	" "
8 white	7.00	74.0	" "
9 "	7.75	77.8	" "
10 orange	5.00	58.6	" "
11	6.75	44.4	Col. Spirit and grain.
12 white	6.50	40.0	" " "
13 garnet	3.50	35.1	" " "
14 orange	4.50	19.3	Wood Alcohol.
15 white	6.00	46.8	Columbian Spirit.
16 "	4.50	10.0	Wood Alcohol.
17 "	4.50	23.8	" "
18 "	4.50	12.2	" "
19 orange	4.50	16.2	" "

Of the above only Nos. 14, 16, 18 and 19 are pure. A genuine shellac varnish is rarely met with.

*Colorimetric Test for Adulterants in Shellac Varnish.*—5 c.c. of glacial acetic acid and 5 c.c. of Wijs' solution are added to 5 drops of the varnish. A pure shellac varnish will remain a light yellow with a shade of red. An impure varnish will almost immediately assume a more or less deep reddish-brown colour. This test may be used with both white and orange shellac varnish. A shellac may be tested in the same way by first dissolving in alcohol in the proportion of 4 lb. to the gallon.

In conclusion, I wish to express my thanks to my assistant, Mr. F. S. White, for the careful work in which he has carried out the experimental work in connection with this paper.

NOTE.—After reading this paper my attention was called to a article by M. Wallerstein, "Brewers' Varnishes of Commerce," American Brewer, 1902, 1292 to 1296. Four tables are given containing the iodine absorptions, ester, saponification and acid values of shellacs, other resins, artificial mixtures with 25 to 50 per cent. of adulterant and residues from various shellac varnishes. Light coloured crude shellacs are stated to have iodine values of 8 to 11 dark 23 to 26. Neither Parry nor the author found any such gap between light and dark coloured pure shellacs. Wallerstein's dark samples were probably adulterated. The dark coloured genuine shellacs are admittedly adulterated with 6 to 10 per cent. resin and are largely used in brewers' varnishes. The only hint given as to the method employed is the statement that "the quantity of iodine which the unsaturated acid of shellac dissolved in alcohol is capable of absorbing is the iodine equivalent." The objection made to Parry's paper can be made here. With Hübl, modified Hübl, Wijs and Hanus' solutions all in the field, the time has passed when no description or only a loose description of the method employed can be given.

#### DISCUSSION.

Dr. WALLERSTEIN said he was very much interested in the paper, especially as his experiments were in the lines of some investigations which he carried out about three years ago. The results of these experiments were compiled in a paper read before the United States Brewmasters' Convention, November, 1902, and which appeared in the various brewers' journals ("American Brewer," "Brewers' Journal," "Western Brewer," and "Brewers' Review"). Shellac varnishes were used extensively in breweries where the large fermenting casks were coated in order to protect the beer from coming in contact with the wood. It was of the greatest importance for the purity of the beer that the coating should be resistant and not affected by the liquid. Many brewers have experienced that, notwithstanding the greatest care in varnishing was taken, the result had been disappointing. It was especially noted that the coating turned white as soon as the tubs were filled with beer. This phenomenon had been generally attributed to the improper application of the varnish. As, however, this whitening of the tub often appeared, and even in cases where the greatest pains were taken in applying the varnish, and as this phenomenon only appeared with certain varnishes, it seemed that the quality of the varnish and not the method of applying it was at fault. The various varnishes of commerce were, therefore, examined. A large number of samples of pure shellac and also a variety of rosin and gums (Manila, Kauri, Copal) were obtained and their properties, their solvating agents, and especially the iodine saponification, acid and ester values were determined. Based upon the results, he had been able to point out that pure shellac could be identified by its iodine, saponification, ester and acid values, and that the presence of adulterations could even be quantitatively determined. The brewers' varnishes of commerce were found to be greatly adulterated; in fact, some samples did not contain any shellac at all. He had since then often had the opportunity to prove the correctness of these investigations, and had always been in a position, on the strength of chemical analyses, to judge the quality and purity of the varnishes.

Mr. MAXIMILIAN TOCH said that the iodine absorption method had been used at their factory for the past two or three years, and they had arrived at the determination of the purity of rosins very much on the lines indicated by Dr. Langmuir. In the laboratory of their factory they had adopted both the Hanus and the Hübl methods but had lately discarded the Hübl for the Hanus method.

They had employed several methods for removing the wax contained in shellac. The first and simplest was to centrifuge the dissolved shellac, and the second method which could be sub-divided into any number of methods was the addition of lead or a zinc salt insoluble in water (such as zinc oxide, lead oxide, or lead carbonate) and shaking this into the dissolved shellac; by gravity the wax was carried to the bottom, and the clear shellac solution remained on top.

It appeared to him from the figures which Dr. Langmuir had obtained, that the figures that they obtained at their laboratory for the iodine absorption of shellac were comparatively lower, and he therefore suggested that a uniform method should be adopted for the determination of rosin in shellac, and that all those who were interested



in organic work of this kind should utilize the same methods, the same reagents, and the same standards.

It was a peculiar fact that in 1904 all the shellacs they had received from India, excepting the very dearest grades, were much inferior to those of 1903 and 1902. It might be possible that there was a climatic condition that affected the quality of shellac, as might occur, for instance, in linseed, or wheat, or any indigenous product. He understood that there had been a famine in India, and that conditions had been generally very poor, but that, of course, would not account for any admixture or adulteration of rosin with the shellac in a dry state. In their laboratory they had attempted to standardise and determine the peculiar reactions of all other varnish resins with a considerable degree of success.

Mr. LANGMUIR, in reply, said that he had examined all the standard periodicals in his review of the literature, but it had not occurred to him to look through the brewers' publication. He reiterated the statement that the colour was a poor guide to quality. Admitting that a shellac handler of long experience could recognise a bad shellac, he would have no idea of the proportion of rosin present. The method described was offered to chemists in order that without any special experience they would be able to pass on a shellac, and would be placed in a position to make a definite statement as to the rosin present so that a claim could be made. He recommended the colorimetric test with Wijs' solution as being one which could be used by the layman as well as the chemist. It was simple and reliable, and particularly useful in testing shellac varnish.

## A NEW CAUSTIC SODA PROCESS.

BY HANS A. FRASCH.

In course of investigations made by me some years ago for the Nickel Copper Company of Ontario for the purpose of evolving a practical chemical method for the separation of nickel from copper and other metals, I found that nickel and cobalt could be readily separated from copper by ammoniating a solution of these metals and precipitating the nickel and cobalt, in form of nickel- and cobalt-ammonium chloride, by the addition of sodium chloride to the ammoniated solution, the copper remaining in solution (U.S. Patent 669,899). By these means I succeeded in reducing the nickel contents of solutions containing 125 gm. Ni to 0.05 gm. pr. litre. The nickel salt thereby obtained contains six equivalents of ammonia of which two appear to exist in form of chloride; it corresponds to the formula  $\text{Ni}(\text{NH}_3)_2\text{Cl}_2 \cdot 4\text{NH}_3$ . I then found that nickel hydroxide in presence of ammonia will react upon sodium or potassium chloride, resulting in nickel ammonium chloride and caustic alkali (U.S. Pats. Nos. 688,463, 697,465 and others). Thus, if ammoniated salt brine is treated with nickel hydroxide, the result is nickel ammonium chloride and caustic soda solution. The former, being insoluble in the caustic liquor, is separated by filtration, washed with ammoniated salt brine and subjected to distillation, whereby the ammonia and nickel hydroxide are recovered and returned to the process, while the caustic soda solution is concentrated in the ordinary manner. The amount of nickel hydroxide required is about 80 per cent. of the amount of salt to be converted, but differs in proportion to the amount of water which may be present in the hydrate. If the hydroxide recovered in the process contains 60 per cent. of nickel hydroxide, 200 grms. per litre of ammoniated salt brine yields a 10 per cent. caustic soda solution, converting about 73 per cent. of the sodium chloride contained in the brine. The reaction requires about an hour. What ammonia and unconverted salt the caustic liquor may contain is recovered during the concentration of the liquor. If the process, and particularly the recovery of the nickel oxide is properly conducted, complete conversion of the salt in theoretical quantities may be obtained.

As the nickel ammonium chloride is easily decomposed by water to nickel hydroxide and ammonium chloride, it is important—if high conversion and concentrated caustic liquor is desired—that any excess of water in

the process is avoided, and the conversion should therefore be conducted rather in presence of an excess of salt, so that always a sufficient amount of salt is present to keep the brine saturated as the ammonia is abstracted from it. Besides, an excess of salt forms a good filtering medium after conversion is completed, so that filtration can be conducted in the same vessel which served for the conversion. The presence of an excess of water is also detrimental during the recovery of the nickel oxide, resulting in low per cent., and slow acting, oxide.

The nickel oxide and ammonia are best recovered from the nickel ammonium chloride by distillation in a calcium chloride solution which has been saturated with salt, or in saturated salt brine (U.S. Patent 763,053). A solution of a specific gravity of 1.250 (about 33 per cent. calcium chloride saturated with salt) gives a highly concentrated nickel hydroxide. This solution may in course of the process be brought to a spec. gravity of 1.400 and higher before the calcium chloride liquor is finally discharged. If the nickel ammonium chloride is suspended in such a solution in proportion of 400–500 grms. pr. litre and subjected to distillation, the ammonia in excess of what is bound in the form of chloride is speedily expelled and the nickel oxide more or less hydrated is recovered in coarse form so that it can be readily separated from the calcium chloride solution. It is not necessary to continue distillation until the last of the nickel is precipitated; in fact, it appears more economical to leave a small percentage of the nickel in solution, since the calcium liquor is used over again and only a part of it is removed for the final recovery of the ammonia and nickel it may yet contain in form of chloride.

The ammonium and calcium chloride liquor still containing nickel in solution, after decanting or filtering from the nickel oxide precipitate, is treated with ammonia to convert the nickel contained therein again into nickel ammonium chloride; this may be done by the addition of ammoniated salt brine, caustic soda, or calcium oxide, and it is then again subjected to distillation. If calcium oxide or caustic soda is used, it is well not to add at one time the total quantity required to convert all the ammonium chloride, since a small amount of caustic soda may always be retained by the nickel ammonium chloride of the succeeding charge. The presence of an excess of ammonium chloride—above the amount normally resulting from the nickel ammonium chloride in process—is advantageous in so far as it is a guard against overtreating with lime and allows the treatment of a larger amount of nickel ammonium chloride in proportion to the quantity of calcium chloride liquor used in the process of distillation. An excess of ammonium chloride, however, in course of the distillation, causes also a larger amount of nickel to go in solution in form of chloride, diminishing the quantity of nickel oxide obtainable by distillation before the addition of lime, and this may become troublesome, as, during treatment with calcium oxide, the nickel remaining in solution with the calcium liquor may precipitate before filtration is possible, because the solubility of nickel ammonium chloride in the calcium liquor diminishes as its content of ammonium chloride decreases. Nickel ammonium chloride is also precipitated if too much calcium oxide is added to the liquor, even if its contents of nickel are normal. The amount of calcium oxide to be added to recover the nickel oxide remaining in solution should therefore be regulated by the amount of ammonium chloride which is advantageously left in the calcium liquor and this should be in proportion to the amount of caustic soda retained by the nickel ammonium chloride, plus possibly a small excess. The impurities contained in the lime are allowed to settle, or the treated liquor is filtered, while yet hot, through sand or salt before it is returned to the distilling apparatus. Finally, a sufficient amount of the calcium chloride liquor is withdrawn and replaced by salt brine to again reduce the specific gravity to the desired degree, and to recover the original volume, to which then again fresh nickel ammonium chloride is added. If, for instance, the original volume consisted of 100 litres of liquor containing 30 kilos. of calcium chloride and the liquor after primary distillation has been treated with 5 kilos. of calcium

oxide, it would contain approximately 40 per cent. calcium chloride, so that 25 litres would have to be removed and replaced with salt brine, or water would have to be added and saturated with salt, to reduce the liquor again to 30 per cent., the surplus being removed, it it were desired to operate with 30 per cent. liquor.

To reduce the amount of waste liquor, it is advisable to remove the 25 per cent. rather than to increase the volume by dilution. If the calcium chloride is allowed to concentrate to its practical limit, not more than about 100 gallons of waste liquor need be produced per ton of caustic soda.

From the treated waste liquor, nickel if still present is first precipitated, and then enough calcium oxide is added for the final decomposition of the ammonium chloride and recovery of the ammonia.

At first glance it would seem that a double or triple distillation is required, but this is not the case, since the distillation may be all done in the same apparatus, only, periodically or continuously, a part of the liquid contents of the distilling apparatus is withdrawn from the nickel oxide to be treated with calcium oxide, filtered, and immediately returned to the apparatus; fresh quantities of still liquor being constantly withdrawn, treated and returned to the still, both the nickel and ammonia are eventually entirely removed and recovered. The distillation of the ammonia and recovery of the nickel oxide requires about four hours, so that six operations can be conducted in 24 hours, and as an apparatus of 10,000 gallons capacity should produce four tons of caustic soda at a charge, it would be possible to produce at least 20 tons per day.

To reduce the possibility of loss of nickel and ammonia, conversion and distillation can be conducted in one and the same apparatus, though at the expense of its capacity, since the time occupied for conversion including filtration and washing may be assumed to occupy four hours. In this instance, the apparatus for a daily production of ten tons of caustic soda would consist of a converting and distilling vessel of 10,000 gallons capacity, equipped with reflux condenser, a collecting tank for caustic soda solution equipped with steam coil for recovery of possible excess of ammonia, treating tank for calcium oxide, arranged to serve also for filter, absorber for ammoniated brine, and the ordinary storage tanks, concentrators, and fuse pots. The expenditure in equipment of plant, as well as cost of manufacture by this method, are less than are involved in the manufacture of soda ash by the ammonia process, with the further advantage that consumers may produce their own caustic solutions direct from salt.

duty on "alcohol" (ethyl) is \$2.25 per proof gallon, while that levied on "fusel oil" is  $\frac{1}{4}$  of 1 cent. per pound.

It can thus be readily perceived that if merchandise containing excessive quantities of "alcohol" could be "entered" and "passed" as fusel oil, it would prove to be an important factor in the case. In view of the possibility that "fusel oil" of this character might be imported, the Customs authorities caused analyses to be made of numerous samples, with the result that the average amount of alcohol in 50 importations was found to be 5.04 per cent. In four instances the amount exceeded 15 per cent.; the results being 16.38 per cent., 18.91 per cent., 27.60 per cent., and 77.35 per cent. respectively.

There appears to be very little literature relating to fusel oil, particularly as regards this phase of the subject, and such methods as have been proposed for the determination of ethyl alcohol in this compound have, upon practical application, failed to yield satisfactory results. The following method is based upon the results of experimental work; and is submitted for the consideration of those who may have occasion to make quantitative determinations of ethyl alcohol in fusel oil.

Mix 20 c.c. of the sample under consideration, 20 c.c. of benzol and 60 c.c. of a saturated sodium chloride solution in a cylindrical graduated separator of about 1 in. diameter (an ordinary burette will answer the purpose) and after separation carefully read the volume of the sodium chloride solution (the precipitation of a small amount of sodium chloride which occasionally occurs has been found to cause no appreciable error in the estimation of the volume). Place 50 c.c. of the sodium chloride solution after separation in a distillation flask with 60 c.c. of water, distill 50 c.c., and estimate the alcohol contained therein by specific gravity and temperature.

The percentage of alcohol thus found, multiplied by the number of c.c. of salt solution after separation, will represent the number of c.c. of alcohol contained in the brine, and consequently the number of c.c. which were contained in 20 c.c. of the sample; the product of this result multiplied by 5 will equal the per cent. of ethyl alcohol contained in the sample of fusel oil.

On behalf of this method, it may be stated that it requires no special apparatus, and possesses the additional advantages of simplicity, rapidity and commercial accuracy.

## Yorkshire Section.

*Meeting held at the Chemists' Club, on Friday,  
December 16th, 1904.*

MR. CLIFFORD RICHARDSON IN THE CHAIR.

### COMMERCIAL FUSEL OIL.

• BY SAMUEL F. BALL.

The constantly increasing demand for fusel oil, the annual consumption of which in the United States may now be estimated at 450,000 gallons, has caused attention to be drawn to its composition; 80 per cent. of the entire quantity consumed is used in the manufacture of amyl acetate, and more than 19 per cent. is refined and placed upon the market as amyl alcohol, or "Refined fusel oil."

From a commercial standpoint the essential ingredient is necessarily the amyl alcohol; but recently a problem has been presented which involves the question of the amount of ethyl alcohol which the oil may contain, and what percentage of the latter would be necessary in order to make a separation and recovery of the ethyl alcohol upon a paying basis.

In addition to the expense of manipulation, an element of primary importance which it is necessary to take into consideration is the United States Tariff. The import

*Meeting held on Tuesday, November 29th, 1904.*

PROF. H. R. PROCTER IN THE CHAIR.

### DISCUSSION ON MODERN GAS PRODUCER PLANTS.

Mr. J. W. COBB opened a discussion on "Modern Gas Producers" by giving an account of the Mond Gas Plant and its working.\* Mr. Cobb described fully the regenerative working of the plant, by which, while the gas is carefully washed and cooled, the heat taken from it is taken up by the ingoing air and steam. This enables a large excess of steam to be used without unduly lowering the temperature of the producer. The excess of steam greatly facilitates the extraction of the nitrogen of the coal in the form of ammonia, so that in this respect the yield is about four times the amount obtained in any other coal distillation processes. Mr. Cobb also described the Talbot mechanical water-cooled poker, which, by radial arm fixed on a revolving central shaft, so stirs the coal as to greatly lessen the manual labour required on gas-producer.

\*For further information see papers by H. Humphrey, entitled—  
"The Mond Producer Plant," Proc. Inst. Civil. Eng., 1897.  
"Power Gas and Large Gas Engines," Proc. Mech. Eng., 1900.



An interesting discussion followed, in which the Chairman; Prof. Thompson, of the Leeds University; Messrs. Davies, Fairley, Murphy, Twynham, Weston and Stoddart took part.

Mr. DAVIES specially referred to the Duff Whitfield process which is now being worked near Darlington.

## Obituary.

SIR ISAAC LOWTHIAN BELL, BART.,  
LL.D., F.R.S.

ORIGINAL MEMBER OF THE SOCIETY OF CHEMICAL  
INDUSTRY, AND PRESIDENT IN 1889-1890.  
FORMERLY PRESIDENT OF THE IRON AND STEEL  
INSTITUTE, &C.

Isaac Lowthian Bell was born on February 15, 1816, at Newcastle-on-Tyne, his father, Mr. Thomas Bell, being an ironmaster, and his mother, a daughter of Mr. Isaac Lowthian, of Newbiggin, in Cumberland. After attending Edinburgh University and the Sorbonne, he spent some time in travel on the Continent, and then, at the age of 24, entered the Walker ironworks, near Newcastle, in which his father was a partner. There he remained till 1850, when he became connected with the chemical works at Washington, in North Durham. Under his direction these became one of the most important concerns of their kind in the North of England. He greatly enlarged them and also laid down extensive plant for the manufacture of an oxychloride of lead introduced as a substitute for white lead by his father-in-law, Mr. H. L. Pattinson, F.R.S., with whom he was associated in the business at Washington. There, too, was introduced in 1860 almost the first plant in England for the manufacture of aluminium by the Deville sodium process.

Soon after the discovery of the main bed of Cleveland ironstone, near Middlesbrough by John Vaughan in 1850, in conjunction with his brothers, Thomas and John, he started ironworks at Port Clarence, on the north bank of the Tees. A little more than half a century ago the site of Port Clarence was a waste of mud and marsh—in fact, the Tees then flooded ground where iron furnaces now stand. Much land in the estuary has since been reclaimed—largely by means of the “cinder balls” from the furnaces, which were used to build retaining walls—and on a portion of this were placed the iron-smelting works of Bell Brothers, among the largest in the Cleveland district. The firm acquired its own ironstone mines, collieries, and limestone quarries, and when it was found that economy in fuel resulted from increase in the height of blast furnaces, the plant, in view of that fact, was reconstructed. The firm was also among the first in the Cleveland district to take advantage of the saving effected by the use of the waste gases for heating the blast. In the development of the Cleveland iron industry it thus played a very important part, and what has been the extent of that development may be judged from the fact that, whereas the district in 1850 produced less than 25,000 tons of pig iron, at the present time Middlesbrough accounts for about one quarter of the total output of this country. Not only was the firm largely responsible for the surveys which revealed the position and extent of the ironstone beds, but it was active in prosecuting those technical studies by which processes have been devised enabling Cleveland ores to compete as raw material for the production of iron and steel with others possessing greater natural advantages. In regard to steel, the great trouble with

those ores is the high percentage of phosphorus (1·8 to 2·0 per cent.) contained in the east iron which they yield; yet Middlesbrough, largely as a result of experiments carried on under Sir Lowthian Bell's direction, at a cost, it is said of between £10,000 and £50,000, produces steel rails in which this percentage is reduced to 0·07 or less. Middlesbrough steel has also been rendered available for shipbuilding purposes, and as chairman of the company he had, in 1901, the satisfaction of announcing that the product of the Clarence Works fulfilled all the requirements of Lloyd's Registry.

Sir Lowthian Bell had an intimate knowledge, both on the scientific and statistical sides, of the iron and coal deposits of the North of England. When the British Association met at Newcastle in 1863, he contributed a paper on the manufacture of iron in connection with the Northumberland and Durham coalfields, in which he calculated that the supply contained in that coalfield was just about sufficient to melt the Cleveland seam, supposing none of it to be used for any other purpose. His aptitude for statistics was also shown in other ways. In 1870 he wrote a paper, bristling with facts and figures, on the sanitary condition of Newcastle, and more recently he compiled an elaborate account of the iron trade of the United Kingdom, compared with that of the other chief iron-making countries. The establishment of a chemical laboratory in connection with the Clarence works shows how fully he realised the importance of the scientific study of industrial processes, and his own researches on the chemistry of iron and steel, some of which have been translated into French and German, have become classic. Many of the most important of these appeared first in the form of papers read before the Iron and Steel Institute, and a number of them were subsequently collected and published in a thick volume entitled “The Chemical Phenomena of Iron Smelting.” Sir Lowthian was also the author of a book on the “Principles of Iron and Steel Manufacture,” as well as of numerous papers contributed to various scientific societies.

One of the original founders of the Iron and Steel Institute in 1869, he filled the office of president from 1873 to 1875, and in 1874 became the first recipient of the gold medal instituted by Sir Henry Bessemer the year before. An original Member of the Society of Chemical Industry, he was elected President in 1889, and his Presidential Address at Nottingham, at the close of his year of office (1890), was a valuable contribution on “*The Smelting of Iron Ores Chemically Considered*.” Among the learned societies he was a member of the Institution of Civil Engineers and of the Chemical Society, and a past president of the Institution of Mechanical Engineers. In a presidential address to the Institution of Junior Engineers in 1900, he gave a short account of the development of the iron trade, and after claiming that Great Britain had been almost the sole author of the improvements that had raised the industry to its present position, declined to admit that our reduced production was due to any inferiority in methods of manufacture. In 1874, the Royal Society made him one of their number; in 1896, he received the Albert Medal from the Society of Arts. He had also the distinction of being elected an honorary member of the American Philosophical Institution. In the municipal affairs of Newcastle he took a prominent part, having been a member of the Town Council for many years, and having held the mayoralty twice. He was a J.P. and D.L. for the county of Durham, and served as sheriff in 1884. The honour of a baronetcy was conferred on him in 1885, and in 1893 he received the degree of LL.D. from Edinburgh University.

Sir Lowthian married, in 1842, Margaret, the second daughter of Mr. H. L. Pattinson, by whom he had six children. He died on December 20th, at his residence, Rounton Grange, Northallerton, aged 88 years.

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## I.—PLANT, APPARATUS, MACHINERY.

### ENGLISH PATENTS.

*Furnaces, Impts. in* — G. S. Kent, Buffalo, U.S.A. Eng. Pat. 23,081, Oct. 26, 1904.

A COMBUSTION chamber having a domed top and side walls which are inclined together towards their lower ends, is enclosed in a casing. The side walls have upper dead-plate and lower toothed sections and form the inner walls of the fuel chamber. The outer walls of the latter are formed by grate bars, having also upper dead-plate and lower-toothed sections, situated one set on each side of and parallel to the inclined side walls and supported by lugs from the top of the casing. Below the combustion chamber and forming its support are bridge-bars, spaced apart, and supported on two parallel walls, forming a central ash-pit. By means of gearing, operated from without the furnace, the grate bars can be spaced out so as to leave an opening between their lower ends and the bridge-bars through which the cinders may fall into two outer ash-pits, one on each side of the central ash-pit. There is also a crushing and agitating device, operated from without, and working in the spaces between the bars on each side. The whole is enclosed in a suitable casing with openings and covers in the top for the introduction of the fuel and admission of air.

—W. H. C.

*Muffles*. The Morgan Crucible Co., Ltd., and J. C. Fox, London. Eng. Pat. 1,694, Jan. 22, 1904.

SEE U.S. Pat. 765,728 of 1904; this J., 1904, 814.—T. F. B.

*Evaporating Apparatus*. B. F. B. Sewell, London. Eng. Pat. 25,589, Nov. 23, 1903.

SEE U.S. Pat. 752,599 of 1904; this J., 1904, 434.—T. F. B.

*Superheated Steam; Production and Manner of Using* — Prince C. de Loewenstein, Arles sur Rhône, France. Eng. Pat. 26,177, Nov. 30, 1903.

THE process claimed, consists: (1) in bringing a certain quantity of saturated steam, contained in a closed vessel, into the superheater; (2) in returning this steam, when superheated to the boiler either totally or after having used a portion of it in a motor; (3) in returning the exhaust steam from the motor as steam to the boiler, making use only of the difference of tension between the superheated and saturated steam.

The apparatus for carrying out the above process consists of a rotating drum divided into a number of compartments by longitudinal partitions, and mounted on supports by means of pivots at each end. The inlet and outlet channels of each compartment are bored through the pivots which thus act as cocks to open and close the steam-pipes which are connected to the bearings in which the pivots work. Two pipes, one from each end of the compartment lead to the boiler, a fan being interposed in one of them to assist the circulation of the steam. Two other pipes and a fan similarly make connection with the superheater, whilst another pipe communicates with the motor. When the drum rotates, each compartment in succession passes first in front of the ducts leading to the boiler and is filled with saturated steam, it is next in communication with the superheater, then with the motor, and lastly with the boiler again, the steam being returned thereto. A modification is claimed in which the steam is taken directly from the superheater to the motor.—W. H. C.

### UNITED STATES PATENTS.

*Filter-Press*. E. Hatschek, New York. Assignor to Niles-Bement-Pond Co., Jersey City, N.J. U.S. Pat. 776,024, Nov. 29, 1904.

THE plates of the press are formed of sheet metal panels, with vertical corrugations, held in a frame. The latter is made in two parts, one forming three sides of a rectangular box, to which the other part, forming the fourth side, is bolted. A groove is formed round the inner edge of the frame to receive the corrugated plate, and is connected to an outlet formed in the lower side. The filter-cloth is held in position round the central feed opening by means of a screw-clamp or "bushing," having flanges with inner corrugated surfaces, which fit into the corrugations on either side of the "panel." The flanges are also provided with prongs, which project across the filtering cell, and serve to transmit "deflecting strains" from plate to plate.—W. H. C.

*Furnace*. W. A. Kōneman, Chicago, Ill. U.S. Pat. 776,185, Nov. 29, 1904.

IN combination with the combustion chamber and ash-pit of the furnace, is interposed a stepped series of perforated coking shelves, with channel spaces between, so that a limited supply of air passes the perforations, to coke the coal on the shelves, whilst through the channel spaces, a comparatively large supply of air passes to promote com-



bustion of the fuel. There is stoking mechanism, comprising a frame having cross extending bars in the planes of the channel spaces, which bars carry a horizontal series of hollow, parallel stoking bars with air-inlets near their forward ends, and air-outlets at their rear ends.—E. S.

*Drier [Drying Apparatus].* W. Angus, Montreal.  
U.S. Pat. 776,581, Dec. 6, 1904.

WITHIN an outer chamber, heated by dry heat, is arranged a rotatable truncated conical cylinder made of wire-cloth, encircled by hoops, the hoops resting on ball-bearings so supported that the lower side of the cylinder is horizontal. The cylinder is rotated by means of a chain passing round a sprocket wheel fixed around the wider end of the cylinder. The material to be dried is fed into the cylinder at the wider end, and leaves it at the truncated end in the dry state.—H. B.

*Centrifugal Machine.* S. R. Kennedy, Shippensburg, Pa., Assignor to the American Dairy Products and Manufacturing Co., Philadelphia, Pa. U.S. Pat. 776,745, Dec. 6, 1904.

A LAYER of material, such as blotting paper, is placed in the bowl or basket of the machine, to retain fatty matters, and is separated from the bowl by means of an intermediate layer of textile material, held in position by retaining rings. The whole basket of the machine is surrounded by a chamber connected by pipes to a vacuum pump.—W. P. S.

*Separator; Water and Gas —.* A. T. Newman, Assignor to J. Threlkeld, Greeley, Kans. U.S. Pat. 776,753, Dec. 6, 1904.

THE separator consists of a closed tank, to which the water and gas are admitted; a float in the tank, perforated at the top, and provided with a siphon, the long leg of which depends inside the float, the short leg being outside it; and a water-discharge pipe, the valve of which is connected to the float so as to be controlled by the rise and fall of the latter.—H. B.

#### FRENCH PATENTS.

*Temperature; Process for varying the —, of various Substances.* S. Stark. Fr. Pat. 345,724, Aug. 13, 1904.

THE liquid or gas to be cooled, passes through a vessel or a series of tubes made of some porous material, around which a current of air is made to circulate. The liquid diffuses through the sides of the vessel, and produces cold by its vaporisation. A suitable porous material is baked clay, artificial stone, tin plate pierced by fine perforations, felt, or clay with which asbestos has been admixed to increase its porosity and strength.—L. F. G.

## II.—FUEL, GAS, LIGHT.

*Water-Gas Plants; Working Results from Dellwik —.* W. King. J. Gas Lighting, 1904, 88, 839—840.

LEWES' proposal (see this J., 1901, 1095) to utilise "blue water-gas," produced by the Dellwik process, by passing

it through the retorts during carbonisation, has now been put into practice on a large scale for a sufficiently long time for a reliable opinion as to its merits to be formed. At Cleethorpes Gas Works the process has been in use for nearly two years. Detailed working results for the past 18 months are quoted, from which it is seen that the average cost of the water-gas in the holder has been 3.50d. per 1000 cb. ft., and the quantity used has been about 22 per cent. of the total make of the mixed gas. With increasing experience of the process, the amount of benzol required for enrichment has steadily fallen—from 0.38 gallon per 1000 cb. ft. of water-gas, during July—September, 1903, to 0.0066 gallon per 1000 cb. ft. during July—September, 1904. During the former period the proportion of water-gas in the mixed gas was 12.6 per cent., the illuminating power of the mixed gas was 16.4 candles, and the calorific value 626 B.T.U. gross; whilst during the latter period the proportion was 21.3 per cent., the illuminating power 15.9 candles, and the calorific value 595 B.T.U. gross. Though practically the whole of the enrichment of the water-gas is now derived from the coal-gas product, there has been no decrease in the yield of coal-gas, but an increase of about 400 cb. ft. per ton. Since the adoption of the plant the tar has been rather thicker, and fetches a slightly reduced price. Tests as to the permanency of the benzol enrichment have been carried out by examining the gas at the works, and at the end of the district, about 1½ miles away, and in no case has the difference in illuminating power reached half-a-candle.

Similar working results, obtained at the Rushden and Higham Ferrers Gas Works during the past ten months, are quoted, and they agree substantially with those given at Cleethorpes. The yield of coal-gas per ton of coal, formerly about 11,100 cb. ft., has increased by 500 to 600 cb. ft. per ton, and in this case the benzol used amounts to 0.292 gallon per 1000 cb. ft. of water-gas, the mixed gas averaging 16 candle-power. At the Iford and Barking Gas Works gratifying results are likewise being obtained with the process, no benzol at all being used at the latter works.—H. B.

*Oxygen in Coal-Gas; Automatic Test for —.*

F. Kropf. XXIII., page 44.

*Photometer for Testing the Illuminating Values of Ordinary and High-Power Auer Burners.* C. Carpenter and J. W. Helps. XXIII., page 45.

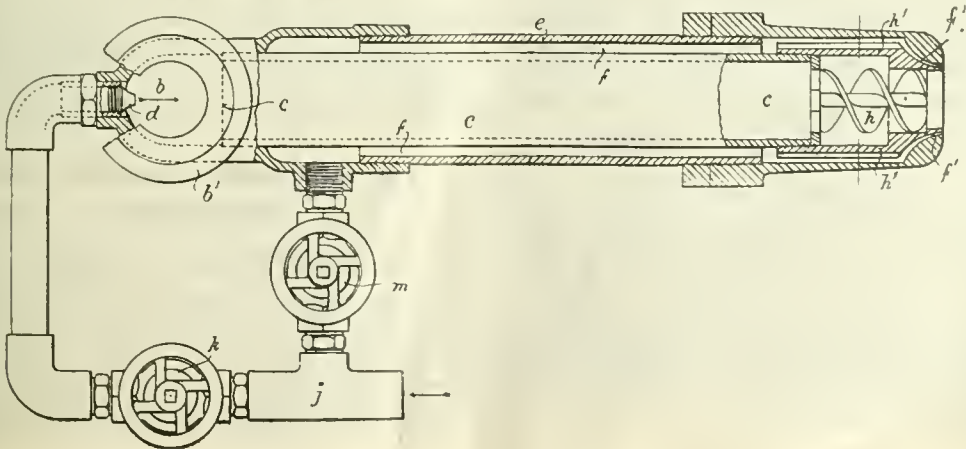
#### ENGLISH PATENTS.

*Fuel Briquettes; Manufacture of —.* V. Conti and A. Levy, Paris. Eng. Pat. 3136, Feb. 8, 1904.

SEE Fr. Pat. 340,244 of 1904; this J., 1904, 745.—T. F. B.

*Oil Fuel Burners; Impts. in —.* G. and T. Wilton, London. Eng. Pat. 22,753, Oct. 21, 1904.

THE burner is constructed as shewn in the figure, which is a sectional plan. The oil is fed from a nozzle placed above the burner into the open cup *b*, provided with an enlargement *b*<sup>1</sup> for convenience of feeding, and is atomised



by the steam from the jet *d*, being at the same time mixed with air drawn through the open cup *b*. The oil spray is carried forward through the inner tube *c* to the cap *h*, in which the spiral *h* rotates and imparts to the spray a rotary motion. The tube *c* is surrounded by an outer tube *e*, leaving an annular space *f* between the tubes. A second supply of steam is sent along this annular space, and leaves by the contracted orifice *p* around the inner jet. The steam is supplied by the pipe *i*, and is regulated by the valves *m* and *k*. It is stated that the intimate mixture of oil spray, air and steam formed in the inner tube, meeting with the annular jet of steam, gives a large and efficient flame with a small consumption of steam, and one which burns with comparatively little noise.—W. H. C.

*Coal Gas or other Gases containing Ammonia and Cyanogen; Treatment of —, for the Extraction of Ammonia and Cyanogen therefrom, and the Partial Regeneration of the Agents Employed in the Extraction.* W. Feld, Hönningen-on-Rhine, Germany. Eng. Pat. 966, Jan. 14, 1904.

SEE Fr. Pat. 341,614 of 1904; this J., 1904, 861.—T. F. B.

*Gas Purifiers; Impts. in —.* A. J. Boulton, London. From La Comp. pour la Fabrication des Compteurs et Matériel d'Usines à Gaz, Paris. Eng. Pat. 22,815, Oct. 22, 1904.

The purifying material is arranged within the purifier in superposed parallel layers inclined at about 40° from the horizontal, that is, having an inclination approaching that of the natural slope formed by a heap of material in grains or powder. The purifying material rests on boards, instead of grids, and at the inclination adopted has no tendency to slide. The purifiers containing the sloping boards may themselves be inclined at the same angle, to enable the material to be introduced from the top at the back, and to be discharged after use at the bottom, in front of the apparatus. If the purifier vessels are of the ordinary horizontal form, the alternate series of parallel, inclined boards are made to slope from right to left, and left to right respectively, passages being provided for distributing the gas through the layers of material.—H. B.

#### UNITED STATES PATENTS.

*Combustion; Method of Producing Complete —.* H. C. Caldwell, Assignor to J. P. Dudley, W. T. Shepard, and A. B. Underhill, Buffalo, N.Y. U.S. Pat. 776,171, Nov. 29, 1904.

A PASTE-LIKE mixture of finely-divided combustible material and water is injected into a combustion chamber maintained at a high temperature by an independent source of heat.—L. F. G.

*Fuel, Composite —; and the Art of Making Same.* M. R. Spelman, New York. U.S. Pat. 776,365, Nov. 29, 1904.

COAL is ground to a fine flour under an inflammable semi-liquid, such as molasses, and the mixture then thinned with crude alcohol. For use it is pumped through pipes and burned in the form of a spray.—L. F. G.

*Gas Generator.* P. Schmidt, Hanover. U.S. Pat. 776,947, Dec. 6, 1904.

SEE Fr. Pat. 338,626 of 1903; this J., 1904, 653.—T. F. B.

#### FRENCH PATENTS.

*Briquettes burning without Smoke or Sulphur; Process and Apparatus for the Manufacture of Solid, Resistant —.* G. Höpfner, First Addition, Aug. 13, 1904, to Fr. Pat. 344,926, June 23, 1904 (this J., 1904, 1205).

The movement of the screw referred to in the principal patent drives the material, under a slight pressure and with thorough kneading, through the mouth-piece, where it is heated and subjected to a gradual pressure; it then passes out in the form of rods with shining surface, to be cut to the required length.—H. B.

*Fuels; Process for Determining the Calorific Value of —.* H. Junkers. Fr. Pat. 345,903, Aug. 27, 1904. Under Internat. Conv., Sept. 1, 1903.

SEE Eng. Pat. 18,847 of 1904; this J., 1904, 1116.—T. F. B.

*Coke Oven; Horizontal —.* Poetter und Co., Akt.-Ges. Fr. Pat. 345,924, Aug. 29, 1904.

SEE Eng. Pat. 17,661 of 1904; this J., 1904, 1140.—T. F. B.

*Carburetted Air; Apparatus for the Production of —.* M. L. Godefroy. Fr. Pat. 345,717, April 25, 1904.

AN air-compressor supplies air to two carburetters, one of which contains a very volatile combustible such as gasoline, whilst the other contains a less volatile liquid, such as alcohol. The second carburettor may be dispensed with and replaced by a simple pipe. The two streams of carburetted air (or, alternatively, the stream of carburetted air and that of ordinary air) are led into a regulating valve which admits them, in any desired proportions, into a pipe leading to the gasholder. The latter is an ordinary floating bell, which is connected by means of levers to a stop, acting upon the air-compressor, so that the compressor ceases to work when the gas-holder is full, and re-starts when it is empty.—H. B.

*Gas; Process and Apparatus for Producing a Combustible — by means of Liquid Hydrocarbons.* F. Cotton. Fr. Pat. 345,933, Aug. 30, 1904.

SEE Eng. Pat. 18,291 of 1904; this J., 1904, 1021.—T. F. B.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

*Masut [Petroleum Residue]; Use of —, for Fuel in Iron and Steel Works.* F. Heck, Stahl u. Eisen, 1904, 24, 1430—1435.

MASUT or astatki has the following average composition: carbon, 87.5; hydrogen, 11.0; and oxygen, 1.5 per cent. It has the sp. gr., about 0.91; temperature of ignition, about 110° C.; coefficient of expansion, 0.00091; and calorific value, about 10,700 cal. The following methods are employed for the utilisation of masut as fuel:—(1) Gasification, with subsequent mixing of the vapour with air, either compressed or at the atmospheric pressure. (2) Atomisation of the masut by means of the so-called "Forsunka" with: (a) steam, (b) compressed air, or (c) by forcing the masut through a jet under pressure. The author describes, with illustrations, various devices which are in use for burning masut. The production of masut in the Baku district has increased from about 74.2 million poods in 1891 to 140.1 million poods in 1900. In 1903, 287.3 million poods or about 4.7 million tons were produced.—A. S.

#### ENGLISH PATENT.

*Meta-cresol from Crude Cresol; Manufacture of —.* E. Schultze and Chem. Fabr. Ladenburg, Ges. m.b. H., Ladenburg, Germany. Eng. Pat. 1881, Jan. 25, 1904.

SEE Fr. Pat. 339,880 of 1904; this J., 1904, 759.—T. F. B.

### IV.—COLOURING MATTERS AND DYESTUFFS.

*Hydrochloride of Rosaniline; A Colourless —.* R. Lambrecht and H. Weil. Ber. 1904, 37, 4326—4327.

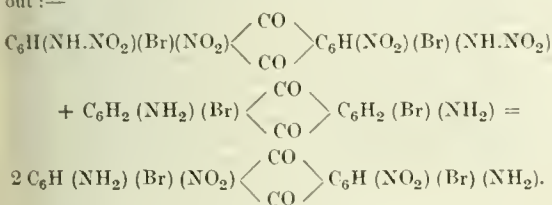
IF ordinary rosaniline be dissolved in 2 parts of 30 per cent. hydrochloric acid, the liquid sets to a paste of crystals, which, when filtered, washed with hydrochloric acid and dried *in vacuo* over quicklime, become quite colourless. The substance dissolves in cold water with a very pale pink coloration. On warming, the intense red colour of Magenta appears. The analysis of the product



agrees fairly well with the formula  $C_{20}H_{21}N_3O \cdot 2HCl \cdot 4H_2O$ . New Fuchsine deposits no crystals on treatment in the same way with 2 parts of 30 per cent. hydrochloric acid.—E. F.

*Nitramines of the Anthraquinone Series.* R. Scholl. Ber. 1904, 37, 4427—4448.

Though it is well-known that mono- and di-alkylated anilines are converted by fuming nitric acid into nitrated nitramines, it has not hitherto been found possible to similarly produce nitramines from primary aromatic amines. On the other hand, the author has produced nitrated nitraminoanthraquinones by treatment of non-alkylated aminoanthraquinones and their substitution products with nitric acid of sp. gr. 1.50—1.52. In this reaction, hydrogen atoms in *o*- and *p*-position to the amino groups are also partially or completely replaced by nitro-groups. The nitro-groups, which are directly bound to nitrogen, can be removed from these compounds by treatment with nitratable substances such as phenols, hydrocarbons and alcohols in absence or presence of acids. The more nitro-groups are present in the nucleus of the nitramine, the more stable are the nitraminic groups. Thus tetra-bromo-1.5-dinitramino-anthraquinone is denitrated by boiling alcoholic hydrochloric acid, whereas 4.8-dinitro-2.6-dibromo-1.5-dinitraminoanthraquinone and tetranitro-1.5-dinitramino-anthraquinone require more powerful denitrating agents, such as concentrated sulphuric acid together with a little phenol. In place of phenol the denitration can be carried out by means of the non-nitrated aminoanthraquinone, if this has free *o*- and *p*-hydrogen atoms. For instance, in presence of sulphuric acid, the following reaction can be carried out:—



It is therefore probable that the nitration of alkylated anilines and amino-anthraquinones takes place in several stages, the amino-groups being first attacked, and nitro-groups transferred from these to the nucleus. Nitramines from  $\beta$ -aminoanthraquinone give green colorations, those from 1.5-diaminoanthraquinone and its bromo derivatives purple colorations, with phenol and sulphuric acid.—E. F.

*2.3-Diamino-anthraquinone and Some Azines of the Anthraquinone Series.* R. Scholl and F. Kaer. Ber., 1904, 37, 4531—4534.

In a previous communication (this J. 1903, 1240) it was shown that Indanthrene is probably *N*-dihydro-1.2.2'.1'-anthraquinone-azine. It is now found that 9'.10'-phenanthro-2.3-anthraquinone-azine obtained by treating 2.3-diamino-anthraquinone with phenanthraquinone in glacial acetic acid solution, does not give a blue product as 1.2.2'.1'-anthraquinone-azine (the root substance of Indanthrene) does, when warmed with alkaline hydro-sulphite solution, but yields a brown, flocculent, insoluble precipitate, almost devoid of dyeing properties. This is regarded as a confirmation of the 1.2-position assigned to the azine ring in Indanthrene.—A. S.

#### ENGLISH PATENTS.

*o*-Oxyanthraquinones and *o*-Oxyanthraquinone-oxysulphoacids [Anthracene Dyestuffs]; Manufacture of —. M. Iljinskij, Krefeld, and R. Wedekind & Co., Uerdingen, Germany. Eng. Pat. 25,738, Nov. 25, 1903.

SEE Fr. Pat. 336,938 of 1903; this J., 1904, 438.—T. F. B.

*Colouring Matters [Azo Dyestuffs]; Manufacture of —.* H. H. Lake, London. From K. Oehler, Offenbach on Maine, Germany. Eng. Pat. 1581, Jan. 21, 1904.

DIAZO compounds of the benzene or naphthalene series are combined in acid solution with 2.5.7.-aminonaphthol-

sulphonic acid or 2.5.3.7.-aminonaphtholdisulphonic acid. The mono-azo dyestuffs thus formed are acted on in alkaline solution by diazotised chloro-*o*-aminophenols or their derivatives. The mono-azo dyestuffs formed by combining diazo compounds of the benzene or naphthalene series in acid solution with 2.5.3.7.-aminonaphtholdisulphonic acid are also combined in alkaline solution with diazotised nitro-*o*-aminophenols or their derivatives. The new dyestuffs dye wool in claret-red to blackish-violet shades, which, on subsequently adding chromium mordants to the dye-bath, become black, and are said to be very fast, particularly against light.—E. F.

*Mordant Dyes [Azo Dyestuffs]; Manufacture of —.* H. H. Lake, London. From K. Oehler, Offenbach on Maine, Germany. Eng. Pat. 13,941, June 20, 1904.

SEE U.S. Pat. 767,070 of 1904; this J., 1904, 863.—T. F. B.

*Colouring Matters of the Naphthalene Series; Production of —.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 2468, Feb. 1, 1904.

DYESTUFFS, yielding shades which become deep blue-black on treatment with bichromate, are obtained by condensing naphthazarin with sulphonic acids of aromatic amines in aqueous solution, in presence of boric acid. The term naphthazarin is here stated to include the ordinary naphthazarin obtainable from 1.5-dinitronaphthalene, and also the dyestuff obtained from 1.8-dinitronaphthalene according to Eng. Pat. 890 of 1900 (this J., 1901, 35). For example, a mixture of 200 parts of a 50 per cent. naphthazarin paste, 100 parts of commercial (80 per cent.) sulphanilic acid, 20 parts of boric acid, and 400 parts of water is stirred for 48 to 72 hours, the temperature being maintained at 25°–30° C. When completely soluble in water, the mixture is poured into concentrated sodium chloride solution, and the dyestuff filtered off.—T. F. B.

*Anthracene Series; Manufacture of Colouring Matters of the — [Anthracene Dyestuffs].* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 4998, Feb. 29, 1904.

SEE U.S. Pat. 763,223 of 1904; this J., 1904, 747.—T. F. B.

*Azo Compounds [Dyestuffs]; [Electrolytic] Manufacture of —.* J. Y. Johnson, London. From C. F. Boehringer und Soehne, Waldhof, Germany. Eng. Pat. 2608, Feb. 2, 1904.

SEE U.S. Pat. 761,310 of 1904; this J., 1904, 712.—T. F. B.

*Sulphurised [Sulphide] Dyestuffs; Manufacture of New —.* C. D. Abel, London. From Act.-Ges. f. Anilin-fabr., Berlin. Eng. Pat. 7725, March 31, 1904.

SEE Fr. Pat. 341,798 of 1904; this J., 1904, 898.—T. F. B.

#### UNITED STATES PATENTS.

*Sulphur Dye [Sulphide Dyestuff]; Blue —, and Process of Making same.* A. Schmidt and F. Bethmann, Assignors to Farbwerke vorm Meister, Lucius and Brüning, Hoechst-on-the-Maine, Germany. U.S. Pat. 776,264, Nov. 29, 1904.

DIALKYL-*p*-AMINO-*p'*-HYDROXY-*m'*-CHLORODIPHENYL-AMINES, or the corresponding indophenols or thiosulphonic acids, are converted into sulphide dyestuffs by heating with 4 parts of alkali sulphide, and more than 1 part of sulphur, in presence of a suitable solvent. The resulting dyestuffs dissolve in sulphuric acid to dark blue solutions, and dye unmordanted cotton blue shades from alkali sulphide solutions. (Compare U.S. Pat. 728,623 of 1903; this J., 1903, 737.)—T. F. B.

*Indoxyl, &c.; Process of Making —.* A. Bischler, Assignor to the Basle Chemical Works, Basle, Switzerland. U.S. Pat. 776,884, Dec. 6, 1904.

INDOXYL and its homologues or derivatives are obtained by heating the alkali salts of the corresponding arylglycin with an alkali and an alkali metal, "to the necessary

temperature, until the greater portion of the alkali metal has reacted," and then adding aniline, or other substance, capable of forming with the alkali metal a compound which will eliminate water from the product, and again heating until the formation of the leuco-indigo compound is complete.—T. F. B.

*Sulphur Dye [Sulphide Dyestuff]: Green —, and Process for Making same.* M. Böniger, Assignor to Chemical Works, formerly Sandoz, Basle, Switzerland. U.S. Pat. 776,885, Dec. 6, 1904.

SEE Fr. Pat. 343,377 of 1904; this J., 1904, 1026.—T. F. B.

#### FRENCH PATENTS.

*Colouring Matters derived from Anthracene; Process for Preparing — [Anthracene Dyestuffs].* Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 339,129, Oct. 28, 1903.

SEE Eng. Pat. 23,392 of 1903; this J., 1904, 931.—T. F. B.

*O-Nitro-o-amido-acetyl-p-amino-phenol and Azo Dyestuffs susceptible to Chroming derived therefrom; Preparation of —.* L. Cassella und Co. Fr. Pat. 339,142, Nov. 2, 1903.

SEE Eng. Pat. 24,409 of 1903; this J., 1904, 1025.—T. F. B.

*Sulphide Dyestuffs for Cotton, Dyeing Violet-blue to Blue Shades; Production of —.* Badische Anilin und Soda Fabrik. Fr. Pat. 339,156, Nov. 7, 1903.

SEE Eng. Pat. 24,930 of 1903; this J., 1904, 1143.—T. F. B.

*Oxidising and Reducing Organic Substances; Process for Electrolytically —.* Farbwerke vorm. Meister, Lucius u. Brüning. Fr. Pat. 345,701, Aug. 19, 1904. Under Internat. Conv., Sept. 12, 1903. XI. A., page 33.

*Indophenols; Process of Manufacturing —.* Act.-Ges. f. Anilinfabrikation. Fr. Pat. 345,009, July 19, 1904.

AROMATIC amines with free *p*-positions are condensed with nitrosophenols by means of concentrated hydrochloric acid in the presence or absence of diluents, such as acetic acid, and with or without the aid of other condensing agents.—E. B.

### V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

#### ENGLISH PATENTS.

*Indigo Paste for Direct Use in the Fermentation Vat; Preparation of —.* J. V. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 3108, Feb. 8, 1904.

THE use of phenol, salicylic acid, formaldehyde, or a fluoride to prevent the formation of mould or other decomposition of the organic substance used in the preparation of indigo paste for the fermentation vat, hinders the fermentation, and also has a deleterious effect upon the vat. The use of certain alkaline substances, however, is free from these drawbacks. Alkali or alkaline-earth oxides and hydroxides, and alkali carbonates are suitable, caustic lime being found to be the best to use. For instance, a 12 per cent. indigo paste is prepared by stirring 540 parts of water into a mixture of 200 parts of pure indigo, 100 parts of bran, 100 parts of wheat flour, 50 parts of molasses, and 10 parts of lime.—T. F. B.

*Dyeing, Bleaching, or Washing Fabrics in the Piece; Machinery used in —.* J. Cadgène, Zürich, Switzerland. Eng. Pat. 21,397, Oct. 5, 1904.

Two metal or wooden rotating cylinders of large diameter are fixed at a short distance apart in the vat, entirely above the level of the liquid. The material is wound on these alternately by means of suitable gearing, and is kept in an approximately horizontal position in the

liquid by means of small guiding rollers, whereby it is claimed that rapid and uniform treatment is obtained, and that a considerable length of material may be treated uniformly at the same time. The machine may be used for washing or similar purposes by lowering the cylinders into the liquid, or by filling the vat with liquid. An arrangement of cylinders is appended by means of which the finished material can be conveniently wrung out as it leaves the bath.—T. F. B.

*Waterproofing Textile and other Fabrics, String, Ropes, and the like; Manufacture of Compounds for —, and Apparatus therefor.* V. B. Brydon Wright, Gresford; W. K. Poulson, Liverpool; and W. M. Mackintosh, Liverpool. Eng. Pat. 25,000, Nov. 17, 1903.

THE compound is obtained from paraffin wax (60 parts), almadina (or alsadina) gum, or gutta percha (20 parts), resin oil (10 parts), and carnauba wax (10 parts). For special purposes the carnauba wax may be omitted, in which case a sticky compound is obtained.—E. F.

*Leather, Leather Cloths, and Animal and Vegetable Fabrics; Manufacture and Waterproofing of —.* P. C. D. Castle. Eng. Pat. 2167, Jan. 28, 1904. XIV., page 36.

#### UNITED STATES PATENT.

*Dyeing Machine.* J. R. Greenwood, Boothwyn, Pa. U.S. Pat. 776,237, Nov. 29, 1904.

THE combination is claimed of a dye-vat in which is suspended a removable framework having a series of top and bottom rollers, a driving and pressure roller to draw the material to be dyed over the former rollers, guide rollers to pass the material back for successive passages, and guide-plates having offset openings, "whereby adjacent courses of the material may be separated and also guided in parallel alignment." A "double series" of these offset openings is provided in such a way that each series of openings may come opposite the spaces between the openings of the other series.—T. F. B.

#### FRENCH PATENTS.

*Silk; Process and Apparatus for Degumming, Bleaching, and Dyeing —.* Soc. Schmid Frères. Fr. Pat. 345,173, July 27, 1904.

SILK yarns are placed in the form of hanks upon reels within a movable chamber, and are there treated with hot soap froth, produced by blowing compressed air into a heated soap bath, above which the chamber is for the time being brought. After the yarns have been thus acted upon for about 35 minutes, the chamber is removed and immersed in water, when about four-fifths of the silk-glue present becomes dissolved. The remainder may be removed from the silk by repeating the operations. Silk waste is spread upon wire-gauze trays, which are put one above another into the chamber, or it is packed into suitable receptacles and attached to an endless chain or to a vertically rotating wheel, and thus treated with the hot froth. To dye the silk, the same process is followed, but a dye-bath is employed in place of the soap bath.—E. B.

*Dyeing Fibres and Tissues [Aniline Black]; Process of —.* C. E. Wild. Fr. Pat. 345,254, July 30, 1904.

TEXTILE materials composed of cotton, wool, silk, &c., are dyed in Aniline Black according to the following process:—The materials are immersed in a bath of aniline hydrochloride, acetic acid, sodium chlorate, ammonium chloride (about double the proportion of this salt commonly used), copper sulphate, and copper acetate. They are then dried in a current of air heated at a temperature of 43°–55° C., which, after passing through them, is allowed to escape. A current of cold or slightly heated air is then circulated in a closed circuit through them until the development of the black is almost complete. Finally, to complete this, steam is forced through them. The materials, which, it is stated, are not injured by the treatment described, are then passed through a dilute chroming bath at the ordinary temperature, and are washed and dried.—E. B.



*Degreasing with Volatile Solvents, and Drying, with Recovery of Solvents used.* E. Bataille. Fr. Pat. 345,367, Aug. 3, 1904.

THE materials, e.g., garments which are to be "dry-cleaned," are placed in a revolving cylinder contained within a boiler connected by pipes with a heating vessel, a still, a condenser, and a solvent-tank. The boiler is then filled with a solvent either by exhausting the air from it, or by displacing this with the vapour of the solvent, and then admitting the latter. This may be used cold, or it may be heated by means of a steam coil at the bottom of the boiler. After a while, the first charge of solvent is withdrawn to the still, and a second, and, if necessary, a third, &c., charge is admitted and similarly removed. The materials are then dried by passing through them an inert gas, such as carbon dioxide, which is circulated successively through the cylinder, through a condenser, to remove as much as possible of the solvent from the gas, through an apparatus in which it is heated to a temperature of about 50° C., and then again through the cylinder, &c., its return to the cylinder.

The apparatus may also be employed in drying tissues which have been treated with indiarubber solutions, for the purpose of recovering the solvents used.—E. B.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

*Chrome Leather : Dyeing of —, and Storing in the "Crust."* M. C. Lamb. J. Soc. Dyers and Colourists, 1904, 20, 268—273.

CHROME leather previous to dyeing requires to be washed to remove soluble salts, and the acidity retained by the leather after tanning neutralised by treatment with a weak alkaline solution; 2½ per cent. of borax (calculated on the weight of the drained goods) or ¾ per cent. of sodium bicarbonate are recommended, the leather being afterwards washed previous to dyeing or fat-liquoring.

In order to increase the affinity of the leather for coal tar dyestuffs, it is treated with a tannin or dyewood decoction. The most common tannin and dyewood extracts employed, and the colours they produce are: logwood (violet purple), fustic (buff yellow), gambier (brownish yellow), palmetto (reddish drab), peachwood (bluish red). The maximum amount of the tannin or dyewood extract is about 2 per cent. calculated on the drained weight of the leather; it is applied to the goods at 60° C. in the drum for 20-30 minutes. Strong solutions of tannin or dyewood extracts have a detrimental effect upon chrome leather, reducing the strength, tightening the grain, and impairing the strength of the fibre. When dyeing with basic dyestuffs, it is customary to fix the tannin by adding tartar emetic to the contents of the drum. The author recommends potassium titanium oxalate, "tannotitanium oxalate" or titanium lactate for this purpose. The yellow titanium tannate produced when tannin extracts have been previously employed, reduces the amount of dye necessary in the dyeing. Logwood and titanium produce a black, peachwood and titanium a reddish-yellow colour. The titanium solutions may be employed after the dyeing when acid dyestuffs are employed.

The dyeing is performed in the drum at 65° C. for three-quarters of an hour, the concentrated dyestuff solution being added whilst the drumming proceeds, the fat-liquor being afterwards added to the waste dye-bath and drumming continued for half an hour longer. The fat-liquor usually has a detrimental effect in stripping or altering the shade of colour owing to the large amount of soap present, and the liquor being alkaline.

The author endeavoured to produce a fat-liquor emulsion without using soap, and finally adopted the plan of treating the leather with a preparatory fat-liquor made by dissolving 5 lb. of sodium alginate and 8 lb. of glucose in 2 gallons of water by boiling, afterwards adding 3 lb. of castor or neatsfoot oil, and continuing the boiling for 10-15

minutes. The mixture, which is sufficient for 200 lb. of "struck-out" leather, is afterwards emulsified with 6 gallons of cold water in which 3 or 4 egg yolks have been mixed. The emulsion is applied in the drum at 75° C. for three-quarters of an hour; the goods are afterwards removed and dried for "crust" stock and wet down by drumming in hot water, when required to be dyed, giving the goods a final fat-liquoring after dyeing, using 3 lb. of sodium alginate, 3 lb. of neatsfoot or castor oil in 6 gallons of water for 200 lb. of leather.

Blacks are usually dyed with logwood and iron, the leather sometimes being coloured on the flesh side with a coal-tar dyestuff, e.g., Methyl Violet, Acid Violet, Methylene Blue, &c., before being passed through a weak solution of a mixture of logwood and fustic extract, followed by a weak solution of "nitrate of iron" or ferrous sulphate. The black may be accentuated by treatment with a solution of a titanium salt, either before or after the application of the iron.

Coal tar blacks are little used on chrome leather, the most useful are Naphthylamine Black, Phenylamine Black, Chrome Leather Black C., Corvoline, &c.

Sulphide dyestuffs have been tried with promising results, the necessary addition of sodium sulphide being made to the fat-liquor used after dyeing; also the alkali blues for blue backing, the dyestuff being added to the borax or sodium bicarbonate solution used for neutralising the acidity of the leather.—M. C. L.

### ENGLISH PATENT.

*Printing Paper Hangings and the Like; Machines for —.* J. Grantil, Chalons-sur-Marne, France. Eng. Pat. 19,795, Sept. 14, 1904.

SEE Fr. Pat. 344,380 of 1904; this J., 1904, 1145.—T. F. B.

### FRENCH PATENT.

*Hair; Dyeing Human — with Paraphenylenediamine and Similar Bases.* E. Guesquin. Fr. Pat. 345,257, July 2, 1904.

IN order considerably to reduce the formation of quinone and to render the solutions employed innocuous to the skin, the solution of *p*-phenylenediamine or other similar base which is first applied, and the water subsequently used in washing the dyed hair, are rendered alkaline with sodium bicarbonate, Vichy salts, &c.—E. B.

## VII.—ACIDS, ALKALIS, AND SALTS.

*Bleaching Powder; Formation and Constitution of —.* N. Tarugi. Gaz. chim. ital., 1904, 34 [2], 254—260. Chem. Centr., 1904, 2, 1531.

ACCORDING to Lunge and Schaeppi the most active bleaching powder is obtained by using slaked lime containing 27.8 per cent. of water, and working at a temperature of 30°—50° C. The author finds, however, that the presence of oxygen also has an influence on the reaction. A homogeneous mixture of 28 grms. of pure calcium oxide (free from iron) and 9 grms. of distilled water was exposed to the air for some time, and then gave the reactions characteristic of peroxides (blue coloration with tincture of guaiacum resin, red coloration with ferrous sulphate and potassium thiocyanate, blue coloration with chromic acid and ether). The author's view is that in the slaked lime used for the production of bleaching powder, there is present a small quantity of a peroxide; the chlorine acts in the usual way upon water, with evolution of hydrochloric acid and oxygen, which latter immediately reacts with a fresh quantity of calcium hydroxide, producing hydrated calcium peroxide:—

- (1)  $4\text{Cl} + 2\text{H}_2\text{O} = 4\text{HCl} + \text{O}_2$ ;
- (2)  $\text{CaO}_2\cdot\text{H}_2\text{O} + 2\text{HCl} = \text{CaO}_2\text{Cl}_2 + 2\text{H}_2\text{O}$ ;
- (3)  $\text{CaO}\cdot\text{H}_2\text{O} + \text{O}_2 = \text{CaO}_2\cdot\text{H}_2\text{O}$ ;
- (4)  $\text{CaO}_2\cdot\text{H}_2\text{O} + 2\text{HCl} = \text{CaO}_2\text{Cl}_2 + 2\text{H}_2\text{O}$ .

It is concluded that hypochlorites are chlorides of peroxides, and that a bleaching powder yielding 44.09

per cent. of active chlorine corresponds to the formula,  $\text{CaO}_2\text{Cl}_2 \cdot \text{Hg}$ . As a confirmation of this view the author points out that bleaching powder converts mercury quantitatively into mercuric chloride, according to the equation:— $\text{CaO}_2\text{Cl}_2 + \text{Hg} = \text{CaO}_2 + \text{HgCl}_2$ . —A. S.

*Nitrates of the Alkali Metals and of Metals of the Alkaline Earths, and their Decomposition by Heat.* P. C. Ray. Chem. Soc. Proc., 1904, 20, 240—241.

NITRITES of the alkali and alkaline-earth metals are faintly yellow coloured. Their solutions, excepting that of the magnesium salt, can be boiled and evaporated to dryness without decomposition or oxidation. Magnesium nitrite separates with  $3\text{H}_2\text{O}$ , when its solution is evaporated over sulphuric acid. In the desiccator, one mol. of water is lost. Even at  $60^\circ$ , its solution evolves nitric oxide; at  $120^\circ$  C. the residue consists of  $\text{Mg}(\text{NO}_2)_2$ ,  $\text{MgO}$ . Barium nitrite decomposes below  $300^\circ$ , into barium nitrate, barium oxide, nitric oxide, and nitrogen. At higher temperatures, the nitrate thus produced decomposes in the well-known way. —A. S.

*Sparingly Soluble Salts; Solubility in Water of —.* F. Kohlrausch. Z. physik. Chem., 1904, 50, 355—356.

The following table gives the results of the author's determinations, calculated from the electric conductivity of saturated solutions at  $18^\circ$  C.

	Conductivity $\times 10^{-10}$	Contents per litre.	
		mgms.—equiv.	mgms.
Barium fluoride .....	1530	18.4	1630
Strontium fluoride .....	172	1.87	117
Calcium fluoride .....	40	0.42	16
Fluorspar .....	37	0.39	15
Magnesium fluoride .....	224	2.8	76
Lead fluoride .....	431	5.2	640
Silver chloride .....	1.25	0.010	1.6
Silver bromide ( $21^\circ$ ) .....	0.075	0.00057	0.107
Silver iodide ( $21^\circ$ ) .....	0.002	0.000015	0.0035
Thallous chloride .....	1514	12.7	3040
Thallous bromide .....	192	1.48	420
Thallous iodide .....	22.3	0.17	56
Mercurous chloride .....	1.2	0.01	2
Mercuric iodide .....	0.2	0.002	0.4
Silver iodate .....	11.9	0.14	40
Lead iodate .....	6.2	0.067	19
Barium sulphate .....	2.4	0.020	2.3
Heavy spar .....	2.8	0.024	2.7
Strontium sulphate .....	127	1.24	114
Celestine .....	127	1.24	114
Gypsum .....	1885	29.9	2040
Lead sulphate .....	32.4	0.27	41
Barium chromate .....	3.2	0.03	3.8
Silver chromate .....	18.5	0.15	25
Lead chromate .....	0.1	0.001	0.2
Barium oxalate ( $2\text{H}_2\text{O}$ ) ..	78.3	0.76	86
Strontium oxalate .....	54.0	0.52	46
Calcium oxalate ( $\text{H}_2\text{O}$ ) ..	9.6	0.087	5.6
Magnesium oxalate ( $2\text{H}_2\text{O}$ )	200	5.36	300
Zinc oxalate ( $2\text{H}_2\text{O}$ ) .....	8.0	0.083	6.4
Cadmium oxalate ( $3\text{H}_2\text{O}$ ) ..	27.0	0.33	33
Silver oxalate .....	25.5	0.23	35
Lead oxalate .....	1.3	0.010	1.5

—J. T. D.

*Salts in Non-aqueous [Acetone and Pyridine] Solutions; Reactions of —.* A. Naumann. Ber. 1904, 37, 4328—4341; 4609—4614. (See this J., 1904, 1088.)

THE following are soluble in anhydrous acetone:—Aluminium bromide, chloride,\* nitrate.\* Ammonium bromide, chromate,\* trichromate, bichromate,\* iodide, nitrate, perchlorate, thiocyanate, thiosulphate.\* Antimony tribromide, trichloride, tri-iodide. Barium bromide, chlorate,\* iodide, nitrate.\* Bismuth trichloride, tri-iodide. Bromine. Cadmium bromide, chlorate, chloride,\* iodide, nitrate. Cesium nitrate. Calcium bromide, chlorate, chloride,\* bichromate, iodide, nitrate. Cerium bromide, chloride, iodide, nitrate. Chromic nitrate. Chromic anhydride. Cobaltous bromide, chloride, iodide, nitrate. Cupric bromide, chlorate, chloride, Didymium nitrate. Erbium nitrate. Ferric chloride,

nitrate, ferrous chloride. Iodine. Lanthanum nitrate. Lead bromide, nitrate. Lithium bromide, chlorate,\* chloride, iodide, nitrate. Magnesium bromide, chlorate, chromate, iodide. Mercuric bromide, chloride, iodide.\* Palladium chloride. Platinic chloride. Potassium bromide, chlorochromate, ferricyanide, ferrocyanide, iodide, nitrate.\* Permanganate, mercuric iodide, thiocyanate. Rubidium bromide.\* Silver nitrate, nitrite. Sodium bichromate.\* Stannic chloride, bromide, stannous chloride, bromide. Strontium chloride,\* nitrate.\* Sulphur. Thallic chloride, thallous nitrate. Thorium nitrate.\* Uranium bromide. Uranyl chloride, iodide, nitrate. Zinc chloride.

The following are insoluble:—Aluminium arsenate, carbide, fluoride, hydroxide, potassium sulphate, oxide, phosphate, silicate, silicofluoride, sulphate, sulphide. Ammonium carbonate, chloride, bichromate, hypophosphite, meta-arsenite, phosphite, pyrophosphate, silicofluoride, sulphate, sulphite. Di-ammonium arsenite and phosphate. Monoammonium carbonate, phosphate, sulphate, sulphite. Triammonium phosphate. Antimony nitrate, oxychloride, oxide, metantimonic acid. Arsenic trioxide. Barium bromate, carbonate, chloride, chromate, ferrate, hydroxide, iodate, nitrite, oxide, peroxide, sulphite, thiosulphate. Beryllium chloride, sulphate. Bismuth chromate, nitrate, oxychloride, oxide, sulphide. Cadmium carbonate, oxide, sulphate, sulphite. Cesium chloride, sulphate. Calcium carbonate, chromate, dithionate, fluoride, hydroxide, oxide, sulphite. Dicalcium phosphate, Tricalcium phosphate. Chromium-ammonium sulphate. Chromic chloride, fluoride, hydroxide, oxide, phosphate, sulphate. Cupric carbonate, chromate, fluoride, oxide, sulphate, sulphide, cuprous bromide, chloride, iodide, sulphide. Didymium carbonate, oxide, sulphate, sulphite. Ferroso-ferric oxide, sodium-ferric pyrophosphate, ferric oxide, phosphate, sulphate, ferrous phosphate, sulphate. Lanthanum carbonate, chloride, oxide, sulphate. Lead chloride, chromate, basic chromate, fluoride, hydroxide, oxide, peroxide, red-lead, lead iodide, pyrophosphate, silicate, silicofluoride, sulphate. Lithium carbonate, fluoride, hydroxide, metaborate, pyroborate, phosphate, silicofluoride, sulphate. Magnesium carbonate, hydroxide, oxide, sulphate. Manganese dioxide, sesquioxide, -ammonium phosphate, manganous fluoride, pyrophosphate, sulphate, sulphide, sulphite. Mercuric chromate, oxide, sulphate, sulphide. Mercurous bromide, chloride, chromate. Nickelous chloride, sulphate. Phosphorus pentoxide. Potassium bromate, carbonate, chlorate, chloride, chromate, bichromate, hydroxide, nitrite, pyroantimonate, stannate, sulphate, sulphide. Rubidium chloride, sulphate. Silica. Silver bromide, carbonate, chloride, iodide, oxide, phosphate, pyrophosphate, sulphate sulphide, disulphide. Sodium carbonate, chloride, chromate, hydroxide, stannate, sulphate. Stannic sulphide, stannous oxide, sulphate, sulphide. Strontium carbonate, hydroxide, metaborate, oxide, peroxide, sulphate, sulphide. Thallous bromide, carbonate, chloride, iodide, sulphide. Zinc carbonate, chromate, oxide, sulphate.

*Cupric chloride*: The saturated solution has a sp. gr. of 0.8154, and contains 1 gm. in 34.7 grms. of acetone. It reacts completely with stannous chloride, giving a precipitate of cuprous chloride. With soluble bromides it forms cupric bromide, which partially dissociates giving insoluble cuprous bromide and bromine. With iodides, it forms insoluble cuprous iodide and iodine. It absorbs ammonia gas, forming the insoluble compound,  $\text{CuCl}_2 \cdot 2\text{NH}_3$ . It absorbs hydrochloric acid gas, forming a solution, probably of a readily decomposable addition-compound.

*Cupric bromide*: The solution slowly dissociates (see above). With mercuric chloride, double decomposition occurs, but no precipitation.

*Cuprous chloride*, suspended in acetone, is converted by chlorine gas into cupric chloride, which dissolves. Bromine gives a mixture of cupric chloride and bromide. Iodine forms cupric chloride and cuprous iodide.

*Mercurous chloride*, suspended in acetone, forms with chlorine, bromine and iodine, the corresponding mercuric salts, along with mercuric chloride.

*Bismuth trichloride*: The saturated solution has the sp. gr. 0.9194, and contains 1 gm. in 5.59 grms. of acetone. It is completely precipitated by ammonia gas, forming

\* Soluble with difficulty.



a mixture of the compounds  $\text{BiCl}_3 \cdot 2\text{NH}_3$  and  $\text{BiCl}_3 \cdot 3\text{NH}_3$ . With potassium iodide, potassium chloride is precipitated, and a dark-red solution of bismuth iodide formed. With silver nitrate, complete double decomposition occurs, and precipitation of the whole. Hydrogen sulphide precipitates bismuth sulphide.

*Antimony trichloride*: Very soluble, 1 grm. dissolves in 0.186 grm. of acetone, sp. gr. of solution 2.216. The solution is precipitated by ammonia gas, the compound  $\text{SbCl}_3 \cdot 3\text{NH}_3$  being deposited. With potassium iodide and silver nitrate the reactions are the same as with bismuth trichloride. Hydrogen sulphide gives no precipitate.

*Ferric chloride*: 1 grm. dissolves in 1.59 grms. of acetone; sp. gr. of solution 1.160. The solution is completely reduced by stannous chloride. With potassium iodide it forms ferrous iodide and potassium chloride, which precipitates, the liberated iodine combining with excess of potassium iodide. Silver nitrate precipitates silver chloride. Hydrogen sulphide partially reduces it to ferrous salt with separation of sulphur.

*Cobaltous chloride*: 1 grm. dissolves in 36.4 grms. of acetone; sp. gr. of solution 0.825. With ammonia, the solution forms blue  $\text{CoCl}_2 \cdot 2\text{NH}_3$ , changing with excess to red  $\text{CoCl}_2 \cdot 6\text{NH}_3$ . Silver nitrate precipitates silver chloride. Potassium thiocyanate forms a deep blue solution of cobaltous thiocyanate, and precipitates potassium chloride.

*Mercuric chloride*: 1 grm. dissolves in 0.7 grm. of acetone; sp. gr. of solution 1.956. Ammonia precipitates  $\text{HgCl}_2 \cdot 2\text{NH}_3$ . Hydrogen sulphide precipitates  $\text{HgCl}_2 \cdot 2\text{HgS}$ . Stannous chloride precipitates mercurous chloride, which is not reduced to mercury by excess. Cadmium iodide precipitates a mixture of cadmium chloride and mercuric iodide. Bismuth iodide precipitates mercuric iodide. Cupric bromide precipitates cuprous chloride, chlorine being liberated. Potassium or ammonium thiocyanate precipitates the corresponding chloride. Silver nitrate precipitates silver chloride.

*Stannous chloride*: 1 grm. dissolves in 1.8 grms. of acetone; sp. gr. of solution 1.6. Ammonia precipitates  $\text{SnCl}_2 \cdot 4\text{NH}_3$ . Hydrogen sulphide precipitates stannous sulphide. Silver nitrate is not reduced, but precipitates silver chloride. Barium iodide precipitates barium chloride. Cupric chloride or bromide forms cuprous chloride, and stannic chloride or bromide. Chlorine, bromine, and iodine form the stannic halides.

*Cadmium bromide*: 1 grm. dissolves in 64.5 grms. of acetone; sp. gr. of solution 0.8073. Ammonia precipitates  $\text{CdBr}_2 \cdot 2\text{NH}_3$ . Hydrogen sulphide precipitates cadmium sulphide, which slowly redissolves as excess of the gas is led in. Silver nitrate precipitates silver bromide. Mercuric chloride precipitates cadmium chloride. Chlorine precipitates cadmium chloride, and liberates bromine.

*Cadmium iodide*: 1 grm. dissolves in 4 grms. of acetone; sp. gr. of solution 0.994. Ammonia precipitates  $\text{CdI}_2 \cdot 2\text{NH}_3$ . Hydrogen sulphide precipitates  $\text{CdI}_2 \cdot 2\text{CdS}$ . Silver nitrate precipitates silver iodide.

*Zinc chloride*: 1 grm. dissolves in 2.3 grms. of acetone; sp. gr. of solution 1.14. Ammonia precipitates  $\text{ZnCl}_2 \cdot 2\text{NH}_3$ . Hydrogen sulphide causes a white turbidity which disappears as more gas is led in. Silver nitrate precipitates silver chloride. Alkali thiocyanates behave as with mercuric chloride. Finely powdered potassium chloride shaken with the solution dissolves; the filtered liquid, evaporated, gives crystals of  $\text{ZnCl}_2 \cdot 2\text{KCl}$ .

*Silver Nitrate*: 1 grm. dissolves in 227 grms. of acetone; sp. gr. of solution 0.798. Hydrogen sulphide precipitates silver sulphide. A solution of roll sulphur in acetone, heated with the solution for 2 hours under a reflux condenser, gives a dark-brown powder of the composition  $\text{Ag}_2\text{S}_2$ . Ammonia precipitates  $\text{AgNO}_3 \cdot 2\text{NH}_3$ . Potassium thiocyanate precipitates silver thiocyanate and potassium nitrate; excess of potassium thiocyanate redissolves the former. Ammonium thiocyanate reacts similarly, but the ammonium nitrate remains in solution. Hydrochloric, hydrobromic, and hydriodic acids precipitate the corresponding halides, the two last redissolving in excess of the acid.

The following are soluble in pyridine (those marked with an asterisk sparingly so):—Aluminium chloride,\* iodide,\* thiocyanate. Barium bromide,\* chloride,

iodide. Bismuth trichloride. Cadmium bromide,\* iodide.\* Calcium bromide, chloride, iodide, nitrate. Cerium bromide, chloride. Chromic anhydride. Cobalt bromide, iodide, nitrate.\* Cupric bromide, chloride, cyanide,\* fluoride, cuprous bromide, chloride. Ferric chloride, ferrous chloride. Gold trichloride. Iodine. Lanthanum chloride. Lead bromide, chloride, iodide,\* nitrate. Lithium bromide, chloride, iodide, nitrate. Magnesium bromide, chloride, iodide. Manganous chloride. Mercuric bromide, chloride, cyanide, iodide, nitrate.\* Nickel chloride,\* nitrate.\* Palladium chloride,\* nitrate.\* Platinic chloride. Potassium chloride,\* cyanide,\* iodide,\* mercury iodide, permanganate, thiocyanate. Silver bromide, chloride, cyanide, nitrate, nitrite, sulphate, thiocyanate. Sodium bromide, iodide, nitrite. Stannic chloride, stannous bromide, chloride. Strontium chloride. Sulphur. Uranium bromide. Uranyl chloride, iodide, nitrate. Zinc bromide, chloride. Insoluble are:—Aluminium fluoride, nitrate, phosphate, silicate, sulphate. Ammonium carbonate, chloride, chloroplatinate, metarsenate, pyroborate, pyrophosphate, silicofluoride, sulphate, sulphite, thiosulphate. Monammonium carbonate, hypophosphite, phosphate, sulphate, sulphite. Triammonium phosphate. Barium bromate, carbonate, chlorate, chromate, cyanide, iodide, phosphate, sulphate, sulphide, sulphite. Beryllium chloride, sulphate. Cadmium chloride, nitrate, sulphate. Cesium chloride, nitrate, sulphate. Calcium carbonate, sulphate. Dicalcium phosphate, tricalcium phosphate. Chromium carbonate, chloride, fluoride, phosphate, sulphate. Cobaltic arsenate, phosphate, sulphate. Cobaltous carbonate. Cupric arsenate, arsenite, carbonate, nitrate, silicate, silicofluoride, sulphate, sulphide. Erbium sulphate. Ferric phosphate, sulphate. Ferrous phosphate, sulphate, sulphide. Lanthanum carbonate, sulphate. Lead cyanide, fluoride, phosphate, sulphate. Lithium arsenate, carbonate, fluoride, hydroxide, iodate, metaborate, pyroborate, silicate, silicofluoride, sulphate. Magnesium carbonate, sulphate. Manganous carbonate, silicate, sulphate. Mercuric chromate, sulphate, sulphite. Nickel phosphate, sulphate. Potassium bromate, bromide, carbonate, chromate, bichromate, ferriocyanide, ferrocyanide, hydroxide, iodate, nitrate, perchlorate, pyroantimonate, sulphate. Rubidium bromide, chloride, iodide, nitrate, sulphate. Silver arsenite, carbonate, iodate, metaborate, phosphate. Sodium bicarbonate, bisulphate, bisulphite, bromate, carbonate, chlorate, chloride, metaborate, pyroborate, sulphate, sulphite. Stannic sulphide. Stannous sulphide. Strontium carbonate, metaborate, sulphate. Thallium bromide, carbonate, chloride, iodide. Zinc carbonate, cyanide, sulphate, sulphide.

*Mercuric chloride*: Great heat is evolved on mixing this salt with pyridine, and on cooling, the excess of the salt crystallises out as the compound  $\text{HgCl}_2 \cdot \text{C}_5\text{H}_5\text{N}$ . Ammonia gives a white precipitate of  $\text{HgCl}_2 \cdot 2\text{NH}_3$ . Ammonium thiocyanate gives a precipitate of ammonium chloride. Hydrogen sulphide throws down black mercuric sulphide, which in presence of excess of hydrogen sulphide rapidly turns red. In presence of sulphur in the pyridine solution (which itself does not react on mercuric chloride), the change from the black to the red form does not occur even with large excess of hydrogen sulphide. Hydrogen sulphide reacts with mercuric cyanide, bromide, or iodide, as with the chloride; but the change to the red form of the sulphide is more rapid and pronounced. Silver sulphate precipitates mercuric sulphate. Stannous chloride precipitates metallic mercury. Mercurous salts in contact with pyridine break up into mercuric salts, and metallic mercury; the finely divided mercury is very active chemically.

*Cupric chloride*: Reacts with pyridine to form  $\text{CuCl}_2 \cdot 2\text{C}_5\text{H}_5\text{N}$ , which separates; the bright blue solution contains but little cupric chloride. Hydrogen sulphide throws down cupric sulphide, a little remaining in solution, colouring the solvent brown. Silver sulphate forms very slowly a precipitate of copper sulphate. Nitrates (lead or silver) precipitate copper nitrate. Silver cyanide produces a change of colour, indicating reaction, but no precipitate. Thiocyanates change the colour from blue to green,

indicating the formation of cupric thiocyanate; but there is no precipitate unless the chloride formed is insoluble. Similar remarks apply to bromides and iodides.

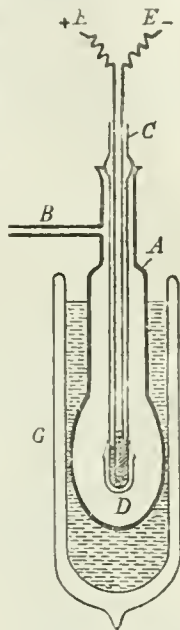
*Silver nitrate*: Hydrogen sulphide precipitates silver sulphide, as in aqueous solution. Sulphur, when the warm solutions are mixed, throws down  $\text{Ag}_2\text{S}$ , with considerable evolution of heat; other silver salts behave similarly towards sulphur. Potassium thiocyanate precipitates potassium nitrate. Chlorides, bromides, or iodides give no visible reaction unless the nitrate formed by double decomposition is insoluble.

*Silver sulphate* behaves similarly in all respects to the nitrate.

Pyridine solutions show the peculiarity, that where they exhibit reactions opposed to those of aqueous solutions of the same substances, these reactions persist in the pyridine sense, even in presence of a considerable amount of water.—J. T. D.

*Yellow Arsenic*; Preparation of —. A. Stock and W. Siebert. Ber., 1904, 37, 4572—4575.

THE vessel A, which can be immersed in liquid air in G, carries the tube-stopper C, hung to the bottom of which by platinum wires is the small beaker C. Stout copper wires E E convey the current from four accumulators through a cryptol resistance at the lower end of C, by means of which a temperature of about  $400^\circ\text{C}$ . can be maintained there. Metallic arsenic (sublimed in vacuo) is placed in the small beaker, C is placed in position, the joint made tight with sealing-wax, and the vessel A exhausted by the mercury pump. The whole is cooled by liquid air, and the cryptol heated by the current. The arsenic sublimates, and condenses on the walls entirely as the yellow modification: either like flowers of sulphur or as a transparent yellow coating or lacquer on the glass. Heat rapidly transforms it into the ordinary form; sun-light does so too, though if the temperature be kept low, the transformation effected by light is relatively slow—the transformed outer layers act as screens. The change is accompanied by contraction of volume, and seems to be exothermic. The identity of this yellow arsenic with that obtained by Erdmann and von Unruh by distillation into carbon bisulphide, was established.—J. T. D.



*Silicic Acid*; Detection of —. J. Petersen. XXIII., page 45.

*Potassium Chlorate*; Action of Hydrochloric Acid on —. A. Kolb and E. Davidson. XXIII., page 45.

*Zinc*; Electrolytic Separation of —, from Zinc Chloride in Acetone Solution. H. E. Patten. XI. B., page 33.

*Hydrogen Peroxide*; Colorimetric Valuation of —. P. Planis. XXIII., page 45.

*Iodine in soluble Iodides and in Mixtures of these with Bromides and Chlorides*; Determination of —. H. Ditz and B. M. Margosches. XXIII., page 45.

#### ENGLISH PATENTS.

*Barium Oxide*; Manufacture of [Porous] —. C. D. Abel, London. From Gebr. Siemens und Co., Charlottenburg, Germany. Eng. Pat. 4217, Feb. 19, 1904.

SEE Fr. Pat. 341,200 of 1904; this J., 1904, 823.—T. F. B.

*Lime*; Manufacture of Hydrated — from Quicklime. J. Reaney, Rider P.O., Md., U.S.A. Eng. Pat. 22,940, Oct. 25, 1904.

SEE U.S. Pats. 773,029 and 773,030 of 1904; this J., 1904, 1088 and 1089.—T. F. B.

*Sea Water*; Compound for Treating —, to Prevent Incrustation and Corrosion in Vessels in which it is Evaporated. A. Gutensohn, Southend. Eng. Pat. 27,888, Dec. 19, 1903.

SEE U.S. Pat. 773,494 of 1904; this J., 1904, 1109.—T. F. B.

*Alkali Nitrites*; Improved Method of Manufacturing —. J. Grossmann, Manchester. Eng. Pat. 1452, Jan. 20, 1904.

A MIXTURE of graphite and slaked lime is added in small portions, with stirring, to melted alkali nitrate, which may contain a small proportion of caustic alkali. The mass, after cooling, is lixiviated, the solution is evaporated to dryness, and the dry mixture of nitrite and nitrate is again fused with lime and graphite, the operations being repeated until practically the whole of the nitrate is reduced. For lime, other alkaline-earth oxides or hydroxides may be substituted.—E. S.

*Nitrates or Similar Salts*; Extraction, or Preparation of — [from "Caliche," &c.]. J. C. W. Stanley, London. Eng. Pat. 4796, Feb. 26, 1904.

FINELY-POWDERED "caliche" ("the earth containing the sodium nitrate, mixed with common salt and mineral matter") is added to hot water, and the mixture is boiled until it attains a boiling point of about  $240^\circ\text{F}$ ., and then allowed to settle. After a time, the liquor is run into a heated tank, provided with agitators, from which it is pumped, whilst hot, through a filter-press. The filtrate is passed into V-shaped vessels that can be readily tipped on one side, and crystallisation is promoted by passing cooled air through pipes submerged in the solution. If much sodium chloride is present, this is salted out by boiling the solution, and the magma is filtered hot, the sodium chloride remaining in the filter-press.—E. S.

*Sodium Ferrocyanide*; Manufacture of —. A. G. Bloxam, London. From Administration der Minen von Buchweiler, Buchweiler, Germany. Eng. Pat. 3349, Feb. 10, 1904.

SEE Fr. Pat. 339,966 of 1904; this J., 1904, 714.—T. F. B.

#### UNITED STATES PATENTS.

*Air*; Process of Heating — [Production of Nitrogen Peroxide]. H. Pauling, Brandau, Austria-Hungary. U.S. Pat. 777,485, Dec. 13, 1904.

SEE Fr. Pat. 323,760 of 1902; this J., 1903, 495.—T. F. B.

*Nitric Acid*; Process of Manufacturing — [from Air]. H. Pauling, Brandau, Austria-Hungary. U.S. Pat. 777,486, Dec. 13, 1904.

SEE Fr. Pat. 323,760 of 1902; this J., 1903, 495.—T. F. B.

*Cyanides*; Process of Making Metallic —. M. Voigt, Charlottenburg, and A. R. Frank, Berlin, Assignors to The Firm Cyanid-Gesellschaft, m.b.H., Berlin. U.S. Pat. 775,953, Nov. 29, 1904.

A CRUDE metallic cyanamide is dissolved, and from the cleared solution the cyanamide is separated, and is heated to its melting point under pressure in presence of carbonaceous substances, powdered fluxes, and of inorganic substances containing the base, the cyanide of which it is desired to produce. (See also Eng. Pat. 16,298 of July 22, 1902; this J., 1903, 554.)—E. S.

*Ammonia*; Process of Making — [from Cyanamide]. A. Frank, Charlottenburg, Germany. U.S. Pat. 776,314, Nov. 29, 1904.

To obtain ammonia, cyanamide is heated under pressure, in presence of carbon dioxide gas, to not less than  $100^\circ\text{C}$ ., with a proportion of water of not less than three molecules to two atoms of the nitrogen present in the cyanamide. Ammonia and a formate are obtained by heating cyanamide with steam in the proportions above stated, to about  $300^\circ\text{C}$ .—E. S.



## VIII.—GLASS, POTTERY, AND ENAMELS.

## ENGLISH PATENTS.

*Furnaces or Kilns for Enamelling, Melting, or Baking Metals, Glass, Porcelain, Pottery, and the like; Impts. in —.* H. H. Cunynghame, London. Eng. Pat. 26,363. Dec. 2, 1903.

MUFFLE or crucible furnaces are constructed with a thin layer of refractory material forming an inner furnace lining, covered with a comparatively thick outer jacket. The latter is formed of non-conducting materials; such as asbestos, plaster of Paris, or the like cemented together with a solution of sodium silicate or other building material, and applied as a plastic mass to the inner refractory lining.—W. H. C.

*Glassware; Method of Manufacturing —.* J. L. C. V., F. J., F. L., and P. R. Arbogast, Pittsburg, U.S.A. Eng. Pat. 15,866, July 16, 1904. Under Internat. Conv., July 16, 1903.

SEE U.S. Pat. 756,558 of 1904; this J., 1904, 490.—T. F. B.

*Glass; Manufacture of —, and Apparatus therefor.* J. Forster, St. Helens. Eng. Pat. 20,444, Sept. 22, 1904.

THIS apparatus for the manufacture of hollow glass articles consists of a rotating vessel of refractory material arranged in a heating vessel, and containing the molten glass. Above this vessel is a blow-pipe, attached to a vertically movable cross-frame; the containing vessel and the blow-pipe are rotated at the same rate. Above the vessel containing molten glass, is a graduated cooling chamber. Cooling air is admitted into an annular space in the wall of the chamber, and becomes heated by the sensible heat of the glass cylinder, and passes then into a lower annular space in the wall, thus forming a graduated series of cylinders or rings of cooling air. In the upper part of the chamber is a coil for the circulation of a cooling fluid. Air is admitted to the blow-pipe from a compressor, in quantities proportional to the size of the cylinder drawn, the compressor being regulated by the vertical movement of the blow-pipe. The lower end of the cylinder is finished by cutting off the air-supply, and tapering off the bottom of the cylinder into a thread which is cut off, and the bottom perforated, re-heated, and rotated to open out into a cylinder. A vertically movable frame, capable of revolving horizontally or vertically, and provided with gripping bands, is provided for the removal of the cylinders.—W. C. H.

*Glass; Manufacture of Sheet —, and Apparatus therefor.* O. Imray, London. From The Window Glass Machine Co., Pittsburg, Pa. Eng. Pat. 22,065, Oct. 13, 1904.

TO the end of a tank furnace, a small chamber is attached, in which is a pivoted ladle, with a slot in it through which the molten glass flows up to a certain level. By tilting this ladle the required amount of glass flows into a drawing pan, supported on vertical supports, by which it can be raised or lowered horizontally or inclined to allow surplus glass to be run off into a receptacle. Above the drawing pan is a frame carrying a group of drawing baits, whereby a number of sheets can be drawn upwards simultaneously into a chamber with an enclosed atmosphere, the outer sheets preventing the inner ones from warping. The lower ends of the sheets are severed from the mass of glass, and the group of baits with the dependent sheets is moved mechanically from the drawing- to an annealing chamber. The chilling device near the point of drawing consists of two concentric tubes, through the inner of which water is circulated. The drawing chamber has hollow walls and means for leading the heat from below the pan to the walls. The pan is provided with a movable cover, which is allowed to be over the pan during re-heating and filling. The sheets are separated from the mass of glass by burning off, and to prevent the heat from the burners affecting the upper part of the sheets, oblong or elliptical water tubes are arranged between the sheets, and can be turned with the longer axes horizontal, to reduce the spaces between the sheets.—W. C. H.

## UNITED STATES PATENT.

*Glass-melting Furnace.* W. T. Nicholls, Wellsburg, W. Va. U.S. Pat. 776,196, Nov. 29, 1904.

THE patent relates to a tank-furnace, through which flames and gases can be passed. Refractory tiles, provided with projecting portions to increase the heating surface, are arranged to float on the surface of the bath of molten glass, and are prevented from floating out of the furnace. The object of the tiles is to protect the glass from the action of the flame, and means are provided for the introduction of raw material to the bath below the level of the tiles.—W. C. H.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

*Fire-Bricks; Refractoriness of Some American —.* R. F. Weber. Amer. Inst. Mining Eng., Sept., 1904.

THIS paper contains an account of a series of observations made on 44 samples of American fire-bricks, in order to trace the relation between chemical composition, refractoriness and texture; and also gives a comparison of a number of American and foreign analyses and fire tests. In the literature of the subject, it is pointed out, that though the analytical data are fairly complete, the details of the fire tests are meagre, and cannot be reduced to a comparable basis.

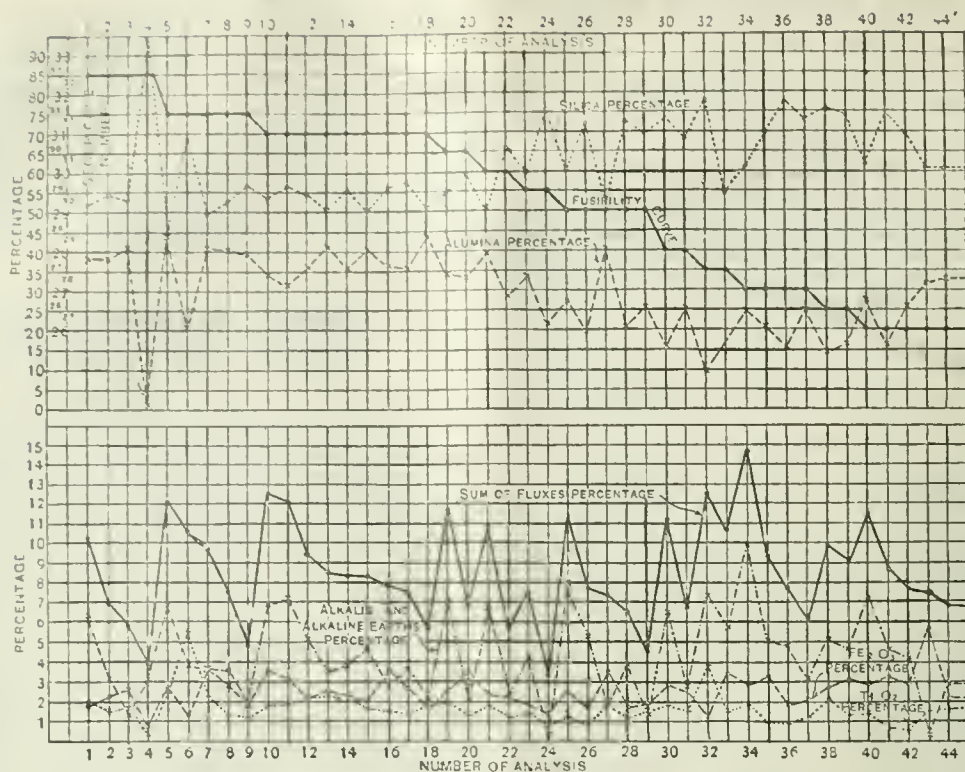
The samples examined were submitted to a partial chemical analysis, and the fusing point determined, in a Deville furnace, by means of Seger cones, observations of the texture of the bricks being also recorded. The partial analysis included the determination of—total silica, alumina, ferric oxide, and titanium oxide; the difference between the aggregate percentages of these components and 100, represents the percentage of alkaline earths and alkalis. The analytical methods used were mainly those suggested by Richardson and Hillebrand for the analysis of cement (this J., 1902, 30), the titanium oxide being determined by Weller's method.

In any brick there is usually a large number of very coarse angular or rounded grains from 1 to 5 mm. in diameter, of flint-clay, quartz, or burnt material, surrounded by a more or less fine-grained matrix, which usually fuses first, and may cause the brick to lose its shape rapidly. The point at which the matrix softened sufficiently to cause the brick to lose its shape was taken as the fusion point.

The influence of texture on fusibility is emphasised from an observation of Ries that the fusibility of almost any of the New Jersey fire-bricks he examined, could be reduced four or five cones by grinding the brick sufficiently fine to pass through a 100-mesh sieve.

Titanium oxide, together with the ferric oxide, alkaline earths and alkalis, is included under the term "sum of the fluxes," since Ries has shown that 2 or 3 per cent. of it added to a high-grade kaolin, will lower the fusion point two or three cones. In many published analyses the amount of titanium oxide is not given, and consequently the alumina content appears too high and the total fluxes too low, by the amount of titanium oxide present.

The table given shows graphically the results of the author's tests. The following salient points may be noted:—In all the bricks fusing above cone No. 30, 55 per cent. of silica is a fairly good mean, and 65 per cent. for bricks fusing below that temperature; hence the silica content is a rough estimate of refractoriness. It should be noted that No. 4 is a silica-brick. The high percentages of total fluxes in samples 10 and 32, show that except for the presence of fluxes, an increase in silica naturally accompanies a decrease in alumina. A fair refractoriness of a brick, in spite of moderately high percentages of silica and total fluxes, may be due to the fact that much of the quartz, which is a powerful fluxing element, is bound up in grains sufficiently coarse to prevent an active fluxing action. Samples Nos. 25 and 40 illustrate this, the latter being fine-grained, while the former contains many flinty



particles 2 to 5 mm. in diameter. A high content of total fluxes does not necessarily indicate a low refractoriness, though a coarse grain may in such cases account for the result. The author concludes that the refractoriness of a fire-brick depends upon the percentages of silica, and total fluxes, and on the coarseness of grain, and that, therefore, except within wide limits, chemical analysis alone is an insufficient guide. In the case of clays, however, the texture may be regarded as practically uniform, and chemical analysis will, therefore, indicate the refractoriness much more closely.

In conclusion, the author gives some published data referring to foreign bricks and clays similar to those he obtained for American bricks, and the results tend to confirm those given above.—W. C. H.

*Slags; Formation of* —, in *Smelting Operations. Constitution of the Slags and their Industrial Application.* Mathesius. X., page 31.

#### ENGLISH PATENTS.

*Stone; Process for Colouring Natural* —. H. H. Lake, London. From Chem.-Techn. Fabrik, Dr. A. R. W. Brand and Co., Charlottenburg, Germany. Eng. Pat. 22,547, Oct. 19, 1904.

SEE U.S. Pat. 770,643 of 1904; this J., 1904, 985.—T. F. B.

*Slag Powder [Cement]; Process of Manufacturing* —. W. Mathesius, Hoerde, Germany. Eng. Pat. 199, Jan. 4, 1904.

SEE Fr. Pat., 339,374 of 1904; this J., 1904, 663.—T. F. B.

#### UNITED STATES PATENTS.

*Calcining Furnace [for Gypsum, &c.]*. W. A. Koenen, Chicago, Ill. U.S. Pat. 776,186, Nov. 29, 1904.

The furnace is intended for calcining gypsum or the like. The calcining chamber has its feed opening at the upper part and its discharge opening below, so that the gypsum descends by gravity, past the sides of heating

flues crossing the chamber, which, as well as flue-spaces on opposite sides, are closed, so that the products of combustion traversing the flues, do not come in contact with the descending gypsum. Each flue-space communicates at its lower end with the heating medium, and has its outlet towards its upper end, diaphragms in the flue-space operating to direct the hot gases in a zigzag course through the flues and flue-spaces. There are air-supplying and distributing, and vapour-abstracting conduits opening into the chambers, and extending parallel with the flues, and mechanical means for agitating the descending material.—E. S.

*Stone; Manufacture of Artificial* —. C. Rubitschung, Frankfurt-on-the-Maine, Germany. U.S. Pat. 777,145, Dec. 13, 1904.

SEE Eng. Pat. 17,618 of 1902; this J., 1903, 867.—T. F. B.

#### FRENCH PATENTS.

*Bricks; Process for Covering* —, with a *Protective Coating to Prevent Efflorescence and Blackening*. M. Perkiewicz. Third addition, dated Aug. 6, 1904, to Fr. Pat. 330,655, March 27, 1903.

This addition to the original patent (see Eng. Pat. 3760 of 1904; this J., 1904, 662) is for improvements in applying the coating on the belt coming obliquely up or down from the press, or coming from a mouth-piece with inclined edges, or for using the covering, in place of oil, by spreading it on separate moulds, or on the moulding pistons, the moulded articles being able also to be placed on an arrangement which brings them back to receive the coating.—W. C. H.

*Floors; Material for Covering* —, and *Method of Manufacturing it*. Deutsche Bodenbelag-Ges. Stuttgart, Stegmeyer and Maurer. Fr. Pat. 345,669, Aug. 18, 1904.

The material consists of a thick mixture of coloured casein, nut-galls, animal or vegetable fibres, and a resinous substance finely-divided and dissolved in, say,



turpentine. This mixture is obtained as a pulp in the cold, and may be spread with rollers on a suitable foundation, such as wood, textile fabrics, glass, &c., and solidifies on drying, and can then be worked down with glass-paper, polished and waxed. It gives a floor or wall covering of equal thickness all over the surface, without any joints, and is impermeable, and easily cleaned.—W. C. H.

*Cement; Process of Manufacturing Impermeable and Acid-proof* —. R. Liebold. Fr. Pat. 345,421, Aug. 8, 1904.

THE acid-proof cement is made by moistening 100 kilos of unbroken, calcined cement with a mixture of 300 grms. of Japan wax and 20 grms. of caustic alkali emulsified with 8 litres of boiling water. The product is then dried and finely powdered. (See also Eng. Pat. 4606 of 1904; this J., 1904, 490.)—W. C. H.

## X.—METALLURGY.

*Steel Worked "in the Blue."* ["Blue-shortness."] *Absence of Brittleness in* —. C. Frémont. Comptes rend., 1904, 139, 1032–1033.

It is generally supposed that all irons and steels acquire shortness when subjected to permanent deformation, either by pressure or by shock, whilst at a temperature lying between 200° and 450° C. (Compare Ledebur, this J., 1887, 42.) The author has found that some steels, particularly those used in the construction of certain locomotive boilers, do not become brittle under these conditions, and he concludes that "blue-shortness" is not an absolute property of iron or mild steel, but a defect which may in certain cases be avoided by suitable conditions of manufacture.—H. B.

*Chlorination [Gold Extraction]; The New* —. W. E. Greenawalt. Eng. and Mining J., 1904, 78, 872–874.

THE author discusses the relative costs and advantages of the chlorination and cyanide processes of gold extraction, more particularly with regard to the treatment of Cripple Creek ores. He concludes that with the application of chlorine generated electrolytically from sodium chloride, the cyanide process will no longer be able to compete successfully with chlorination for the treatment of Cripple Creek gold ores. It is estimated that electrolytic chlorine would cost only 15 cents per ton of ore as compared with 75 cents for chlorine obtained from bleaching powder and acid; whilst if plant were provided for recovering and refining the caustic soda produced in the electrolytic process, the value of this product would about cover the total expense of generating the chlorine.—A. S.

*Metals; Action of Potassium Cyanide Solution on* —. A. Brochet and J. Petit. Bull. Soc. Chim., 1904, 31, 1255–1257.

ALUMINIUM and magnesium are readily attacked by a solution of potassium cyanide in the cold; but of the other metals only copper and zinc cause an appreciable evolution of hydrogen, a double cyanide being formed. In the case of zinc, the action soon stops owing to the formation of the insoluble double cyanide  $\text{Zn}(\text{CN})_2 \cdot 2\text{KCN}$  which protects the metal. At the boiling point the reaction is much accelerated. Certain metals, e.g., cadmium and silver, will dissolve only in the presence of air or oxygen; whilst mercury remains unattacked.

Quantitative experiments show that when a strip of platinum is boiled with potassium cyanide solution, the surface gradually becomes pitted, and there is a decrease in weight. If the metal is then placed in a fresh solution and the boiling repeated, the loss of weight is greater and approximates to 0.030 gm. per sq. dem. per hour.—B. J. S.

*Slags; Formation of* —, in *Smelting Operations. Constitution of the Slags and their Industrial Application*. Mathesius. Berg- u. Hüttenm.-Zeit., 1904, 63, 381–387; Z. angew. Chem., 1904, 17, 1891.

IX dealing with the constitution of slags of the work of Ackermann and Vogt on silicates, and of G. Hilgenstock

on phosphate slags (this J., 1886, 606) is reviewed. The technical applications of slags are then discussed, especially the manufacture of "slag-cements" and the use of Thomas slag as a manure. A process (due partly to the author) is described in which granulated blast-furnace slag, sufficiently basic, is treated with exhaust steam, which causes it to swell and fall to a soft dry amorphous powder of great fineness, which sets and hardens with water like a cement; the cost of milling and burning is thereby saved.—F. Sch.

*Masut [Petroleum Residue]; Use of* —, for *Fuel* [in *Iron and Steel Works*]. F. Heck. III., page 22.

*Manganese in Cyanide Solutions; Colorimetric Detection and Determination of* —. J. E. Cennell. XXIII., page 46.

*Copper [in Ores, Mattes, &c.]; Iodometric Determination of* —. A. M. Fairlie. XXIII., page 46.

*Copper [in Copper Pyrites]; Determination of* —, in *presence of Iron and Arsenic, by the Iodide Method*. L. Moser. XXIII., page 46.

## UNITED STATES PATENTS.

*Dry Separator [for Ores, &c.]*. T. A. Edison, Llewellyn Park, N.J. U.S. Pat. 775,965, Nov. 29, 1904.

A BLAST of air is sent through a tube of substantially uniform cross-sectional area, and having two screen diaphragms, spaced apart, extending across the whole area of the tube. The first of these diaphragms is of coarser mesh than the second, and the space between them serves as a pressure-equalising chamber. The feed hopper, which is situated on the upper side of the tube, immediately after the second screen, delivers a thin, uniform, vertical sheet of pulverulent or granular material, which falls across the whole area of the tube. The material is graded by the air blast, and falls into suitable separate receptacles placed on the lower side of the tube.—W. H. C.

*Metallic Constituents of Ores; Separation of* — *from Gangue*. A. E. Cattermole, London. U.S. Pat. 777,273, Dec. 13, 1904.

SEE Eng. Pat. 18,589 of 1903; this J., 1904, 256.—T. F. B.

*Minerals; Separation of* — *from Ores*. A. E. Cattermole, H. L. Sulman, and H. F. Kirkpatrick-Picard, London. U.S. Pat. 777,274, Dec. 13, 1904.

SEE Eng. Pat. 17,109 of 1903; this J., 1904, 902.—T. F. B.

*Gold and Silver Ores; Process of Treating* —. C. H. Rider, St. Louis, Mo. U.S. Pat. 776,424, Nov. 29, 1904.

THE crushed ore is placed in vessels connected in series by tubes passing from near the bottom of one vessel to the top of the next, and stated proportions of water, sulphuric acid, and nitric acid are added, to dissolve the silver. The solution is removed to another set of vessels, and into the first series of vessels a mixture of water and nitric and hydrochloric acids is introduced to dissolve the gold. The solutions containing dissolved silver and gold are combined, and after precipitation of the silver, ferrous sulphate is added to precipitate the gold.—E. S.

*Pressure-Filter for Slimes*. W. A. Prichard, Kalgoorlie, Australia. U.S. Pat. 776,084, Nov. 29, 1904.

THE pressure-filter includes a receiving chamber for the slime, open at one end, and exits for the solution which passes through a filtering medium between the inlet and the exits. There is also an outlet for the insoluble residue. Baffle blades are disposed longitudinally in the chamber, in which a perforated rotating shaft is longitudinally mounted, and propeller blades are mounted on the shaft between the baffle blades. The shaft is divided into two compartments, and there are means for injecting into the lower of these a washing medium, and into the opposite end a drying agent.—E. S.

*Metall Welding.* H. Wachwitz, Hersbruck, Germany. Assignor to The Wachwitz Patents Syndicate, Ltd., London. U.S. Pat. 776,706, Dec. 6, 1904.

SEE Fr. Pats. 322,159 and 322,160 of 1902; this J., 1903, 303.—T. F. B.

*Gases of Blast Furnaces, Generators, &c.; Apparatus for Cleansing the —.* E. Kratochvil, Kraluv Dvur, Austria-Hungary. U.S. Pat. 777,112, Dec. 13, 1904.

SEE Eng. Pat. 6387 of 1903; this J., 1903, 860.—T. F. B.

#### FRENCH PATENTS.

*Iron and Steel; Apparatus for the Treatment of Iron Ore for the Manufacture of —.* M. Moore and T. J. Heskett. Fr. Pat. 345,599, Aug. 16, 1904.

THE furnace is adapted for the continuous treatment of iron sand or powdered iron ores, which are mechanically delivered into a vertical shaft, set with baffle arrangements, in which the descending ore is met by waste or other heating gases. The ore thus heated is deflected at length into a side chamber, from the bottom of which it is worked by a horizontal screw into the second division of the shaft, also provided with baffles; the ore then descends to a channel leading to the hearth, meeting on its way reducing gases. The hearth, on to which the reduced and heated ore thus descends, may be revolved, or moved upwards or downwards. The upper portions of the shaft, in which the ore is heated, may be replaced by an inclined revolving cylinder.—E. S.

*Iron and Steel; Process for Hardening and Cementing Soft —.* Soc. Cyanid Gesellschaft. Fr. Pat. 345,642, Aug. 17, 1904.

THE iron or steel article is heated with a cyanamide or with one of its alkali or alkaline-earth compounds, with addition of a substance containing carbon, followed by a flux, such as sodium carbonate or chloride, or calcium chloride or fluoride. The mixture of calcium cyanamide with charcoal may be obtained as described in Fr. Pat. 289,826, of June 12, 1899.—E. S.

*Calcareous Minerals; Process of Enriching —.* E. Ledue and C. Griffiths. Fr. Pat. 339,162, Nov. 12, 1903.

SEE Eng. Pat. 12,797 of 1904; this J., 1904, 826.—T. F. B.

*Soldering Paste; Manufacture of —.* R. Küpper. Fr. Pat. 345,593, Aug. 13, 1904.

THE soldering paste is composed of a powdered metal or alloy; a soldering agent which does not leave an acid residue, such as ammonium chloride, borax, or soluble glass (alkali silicate), and glycerin or other liquid inert carbon compound, which will not evaporate before the soldering agent, or the metal employed in soldering, fuses.—E. S.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A).—ELECTRO-CHEMISTRY.

*Hydrogen-Oxygen Cell; Potential of the —.* F. J. Brislee. Paper read before the Faraday Society, Nov. 23, 1904.

THE potential of the galvanic cell:

Platinised platinum } N acid { Platinised platinum  
charged with hydrogen } acid { charged with oxygen

on measurement by different experimenters, has been found to lie between 1.076 and 1.14 volts.

It is not at all unlikely that a little persulphuric acid, hydrogen peroxide and ozone may have resulted during the electrolysis, and the investigations here recorded were undertaken with a view to determine the influence of traces of these bodies upon the oxygen potential. Two lines of work were followed:—First, the electrodes were

polarised by electrolysis extending over 2 or 3 days; and second, the electrodes were freed from gases as completely as possible, and then the respective gases were passed through the liquid and the potential was measured from time to time till constant. Thus, two potential limits were obtained—the first, starting from a high potential and gradually falling, and the second rising to a constant value. When the potentials were constant to about 1–2 millivolts, the effect of the addition of the various substances was tried.

The combination  $\text{Pt} \text{ H}_2 / \text{N} / \text{H}_2\text{SO}_4 / \text{Pt} \text{ O}_2$  was found

to give a potential difference of about 1.082 volts at 18° C. The addition of hydrogen peroxide lowers the oxygen potential, whereas persulphates and ozone raise the oxygen potential and diminish the rate of discharge of oxygen by an electrode supersaturated with oxygen by electrolysis. By employing electrodes of extremely thin platinum deposited upon glass and platinised, the same potential was obtained independently of the method of charging the electrode with oxygen. Such electrodes give a potential in close agreement with that calculated from Holmholtz's formula.—R. S. H.

*Electrolytic Oxidation of Hydrocarbons of the Benzene Series. I. Hydrocarbons containing the Methyl Group.* H. D. Law and F. M. Perkin. Paper read before the Faraday Soc., Oct. 25, 1904.

THE authors have investigated the electrolytic oxidation of toluene, *o*-, *m*- and *p*-xylene, mesitylene and pseudocumene, the hydrocarbons being partially dissolved in acetone, with sulphuric acid as electrolyte. It was found that electrolytic oxidation under these conditions is not so energetic or far-reaching as oxidation by chemical reagents. The chief product of the electrolytic oxidation was, in each case, the corresponding mono-aldehyde. In the case of the xylenes, the ortho and para compounds gave higher yields of the corresponding aldehydes than the meta compound, the latter being more readily oxidised to carbon dioxide and water. When three methyl groups are present in the hydrocarbon, they all appear to be more or less attacked, so that by the oxidation of pseudocumene, a mixture of different compounds is produced. Some of the yields of mono-aldehyde obtained were as follows, the percentages being calculated on the weight of the hydrocarbon employed. Benzaldehyde from toluene, about 7 per cent.; *m*-toluic aldehyde from *m*-xylene, 10–15 per cent.; *o*-toluic aldehyde from *o*-xylene, 25–30 per cent.; *p*-toluic aldehyde from *p*-xylene, 25–35 per cent.; aldehydes from pseudocumene, 10–12 per cent.; aldehyde from mesitylene, 10–15 per cent.—A. S.

*Cobalt and Nickel; Electrolytic Analysis of —.* F. M. Perkin and W. C. Prebble. XXIII., page 46.

*Yellow Arsenic; Preparation of —.* A. Stock and W. Siebert. VII., page 28.

*Flour; Influence of Ozone on the Properties of —.* K. Brahm. XVIII. A., page 39.

### ENGLISH PATENT.

*Ozone; Method of Converting Oxygen into —.* F. S. Blackmarr and J. L. Willford, Minneapolis, U.S.A. Eng. Pat. 295, Jan. 5, 1904.

SEE U.S. Pats. 743,431, 743,432, and 743,433 of 1903; this J., 1903, 1298.—T. F. B.

### UNITED STATES PATENT.

*Ammonium Formate; [Electrolytic] Process of Manufacturing —.* H. Pauling, Brandau, Austria-Hungary. U.S. Pat. 776,543, Dec. 6, 1904.

AMMONIUM formate is produced by subjecting a mixture of hydrogen, nitrogen, carbon monoxide and steam to non-luminous electric discharges, in presence of porous contact substances.—T. F. B.



## FRENCH PATENTS.

*Electrolytic Process and Apparatus.* C. P. Townsend.  
Fr. Pat. 345,871, Aug. 26, 1904.

This invention comprises an electrolytic cell divided into two compartments by a permeable cathode of iron wire gauze, and a diaphragm permitting of a limited filtration of the electrolyte. One compartment contains the anode of graphite and the electrolyte, which may be a solution of a salt of an alkali metal, and in the other is a liquid, such as a non-saponifiable oil, which will not mix nor react chemically with the product of electrolysis formed at the cathode. A circulation of the oil is produced by the rising bubbles of hydrogen, and the circulation and the rising bubbles of gas assist in detaching and carrying away the globules of caustic solution from the surface of the cathode. An arrangement is provided in the cathode compartment, whereby the temperature of the oil, and thus the temperature of the electrolyte, may be varied.—B. N.

*Oxidising and Reducing Organic Substances; Process for Electrolytically* —. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 345,701, Aug. 19, 1904. Under Internat. Conv., Sept. 12, 1903.

Organic substances can be easily reduced or oxidised electrolytically in presence of small quantities of vanadium compounds. The salts of the oxides  $V_2O_5$  and  $V_2O_3$  are suitable for reducing, whilst  $V_2O_4$  and  $V_2O_5$  are oxidising agents. For example, azobenzene is reduced to benzidine by electrolysis in a 20 per cent. solution of sulphuric acid containing about 2 per cent. of vanadium trioxide; the bath is heated to about  $50^\circ\text{C}$ ., and a current density of 100–200 amperes per sq. metre is employed. Anthracene may be oxidised in a 20 per cent. solution of sulphuric acid containing 1 per cent. of vanadic acid, at a temperature of about  $80^\circ\text{C}$ ., using lead electrodes; a current density of 300 amperes per sq. metre at 1.6 volts is employed. (Compare U.S. Pats. 729,502 and 742,797 of 1903; this J., 1903, 872 and 1355.)—T. F. B.

*Vulcanisation of Rubber; Impts. in [Electrical] Heating Apparatus, especially those used in the* —. Electric Moulding and Heating Co. Fr. Pat. 345,606, Aug. 16, 1904. XIX C., page 36.

## (B.)—ELECTRO-METALLURGY.

*Sted; Electric Furnace for the Manufacture of* —. G. Dary. L'Electricien, 1904, 27, 305. Proc. Inst. Civil Eng., 1904, 158, 37.

THE author gives a description of a new type of Kjellin electric furnace without electrodes. The ore is placed in a circular chamber, around a coil wound with copper wire, and provided with a rectangular laminated core of thin plates of soft iron. On passing an alternating current through the coil, a variable magnetic flux is set up in the core and induces an alternating current in the furnace-charge. The intensity of the current passing through the charge is equal to the number of amperes flowing through the coil multiplied by the number of turns in the coil. A high tension alternator may be used as a direct source of current, and the furnace is therefore specially suitable where water-power is utilised. The system has been under trial in Sweden since 1900, and recent tests are stated to have given good practical results. With a furnace of 1800 kilos. capacity, and an alternator of 165 kilowatts, 4100 kilos. of steel were produced in 24 hours. 1000 kilos. of steel are withdrawn at each cooling, and 800 kilos are always left in the furnace to form a secondary circuit. The cost of production of the steel amounts to 0.015 franc per h.p.-hour. The cost of maintenance of the furnace is very low.—A. S.

*Potassium Cyanide; Action of* — on Metallic Electrodes. A. Brochet and J. Petit. Bull. Soc. Chim., 1904, 31, 1257–1261.

THE action of potassium cyanide solution on metallic anodes depends largely on the current density used. Copper, cadmium, silver, and within certain limits of C.D., nickel, dissolve quantitatively. Cobalt and mercury dissolve,

but the latter becomes coated with a black insulating layer, whilst lead, iron and platinum may be considered as insoluble anodes. Silver and cadmium are readily deposited on the cathode, a very small percentage remaining in solution; zinc, copper and nickel, however, are deposited only with difficulty. Iron and cobalt persistently remain in solution. When a current is passed between platinum electrodes, the cathode gradually loses in weight, probably alloying with the alkali metal, and subsequently separating as finely divided platinum. The authors believe these mechanically separated particles to be more attenuated than Bredig's "colloidal platinum," since they dissolve more readily in potassium cyanide solution, and after the current has ceased, the liquid continues to evolve hydrogen for 1–2 hours. The solution of the cathode appears to be greater with barium cyanide.—B. J. S.

*Metals; Theory of the Solution of* —, in Potassium Cyanide, under the Influence of Alternating Currents. A. Brochet and J. Petit. Bull. Soc. Chim., 1904, 31, 1261–1265.

Those metals which are dissolved by potassium cyanide at the anode, using direct current, and quantitatively deposited at once at the cathode, remain unattacked when an alternating current is used. Thus silver is unattacked; cadmium behaves somewhat similarly, whilst copper, nickel, zinc, and cobalt readily dissolve. The action on platinum is, however, entirely dependent on the process of cathode solution described in the preceding abstract, and the metal is rapidly dissolved. Curves are given showing the behaviour of metals under varying frequencies, and of nickel under varying frequency and current density. The authors summarise their results as follows:—

- (1). The alternating current admits of the preparation of different compounds.
- (2). The frequency has an important bearing on the behaviour of the electrodes. (See also page 31.)—B. J. S.

*Zinc; Electrolytic Separation of* —, from Zinc Chloride in Acetone Solution. H. E. Patten. J. of Phys. Chem., 1904, 8, 483–487. Chem. Centr., 1904, 2, 1532.

THE current-curve corresponding to the separation of zinc with platinum electrodes from a solution of zinc chloride in acetone is shown in Fig. 1. The

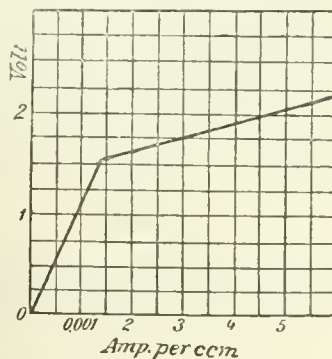


Fig. 1.

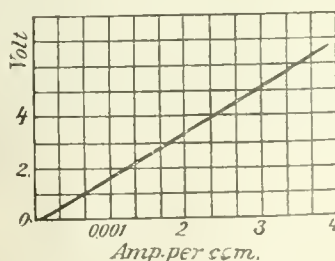


Fig. 2.

a composition point is at about 2 volts. Chloroform, chloroacetone, and other alkyl chlorides are formed at the anode, whilst at the cathode zinc is deposited in a compact form. Between the electrodes the current takes the form of a straight line (see Fig. 2); no polarisation is exhibited. At the anode, zinc goes into solution quantitatively, according to Faraday's law.—A. S.

*Tin; Note on the Electrolytic Recovery of —.* F. Gelstharp. Chem. News, 1905, 91, 1.

WHEN a current is passed through a solution of caustic soda 10° T. at 80° C. with electrodes of tin plate, only a little hydrogen and oxygen are evolved, and the anode is protected by a film of a brown substance, probably oxide, which forms on its surface. The tin of the anode may, however, be soon dissolved and deposited on the cathode as a sponge by reversing the current for a short time to reduce the oxide, and again reversing. Agitation of the cathode economises electrical energy by 30-40 per cent., and instead of reversing the current, the same result may be obtained by placing a piece of clean iron in contact with the anode for a short time. The recovered tin, on plunging into water, gives off hydrogen, probably owing to the presence of traces of sodium. It is generally obtained slightly crystalline by this method, and hence is not suitable for making tin paste.—B. J. S.

*Tin Paste; Electrolytic Preparation of —.* F. Gelstharp. Chem. News, 1904, 90, 324.

ANODES of tin are placed in dilute hydrochloric acid of 5° T. (free from arsenic), and a current passed, using a C.D. of 270 amperes per sq. m. Tin paste, suitable for making "silvered" paper, is thus deposited at the cathode, and can be removed from time to time, since the occluded hydrogen causes it to float on the liquid. The electrolyte must be stirred, or crystalline tin will form, owing to over concentration at the bottom of the vat. It is necessary to varnish the cathode with a non-conducting substance to a depth of 5-7.5 cm. below the surface of the liquid, although the current efficiency is thus reduced to 50 per cent. Experience shows that unless hydrogen is separated with the tin, the product is obtained crystalline.—B. J. S.

*Cadmium [on Iron]; Electro-deposition of —.* A. Fischer. Chem. Zeit., 1904, 28, 1209.

FOR plating iron objects with cadmium, 32 grms. of cadmium chloride are dissolved in about  $\frac{1}{2}$  litre of water and precipitated with sodium carbonate solution. The precipitate is well washed and dissolved, whilst still moist, in a solution of 50 grms. of potassium cyanide in 1 litre of water. The bath is best kept at 40° C.; cadmium anodes are used, and 4-5 volts applied. The deposit, after buffing, is of the same colour as, but rather harder than tin.—W. A. C.

#### ENGLISH PATENTS.

*Furnace; Improved Process and —, for Subjecting Solid Materials to the Action of the Electric Arc.* K. Birkeland and S. Eyde, Christiania, Norway. Eng. Pat. 26,003, Sept. 16, 1904. Under Internat. Conv., Sept. 19, 1903.

THE furnace consists of two walls of insulating fire-proof material, which, with the end walls and roof, enclose a high, narrow space forming the furnace chamber, and into this the powdered materials, with or without other substances, such as carbon, are fed at the top in a thin, even stream. The electrodes may be arranged horizontally or vertically, and may be hollow for the introduction of air or reducing gas. The ends of the electrodes inside the chamber are situated in a strong magnetic field, whereby a disc-shaped electric arc is produced, which almost fills the chamber, and through which the materials to be treated must pass. The materials are removed at the bottom through two inclined shoots, and there are also two outlets for the escape of the furnace gases.—B. N.

*Tin; Process and Apparatus for the Electrolytic Recovery of —, from Materials Containing the Same, and for the Simultaneous Recovery of Other Metals.* F. E.

Clotten, Frankfort-on-Maine, Germany. Eng. Pat. 25,550, Nov. 23, 1903.

THE material to be treated, which forms the anode, is placed in a wire gauze or wooden basket, and the electrolyte is circulated through the basket and cell by means of upper and lower tanks and a pump. A neutral electrolyte, containing stannic chloride, ammonium chloride or other suitable ammonium salt, and organic acids, is used, the stannic chloride being regenerated, whilst the organic acidist furnish carbon dioxide by decomposition. The crystals of metallic tin form on the outer iron wall of the cell, which is used as the cathode, and is lined at the base with insulating material. An insulated filter-like diaphragm, built up of narrow vertical sheet metal plates arranged in terrace-like manner, and with strips attached to and forming acute angles with the plates, divides the cell into cathode and anode compartments; any lead and silver collect in the latter as basic carbonate and chloride, the diaphragm preventing the entrance of the mud into the cathode compartment. Iron present in the scrap remains at the anode, and copper, antimony, and bismuth are left as a loose sponge coating the anode.—B. N.

#### XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*Baobab Seeds; Oil of —.* Balland. J. Pharm. Chim., 1904, 20, 529-531.

THE baobab tree (*Adansonia*) is a native of tropical Africa, but has been transplanted to Asia and America. The pulp of the fruit ("monkey bread") is eaten by the negroes, whilst the fat is extracted by the natives of Madagascar by boiling the crushed seeds with water. The seeds examined by the author weighed about 1 gm. each, and had a maximum diameter of 16 to 17 mm. 100 grms. of the seeds yielded 63.3 per cent. of kernels, which had the following composition:—Water, 5.4; nitrogenous matters, 17.0; fat, 63.20; extractive substances, 9.72; cellulose, 1.05; and ash, 3.55 per cent. The phosphoric acid amounted to 1.34 per cent. Starch was not found. A specimen of the fat obtained from Madagascar was a whitish solid which began to melt at about 25° C., becoming perfectly fluid at 31° C. It had an odour recalling that of Tunisian olive oil, and was quite free from any trace of rancidity, although it had been prepared some 8 or 9 months. The author points out that this fat could be advantageously used in place of cocoanut oil in the manufacture of vegetable lards, and also for high-priced toilet soaps and unguents.—C. A. M.

#### UNITED STATES PATENT.

*[Fats]; Apparatus for Rendering or Reducing —.* E. R. Edison, Cleveland, Ohio. U.S. Pat. 776,227, Nov. 29, 1904.

THE apparatus described consists essentially of a closed tank provided with a perforated false bottom, and an outlet at the top for the escape of vapours. Fluid can be introduced through a central pipe extending downwards and communicating with perforated arms radiating laterally, and supported at their outer ends by projections from the walls of the chamber, or other means. There may also be a central multiple pipe coupling at the bottom of the chamber with perforated lateral pipe sections for the introduction of fluid, whilst the false bottom above these pipes may be constructed in sections held in position by means of a central screw or otherwise.—C. A. M.

#### FRENCH PATENT.

*Soap; Apparatus for Solidifying Liquid —, in Moulds.* F. Daum. Fr. Pat. 345,748, Aug. 20, 1904.

CLAIM is made for a revolving drum provided on its periphery with pockets to receive the liquid soap, and with means for cooling its interior by water, cold air, &c., with or without the addition of an external cooling device. The solidified tablets are removed by hand, or by mechanical



means, such as a series of pistons, the heads of which form the bottoms of the moulds, and as the drum revolves, work upwards and expel the soap. Or the sides of the moulds may be closed by plates in which are openings for the introduction of a rod to expel the bar of soap laterally.—C. A. M.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

#### (A.)—PIGMENTS, PAINTS.

##### ENGLISH PATENT.

*Paints or Pigments; Manufacture of* —. M. Hérisson, Paris. Eng. Pat. 2376, Jan. 30, 1901.

SEE Fr. Pat. 337,440 of 1903; this J., 1904, 495.—T.F.B.

##### FRENCH PATENT.

*Basic Zinc Carbonate [Pigment]; Manufacture and Application of* —. C. J. Barbier. Fr. Pat. 339,151, Nov. 7, 1903.

WATER saturated naturally or artificially with calcium carbonate or carbonic acid is electrolysed with anodes consisting of plates of zinc, and cathodes of any suitable conducting substance such as carbon or a metal. The zinc is converted into a basic carbonate, which, after drying, is used as a pigment in place of white lead. It is said to cover better than the latter, and is non-poisonous.—M. J. S.

#### (B.)—RESINS, VARNISHES.

##### FRENCH PATENTS.

*Amber; Method of Utilising Waste Yellow* —. H. Thiemann. Addition dated July 15, 1904, to Fr. Pat. 345,196, July 15, 1904 (this J., 1904, 1226).

THE  $\gamma$ -resin remaining in the insoluble residue obtained by treating waste amber with chloroform, as described in the main patent, is purified by fusion, and is then treated with boiled linseed oil and turpentine to produce a lac or varnish, which is stated to give a harder film than that obtained from amber itself. The proportions specified are 45 parts of boiled linseed oil and 80 parts of turpentine for 75 parts of the  $\gamma$ -resin.—A. S.

*Linerusta and Similar Materials; Process and Apparatus for Embossing and Colouring or Painting* —. F. Walton. Fr. Pat. 345,848, July 29, 1904.

THE invention has reference to a machine by which the embossing and colouring of linerusta are effected in one operation and continuously. The materials for forming the linerusta are compressed into a sheet of suitable thickness, which is then passed between the embossing cylinders. From these it passes to one or more colouring rollers, each of which applies a different colour. These rollers, which are made of printers' roller composition, are facsimile reproductions of the embossing cylinder, and are obtained by taking a plaster cast of the embossing cylinder, which cast is then used as a mould for the roller composition. Any parts of the colouring rollers which are not to apply paint to the linerusta are cut away, and all the rollers are so geared together that corresponding parts will be applied to the same parts of the sheet of linerusta.—M. J. S.

#### (C.)—INDIA-RUBBER, &c.

*Caoutchouc; Pre-existence of* —, in the Latex. W. Esch and A. Chwölles. Gummi-Zeit., 1904, 19, 165-166. (See this J., 1903, 1200; 1904, 990, 1036, 1154.)

THE authors review the discussion which has recently taken place as to the form in which caoutchouc is present in the latex, and conclude that it is indisputable that in all the more important rubber-yielding latices there is present not ordinary caoutchouc, but globules of an oily fluid which is converted into caoutchouc by polymerisation.

The substance enclosing the globules of oil probably consists, as Weber states, of an albuminoid compound, but the proof of this view is by no means complete. Weber considers that the oily fluid is an olefinic diterpene,  $C_{20}H_{32}$ , but the authors incline to Harries' view that it consists of a compound with a tolerably high molecular weight. Weber's argument, based upon the solubility of the oil in ether, is quite invalid since ordinary caoutchouc is soluble to a considerable extent in ether, as has been shown by Fendler (this J., 1904, 1103), and is not completely insoluble as stated by Weber.—A. S.

*Mascarenhasia. Rubber Plants of Madagascar. India-Rubber J.*, 1904, 28, 620.

THE black rubber of Madagascar is obtained from the *Mascarenhasias*, *M. lisianthifolia*, *M. anceps* and *M. longifolia*, the pink from the *Landolphias*, and the white from *Euphorbia latifolia*. The three *Mascarenhasias* grow in dry, damp and wet soils respectively. The coagulating medium employed is an aqueous decoction of the tamarind, the latex being poured into the extract to ensure complete coagulation. The "tears" resembling resin on the outside of the lumps are characteristic of these species. The latices of *M. anceps* and *Landolphia Perrieri* are practically identical, but the former yields from 640 to 666 grms. of rubber per litre, and the latter only about 460 grms. per litre. A single plant of *M. anceps* will yield 1 litre of latex each season. *Mascarenhasia* latex cannot be coagulated by boiling or smoking and unlike that from the *Landolphias*, it is not properly coagulated by lemon juice, sakoa bark or decoction of *Vahia monjym*. On the other hand a 3 per cent. solution of sulphuric acid will completely precipitate ten times its volume of latex.—J. K. B.

*India-Rubber; Red Kasai* —. E. de Wildeman and L. Gentil. *India-Rubber J.*, 1904, 28, 622-623.

RED Kasai and Congo rubbers are obtained from the same species of vines, namely, the *Landolphia*, *Ovaricosis Pal. Beauv.*, *L. Gentilii* De Wild and *L. Broogmansiana* De Wild, and the difference in colour, which is the chief distinction, is probably due to the different climatic conditions in the two districts, and different modes of collecting and coagulating, and not to any inherent property of the latices. The *Landolphia Klainer* also gives a reddish rubber when grown under the same conditions as the above mentioned species. The red colour of the rubber appears to be accentuated more and more as the district in which the vine is cultivated is farther from the zone known as the Great Equatorial Forest. In the south of the Congo territory, for instance, latitude  $7^{\circ}$  and  $8^{\circ}$ , the india-rubber collected is almost red. In the Upper Congo the latex from these varieties is very watery, whilst in the Kasai district it is thick. In the former district it is coagulated by means of Bosanga, and in the latter it coagulates spontaneously in contact with air.—J. K. B.

*Caoutchouc and Gutta-Percha; Assay of* —. W. Esch and A. Chwölles. XXIII., page 47.

##### UNITED STATES PATENT.

*Rubber; Process of Reclaiming* —, from Vulcanised Rubber Waste. W. A. Koenigman, Chicago, Ill. U.S. Pat. 776,187, Nov. 29, 1904.

THE disintegrated vulcanised rubber waste is heated with caustic alkali in a closed cylindrical vessel, within which is a vertical rotating shaft carrying beaters or knives. The alkali is then washed out, the reduced fibre, separated from the rubber by the action of the beaters, is dissolved in acid, and the resulting devulcanised rubber is washed and dried.—E. S.

##### FRENCH PATENTS.

*Rubber; Process for Regenerating Waste Vulcanised* —. R. B. Price. Fr. Pat. 345,793, Aug. 8, 1904. Under Internat. Conv., May 26, 1904.

SEE U.S. Pat. 762,843 of 1904; this J., 1904, 719.—T.F.B.

*Vulcanisation of Rubber: Impts. in Heating Apparatus, especially those used in the —.* Electric Moulding and Heating Co. Fr. Pat. 345,605, Aug. 16, 1904.

THE specification relates to the application of electrical energy for closing and heating vulcanising moulds, &c., the heating effect due to hysteresis and Foucault or secondary currents being utilised when an alternating current is employed. Various forms of moulds, &c., are described, the essential features being that they are made of a magnetisable metal (soft steel or cast iron), and in two pieces, which under the action of an electric current, are brought together and heated. It is preferable to use a direct current for magnetising the moulds, and an alternating current for heating them.—A. S.

#### XIV.—TANNING, LEATHER, GLUE, SIZE.

*Sumach; Detection of Adulterants in —, by Microscopical Examination.* M. C. Lamb. XXIII., page 46.

*Chrome Leather; Dyeing of — and Storing in the "Crust."* M. C. Lamb. VI., page 25.

##### ENGLISH PATENTS.

*Skins; Process for the Preparation of —.* J. B. Dolat, Paris. Eng. Pat. 26,049, Nov. 28, 1903. Under Internat. Conv., June 18, 1903.

SEE Fr. Pat. 333,187 of 1903; this J., 1903, 1300.—T. F. B.

*Leather, Leather Cloths, and Animal and Vegetable Fabrics; Manufacture and Waterproofing of —.* P. C. D. Castle, Bebington, Cheshire. Eng. Pat. 2167, Jan. 28, 1904.

CLAIM is made for the addition of flour made from the locust bean to a low-nitrated cellulose solution, whereby the thickening and adhesive power of the latter is increased to such an extent as to allow of a sufficient quantity of the mixture being applied in one operation to render the material coated with it thoroughly waterproof. The coating liquid may be mixed with an oil such as castor oil.—M. C. L.

*Gelatinous and the like Solutions; Process and Apparatus for Evaporating —.* C. H. Parkes, Whaley Bridge. Eng. Pat. 1144, Jan. 16, 1904.

A HEATED drum is caused to rotate in contact with the solution until the required thickness of semi-solid material has collected on the drum. The latter is then raised from the tank, or the supply of solution cut off, and the material on the drum further dried, and removed.

—W. P. S.

##### UNITED STATES PATENT.

*Leather; Process of Treating [Waterproofing] Manufactured —.* A. W. Case, Highland Park, Conn. U.S. Pat. 776,453, Nov. 29, 1904.

A SHEET of leather formed from a pulp of leather scrap is treated in a bath composed of melted wax or of a hot solution of a water-resisting substance, until the capillary cells of the material are completely filled.—A. S.

##### FRENCH PATENT.

*Tannin Matters of Wood and Barks; Apparatus for the Extraction of —, in the Cold.* A. Lantard. Addition dated July 30, 1904, to Fr. Pat. 338,360, Dec. 23, 1903 (this J., 1904, 615).

THE extractors described in the main patent (*loc. cit.*) may be replaced by vats of iron-cement (slag cement) closed hermetically. The vats described are in the form of long, horizontal cylinders.—A. S.

#### XV.—MANURES, Etc.

*Ferrous Sulphate as a Fertiliser.* E. Leclercq. Bull. Cercle Etudes Agron., Brussels, 1903. Eng. and Mining J., 1904, 78, 942.

THE author's experiments show that as a fertiliser for oats, 250 kilos. of copperas (ferrous sulphate) are equivalent to 150 kilos. of sodium nitrate, whilst the prices of the two compounds are as 1:5. The ferrous sulphate has the advantage also, that it acts as a weed-killer. It is stated that the fertilising value of the copperas lies in the iron, and not in the sulphuric acid.—A. S.

##### ENGLISH PATENTS.

*Manure; Manufacture of Artificial —, from Sewage and other like Matter.* W. Wardle, Burton-on-Trent. Eng. Pat. 25, Jan. 1, 1904.

THIS is an extension of Eng. Pat. 10,581 of 1903 (this J., 1904, 379). Refuse of a solid or semi-solid nature, such as "sewerage, blood, night soil, town refuse, ashpit collections, brewers' and distillers' or other like refuse" is mixed with a certain proportion (varied according to circumstances) of finely-ground gypsum, and of sodium chloride. The mixture is preferably heated or dried at a moderate temperature in an oven or kiln. (See also Eng. Pat. 6971 of 1901; this J., 1902, 183.)—E. S.

*Nitrates or Similar Salts; Extraction or Preparation of —.* J. C. W. Stanley. Eng. Pat. 4796, Feb. 26, 1904. VII., page 28.

#### XVI.—SUGAR, STARCH, GUM, Etc.

*Sugar Canes; Buying —, according to Juice Density.* Boname. Bull. Assoc. Chim. Sucr. Dist., 1904, 22, 405–407.

WITH the increasing centralisation of cane sugar manufacture it is of importance that a better basis for payment should be made than that of the mere weight of canes delivered. The density alone of the juice also is not sufficient, as juice of the same density gives very varying yields of sugar according to the variety of cane crushed: the yield of sugar therefore affords the only true basis in the interest of the manufacturer. It is also misleading in calculating the yield of sugar per acre to multiply the weight of canes by the average yield of the factory instead of by that of the particular variety of cane in question.—L. J. DE W.

*Diffusion; Determined and Undetermined Losses in —.* P. Herrmann. Bull. Assoc. Chim. Sucr. Dist., 1904, 22, 407–421.

THE author reviews the various causes which have been assigned for the losses in the diffusion battery, and finds that losses due to inversion of sugar by the acids present, and its destruction by micro-organisms or by enzymes are extremely small or nil. Apparent losses are often due to errors in analysis or bad sampling. The most reliable results are those of Claassen, as given below, which show only 0.10 to 0.15 per cent. of undetermined loss during diffusion:—

	1901–2.	1902–3.	1903–4.
Total losses .....	1.57	1.50	1.23
Determined .....	0.70	0.73	0.67
Undetermined .....	0.87	0.77	0.56
Losses in diffusion .....	0.64	0.70	0.63
Determined .....	0.52	0.55	0.53
Undetermined .....	0.12	0.15	0.10
Losses in working the juice .....	0.93	0.80	0.60
Determined .....	0.18	0.18	0.14
Undetermined .....	0.75	0.62	0.46

—L. J. DE W.

*Undetermined Losses [Sugar Manufacture].* Hanus and Hruska. Z. Zuckerind. Böhmen, 1904, 28, 348.

THE authors found that in certain tests, diffusion juice to which milk of lime had been added, and which had then been carbonated, polarised less than the same juice clarified with basic lead acetate. This loss of polarisation was in two cases 0.18 per cent., which, for an extraction of 12.5 per cent. of juice, would correspond to a loss of 0.223

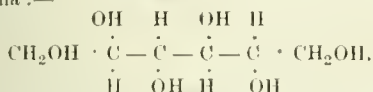


per cent. on the beetroots. They suppose that carbonation precipitates a dextrorotatory substance which, in the analysis of the scums, does not pass into solution again, and thus explains part of the undetermined losses in the sugar factory.—L. J. DE W.

*Sugars; Action of Secondary Asymmetric Hydrazines on*—R. Ofner. XXIII., page 47.

*Sorbieritol [d-Iditol]; Synthesis and Chemical Nature of*—G. Bertrand. Comptes rendus, 1904, 139, 983—986.

The author has synthesised and isolated *d*-iditol from sorbose by reducing it by hydrogenation in an acid medium, and oxidising away the *d*-sorbitol simultaneously formed, by means of the sorbose bacterium. This hexahydric alcohol (*d*-iditol) is found to be identical with sorbieritol (extracted from the juice of sorb), which has the formula:—



It must be concluded that natural *d*-iditol originates from the hydrogenation of sorbose, which is derived from sorbitol by oxidation.—T. H. P.

*Scammonose; So-called*—E. Votocek and R. Vondráček. Ber., 1904, 37, 4615—4616.

REQUER has recently stated (J. Pharm. Chim., 1904, 20, 148-151 and 213-217) that he has obtained from scammonin (or scammonic acid), by boiling with dilute mineral acids, a saccharine syrup which deposits crystals of a pentose; this he describes provisionally as a methyl-tetrose. The authors cannot confirm these observations, as they find that the sugars obtained in the above way consist at most of traces of pentose and are mainly dextrose, rhodose, and another methylpentose, which is probably isorhodose. The name scammonose must therefore be discarded.—T. H. P.

*Beetroot Juice; Determination of Reducing Sugars in*—H. and L. Pellet. XXIII., page 47.

*Milk Sugar and Maltose; New Colour Reaction for*—A. Wöhler. XXIII., page 47.

*Fructose; Methylphenylhydrazine Reaction of*—C. Neuberg. XXIII., page 46.

*Molasses containing Reducing Sugars; Analysis of Refinery*—H. Pellet. XXIII., page 47.

#### ENGLISH PATENTS.

*Sugar Cane, Beetroot, and the like; Treatment of*—R. Harvey, Glasgow. From L. Nandet, Paris, and H. C. Hinton, Madeira. Eng. Pat. 27,606, Dec. 17, 1903.

FRESH raw cane juice from the crushing mill is sulphured, mixed with milk of lime and heated to a suitable temperature. The juice is then pumped into a macerating vessel filled with fresh megasse, and previously drawn juice is added to fill the vessel completely. Forced filtration of the juices is effected by the aid of a pump, and when the filtration is complete, the megasse in the macerating vessel is exhausted by water, removed to a second cane-mill and pressed. The maceration vessels are worked in batteries of from 4 to 12 vessels, in such a way that the filtration and exhaustion are conducted as economically as possible.—J. F. B.

*Cane Juice, Beet Juice, and other Liquids; Evaporators for*—R. Harvey, London. Eng. Pat. 28,617, Dec. 30, 1903.

THE combined heater and film-evaporator, for use with either single or multiple effects, has a calandria composed of a number of tubes fixed in two tube-plates, and surrounded by a vapour-jacket. The vapour-jacket has a number of holes in its inner wall, differing in size according to the distance from the steam inlet, and ensuring a

uniform supply of steam to all parts of the calandria. The bottom of the calandria is also surrounded by a steam-jacket. The tubes are maintained about one-third full of juice, which, being heated, boils up to the top in such a way that the upper portions of the tubes act as film-evaporators. J. F. B.

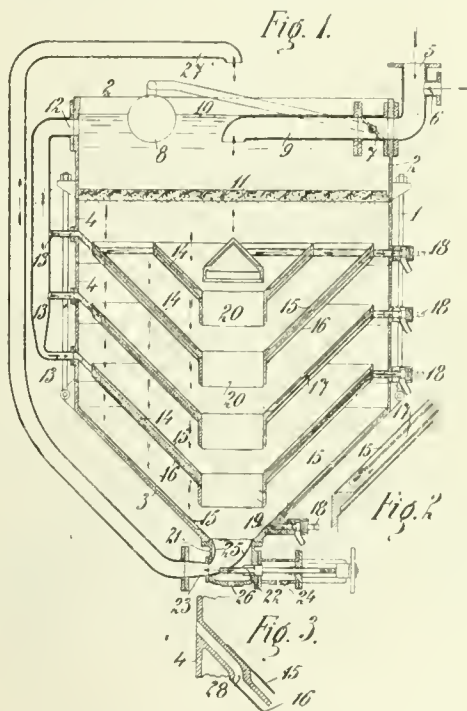
*Sugar Cane, Beet and other Juices or Liquids; Evaporator for Concentrating*—R. Harvey, London. Eng. Pat. 28,711, Dec. 31, 1903.

THE evaporator has a jacketed calandria fitted with three tube-plates, with a juice-space between the intermediate and the bottom tube-plates. Narrow tubes extend from the bottom tube-plate to the top one, through the juice-chamber. These narrow tubes are connected with the steam casing, and their interior is filled with steam. Wider tubes extend from the intermediate tube-plates to the top plate, and surround the narrow tubes, so as to form an annular passage which is supplied with juice from the juice chamber. Thus the film-evaporating tubes are heated with steam both inside and outside.

—J. F. B.

*Filters [Sugar]; Impts. in [Sand]*—J. Kostalek, Prague, Austria. Eng. Pat. 20,857, Sept. 28, 1904.

THE sand filter consists of a series of superposed cylindrical sections (4) fitted with cone-shelves (14), so constructed as to enable the sand to pass without hindrance to the base of the apparatus, the annuli (20) preventing the mixing of the filtered and unfiltered juice. Above and



below the shelves are perforated plates. The juice to be filtered entering at (5) is admitted by the automatic arrangement (7, 8) and passes through the sand (11) or overflows by the side inlets (13) to the space (28) (Fig. 3) between the shelves (14) and the perforated plates (16), through the sand downwards in parallel streams; the filtrate passing through the perforated plates (15) (Fig. 2) away by the outlets (18) where the outflow is controlled by regulating screws. To the base of the apparatus is connected the washing apparatus (21) with a horizontal hollow sliding injection tube (22) and junction piece (23), by means of which the sand, saturated with seum, is carried away by the flow of water under pressure through

the pipe (27) into the upper part of the filter, and thereby washed. The residue of juices flows off from the sand through the perforated funnel (25) and away by the opening (26).—L. J. DE W.

#### FRENCH PATENT.

*Sugar Mould; Plut* —, giving Rapid Cooling. F. Lafenille. Fr. Pat. 339,168, Nov. 14, 1903.

SEE ENG. PAT. 26,779 of 1903; this J., 1904, 994. T. F. B.

### XVII.—BREWING, WINES, SPIRITS, Etc.

*Malt (Distillery); Application of Somlo's Process of Washing* —, G. Frede. Z. Spiritusind., 1904, 27, 504.

THE author describes details of experiments made on the washing of green malt for distillery use with hot water, according to Somlo's process (see this J., 1904, 674). The malt was of very bad quality, the refuse of the malting floors, containing many crushed and damaged corns, sand, stones, &c., and in the ordinary way of working it was very mouldy. For the washing process, a disused yeast-tun was filled with hot water at 53°–55° C., and so much malt was introduced as sufficed to bring the temperature down to 50° C., after thorough mixing. Careful stirring was continued until the sound malt-corns had sunk to the bottom, whilst the debris, broken corns, root-lets, &c., were skimmed off the top. The stirring and skimming were then repeated for a second time and the malt was collected on a sieve. This malt was then placed in cold water in a second tun and cold water was introduced at the bottom by means of a hose, until the water which overflowed was free from impurities. Finally the washed malt was drained on a hurdle. In the case of very mouldy malt, lime may be mixed with the hot water with advantage. The washed malt was always used for the preparation of the yeast-mash, whereby a purer yeast was ensured. Mashies prepared with this malt fermented earlier and with greater intensity than those prepared from unwashed malt. The washing process involves a loss of about 2 per cent. of the available mashing space on account of the water absorbed by the malt.—J. F. B.

*Beer Wort; Tables for Calculating the Original Percentage of Extract in* —, P. Lehmann and H. Stadlinger. Z. anal. Chem., 1904, 43, 679–687.

THE original gravity of the wort expressed, according to Continental custom, in terms of the percentage of extract [degrees Balling] is calculated by the formula  $100(E + 2.0665A)/(100 + 1.0665A)$ , in which E = the percentage of residual (unfermented) extract in the beer, and A = the percentage of alcohol by weight.

Since the calculation of this expression is a tedious operation, the authors have compiled tables, applicable to beers containing from 1.5 to 5 per cent. of alcohol in increments of 0.01 per cent., by reference to which the percentage of extract in the original wort can be calculated simply by multiplying the residual extract of the beer by a single factor which is indicated in one column of the table, and adding to the product a number indicated in another column.—J. F. B.

[Brewing] *Gauging by the Titrimetric Method*. C. Bleisch. Z. ges. Brauw., 1904, 27, 877–879.

AFTER carefully testing the (sodium thiosulphate) titrimetric method of gauging the capacity of fermenting tuns and other brewing vessels, the author finds that the limits of experimental error in the method may be so wide as to lead to greater inaccuracy in the results than when direct measurement of the liquid is practised, or the pycnometric method is used for determining the gravity of the wort. It is therefore entirely unsuitable for the purposes of exact measurement, and must be restricted to approximate determinations, and as a check on results when the existence of any serious error in mechanical gauging is suspected.—C. S.

*Wines; Reduction of the Amount of Sulphurous Acid in White* —, P. Carles. J. Pharm. Chim., 1904, 20, 551–557.

THE amount of sulphurous acid (free and combined) added to white wines to develop their characteristics may reach as much as 0.4 gm. per litre. Aeration has hitherto been the only means of effecting a reduction in the amount of this acid when once added, but the author points out that this method is uncertain in its results, and not very practicable on a large scale. Hydrogen peroxide is a much more satisfactory desulphurising agent. Thus, in experiments with different types of wines containing from 0.035 to 0.35 gm. of free sulphurous acid, and 0.09 to 0.607 gm. of free and combined sulphurous acid per litre, it was found that by the addition of 1 gm. of hydrogen peroxide (10 volume medicinal solution) to a litre of the wine, the amount of free acid was reduced on the average by 0.026 gm., and the amount of total sulphurous acid by 0.037 gm. The other effects of the treatment on the wine were a slight darkening in colour and occasionally a slight turbidity. All sulphurous odour was destroyed, whilst the aroma of the wine was not affected. The flavour was rendered softer, except when the amount of hydrogen peroxide added exceeded 3 grms. per litre, when a slight bitterness was sometimes perceptible.

—C. A. M.

*Barley; Direct Determination of Extract in* —, G. Merz. Woch. f. Brau., 1904, 21, 791–793.

THE most convenient and rapid method for determining the extract-value of brewing barley is by preparing a raw-grain wort by means of a diastatic malt-extract. The calculation of the results in terms of malt necessitates a knowledge of the relations between the extract of the barley and that of the malt obtained from it, according to the particular type of malt prepared and the methods of malting and kilning it is intended to employ. This ratio can, however, in most cases be ascertained or estimated by experience. The diastatic extract, which should be freshly prepared, is made from green malt, dried at 37.5° C., and extracted with water in the proportion of 1 : 2 for 6 hours. Twenty-five grms. of very finely ground barley meal are mashed in a beaker with 400 grms. of water, and about 0.5 c.c. of the diastase solution, 75 grms. of which have previously been weighed out for the experiment. The mash is slowly brought to the boiling point over an asbestos plate, and when it begins to boil, 6 drops of 33 per cent. caustic soda lye are added. The mash is boiled with constant stirring for 30 minutes, the evaporated water being replaced from time to time; it is then cooled to 50° C., and 8 drops of hydrochloric acid, sp. gr. 1.124, are added to neutralise the soda. At this stage, the rest of the 75 grms. of diastatic extract are added, and the temperature is raised in 20 minutes to 70° C., at which it is maintained until saccharification is complete. After cooling to 17.5° C., the total weight of the mash is brought up to 500 grms. by the addition of water, and the clear wort is filtered off.

The extract in the wort is then determined by means of the pycnometer, and the value is corrected by deducting the equivalent weight of the salt and of the extract present in the diastase solution (after coagulation of the albumin).—J. F. B.

#### ENGLISH PATENT.

*Wort; Device for Agitating and Aerating* —, S. A. Ward, Sheffield. Eng. Pat. 2398, Feb. 1, 1904.

THE agitating device consists of a wide outer tube, terminating at the top in a bell-shaped mouth, which is covered by a deflecting plate at a slight distance above the mouth. Compressed air is conducted to the bottom of the wide tube by means of a central narrow tube. This air-tube terminates in a cup-shaped cap with a central cone, which distributes the air upwards in all parts of the annular space between the two tubes. The ascending current of air sucks the wort up through the annular space and causes it to be discharged through the bell-mouth at the top.—J. F. B.



## UNITED STATES PATENT.

*Mashing and Converting Process.* C. H. Caspra, Newark, N.J., Assignor to J. P. Fitzgerald, Scranton, Pa. U.S. Pat. 776,999, Dec. 6, 1904.

A MIXTURE of ground malt and raw grain is mashed with water. The mash is then boiled under reduced pressure, the vapours being condensed and returned to the mash by forcing the condensed liquid upward into the mash, in order "to effect the filtration of the wort."—W. P. S.

## FRENCH PATENT.

*Spirits; Apparatus for Continuous Rectification of —.* E. A. Barbet. First addition, dated July 9, 1904, to Fr. Pat. 343,488, April 16, 1904. (See this J., 1904, 1039.)

THE rectifying apparatus is caused to separate the various "tail" products at the same time as the "head" products, either by effecting the total exhaustion of the phlegms in the preliminary purification, the crude phlegms being treated at their full alcoholic strength, or else by not exhausting the phlegms but treating them at a low alcoholic strength. In either case, the extraction of the "head" products and the two principal classes of "tail" products causes a high degree of preliminary purification, facilitating the action of the rectifying column. Further, the special intermediate condenser of the rectifier is provided with a connection by which a portion of the condensed liquid is withdrawn, gauged, and returned direct to the purifying column.—J. F. B.

## XVIII.—FOODS; SANITATION; WATER PURIFICATION, &amp; DISINFECTANTS.

## (A).—FOODS.

*Flour; Influence of Ozone on the Properties of —.* K. Brahm. Z. Untersuch. Nabr. u. Genussm., 1904, 8, 669—673.

THE author's experiments show that the bread-making qualities of wheaten flour greatly deteriorate when ozone has been applied as a bleaching agent.—W. A. C.

*Milk; Use of Methylene Blue to distinguish Cooked Milk from Raw —.* Schardinger. XXIII., page 47.

*Milk Sugar [in Milk] and Maltose; New Colour Reaction for —.* A. Wöhlk. XXIII., page 47.

*Fat in Butter; Determination of —.* A. Hesse. XXIII., page 47.

## ENGLISH PATENTS.

*Alimentary Products Constituting a Phosphated Vinegar.* R. Combret, Paris. Eng. Pat. 20,885, Sept. 28, 1904. Under Internat. Conv., Sept. 28, 1903.

THE product claimed is prepared by dissolving in any suitable vinegar a variable quantity of either tricalcium phosphate (preferably in a freshly precipitated or gelatinous condition), dicalcium phosphate or monocalcium phosphate. In order not to diminish the acidity of the vinegar, the two first-mentioned phosphates may be dissolved in acetic, phosphoric or hydrochloric acid before being added to the vinegar. The phosphates may also be added during the acetic fermentation.—W. P. S.

*Vegetable Food Stuffs; Production of Soluble Earthy-alkaline and Metallic Salts of the Organic Phosphorus Compound contained in —.* S. Posternak, Paris. Eng. Pat. 22,030, Oct. 13, 1904.

TEN kilos. of the insoluble lime salt of the organic phosphorus compound obtained from vegetable foodstuffs, are dissolved in about 30 litres of 10 per cent. hydrochloric acid. The solution is then filtered and precipitated by the addition of about 35 litres of 95 per cent. alcohol. The precipitate is filtered off and pressed, the cakes being again mixed with alcohol, filtered off, and dried under reduced pressure at a temperature of 50°—60° C.

The product is a snow-white powder, which is quite soluble in water and consists of a di-basic calcium salt. In a similar way, soluble salts of magnesium, strontium, or manganese can be prepared. (See also this J., 1904, 126.)—W. P. S.

*Water and other Liquids; Sterilisation of —, and of Alimentary Substances, to render the same Potable or Edible.* V. B. Nesfield. Eng. Pat., Dec. 3, 1903. XVIII.B., page 39.

*Gelatine or Gelatinous Foodstuffs; Impts. relating to —.* J. Wetter, London. From the Thüringer Gelatine-Fabrik, E. Jetter and Krause, Stadtilm, Germany. Eng. Pat. 22,952, Oct. 25, 1904.

A SOLUTION of casein is gelatinised by the addition of gelatin, and the jelly cut into sheets and dried, as in ordinary gelatin manufacture: the product being intended for use as a foodstuff.—M. C. L.

## UNITED STATES PATENT.

*Centrifugal [Milk] Separators; Liner for —.* A. M. Amberg. Assignor to Nya Aktiebolaget Radiator, Stockholm, Sweden. U.S. Pat. 776,102, Nov. 29, 1904.

THE liner for a centrifugal separating-drum consists of a series of conical plates arranged one above the other. The liner is provided with distributing pipes, having division walls, dividing them into separate chambers. The distributing pipes have outlets, placed at different levels in the different chambers and caps at the upper ends, provided with outlet pipes.—W. H. C.

## (B).—SANITATION; WATER PURIFICATION.

## ENGLISH PATENTS.

*Manure; Manufacture of Artificial —, from Sewage and other like Matter.* W. Wardle. Eng. Pat. 25, Jan. 1, 1904. XV., page 36.

*Water and other Liquids; Sterilisation of —, and of Alimentary Substances to render the same Potable or Edible.* V. B. Nesfield, London. Eng. Pat. 26,495, Dec. 3, 1903.

THE water is treated with iodine or with a mixture from which iodine can be liberated. Such a mixture may consist of sodium iodide and iodate together with citric or tartaric acid. The sodium salts can be replaced by the corresponding potassium or calcium salts. Instead of using citric acid in the mixture, the iodine may be liberated in the water by aeration with carbon dioxide or by other means. The freed iodine is afterwards destroyed by the addition of sodium thiosulphate or sulphite. The iodine-liberating mixture and the thiosulphate may be added both together in the form of a pill or tablet, the outside of which consists of the iodide mixture and the core of thiosulphate, an isolating layer of gelatin or sugar being placed between the two. Solid alimentary substances are sterilised by immersing them in water in which iodine has been liberated as above.—W. P. S.

*Water; Apparatus for Purifying and Softening —.* C. Erith, London. Eng. Pat. 6946, Mar. 22, 1904.

THE apparatus consists of a heater, a reaction-tank, a settling tank and filter, and a storage tank. In the heater is suspended a series of inclined trays, over which the water and softening agent flow, steam being passed into the chamber to heat the mixture. The reaction-tank is placed beneath the heater, and is connected at its bottom with the settling tank. A layer of filtering material is provided across the latter at the top. After passing the filter the softened water flows over a partition into the storage tank. The supply of water and reagent to the heater is regulated by a float or ball-valve in the reagent tank or outside it. This float is connected by pivoted rods to valves in the water- and reagent-supply pipes. The softening reagent may be a solution of sodium carbonate. Means are provided for flushing the sludge from the tanks, and a vent in the heating chamber allows any liberated gases to escape.—W. P. S.

## UNITED STATES PATENT.

*Water; Process of Purifying* ——. T. E. Fulghum. Assignor to A. A. Miller, Grand Junction, Colo. U.S. Pat. 776,508, Dec. 6, 1904.

THE water is treated with suitable proportions of a mixture consisting of a saturated solution of sodium hydrogen carbonate, 5 lb.; sodium carbonate, 5 lb.; and sodium borate, 1 lb. The treated water is agitated and aerated. After a time a solution of ferric chloride is added, the whole again agitated and aerated, and then allowed to settle.—W. P. S.

## FRENCH PATENT.

*Chlorine or Oxygen Compounds of Chlorine; Process of Eliminating* ——. from Water designed for Drinking, Industrial or Agricultural Uses. G. Demoussy. Fr. Pat. 339,163, Nov. 12, 1903.

THE process relates to the treatment of water which has been sterilised by means of chlorine or hypochlorites. Ferrous hydroxide or carbonate, prepared in any suitable manner, is added in quantity corresponding with the quantity of chlorine in the water, and the latter may also be charged with carbon dioxide, so as to form a solution of an unstable compound of iron. The peroxide of iron ultimately formed and precipitated purifies the water by carrying down organic matter.—B. N.

## XIX.—PAPER, PASTEBOARD, Etc.

## ENGLISH PATENTS.

*Papers; Manufacture of Sensitised Copying* ——. J. Hawke, New Barnet. Eng. Pat. 1857, Jan. 25, 1904.

IN order to prevent the destruction of the wire-work of paper-machines by the acid in the pulp, when ferric chloride has been used for sensitising it, an alkali bicarbonate is added. A solution of 12 lb. of potassium bicarbonate may be added to the pulp for making 1000 lb. of paper, which has been sensitised with 5 galls. of a 40 per cent. solution of ferric chloride.—T. F. B.

*Wall-Papers; Manufacture of* ——. such Papers being Applicable for other Decorative and Useful Purposes. A. Fielding, Salford. Eng. Pat. 2323, Jan. 30, 1904.

A MANUFACTURED (preferably unsized) paper is treated with a, e.g., 10 per cent. solution of viscose, and the viscose is fixed by ageing or steaming. The additional strength thus imparted to the paper enables it to be washed and dyed in the same manner as cloth, the viscose acting as a mordant for many dyestuffs. When the dyestuff to be used does not react with the viscose, or when a mineral pigment is used, the colour and viscose are applied as a mixture and the viscose fixed as usual. The paper thus produced has a silky appearance, and can be further decorated by printing or embossing. A paper suitable for lithographic and printing purposes is obtained by treating unsized paper with viscose, steaming, washing, bleaching, and calendering.—T. F. B.

*Paper; Manufacture or Treatment of* ——. for Printing. J. von Schmaedel Ritter, Munich, Germany. Eng. Pat. 8885, April 18, 1904. Under Internat. Conv., May 16, 1903.

SEE Fr. Pat. 342,206 of 1904; this J., 1901, 949.—T. F. B.

*Paper; Grinding Wood for the Manufacture of* ——. F. A. Werle, Breslau, Germany. Eng. Pat. 16,281, July 22, 1904. Under Internat. Conv., Nov. 28, 1903.

IN the "warm grinding" process for the manufacture of mechanical wood-pulp, the heat is generated by the friction of the stone on the wood, which is pressed very heavily against the stone. According to the present invention the useful effect of the heat in producing a fine, long-fibred material is obtained by using water at 60° to 80° C. for the grinding process, whereby the wearing away of the stones may be considerably decreased by lightening the pressure applied to the wood.—J. F. B.

*Viscose; Apparatus [Heater] for Treating* ——. F. W. Howorth, London. From Soc. Franç. de la Viscose, Paris. Eng. Pat. 2357, Jan. 30, 1904.

SEE Fr. Pat. 339,564 of 1904; this J., 1904, 725.—T. F. B.

## FRENCH PATENTS.

*Paper; Purifier for the Manufacture of* ——. [Pulp Strainer]. P. Nebrich. Fr. Pat. 345,827, July 26, 1904.

SEE Eng. Pat. 16,403 of 1901; this J., 1904, 949.—T. F. B.

*Vegetable Fibres [Paper Pulp]; Treatment of* ——. C. Tennant-Lee. Fr. Pat. 345,632, Aug. 4, 1904.

VEGETABLE matters, particularly crushed sugar cane bagasse, are boiled in an alkaline, saccharine solution, such as a solution of calcium or magnesium sucrate. The time of boiling and the concentration of the solution are regulated so as to cause the minimum of damage to the delicate fibres.—J. F. B.

*Paper; Manufacture of a New Type of Flexible and Strong* ——. Soc. Cartiere di Maslianico. Fr. Pat. 345,836, Aug. 23, 1904.

PAPER is treated with sulphuric acid in the manner usually employed for the preparation of parchment paper, but the action is arrested before the acid has time to convert the interior of the sheet.—J. F. B.

*Cellulose Acetates; Manufacture of* ——. Fabr. de Prod. Chim. Flora, S.A. Fr. Pat. 345,764, Aug. 23, 1904.

CELLULOSE, 30 parts, is heated with a mixture of acetic anhydride, 70 parts, glacial acetic acid, 120 parts, and dimethyl sulphate, 3 parts, at the temperature of the boiling water-bath, until complete solution is effected. The product agrees in composition and solubility with cellulose tetracetate. A different product which is soluble in acetone and alcohol can be prepared by increasing the proportion of dimethyl sulphate to 15 parts.—J. F. B.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Zinc Borate [or Oxyborate]; Preparation of* ——. E. Holdermann. Archiv der Pharm., 1904, 242, 567—8.

FIVE hundred grms. of zinc sulphate (or a solution of about 115 grms. of metallic zinc in a mixture of 175 grms. of strong sulphuric acid and 2 litres of water) are dissolved in 5 to 10 litres of water and precipitated by the gradual addition, with constant agitation, of a solution of 443.6 grms. of borax and 309 grms. of a 15 per cent. solution of sodium hydroxide. The precipitate after washing and drying in the usual manner has the formula  $Zn_3(B_4O_7)_2(OH)_2$ .—J. O. B.

*p-Phenetidine; Ethylsulphonic Derivatives of* ——. and their Pharmacological Significance. W. Antenrieth and R. Bernheim. Archiv der Pharm., 1904, 242, 579—589.

AS soon as the fact was recognised that, in the organism, aniline becomes oxidised into the toxic *p*-aminophenol, steps were taken to substitute derivatives of *p*-aminophenol as antipyretics instead of the simple aniline derivatives, such as acetanilide; for although *p*-aminophenol is itself poisonous, its derivatives are for the most part relatively non-toxic.

The following ethylsulphonic derivatives of *p*-phenetidine are described:—

*n-Ethylsulphone-p-phenetidine*  $(1)C_2H_5O.C_6H_4.NH.SO_2.C_2H_5(4)$  forms shining white leaflets, m.pt. 80—81° C.; it is obtained by the action of ethylsulpho-chloride on *p*-phenetidine. It is a monobasic acid and forms well crystallised salts.

*n-Ethylsulphonephenacetine*  $C_2H_5O.C_6H_4.N(SO_2.C_2H_5)(COCH_3)$ , forms leaflets m.pt. 78° C. insoluble in cold water; it is prepared by the action of acetic anhydride on ethylsulphone-*p*-phenetidine.



*n*-Ethylsulphonbenzoyl-*p*-phenetidine,  $C_2H_5O.C_6H_4.N(SO_2.C_2H_5)(CO.C_6H_5)$ , in fine prisms, m.pt. 117° C.  
*n*-Ethylsulphonemethyl-*p*-phenetidine,  $C_2H_5O.C_6H_4.N(SO_2.C_2H_5)(CH_3)$ , in prisms, m.pt. 49° C.  
*n*-Ethylsulphone-ethyl-*p*-phenetidine,  $C_2H_5O.C_6H_4.N(SO_2.C_2H_5)(C_2H_5)$  in prisms, m.pt. 57° C.  
*n*-Ethylsulphone-*p*-phenetidino-carboxylic acid ethyl ester,  $C_2H_5O.C_6H_4.N(SO_2.C_2H_5)(CO_2C_2H_5)$ , in crystalline leaflets, m.pt. 112° C.  
*p*-Phenetidinecarboxylic acid ethyl ester,  $C_2H_5O.C_6H_4.NH.CO_2C_2H_5$ , in colourless leaflets, m.pt. 93.5° C.  
*o*-Nitro-*n*-ethylsulphon-*p*-phenetidine,  $(C_2H_5O)(NO_2)C_6H_3.NH.SO_2.C_2H_5$ , in yellow needles, m.pt. 179° C.

—J. O. B.

*Piperonal*: Action of Magnesium-ethyl iodide on —  
*New Synthesis of Isosafrol*, E. Mameli, Atti R. Accad. dei Lincei Roma, 1904, 13, 315—323. Chem. Centr., 1904, 2, 1567-1568.

ETHEREAL solutions of magnesium-ethyl iodide and piperonal were mixed, and the reaction product was treated with water. In this way the hitherto unknown

ethylpiperonyl alcohol (3,4-methylene-3,4-dioxyphenyl-1-propane-1'-ol),  $(CH_2O_2)C_6H_3.CH(OH).C_2H_5$ , was produced. It is an oil with a faint odour, sp. gr. at 15° 0.889, b. pt. 172—175° C.; it is soluble in ether, petroleum spirit, chloroform, alcohol, acetic acid and pyridine, but insoluble in water. When heated, it decomposes, a molecule of water being split off, and isosafrol (3,4-methylene-3,4-dioxyphenyl-1'-propene),  $(CH_2O_2)C_6H_3.CH:CH.CH_3$ , formed. On oxidation with chromic acid mixture, ethyl-piperonyl alcohol yields propioperone or piperonyl-ethyl ketone (3,4-methylene-3,4-dioxyphenyl-1-propane-1-one),  $(CH_2O_2)C_6H_3.CO.C_2H_5$ . —A. S.

*Essential Oils of Eucalyptus* [Constituents of the Oils of Various Species], H. G. Baker and R. T. Smith. Schimmel's Report, Oct., 1904, 31—37.

The following table indicates the botanical and geographical sources, the percentage yield, and the main chemical constituents of the essential oils of eucalyptus examined by the authors:—

Botanical Name.	Vernacular Name.	Geographical Origin.	Average percentage yield of oil.	Principal Chemical Constituents.
<i>E. tessellaris</i> F. v. M. ....	Moreton Bay, Ash .....	Narrabri, N. S. W. ....	0.151	Pinene, sesquiterpene.
<i>E. trachyphloia</i> F. v. M. ....	Bloodwood .....	Murrumbidgee, N. S. W. ....	0.199	Pinene, sesquiterpene.
<i>E. cymia</i> R. T. B. ....	White Bloodwood .....	Springwood, N. S. W. ....	0.462	Pinene.
<i>E. botryoides</i> Sm. ....	Bastard Mahogany .....	Milton, N. S. W. ....	0.086	d-Pinene.
<i>E. robusta</i> Sm. ....	Swamp Mahogany .....	La Perouse, N. S. W. ....	0.161	Pinene.
<i>E. saligna</i> Sm. ....	Blue Gum .....	Gosford, N. S. W. ....	0.241	Pinene.
<i>E. umbra</i> R. T. B. ....	Black Peppermint .....	Waleha, N. S. W. ....	0.51	Terpenes.
<i>E. dextropinea</i> R. T. B. ....	A Stringybark .....	Lismore, N. S. W. ....	0.1615	Pinene, also an acetic acid ester
<i>E. Wilkinsiana</i> R. T. B. ....	Small Leaved Stringybark .....	Barber's Creek, N. S. W. ....	0.798	d-Pinene.
<i>E. laevopinea</i> R. T. B. ....	Silver Top Stringybark .....	Barber's Creek, N. S. W. ....	1.01	l-Pinene.
<i>E. Bauertii</i> F. v. M. ....	Brown Gum .....	Rylstone, N. S. W. ....	0.66	l-Pinene.
<i>E. propinqua</i> D. & M. ....	Grey Gum .....	Monga, N. S. W. ....	0.328	Terpenes, cineol [eucalyptol], chiefly the former.
<i>E. alba</i> D. & M. ....	Black Box .....	Woodburn, N. S. W. ....	0.235	
<i>E. pulchra</i> R. T. B. ....	Swamp Gum .....	Grenfell, N. S. W. ....	0.259	
<i>E. lactea</i> R. T. B. ....	Spotted Gum .....	Barber's Creek, N. S. W. ....	0.197	Terpenes.
<i>E. intertexta</i> R. T. B. ....	Gum or Red Gum .....	Ilford, N. S. W. ....	0.557	Pinene, cineol.
<i>E. maculata</i> Hook .....	Spotted Gum .....	Nyngan, N. S. W. ....	0.395	Pinene, cineol, chiefly the former.
<i>E. quadrangulata</i> D. & M. ....	Grey Box .....	Currawang Creek, N. S. W. ....	0.169	
<i>E. conica</i> D. & M. ....	Box .....	Milton, N. S. W. ....	0.684	Pinene, cineol.
<i>E. bosistoana</i> F. v. M. ....	Box .....	Parkes, N. S. W. ....	0.587	Pinene, cineol.
<i>E. angustata</i> Sieb. ....	White Stringybark .....	Barber's Creek, N. S. W. ....	0.968	Pinene, cineol, chiefly the former.
<i>E. resinifera</i> Sm. ....	Mahogany .....	Canterbury, N. S. W. ....	0.742	Terpenes, cineol.
<i>E. polyantha</i> Sieb. ....	Red Box .....	Gosford, N. S. W. ....	0.302	
<i>E. hirsuta</i> F. v. M. ....	Mallee Gum .....	Pambula, N. S. W. ....	0.825	Pinene, cineol.
<i>E. rostrata</i> R. T. B. and H. G. S. ....	White or Brittle Gum .....	Wyalong, N. S. W. ....	0.614	
<i>E. aculeata</i> A. Cunn. ....	Red Box .....	Bathurst, N. S. W. ....	0.65	Pinene, cineol, also piperitone <sup>1</sup>
<i>E. dealbata</i> A. Cunn. ....	Cabbage or Mountain Gum .....	Nyngan, N. S. W. ....	0.67	Pinene, cineol, chiefly the latter
<i>E. rostrata</i> Schl. var. <i>borealis</i> R. T. B. and H. G. S. ....	River Red Gum .....	Condobolin, N. S. W. ....	0.856	Pinene, cineol, chiefly the latter
<i>E. maculosa</i> R. T. B. ....	Spotted Gum .....	Nyngan, N. S. W. ....	1.001	Pinene, cineol.
<i>E. camphora</i> R. T. B. ....	Sallow .....	Bungendore, N. S. W. ....	0.846	Pinene, cineol.
<i>E. punctata</i> D. C. ....	Grey Gum .....	Delegate, N. S. W. ....	0.836	Cineol.
<i>E. squamosa</i> D. & M. ....	Ironwood .....	Canterbury, N. S. W. ....	0.681	Pinene, cineol.
<i>E. bridgesiana</i> R. T. B. ....	Apple or Woollybutt .....	National Park, N. S. W. ....	0.743	
<i>E. goniacalyx</i> F. v. M. ....	Mountain Gum .....	Ilford, N. S. W. ....	0.619	Cineol.
<i>E. bicolor</i> A. Cunn. ....	Bastard Box .....	Monga, N. S. W. ....	0.881	
<i>E. cinnamalis</i> , var. (a) ....	Grey Mallee .....	St. Mary's, N. S. W. ....	0.52	
<i>E. populifolia</i> F. v. M. ....	Poplar Leaved Box .....	Crookwell, N. S. W. ....	0.701	Pinene, cineol, benzaldehyde(?)
<i>E. longifolia</i> Fink .....	Woollybutt .....	Nyngan, N. S. W. ....	0.758	
<i>E. maidenii</i> , F. v. M. ....	Blue Gum .....	Canterbury, N. S. W. ....	0.535	
<i>E. globulus</i> ....	Blue Gum .....	Barb'r's Creek, N. S. W. ....	1.304	Cineol.
<i>E. pulverulenta</i> Sims .....	Blue Gum .....	Jenolan, N. S. W. ....	0.745	
<i>E. cinerea</i> F. v. M. ....	Argyle Apple .....	Bathurst, N. S. W. ....	2.22	
<i>E. cordata</i> Labill. ....	Grey Mallee .....	Barber's Creek, N. S. W. ....	1.20	Cineol, some valeric ester
<i>E. morrisii</i> R. T. B. ....	Gully Ash, or White Top .....	Tasmania .....	2.32	
<i>E. smithii</i> R. T. B. ....	Red Flowering Iron Bark .....	Gerilambone, N. S. W. ....	1.69	Cineol.
<i>E. cambagei</i> D. & M. ....	Bastard Box or Bundy .....	Monga, N. S. W. ....	1.434	
<i>E. polybractea</i> R. T. B. ....	Blue Mallee .....	Liverpool, N. S. W. ....	0.537	Pinene, cineol.
<i>E. dumosa</i> A. Cunn. ....	White Mallee .....	Bathurst, N. S. W. ....	0.735	Cineol, some aromadendral.
<i>E. oleosa</i> F. v. M. ....	Red or Water Mallee .....	Wyalong, N. S. W. ....	0.135	Pinene, cineol, aromadendral.
<i>E. encoryfiata</i> D. C. ....	Mountain Mallee .....	Coolabah, N. S. W. ....	1.00	Terpenes, cineol, aromadendral.
<i>E. stricta</i> , Sieb. ....	Yellow Box .....	Nyngan, N. S. W. ....	0.97	Pinene, cineol, aromadendral.
<i>E. melliodora</i> A. Cunn. ....	Red Box .....	Kangaroo Island .....	0.494	Cineol.
<i>E. ovalifolia</i> var. <i>lanceolata</i> R. T. B. ....	Ridson or Drooping Gum .....	Blue Mountains, N. S. W. ....	0.476	Pinene, cineol, frequently phellandrene.
<i>E. risdoni</i> Hook f. ....	A Mallee .....	Rylston, N. S. W. ....	0.676	Pinene, cineol, phellandrene.
<i>E. punctata</i> D. C. var. <i>didyma</i> R. T. B. & H. G. S. ....	Green Mallee .....	Camboon, N. S. W. ....	0.579	
<i>E. gracilis</i> F. v. M. ....	White Box .....	Tasmania .....	1.348	Cineol, phellandrene, piperitone.
<i>E. viridis</i> R. T. B. ....	Green Mallee .....	Barber's Creek, N. S. W. ....	0.428	Pinene, cineol, aromadendral.
<i>E. albens</i> , Mig. ....	White Box .....	Gunbar, N. S. W. ....	1.06	Terpenes, a small qty., aromadendral.
		Gerilambone and Nyngan, N. S. W. ....	0.449	Aromadendral.
		Rylston, N. S. W. ....	0.101	

<sup>1</sup> With the name "piperitone" the authors designate a constituent with a peppermint-like odour, which is present in various eucalyptus oils.

Botanical Name.	Vernacular Name.	Geographical Origin.	Average percentage yield of oil.	Principal Chemical Constituents.
<i>F. hemiphysa</i> F. & M.	Box	Belmore, N. S. W.	0.554	Pinene, cineol, aromadendral.
<i>F. riminalis</i> Labill.	Manna Gum	Cadla, N. S. W.	0.354	Phellandrene, cineol.
<i>F. rostrata</i> Sch.	Murray Red Gum	Alvury, N. S. W.	0.299	Chiefly terpenes; also cineol and aromadendral, sometimes phellandrene.
<i>F. ovalifolia</i> R. T. B.	Slaty Gum	Rylstone, N. S. W.	0.216	Pinene, cineol, phellandrene.
<i>F. darseni</i> R. T. B.	Apple Topped Box	Rylong, N. S. W.	0.172	Phellandrene, sesquiterpene.
<i>F. apophyllodes</i> R. T. B.	Apple Topped Box	Towrang, N. S. W.	0.185	Terpenes, among which phellandrene.
<i>F. testigata</i> D. & M.	Cut Tail	Monga, N. S. W.	0.263	Pinene, phellandrene, eudesmol.
<i>F. macrophylla</i> F. & M.	Red Stringybark	Rylstone, N. S. W.	0.272	Terpenes, cineol, eudesmol.
<i>F. capitelata</i> Sm.	Brown Stringybark	Canterbury, N. S. W.	0.103	Terpenes, small quantities of cineol.
<i>F. niara</i> R. T. B.	Black Stringybark	Woodburn, N. S. W.	0.0295	Phellandrene.
<i>F. pilularis</i> Sm.	Blackbutt	Belmore, N. S. W.	0.13	Terpenes, also an as yet unknown alcohol.
<i>F. acmenoides</i> Sch.	White Mahogany	Lismore, N. S. W.	0.358	Terpenes, among which phellandrene.
<i>F. traxinoides</i> H. D. & J. H. M.	White Ash	Monga, N. S. W.	0.985	Terpenes, chiefly phellandrene.
<i>F. fletcheri</i> R. T. B.	Lignum Vitae or Box	Whirlmore, N. S. W.	0.352	
<i>F. microlacca</i> F. & M.	Coolybah or Tongoon	Narrabri, N. S. W.	0.150	Phellandrene, sesquiterpene.
<i>F. haemastoma</i> Sm.	White or Scribbly Gum	Barber's Creek, N. S. W.	0.241	
<i>F. crebra</i> F. & M.	Narrow Leaved Ironbark	Rylstone, N. S. W.	0.159	Pinene, phellandrene, cineol.
<i>F. piperita</i> Sm.	The Sydney Peppermint	Gostord, N. S. W.	0.627	eudesmol and piperitone.
<i>E. amygdalina</i> Labill.	Messmate	Moss Vale, N. S. W.	3.393	Phellandrene, cineol and piperitone.
<i>E. vitrea</i> R. T. B.	White Top Messmate	Crookwell, N. S. W.	1.48	Phellandrene, cineol.
<i>E. Luehmanniana</i> F. & M.	"	National Park, N. S. W.	0.289	Phellandrene.
<i>E. coriacea</i> A. Cunn.	Cabbage Gum	Ilford, N. S. W.	0.452	Phellandrene, piperitone.
<i>E. sieberiana</i> T. & M.	Mountain Ash	Barber's Creek, N. S. W.	0.421	Phellandrene, piperitone.
<i>E. oreades</i> R. T. B.	A Mountain Ash	Lawson, N. S. W.	1.16	
<i>E. dives</i> Sch.	Broad Leaved Peppermint	Fagan's Creek, N. S. W.	2.233	Phellandrene, piperitone.
<i>E. radiata</i> Sieb.	White Top Peppermint	Monga, N. S. W.	1.641	
<i>E. delegatensis</i> R. T. B.	White Ash, Silver Top Mountain Ash	Delegate Mountain, N. S. W.	1.76	Phellandrene, a small quantity aromadendral.
<i>E. obliqua</i> L'Hér.	Stringybark	Monga, N. S. W.	0.677	
<i>E. stellulata</i> Sieb.	Lead Gum	Rylstone, N. S. W.	0.293	Phellandrene.
<i>E. Macarthurii</i> H. D. & J. H. M.	Paddy River Box	Wingello, N. S. W.	0.112	Geranyl acetate.
<i>E. virgata</i> Sieb.	"	Springwood, N. S. W.	0.283	Eudesmol.
<i>E. patendineris</i> R. T. B.	Mahogany	Belmore, N. S. W.	0.254	Terpenes, citral and an as yet unknown alcohol.
<i>E. apiculata</i> R. T. B. & H. G. S.	"	Berrima, N. S. W.	0.296	Terpenes, piperitone.
<i>E. citriodora</i> Hook.	Citron Scented Gum	Sydney, N. S. W.	0.586	Citronella.

—J. O. B.

*Santalum* and *Sandalwood Oils*. Seidler. Apoth. Zeit., 1904, 19, 795. Pharm. J., 1904, 73, 813.

A good sample of East Indian sandalwood oil should be of a pale yellow colour, and the greater portion of it should distil between 297° and 305° C. It should have the specific gravity, 0.975—0.985; optical rotation, —17° to —19°; solubility in 70 per cent. (by volume) alcohol, 1:5; acid value, not above 2.75; saponification value, not above 7.5; acetyl-saponification value, not below 197. Santalol, the active constituent of sandalwood oil should have a sp. gr. of at least 0.980; optical rotation, —18 to —19°, and should form a clear solution with 4 parts of 70 per cent. (by volume) alcohol. It should distil mainly between 302° and 306° C.—A. S.

*Lichens*; *Characteristic Constituents of* —, O. Hesse. J. prakt. Chem., 1904, 79, 449, 502. (See also this Journal 1901, 161.)

The acids were isolated by extracting with ether and shaking out the ethereal extract with potassium bicarbonate solution.

*Cladonia squamosa* (Hoffm.) frondosa (Nyl.). The only characteristic principle isolated from this lichen was a squamatic acid  $C_{19}H_{20}O_9$ .

*Cladonia (Cladina) destriata* (Nyl.) contained l-usnicic acid, m.pt. 196–197° C.;  $[a]_D^{20} = -435.9$  in chloroform solution at 15° C. and  $c = 2$ ; also squamatic acid, cladestins and a colouring matter. Cladestins occurs as a white crystalline powder, m.pt. 252° C. It is neutral; insoluble in alkalis and water, dissolved in strong sulphuric acid with a deep yellow colour, which passes to ponceau red on warming.

*Cladonia furcata* (Huds.) Fr.  $\beta$  (*racemosa* b) *recurva* Hoffm. This lichen yielded only a trace of an acid to potassium bicarbonate.

*Cetraria islandica* (L.). The author was unable to

isolate the acid described by R. Boehm (Archiv Pharm.) 241, 3, 4), having the composition  $C_{19}H_{32}O_4$ , but obtained proto-a-lichesterinic acid  $C_{19}H_{30}O_5$ ; fumaric acid, both free and combined; fumariprotocetraric acid,  $C_{26}H_{46}O_{13} + 2H_2O$ , in small white needles, which turn brown at 240° C., and black without melting, at 260° C. Protocetraric acid,  $C_{54}H_{92}O_{27}$ , was obtained by saturating fumariprotocetraric acid with half a molecular equivalent of alkali. It crystallises from hot solutions in spheroidal aggregations. It is slightly soluble in water when freshly precipitated. From another closely allied lichen, *Cladonia rangiferina*, var. *vulgaris*, fumariprotocetraric acid was obtained.

*Parmelia saxatilis* var. *sulcata* and var. *panniformis* both gave an acid, parmatic acid, at first considered to be fumariprotocetraric acid, but which yielded no sublimate of fumaric acid on heating.

*Parmelia borrieri* (Turn.) was found to contain lecanoric acid as stated by Zopf (Annalen, 313, 331), and also a small amount of lecanorin, which was not found by that author.

*Parmelia tinctorum* (Despreaux, Nyl.) on the bark of East Indian *Cinchona officinalis*, contained lecanoric acid and atranorin.

*Parmelia perlata* L. also on *Cinchona* bark, distinguished from *P. tinctoria* by not giving a red colour-reaction when touched with chlorinated lime solution, gave atranorin and perlatic acid,  $C_{27}H_{42}O_9 \cdot OCH_3 + 2H_2O$ , crystallising in white needles. This becomes partially dehydrated at 80° C., melts at 90–95°, but does not become anhydrous below 110° C. The water-free acid melts at 100–105° C. when slowly heated, and at 125–130° C. when the temperature is quickly raised. Its alcoholic solution reddens blue litmus.

*Parmelia caperata*, L., contained d-usnicic, capraric and caperic acids, the last two predominating. No caperin was found.



*Sticta pulmonaria* L. (Schaerer), was found to contain new acid named stictic acid,  $C_{17}H_{11}O_8 \cdot OCH_3$ , crystallizing in faintly yellow needles, containing water of crystallization, which is driven off at  $100^\circ C$ ; it becomes coloured at  $240^\circ$ , and melts at  $264^\circ C$ . It is monobasic, has the same percentage composition as, and is closely related to, protocetraric acid. Its alcoholic solution, when heated with sulphuric acid gives a brown, not blue, colour.

*Aspicilia gibbosa* (Kbr.) contained two acids, one not obtained in sufficient amount for identification; the other picilic acid, forming colourless leaflets melting at  $9^\circ C$ . The chief constituent of the lichen is an indifferent crystalline body, aspicilin, isolated, after removing the acid, as colourless shining leaflets, melting at  $150^\circ C$ , and stilling at a higher temperature without decomposition.

*Ureolaria scruposa* var. *vulgaris* (Ach.) The author is isolated atranorin and lecanoric acid  $C_{16}H_{11}O_7 + 2O$ , from this lichen: Zopf (Annalen, 324, 74) has stated that it contains patellarie acid.

*Chiodecton sanguineum* (Sw.) = (*Ch. rubrocinctum* (Ehrh.) on Bolivian cinchona bark, slowly yields a red colouring matter to ether, chiodectonic acid  $C_{14}H_{18}O_5$ . After removing this acid, another red neutral, crystalline body, chiodectin, remains in the ethereal solution; when purified, it melts at  $120^\circ C$ .

*Pertusaria dealbata* (Nyl.) yielded no crystalline constituents to ether. Orcin, previously recorded as present, was not found.—J. O. B.

Vanillin: Occurrence of —, E. O. von Lippmann. Ber., 1904, 37, 4521—4522.

A VERY strong odour of vanillin has often been observed in the neighbourhood of wooden structures in which salt has dried, and, on scraping the surface of the wood, the author finds that the scrapings contain this substance. Grafe (this J., 1904, 1158) has recently shown that wood contains a small quantity of vanillin.—T. H. P.

#### ENGLISH PATENTS.

Iron-Peptone or Iron-Manganese-Peptone; Production of a Stable, Non-alcoholic Solution of —, S. S. Bromhead, London. From Chem. Fab. Helfenberg, Ltd., formerly E. Dieterich, Dresden, Germany. Eng. Pat. 20,273, Sept. 20, 1904.

SOLUTIONS of iron-peptone or iron-manganese-peptone containing 0.6 per cent. of iron, and 0.1 per cent. of manganese are prepared, free from alcohol, by dissolving the commercial compounds in water slightly acidified with hydrochloric acid. The solution is cooled to  $0^\circ C$ , and impregnated with carbon dioxide at a pressure of 3 atmospheres. It is then stored in closed, air-tight bottles for 2 or 3 months at a low temperature, whereby an unstable combination of the carbonic acid is formed, and the medicinal compound is protected from decomposition and oxidation.—J. F. B.

Aldehydes; Manufacture of Certain —, and Intermediate Products [Perfumes]. G. Darzens, Paris. Eng. Pat. 21,047, Sept. 30, 1904. Under Internat. Conv., Nov. 28, 1903.

SEE Fr. Pat. 337, 175 of 1903; this J., 1904, 455.—T. F. B.

Phenylmethylamidochloropyrazole; Manufacture of —, Farbwerke, vorm. Meister, Lucius und Brüning, Höchst am-Maine, Germany. Eng. Pat. 22,064, Oct. 13, 1904. Under Internat. Conv., Nov. 11, 1903.

1-PHENYL-3-METHYL-4-AMINO-5-CHLOROPYRAZOLE is obtained by treating 1-phenyl-3-methyl-4-arylazo-5-chloropyrazole with an acid reducing agent. On reducing phenetol-azo-chloropyrazole in a similar manner, amino-chloro-pyrazole is produced. Methylation of the phenylmethylaminochloropyrazole produces phenyldimethylaminopyrazolone.—T. F. B.

#### UNITED STATES PATENT.

Ammonium Formate; [Electrolytic] Process of Manufacturing —, H. Pauling, U.S. Pat. 776,543, Dec. 6, 1904. XI.A., page 32.

#### FRENCH PATENT.

Amino-Alcohols and their Derivatives; Process for Preparing —, Poulenc frères and E. Fournau, Fr. Pat. 339,131, Oct. 29, 1903.

AMINO-ALCOHOLS of the general formula



are prepared by the action of organo-magnesium halides on dialkyl-, diaryl-, or alkyl-aryl-amino-acetones, or by the action of a substituted fatty amine on the halohydrin of the constitution  $RI''C(OH)CH_2X$ , where X represents a halogen atom. The acyl derivatives of the amino-alcohols are also claimed. The following amino-alcohols are described:—Ethyldimethylaminopropanol, propyldimethylaminopropanol, isobutyldimethylaminopropanol, isoamyldimethylaminopropanol, ethyldimethylaminobutanol, phenylmethylaminopropanol, phenyldimethylaminopropanol, phenyldiethylaminopropanol, phenyldimethylaminobutanol, benzyldimethylaminopropanol, and  $\alpha$ -methyl dimethylaminopropanol. Many of these compounds are applicable to perfumery. (See also Fr. Pat. 338,889 of 1903; this J., 1904, 910.)—T. F. B.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Hydrogen Peroxide; Radio-active-like Phenomena of —, L. Graetz. Physik. Zeits., 1904, 5, 688—690. Chem. Centr., 1904, 2, 1561.

HYDROGEN peroxide acts on a photographic plate in the same way as light: a radiation proceeds from the peroxide, capable of penetrating paper, ebonite, and thin metal foil. It is shown that the action is not due to hydrogen peroxide vapour, ozone, oxygen, or other substances. Contrary to the statement of Schenck and Richarz, the author finds that ozone has no action on a photographic plate. Objects can be photographed by placing them on the reverse side of a plate subjected to the influence of hydrogen peroxide, the images produced being light or dark according to the experimental conditions. The phenomena depend, in the first instance, upon differences of temperature in the plate. All the parts that are warmer than those adjoining, appear light on a dark ground, and *vice versa*. A difference of even  $\frac{1}{10}^\circ C$ . becomes perceptible in this manner. The lightness or darkness of the image is not uniform throughout, "edge effects" being produced. Those places from which the heat proceeds appear black, whilst those to which it travels, appear white. The essential point is thus not the temperature, but the fall of temperature. The author concludes that there is a non-thermal difference between the poles of a heat-current, just as with an electric current. In the discussion the author remarked that there may be present in commercial hydrogen peroxide a resinous substance to which the activity may be due.—A. S.

Sodium Hydrosulphite and some Organic Hydrosulphites; Developing Properties of Pure —, A. and L. Lumière and A. Seyewetz. Brit. J. Phot., 1904, 51, 1086—1087.

HYDROSULPHITEOUS acid alone has been found to possess some developing properties, but the images obtained were weak and fogged. Sodium hydrosulphite, prepared by the action of sodium bisulphite on zinc, gave still poorer results. Pure anhydrous sodium hydrosulphite (see Eng. Pat. 2204 of 1903; this J., 1903, 1347), however, acts as a vigorous developer in aqueous solutions, but fogged negatives result by prolonging the development. It is found that this tendency can be overcome by the addition of potassium bromide and sodium bisulphite, the following composition having been proved satisfactory:—Sodium hydrosulphite, 20 grms.; "commercial" sodium bisulphite, 100 c.c.; 10 per cent. solution of potassium bromide, 70 c.c.; water, 1000 c.c.; with this developer a normally exposed negative will be fully developed in about 3 minutes. Excess of sodium bisulphite does not appreciably prolong development. The hydrosulphites

of diaminophenol, diaminoresorcinol, triaminophenol,  $\beta$ -phenylenediamine, and other organic "developers," obtained by mixing concentrated solutions of sodium hydrosulphite and the hydrochloride of the base, were found to possess feeble developing properties when used in aqueous solution: the addition of sodium sulphite, sodium bisulphite and bromide increased their activity, but gave rise to the formation of excessive fog. The hydrosulphites of aromatic monamines appear to possess no developing properties.—T. F. B.

#### ENGLISH PATENT.

*Flash-Lights for Photography: Manufacture of* —. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 3794, Feb. 15, 1904.

SEE Fr. Pat. 340,459 of 1904; this J., 1904, 836.—T. F. B.

### XXII.—EXPLOSIVES, MATCHES, Etc.

*Nitramines of the Anthraquinone Series.* R. Scholl, Ber., 1904, 37, 4427—4448.

AMINOANTHRAQUINONES and their nuclear substitution products are converted by treatment with nitric acid of sp. gr. 1.50 to 1.52 into nitrated nitramines. The nuclear nitro groups replace some or all of the hydrogen atoms in *o*- or *p*-position to the original amino groups. These nitrated nitramines are stable at ordinary, but explosive at higher temperatures. The explosibility increases with the number of nitro groups. 2.4.6.8-Tetranitro-1.5-dinitraminoanthraquinone explodes on slight heating, on percussion and on contact with gaseous ammonia, with formation of red smoke. It is obtained by adding 1.5-diaminoanthraquinone gradually with stirring and cooling in a freezing mixture to ten times its weight of colourless nitric acid of sp. gr. 1.52 and pouring into ice-water. It is soluble in acetic acid, very soluble in acetone, and can be precipitated from the latter solution by methyl alcohol. It is converted into a red, crystalline, explosive product, with evolution of gas, on boiling with glacial acetic acid. This reaction is helped by the presence of a few drops of concentrated sulphuric acid.—E. F. B.

#### ENGLISH PATENTS.

*Explosives.* H. H. Lake, London. From Cyanid-Ges. m. b. H., Berlin. Eng. Pat. 27,515, Dec. 15, 1903.

IN order to reduce the temperature of the gases produced by the detonation of explosives, without diminishing their disruptive power, mono-, di- or tri- cyanamide, or a salt of one of these (e.g., the calcium salt or the oxalate), or a mixture of these substances is added to the explosive. Any explosive may be used for this process, the following being claimed:—Those containing nitrocellulose; nitrocellulose and nitroglycerin; oxidising substances (nitrates, chlorates, &c.); oxidising substances mixed with oxidisable substances (e.g., aluminium, fats, &c.). The cyanamide compound is preferably added in quantity sufficient to convert the oxygen evolved by the explosive into carbon monoxide; if nitrous acid be a normal constituent of the resulting gases, sufficient cyanamide is added to reduce it completely to nitrogen. The following compositions are given:—(1) Cyanamide, 4 parts; nitroglycerin, 93 parts; nitrocellulose, 3 parts. (2) Cyanamide, 5 parts; nitroglycerin, 58 parts; gun-cotton, 37 parts. (3) Cyanamide, 5 to 15 parts; ammonium nitrate, 95 to 85 parts.—T. F. B.

*Safety Explosives [Ammonium Nitrate]* —. The Miners Safety Explosive Co., Ltd., London, and W. Levett, Stanford-le-Hope, Essex. Eng. Pat. 4742, Feb. 26, 1904.

THE explosive is made from 2 components. [A] Ammonium nitrate (95½ parts) is ground for ½ hour at 180° F. Trinitronaphthalene (4½ parts) is then added, and the grinding continued for ½ hour. [B] Sodium nitrate (80 parts) and dinitronaphthalene (20 parts) are treated in the same manner. When cold, the two components are broken up, sifted, and mixed together in the proportions of [A] 33 parts, [B] 67 parts, or [A] 50 parts [B] 50 parts, or [A] 67 parts [B] 33 parts.—G. W. MCD.

*Gunpowder Sheets: Machine for Use in the Manufacture of* —. J. Luciani, Paris. Eng. Pat. 21,398, Oct. 5, 1904.

SEE Fr. Pat. 339,022 of 1903; this J., 1904, 1113.—T. F. B.

#### UNITED STATES PATENT.

*Explosive and Process of Making Same.* A. Müller Jacobs, New York. Assignor to C. Müller-Jacobs Brooklyn and E. Weingartner, New York. U.S. Pat. 777,125, Dec. 13, 1904.

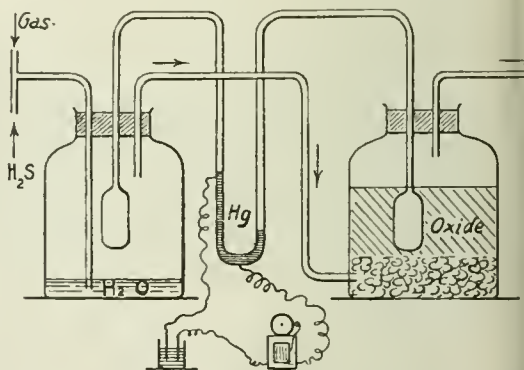
THE explosive is made by printing upon or impregnating nitrocellulose or other explosive cellulose compound with an aqueous solution of ammonium picrate and potassium chlorate, thickened by a suitable adhesive, such as guttragacanth.—T. F. B.

### XXIII.—ANALYTICAL CHEMISTRY.

#### APPARATUS, ETC.

*Oxygen in Coal-Gas: Automatic Test for* —. F. Kropf J. Gasbeleucht., 1904, 47, 1103—1104.

LEYBOLD has shown that, in the practice of admitting small proportion of air to the crude coal-gas, for the purpose of effecting a continuous regeneration of the oxide in the purifiers, the presence of even a small excess of oxygen tends to render the oxide hard and removable only with difficulty from the purifiers; the water-absorbing power and proportion of active substance are lessened, and the oxygen brings about a rapid destruction of the gas holder plates. A continuous, automatic test, capable of indicating the presence of more than 0.1 per cent. of volume of oxygen (equal to 0.5 per cent. of air in excess) has been devised by the author; it is based on the fact that oxide, which has been saturated with sulphuretted hydrogen, emits heat when air is led over it according to the equation:  $\text{Fe}_2\text{S}_2 + \text{S} + 3\text{O} + 3\text{H}_2 \rightarrow \text{Fe}_2\text{O}_3(3\text{H}_2\text{O}) + 3\text{S} + 145 \text{ calories}$ . The heat generated is perceptible if the proportion of oxygen does not fall below 0.1 per cent. The apparatus used is shown in the accompanying figure.



The gas, mixed with excess of sulphuretted hydrogen, passes in succession through two flasks, the first of which contains some water and one bulb of a differential thermometer, whilst the second contains at the bottom small pieces of coke, upon which there is a layer of oxide, about 5 cm. thick, surrounding the second bulb of the thermometer. The water in the first flask saturates the gas with moisture and prevents the drying of the oxide, whilst the sulphuretted hydrogen prevents the exhaustion of the purifying material, by re-forming  $\text{Fe}_2\text{S}_2$  immediately should oxidation occur. The flasks are of 300-400 c.c. capacity. The bulbs of the thermometer, which hold about 3 c.c., are filled about one-third with ether. When the mercury column reaches a predetermined position an electrical contact is established between the wires of the bell circuit, as shown in the figure. The presence of oxygen is therefore indicated by the rise of temperature in the oxide. The oxide must be renewed at least once a fortnight, as its sensitiveness gradually diminishes



different varieties of oxide exhibit very different increments of temperature for a given percentage of oxygen in the gas (thus, 0.2 per cent. of oxygen gave readings varying from 1.7° to 4.6° C. with different preparations); but with the same kind of oxide, approximately uniform results are obtained.—H. B.

*Photometer for Testing the Illuminating Values of Ordinary and High-Power Auer Burners.* C. Carpenter and J. W. Helps. Paper read before the Internat. Commission on Photometry, Zürich; June, 1903.

In order to overcome the difficulty experienced in testing incandescent burners against the standard 10-candle pentane lamp or the carcel lamp, the burner to be tested is not compared directly with the standard lamp, but with a "secondary standard" which has previously been set to the same illuminating power as the standard, and which is obtained by surrounding an incandescent burner with an opaque screen in which is cut a vertical slot, provided with a sliding shutter for regulating the amount of light emitted. Two horizontal graduated bars are used, each carrying a disc-box; they may be arranged at any convenient angle to each other, or in the same straight line, but in any case the secondary standard burner (a Kern burner consuming 3½ cb.ft. of gas per hour) is mounted rotatably at the junction of the two bars, at the other extremities of which are situated the burner to be tested and the standard lamp respectively. On making a test, after the lamp and burners have been alight for a sufficiently long period, the slot of the secondary standard is regulated by means of the sliding shutter until the light emitted is exactly the same as that given by the standard (1 carcel or 10 candles, as the case may be). The secondary standard is then rotated until the index pointer which it carries, coincides with the secondary bar, whereupon direct comparisons with the burner under examination are made. It is stated that when once set, the secondary standard remains constant for several hours; but it can easily be verified at any time by comparison with the standard lamp. As the lights are of equal intensity, though differing in colour, this can be done with great accuracy.—H. B.

#### ENGLISH PATENT.

*Furnace Gases; Method of and Apparatus for Ascertaining the Quantity of Carbonic Acid in —.* A. Schlatter and L. Deutsch, Budapest, Hungary. Eng. Pat. 28,262, Dec. 23, 1903.

SEE Fr. Pat. 337,992 of 1903; this J., 1904, 561.—T.F.B.

#### INORGANIC—QUALITATIVE.

*Silicic Acid; Detection of —.* J. Petersen. Z. anal. Chem., 1904, 43, 619–623.

A METHOD is described for utilising the silicon fluoride test for substances containing as little as ½ per cent. of silicic acid. The reaction takes place in a small platinum crucible of 20 mm. diameter (Fig. 1), into which 0.5 gm. of the substance, 0.25 gm. of cryolite or fluorspar and a few mgrms. of magnesite are introduced and a little sulphuric acid added, preferably from a dropping bottle. The crucible is provided with a handle of platinum wire, and is lowered into the test-tube by a hook also of platinum wire (Fig. 2). A drop of water is then suspended over the crucible on a glass rod, which is widened at the lower end, as shown, and coated with black asphalt varnish. The glass rod and test-tube are protected from the hydrofluoric acid vapours by treating with collodion containing 2 per cent. (by volume) of castor oil. The tube is then warmed in the water-bath for 5 minutes at 50°–60° C.; a higher temperature is inadmissible on account of the collodion. If much silica is present, bubbles form

Fig. 1 Fig. 2



which must be broken by tapping the glass. The separated silica shows up clearly on the black ground.—F. SÖN.

#### INORGANIC—QUANTITATIVE.

*Potassium Chlorate; Action of Hydrochloric Acid on [Determination of] —.* A. Kolb and E. Davidson. Z. angew. Chem., 1904, 17, 1883–1887.

THE authors have experimented on a method for the determination of potassium chlorate with hydrochloric acid and potassium iodide at the ordinary temperature, thus avoiding distillation. They find that the presence of oxygen, especially that dissolved in the reagents, causes too much iodine to be liberated, but good results are obtained when all air is expelled by previous boiling, and the operations are conducted in an atmosphere of carbon dioxide. By using a large excess of hydrochloric acid, the reaction is complete in a few minutes, but the addition of much water retards it. The disturbing oxidation of the hydrogen iodide by air does not occur on dilution, it is concluded, therefore, that only undissociated molecules are affected. The iodine liberated was titrated with thiosulphate in the usual manner.—F. SÖN.

*Hydrogen Peroxide; Colorimetric Valuation of —.* P. Planès. J. Pharm. Chim., 1904, 20, 538–541.

POTASSIUM iodide reacts with hydrogen peroxide forming potassium hydroxide and iodine, which in turn react upon each other with the formation of iodate and other iodine derivatives. This secondary reaction can be entirely prevented by the addition of sulphuric acid, so that the original reaction can be represented by the equation:—

$2\text{KI} + \text{H}_2\text{O}_2 + \text{H}_2\text{SO}_4 = \text{K}_2\text{SO}_4 + 2\text{H}_2\text{O} + \text{I}_2$ ,  
according to which 1 gm. of iodine corresponds to 43.75 c.c. of oxygen, or 1 c.c. of oxygen to 0.022857 gm. of iodine. In the colorimetric method, based on this reaction, 20 c.c. of the hydrogen peroxide solution previously diluted to a tenth of its strength are treated with 12 c.c. of a 10 per cent. solution of potassium iodide, and 4 c.c. of dilute sulphuric acid (8 per cent.), and the resulting coloration matched by means of a standard solution of iodine.

—C. A. M.

*Iodine in Soluble Iodides, and in Mixtures of these with Bromides and Chlorides; Determination of —.* H. Ditz and B. M. Margosches. Chem.-Zeit., 1904, 28, 1191–1194.

IN this J., 1900, 933, a new process for determining potassium iodide, by T. S. Barrie, has been described. A solution of potassium iodide in the presence of chloride or bromide may be treated with one of potassium bichromate and dilute sulphuric acid. Iodine alone is liberated, and is extracted by shaking with toluene (as an immiscible solvent) the iodine being subsequently titrated with thiosulphate. The present authors in their method, propose, however, to use as oxidising agent potassium iodate, and either dilute hydrochloric or sulphuric acid.  $\text{KIO}_3 + 5\text{KI} + 6\text{HCl} = 6\text{KCl} + 3\text{H}_2\text{O} + 3\text{I}_2$ , otherwise proceeding as in Barrie's process, loc. cit.—A. S.

*Silica Determinations [in Iron Ores and Limestones].* H. E. Ashley. The Chem. Eng., Nov., 1904. Chem. News, 1904, 90, 274.

IN the analysis of iron ores, a simple extraction with hydrochloric acid may leave (1) a part, or (2) the whole of the silica as an insoluble residue. In the first case the solution (extract) must be evaporated to dryness, the residue treated with hydrochloric acid, and the silica filtered off, these operations being repeated if necessary. The silica thus obtained is added to the original insoluble residue, and the whole of the insoluble matter is then ignited and weighed, and the amount of silica present, determined by the loss of weight caused by treatment with hydrofluoric and sulphuric acids. In the second case the insoluble residue is directly ignited, weighed, and treated with hydrofluoric and sulphuric acids. The amount of silica in high-grade limestones may be determined in a similar manner. After dissolving the limestone in hydrochloric acid, evaporating the

solution to dryness, treating the residue with hydrochloric acid, and filtering, and then repeating these operations, about one-half of the insoluble residue consists of silica. S. V. Peppel has found that with lower-grade limestones, the loss of weight on treating the insoluble residue with hydrofluoric and sulphuric acids is greater than the amount of silica present.—A. S.

*Manganese in Cyanide Solutions; Colorimetric Detection and Determination of —.* J. E. Cennell. Eng. and Mining J., 1904, 78, 827.

THE presence of manganese in cyanide solutions may have considerable influence on the extraction and precipitation of the gold, and it also interferes in the determination of cyanide by titration with silver nitrate. The manganese may be removed by treating the cyanide solution with sodium sulphide, and removing excess of the latter by agitation with lead carbonate. For the detection and determination of the manganese, 100 c.c. of the cyanide solution are treated with 10 c.c. of concentrated nitric acid, the liquid is heated to boiling, 0.5 gm. of lead peroxide added gradually, and after continuing the boiling for a few minutes, the mixture is allowed to settle. If manganese be present, a pink coloration appears, due to the formation of permanganic acid. The solution is made up to 100 c.c. with distilled water which has been previously boiled and filtered, the first 10 c.c. of filtrate being rejected. The colour of the next 50 c.c. of liquid is then matched against a solution prepared by adding to distilled water a standard solution containing 0.1435 gm. of potassium permanganate and 10 c.c. of nitric acid per litre.—A. S.

*Copper [in Ores, Mattes, &c.]; Iodometric Determination of —.* A. M. Fairlie. Eng. and Mining J., 1904, 78, 787—788.

IN determinations by the iodometric method, the precipitation of copper by aluminium occupies considerable time, and has several other disadvantages. The author has made determinations much more quickly and simply by using ammonium or potassium thiocyanate to precipitate the copper. The cuprous thiocyanate is dissolved in strong nitric acid, the solution boiled until red fumes are no longer evolved, then neutralised with ammonia, acidified with acetic acid, potassium iodide added and the copper determined in the usual manner.—A. S.

*Copper [in Copper Pyrites]; Determination of —, in Presence of Iron and Arsenic, by the Iodide Method.* L. Moser. Z. anal. Chem., 1904, 43, 597—616.

THE author has adapted the iodide method for determining copper in the presence of iron and arsenic, by adding excess of sodium pyrophosphate ( $\text{Na}_4\text{P}_2\text{O}_7$ ) in which all three dissolve forming complex ions. Of these ions, only that containing copper is decomposed by acetic acid (sulphuric acid breaks up all), and on adding potassium iodide therefore only cuprous iodide is precipitated, but it is important to allow time for this, about 15 minutes sufficing. Working conditions are made clear by a description of an actual analysis of copper pyrites containing 27.25 per cent. of copper and 31.84 per cent. of iron. About 2 grms. were digested, with shaking, for 1 hour in the cold with a little fuming nitric acid, and then more nitric acid was added, and the oxidation of the sulphur completed on the water-bath. The nitric acid was displaced by sulphuric acid, and excess of this driven off almost completely on a sand-bath. The residue was taken up with water, and sodium acetate added, which gave a brown solution. The silica and lead sulphate were filtered off and washed with hot water, and the filtrate made up to 100 c.c.; 20 c.c. of this were precipitated with solid sodium pyrophosphate, and the precipitate dissolved in a little strong solution of the same reagent, when a blue solution was obtained. About 4 grms. of potassium iodide and 10 c.c. of 80 per cent. acetic acid were added, and the flask shaken for 10 minutes. The solution was then titrated with thiosulphate as usual. The results given are less than 0.3 per cent. too low.—F. Spx.

*Cobalt and Nickel; Electrolytic Analysis of —.* F. M. Perkin and W. C. Prebble. Paper read before the Faraday Soc., Dec. 19, 1904.

THE following method yields firm, bright deposits, and gives analytically correct results:—One gm. of cobalt ammonium sulphate is dissolved in 50 c.c. of water and 5 c.c. of a 5 per cent. solution of phosphoric acid are added. After a further addition of 25 c.c. of a 10 per cent. solution of sodium dihydrogen phosphate, the liquid is made up to 130 c.c. and electrolysed. A brown deposit of cobalt oxide forms on the anode after half an hour or so, and this is dissolved away by adding about 0.5 gm. of hydroxylamine sulphate or chloride. When the bulk of the cobalt has been deposited, it is advantageous to add a few drops of dilute ammonia to neutralise the excess of electrolytically liberated acid. At a temperature of 55°–60° C., electrolysis is complete after 3½ hours, the current density being kept low for the first hour (0.4 ampère per sq. dm.), and then raised to 1.1–1.8 ampères. Whereas this phosphoric acid bath was found to be the only one suitable for cobalt, nickel which deposits well from several other baths gave unsatisfactory results from it.—W. A. C.

### ORGANIC—QUALITATIVE.

*Sumach; Detection of Adulterants in —, by Microscopical Examination.* M. C. Lamb. J. Soc. Dyers and Colourists, 1904, 20, 265—268.

A METHOD for the detection of adulterants in sumach by means of the microscopical examination of their leaf cuticles has been previously published by the author (this J., 1899, 403); the method now given is for the examination of sumach in powder form.

One or two grms. of the sample to be tested, are treated with nitric acid (1 : 1) until nitrous acid fumes are evolved, the mixture is allowed to stand for 15 to 30 minutes, and then again heated until the solution becomes clear. The liquid is diluted and filtered; the small particles of leaf cuticle remaining on the filter are removed and coloured by treatment with a weak solution of some suitable dyestuff, e.g., Bismarck Brown, Safranin, Methylene Green. The dyed particles are washed and afterwards transferred to a glass-ship for microscopical examination.

The characteristic features of the cuticle of pure sumach when examined with a 1-inch objective, are the hairs which have the appearance of pin-like bodies, and the stomata, consisting of small elliptical openings, surrounded by "guard" cells.

Illustrations taken from photomicrographs of samples of ground sumach adulterated with the two most common adulterants, *Pistacia Lentiscus* and *Tamarix Africana*, are shown in the paper; no hairs appear on the cuticles of either of these leaves. The stomata of the lower cuticle of *Pistacia Lentiscus* are larger and more numerous than those of sumach, whilst the cells are nearly all hexagonal in shape. *Tamarix Africana* leaves possess polygonal cells and very few stomata.

By treatment with nitric acid, pure sumach almost completely dissolves, leaving a sumach "wreck"; the adulterants, however, are unaffected by the treatment.

A "sumach" tanned leather may sometimes be examined for adulteration with *Pistacia* or *Tamarix* by the same method, the leather during the tanning usually becoming impregnated with minute particles of the sumach and adulterants. The leather is first dissolved in caustic soda, and the cuticles prepared by treatment with nitric acid in the same manner as when dealing with sumach.—M. C. L.

*Fructose; Methylphenylhydrazine Reaction of —.* C. Neuberg. Ber., 1904, 37, 4616—4618.

ALTHOUGH it is possible to prepare dextrose-methylphenyl-osazone from dextrose and methylphenylhydrazine (see Ofner, this J., 1904, 993), yet, under the conditions given by the author (this J., 1902, 506 and 1103), the formation of this compound may be used as a test for the presence of levulose. Under these latter conditions, dextrose yields only the methylphenylhydrazine. The preparation of the osazone from dextrose is possibly preceded by the conversion of the dextrose into levulose, a change which is known to be brought about not only by alkali, but also by acetates, neutral salts or phenylhydrazine itself.

—T. H. P.



*Sugars; Action of Secondary Asymmetric Hydrazines on —. First Communication.* R. Ofner. *Monatsh. f. Chem.*, 1904, 25, 1153–1163.

*Benzylphenylhydrazine.*—Although commercial benzylphenylhydrazine gives small quantities of osazone, both with dextrose and fructose, this reaction is attributable to the presence of phenylhydrazine, as a decomposition product, in the reagent. The purified benzylphenylhydrazine gives no crystalline osazone. When phenylhydrazine is purposely added to the pure benzylphenylhydrazine an osazone, previously erroneously regarded as the benzylphenylosazone, is obtained in satisfactory yields, both with fructose and dextrose. This osazone, which melts at 190° C., is in reality the phenyl-benzylphenylosazone of dextrose or fructose. The same primary, secondary, or "mixed" osazone is also obtained by heating phenyldextrosazone with an excess of benzylphenylhydrazine.

*Methylphenylhydrazine.*—The same methylphenylosazone, melting at 153° C., is obtained both from dextrose and fructose, though the latter sugar reacts more easily than the former. When the methylphenylhydrazine is contaminated, either by decomposition or intentionally, with phenylhydrazine, a "mixed" phenyl-methylphenylosazone, melting at 192°–195° C., is produced (see also this J., 1904, 883 and 993). The author concludes that the secondary asymmetric hydrazines are not to be relied on for the separation of ketoses from aldoses.—J. F. B.

*Milk Sugar and Maltose; New Colour Reaction for —.* A. Wöhlk. *Z. anal. Chem.*, 1904, 43, 670–679.

The test is carried out in the following manner:—0.7–0.5 gm. of milk sugar is dissolved in a narrow test-tube in 10 c.c. of 10 per cent. ammonia, and the tube is heated in a water-bath, near the boiling point, in such a manner that the ammonia evaporates gradually. After 15 or 20 minutes a very characteristic madder-red coloration is developed, which is permanent towards light, but gradually turning brown in presence of air.

A large number of carbohydrates and sugars were tested by the author in the same way, but, with the exception of milk sugar and maltose, none of them gave the red coloration. This reaction serves for the detection of milk sugar or maltose in mixtures of carbohydrates, provided either of them is present in such quantities that the red coloration is not masked by the yellow or brown colour produced by the other bodies.

The presence of certain salts, such as tartrates, ammonium sulphate, ammonium chloride, &c., interferes with the reaction, and in many cases it is necessary to isolate the sugar before applying the test. It is suggested that this reaction might form a basis for the colorimetric determination of milk sugar in milk.—J. F. B.

*Milk; Use of Methylene Blue to Distinguish Cooked Milk from Raw —.* Schardinger. *Nouv. Remèdes*, 19, 229. *Pharm. J.*, 1904, 73, 815.

Twenty c.c. of the milk are heated for 10 minutes at 40–45° C., with 1 c.c. of a reagent containing 5 c.c. of an alcoholic solution of Methylene Blue, 5 c.c. of formalin, and 190 c.c. of water. Fresh raw milk completely decolorises the reagent, but boiled milk is without action upon it. If the milk be sour, it must be made neutral or alkaline before applying the test, as acid milk, whether raw or cooked, decolorises the reagent.—A. S.

#### ORGANIC—QUANTITATIVE.

*Kjeldahl Nitrogen Determinations; Influence of Different Kinds of Glass on the Accuracy of —.* H. Schönewald and K. Bartelt. *Woch. f. Brau.*, 1904, 21, 793–791.

By making a series of distillations of ammonia from pure ammonium chloride, in quantities corresponding to those generally employed in the determination of albuminoids by Kjeldahl's method, the authors have proved that the errors involved in the use of apparatus made of ordinary soft Thuringian [soda] glass are very considerable, but that Jena "thermometer glass 16 III." gives very

satisfactory results. The magnitude of the error is proportional to the quantity of ammonia distilled. It makes no practical difference whether the condenser be cooled by air or by water-circulation. The errors are caused by the solvent action of the ammoniacal steam or condensed water upon the alkalis of the glass; pure steam has no noticeable corrosive action even on soft glass.—J. F. B.

*Caoutchouc and Gutta-Percha, Assay of —.* W. Esch and A. Chwölles. *Chem.-Zeit.*, 1904, 28, 1195–1196.

The caoutchouc, &c., is rolled into a thin sheet, over-heating being carefully avoided. A weighed quantity is twisted loosely, between layers of thick filter-paper, into a spiral, which is closed at each end by extraction-thimbles; it is then subjected to extraction by acetone in a Soxhlet apparatus. The resin having thus been determined, the caoutchouc is dissolved out of the residue by toluene vapour in a Pontio's "digesteur-lixiviateur." The residue remaining after this treatment is free from caoutchouc.—W. A. C.

*Beetroot Juice; Determination of Reducing Sugars in —.* H. and L. Pellet. *Bull. Assoc. Chim. Sucr. Dist.*, 1904, 22, 374–378.

From 20 to 50 c.c. of Fehling solution are used with an equal volume of the liquor used direct, but diluted where qualitative tests show the necessity, so as not to contain more than .02 to .03 per cent. of reducing sugars. The mixture is heated in a bath of boiling water to 85–87° C., and the heat maintained 3 minutes longer. 20 to 50 c.c. of cold water are added, and the solution filtered through paper free from ash. The precipitate is washed with boiling water until the washings are neutral, calcined in a muffle and weighed as cupric oxide. From this weight, a deduction is made for the saline matter retained by the paper. A blank experiment usually gives 5 to 7 mgrms. The reducing sugar is calculated by multiplying the weight of cupric oxide by 0.453. It is advisable to check the copper by titrating with stannous chloride where the percentage of reducing bodies is high, as in cane-sugar products, and to confirm the results by parallel tests on known quantities of added invert sugar. Turbid liquids that will not filter clear are defecated with neutral acetate of lead. The lead must not be removed by sodium carbonate. If the liquid is clear, but contains sufficient lime salts to interfere with the precipitation of cuprous oxide, sodium carbonate may be used, avoiding excess. When neutral lead acetate has been used, the precipitate must be ignited in a porcelain crucible, otherwise platinum may be used.—L. J. DE W.

*Molasses containing Reducing Sugars; Analysis of Refinery —.* H. Pellet. *Bull. Assoc. Chim. Sucr. Dist.*, 1904, 22, 373–374.

The procedure indicated by the author (this J., 1904, 1047) for the determination of crystallisable sugar, reducing sugars and dry solids is applicable to the analysis of refinery molasses resulting from working up beetroot sugars more or less mixed with cane sugars, pure cane sugars, or products from candy works. With increase of reducing bodies, the quantity of ash diminishes notably. The nature of the reducing sugars will, however, not be the same as in cane sugars unless these also have been changed by prolonged heating to a high temperature. Although it may happen that direct polarisation gives the true amount of sucrose present, it is indispensable to check this in every case by polarisation before and after inversion.

—L. J. DE W.

*Barley; Direct Determination of Extract in —.* G. Merz. *XVII.*, page 38.

*Fat in Butter; Determination of —.* A. Hesse. *Z. Untersuch. Nahr. u. Genussm.*, 1904, 8, 673–675.

From 1½ to 2 grms. of the well mixed butter are introduced into a stoppered cylinder, and melted by the addition of about 8 c.c. of hot water. One c.c. of ammonia and 10 c.c. of alcohol are added and shaken up with the butter until the albuminoids are dissolved. After cooling, the mixture is shaken with 25 c.c. of ether, and again after

addition of 25 c.c. of light petroleum spirit. The clear ethereal layer is pipetted off, and 50 c.c. of ether are added and pipetted off without shaking. Finally 50 c.c. of equal parts of ether and light petroleum spirit are shaken up, and the clear supernatant layer again pipetted off. The united ethereal liquids are evaporated and the fatty residue weighed. It is claimed that this method precludes the presence of non-fatty matters in the extract, whilst it consumes less time than the other methods in use.

W. A. C.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Solvents: Attractive Force of Crystals for Like Molecules in Saturated —.* E. Soustadt. Chem. Soc. Proc., 1904, 20, 244–245.

SATURATED solutions of various salts were prepared in pairs, and to one of each pair were added crystals of the dissolved salt. The solutions were then kept for some time in a cellar, the temperature of which remained almost constant. It was found that the added crystals removed from solution a certain quantity of the dissolved salt.—A. S.

*Oxidation Phenomena; Some —.* G. Kassner. Z. angew. Chem., 1904, 17, 1851–1856.

THE author reviews the work which has been done on the subject of autoxidation and the formation of "holoxides" or peroxides. He concludes that there are five general modes of formation of holoxides or peroxides:—(1) By the union of molecular oxygen to oxidisable substances in the process of autoxidation, and in the oxidation of certain metals (barium, alkali metals, &c.) at high temperatures. (2) By union of negative ions of oxygenated acids during electrolysis. (3) By decomposition of the ozonides discovered by Harries. (4) In the case of thorium and zirconium, by Pissarjewsky's synthetical method by means of hypochlorites. (5) By transformation of compounds containing labile oxygen atoms; this has up to the present only been observed in the case of the higher oxygenated compounds of lead. (See also this J., 1897, 941; 1898, 387, 579, 1194; 1899, 65, 1124; 1900, 172, 278, 682, 697; 1901, 578, 841, 929, 1151; 1902, 257, 720, 1301; 1903, 969, 1121, 1155.)—A. S.

*Electro-positive Metals; Action of some — on Potassium Iodide.* F. Streintz. Physik. Zeits., 1904, 5, 736–737. Chem. Centr., 1904, 2, 1530.

THE action of metals on photographic plates and on potassium iodide paper, observed by Blaas and Czernak (Physik. Zeits., 5, 363), is explained by the author as an effect due to Nernst's electrolytic solution-pressure: the positive ions discharged from the metal exert an ionising action on the silver salt of the photographic plate, or on the potassium iodide, this action being greater the more electro-positive the metal. Polished magnesium has a much stronger action on potassium iodide paper than zinc, whilst the latter is more active than cobalt. Perfectly bright aluminium has a very strong action on potassium iodide. Magnalium (an alloy of magnesium and aluminium) is more active than magnesium; iron, tin, lead, nickel, copper, mercury, silver, gold and platinum are inactive. If cells of high E.M.F. be constructed (e.g., zinc/glycerin solution/salt), these act strongly, whilst cells of small E.M.F. (e.g., magnesium-zinc) have scarcely any action. The rays will penetrate paper, but not mica, glass or tinfoil.—A. S.

*Mercuric Chloride Solutions; Action of Acetylene on —.* K. A. Hofmann. Ber., 1904, 37, 4459–4460.

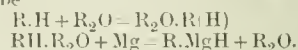
IT has been previously shown (this J., 1898, 1078; 1899, 79) that the white crystalline precipitate obtained by acting with acetylene gas on aqueous solutions of mercuric nitrate, is, according to the conditions, either di- or trimercuraldehyde. If acetylene gas be passed through an ice-cold solution of equimolecular proportions of mercuric and sodium chlorides, a precipitate is produced which, after being washed with ice-cold water and dried by means of alcohol and ether, gives the reactions of

trichloromercuraldehyde ( $(\text{CHg})_3\text{C}\cdot\text{CHO}$ ), but contains more chlorine than that compound. This is probably due to the formation of the compound  $\text{C}_3\text{Hg}_3\text{Cl}_4$  as an intermediate product, from which the trichloromercuraldehyde is produced by hydrolysis. In presence of an excess of sodium chloride, acetylene does not produce any precipitation in mercuric chloride solution. From solutions of mercuric chloride free from sodium chloride, nearly pure trichloromercuraldehyde is precipitated by acetylene.

—A. S.

*Organo-Magnesium Compounds; New Method of Preparing —.* (Grignard's Reaction.) W. Tschelinzell. Ber., 1904, 37, 4534–4540.

THE product of the reaction of magnesium on alkyl or aryl halides in ethereal solution was looked on by Grignard as being, not  $\text{R}\cdot\text{Mg}\text{H}$ , but  $\text{R}\cdot\text{MgH}\cdot\text{R}_2\text{O}$ ; and Baeyer and Villiger regard this substance as an oxonium compound. The author considered that the function of the ether was probably to loosen the bond between radical and halogen in the haloid compound; and that view is confirmed by the fact that the reaction takes place in a benzene solution, if a small quantity of ether be added. Brühl and Oerdt, and also Malmgren, have stated that the reaction occurs in benzene solution even without the presence of ether; the author finds that to be the case only at the high temperature (that of boiling xylene) at which those investigators worked. Ether acts in this reaction as a true catalyst; it causes the reaction to take place easily at the ordinary temperature, or a little above it, and a very small amount of ether is enough for the production of a large amount of halide. The stages of the reaction appear to be



The author had previously shewn that tertiary amines could be substituted for ether in Grignard's reaction. He now finds that these amines also act catalytically, and with greater vigour than ether: using  $\frac{1}{2}$  gram-molecule of benzaldehyde with equivalent amounts of ethyl iodide and magnesium, and  $\frac{1}{100}$  gram-molecule of dimethylaniline, the whole in benzene solution, an 82 per cent. yield of ethyl-phenyl-carbinol was obtained; and a 63 per cent. yield of diphenylcarbinol when phenyl iodide was substituted for ethyl iodide. To carry out the process in practice, the reaction-mixture in pure dry benzene is heated on a water-bath till the benzene boils (unless reaction, shewn by the deposition of white flocks, begins earlier: sometimes the addition of a crystal of iodine will hasten its beginning); the mixture is then removed from the bath till reaction ceases, cooling if necessary, and finally heated again to carry the reaction to an end. The author has as yet used only dimethylaniline; but possibly the nature of the amine may have an influence on the progress of the reaction.—J. T. D.

## New Books

YEAR-BOOK OF PHARMACY, COMPRISING ABSTRACTS OF PAPERS RELATING TO PHARMACY, MATERIA MEDICA, AND CHEMISTRY, contributed to British and Foreign Journals from July 1, 1903, to June 30, 1904, with the Transactions of the British Pharmaceutical Conference at the 41st Annual Meeting held in Sheffield, August, 1904. J. O. BRAITHWAITE, E. SAVILE PECK, and EDMUND WHITE. J. and A. Churchill, 7, Great Marlborough Street, 1904. Price 10s. 6d.

SUBJECT-LIST OF WORKS ON THE FINE AND GRAPHIC ARTS [INCLUDING PHOTOGRAPHY], AND ART INDUSTRIES IN THE LIBRARY OF THE PATENT OFFICE. Darling and Son, Ltd., 34–40, Bacon Street, London, E. Patent Office, 25, Southampton Buildings, Chancery Lane, W.C., 1904. Price 6d.



**DIE INDUSTRIE DER ESSIGSÄURE UND DER ESSIGSAUEREN SALZE.** Von Dr. S. MIERZINSKI. Carl Scholtze (W. Junghans), Leipzig. 1905. Price M.4.50.

8vo volume, containing preface, subject matter filling 209 pages, and illustrated by 38 engravings, and an alphabetical index of subjects. The work commences with (1) A Theoretical Introduction; (2) The Manufacture of Acetic Acid; (3) The Acetates; (4) Acetic Ether (Ester), and (5) Acetone. An alphabetical index of subjects forms the conclusion.

**THE SPINNING AND TWISTING OF LONG VEGETABLE FIBRES** (Flax, Hemp, Jute, Tow and Ramie): A Practical Manual of the Most Modern Methods as applied to the Hackling, Carding, Preparing, Spinning and Twisting of the Long Vegetable Fibres of Commerce. By HERBERT R. CARTER. Charles Griffin and Co., Ltd., Exeter Street, Strand, London. 1904. Price 16s.

8vo volume, containing 353 pages of subject matter, with 161 illustrations, including 10 plates, and an alphabetical index of subjects. The leading themes are as follows:— I. The Long Vegetable Fibres of Commerce. II. Rise and Growth of the Spinning Industry. III. The Raw Fibre Markets and the Purchase of the Raw Material. IV. Storing the Raw Materials, and the Preliminary Operations of Batching, Softening, Knitting, Roughing, Breaking and Cutting. V. Hackling (hand and machine). VI. Sorting. VII. Preparing—Sliver formation. VIII. Tow Carding and Mixing. IX. Preparing, Drawing and Doubling, and Tow Combing. X. Gill Spinning. XI. Flax, Hemp, Jute and Ramie Roving Frame. XII. Their Dry and Demi-Sec. Spinning. XIII. Wet Spinning. XIV. Waste Spinning. XV. Yarn Reeling, Winding, Drying, Cooling and Bundling. XVI. Manufacture of Threads, Twines and Cords from Flax, Hemp, Jute and Ramie Yarns. XVII. Rope Making. XVIII. The Mechanical Department. XIX. Modern Mill Construction. XX. Boilers and Engines, Steam and Water Power. XXI. Power Transmission.

**INKS; THEIR COMPOSITION AND MANUFACTURE, INCLUDING METHODS OF EXAMINATION AND A FULL LIST OF ENGLISH PATENTS.** By C. AINSWORTH MITCHELL, B.A., and T. C. HEPPWORTH. Charles Griffin and Co., Ltd., Exeter Street, Strand. 1904. Price 7s. 6d.

SMALL 8vo volume, containing preface and 242 pages of subject matter with 46 illustrations, including 4 plates. There is an alphabetical index of subjects. The chapters are subdivided as follows:—Historical Introduction. SECTION I. WRITING INKS. (i) Carbon and Carbonaceous Inks; (ii) Tannin Materials for Inks; (iii) Nature of Inks; (iv) Making Iron Gall Inks; (v) Logwood, Vanadium and Aniline Black Inks; (vi) Coloured Writing Inks; (vii) Examination of Writing Inks. SECTION II. PRINTING INKS. (i) Early Methods of Making; (ii) Manufacture of Varnish; (iii) Preparation and Incorporation of the Pigment; (iv) Coloured Printing Inks. SECTION III. INKS FOR MISCELLANEOUS PURPOSES. (i) Copying Inks; (ii) Marking Inks; (iii) Safety Inks and Papers; (iv) Sympathetic Inks; (v) Inks for Special Purposes; (vi) List of British Patents.

**THEORETICAL CHEMISTRY FROM THE STANDPOINT OF AVOGADRO'S RULE AND THERMODYNAMICS.** By Prof. WALTER NEENST, Ph.D., of the University of Göttingen. Revised in Accordance with the 4th German Edition. Macmillan and Co., Ltd., London. 1904. Price 15s. The Macmillan Co., New York.

8vo volume, containing 756 pages of subject matter, with 35 illustrations, and an alphabetical index of subjects and authors. The leading themes are as follows:— I. Introduction to Some Fundamental Principles of Modern Investigation. II. The Universal Properties of Matter. III. Atom and Molecule. IV. The Transformation of Matter (Doctrine of Affinity, i.). V. The Transformation of Energy (Doctrine of Affinity, ii.). In this latter (V.) are included chapters on (i.) Thermochemistry, (ii.) Electrochemistry, and (iii.) Photochemistry.

## Trade Report.

### I.—GENERAL.

**CHEMICAL INDUSTRIES; DISTRIBUTION OF POPULATION ENGAGED IN — THROUGHOUT THE CHIEF COUNTRIES OF THE WORLD.**

*British and Foreign Trade and Industry, Memoranda, Statistical Tables and Charts. Second Series, prepared in the Board of Trade. Cd. 2337. Dec., 1904. Pp. 431—566.*

The following figures show the changes which have taken place in a period of 20 years in the proportions of population engaged in the leather, paper, glass, pottery, and chemical trades, the numbers being "persons per 10,000":—United Kingdom, 1881, 160; 1901, 166. Germany, 1875, 178; 1895, 213. United States, 1880, 79; 1900, 96. The figures for the United Kingdom are taken from the Census Reports for 1901.

The *Leather Trades* statistics show that 9,608 persons were employed in England and Wales as tanners in 1901, 967 in Scotland, and 167 in Ireland; total, 10,742. In Russia, 28,180 persons were engaged in the industry in 1897; in Sweden, 2,376 in 1896, and 2,326 in 1901; in Denmark, 1,375 in 1897; in Holland, 2,545 in 1889, and 2,628 in 1899; Belgium, 6,938 in 1896. In the German Empire (includes currying, varnishing, &c., and parchment manufacture), 45,637 in 1882, and 53,946 in 1895. In France, in 1896, 1,600 persons were engaged in skin dressing and dyeing, 9,500 in tawing, and 20,200 in tanning. 821 persons were employed in tanning in Switzerland in 1901. In the United States 56,024 persons were engaged in manufacturing "leather-tanned, curried and finished (including dressed skins)."

*Paper Trades.*—In 1901, 34,357 persons were employed in paper manufacture in the United Kingdom in 1901. In Russia in 1897, 487 persons manufactured wood pulp, 1,562 wall paper and coloured paper, and 21,528 other kinds of paper. In Sweden, 7,400 persons were engaged in making wood pulp in 1901, and 6,078 in paper manufacture. In the German Empire the paper industry gave employment to 85,104 persons in 1895, as compared with 58,060 in 1882. In Belgium, there were 9,448 workers in 1896, and in France 23,690, of whom 3,469 manufactured coloured paper. In 1901, there were 2,129 paper makers in Switzerland, and 20,257 in Italy. In 1902, 5,026 Japanese were engaged in paper making. Paper and wood pulp mills in the United States gave employment to 53,012 persons in 1900. The total number engaged in all paper trades was 72,159.

*Glass Industry.*—In Great Britain 32,929 persons were engaged in the glass industry in 1901, as against 28,568 in 1891. Other countries employed the following numbers (the year of census being given in brackets):—Russian Empire (1897), 36,193; Sweden (1901), 5723; Denmark (1897), 1117; German Empire (1895), 58,221; Holland (1899), 3,325; Belgium (1896), 22,797; France (1896), 21,428; Switzerland (1901), 816; Italy (1901), 8,039; Austria (1900), 43,069; Hungary (1898), 4,545; United States (1900), 61,164.

*Brick, Tile, and Pottery Industries.*—The following figures give the numbers employed in the years indicated:—Great Britain (1901) 135,618. (1891) 109,173; Russian Empire (1897), 88,303; Sweden (1901), 13,204; Denmark (1897), 10,044; German Empire (1895), 306,919; Holland (1899), 6,773; France (1896), 80,100; Switzerland (1901), 6,870; Italy (1901), 37,203; Austria (1900), 57,255; Hungary (1898), 23,591; United States (1900), 122,277.

*Chemical Trades.*—In Great Britain and Ireland the total number employed in 1901 was 58,232. Included in these figures are dye, paint, ink and blacking, 7,533; explosives and matches, 15,010; manufacturing chemists, 20,444; alkali manufacturers, 9,857; manure manufacturers, 1,991; glue, size, varnish, &c., makers, 3,397. The total figure shows an increase of 17,271 on that of 1891. In Germany, in 1895, the total number engaged was

97,470, compared with 57,388 in 1882. The following classification is adopted:—

	1882.	1895.
Chemical works .....	14,910	26,951
Chemical, pharmaceutical and photographic preparations .....	8,463	12,699
Aniline and aniline dyes .....	4,107	7,266
Coal tar products (other than above) .....	547	4,194
Essential oils and perfumes .....	1,389	2,162
Colours and dyes except aniline and other coal tar dyes .....	9,909	10,386
Explosives .....	5,733	16,516
Matches and other kindling materials .....	4,951	5,893
Artificial fertilisers .....	5,078	8,014

In the United States, 140,515 persons were employed in chemical industry in 1900, compared with 78,204 in 1890. The following figures are given for 1900:—Chemicals, 21,419; perfumery, cosmetics and essential oils, 3,182; dyestuffs and extracts, 1,937; turpentine and resin, 45,945; ink, 1,283; pigments and paints, 11,079; varnishes, 2,863; fertilisers, 13,654; explosives and fireworks, 7,106; matches, 2,120.

Other countries had the following numbers of persons engaged in various chemical industries:—Russian Empire (1897), 32,414; Sweden (1901), 9,488; Denmark (1897), 1938; Holland (1899), 2,607; Belgium (1896), 11,956; France (1896), 42,900; Switzerland (1901), 4,385; Italy (1901), 15,958; Austria (1890), 13,313; Hungary (1898), 7,943.

#### SWITZERLAND: TRADE OF — IN 1903.

*Foreign Office Annual Series, No. 3314.*

The total imports of druggists' sundries, chemicals and colouring materials in 1903 amounted to £1,647,000 (an increase of £109,000 on the imports of 1902), of which £1,469,000 was for manufactured chemical products. The imports from the United Kingdom amounted to £59,500. The imports under this heading show year by year an upward tendency, but last year the auxiliary materials and the manufactures principally accounted for the increase of upwards of £100,000. The imports from all countries, together with the share of the United Kingdom, included the following:—

Articles.	From—	
	All Countries.	United Kingdom.
	£	£
Drugs .....	94,600	2,000
Alkaloids .....	36,300	1,400
Pharmaceutical preparations .....	43,300	5,000
Aniline oil and aniline compounds .....	71,800	1,300
Stearine .....	34,800	4,500
Gelatine and fish-glue .....	8,200	1,000
Varnishes .....	33,900	9,000
Athracene, benzoic acid, benzene, carbolic acid, &c. ....	81,700	1,500
*Colouring materials .....	264,000	1,600
Perfumed soaps .....	10,200	1,120

\* Includes aniline dyestuffs £61,820 and £710 respectively.

The total imports of oils, soaps, and fats in 1903 amounted to £591,400, of which the United Kingdom supplied £24,500, or £2,000 more than in 1902. The principal articles imported from all countries and from the United Kingdom were as follows:—Various liquid greases and oils, £206,000 (from the United Kingdom, £20,000); candles, £2,500 (United Kingdom, £600); ordinary and scented soaps, £42,700 (United Kingdom, £1,500).

The value of the total imports of linoleum was £76,600, an increase of £13,000 on the imports in 1902. The imports from the United Kingdom amounted to £33,500, being an increase of nearly £4,000 on the imports of last year. The imports from Germany amounted to £42,000.

The increase in the demand for linoleum in Switzerland has been rapid, as will be seen from the following figures:—

Year.	Imports.	
	Total.	From United Kingdom.
	Cwts.	Cwts.
1890 .....	4,683	..*
1895 .....	8,884	..*
1900 .....	24,225	13,789
1902 .....	26,080	12,206
1903 .....	31,340	13,720

\* Not given.

The total imports of varnishes in 1903 amounted to £33,900 (an increase of £3,600 on 1902), of which the United Kingdom supplied £9,000. The principal supply came from Germany, representing a value of £16,000.

Exports of "chemicals" from Switzerland in 1903 reached a total value of £1,357,800, of which £150,000 worth went to the United Kingdom.

#### PATENT LAWS IN SWITZERLAND; PROPOSED AMENDMENT OF —.

*Chem. and Druggist, Dec. 24, 1904.*

The Swiss Government proposes to extend patent protection to chemical products, and it is understood that the opponents of the proposed extension in Switzerland are at present the colour-works industry, the industries which utilise these products, and pharmaceutical chemists. The Soc. pour l'Industrie Chimique à Basle is in favour of the suggested legislation if the utilising industries are excepted from its scope. The Government says that if the proposed law is not in force by December 31, 1907, Germany will tax Swiss dyes imported into that country.

#### CUBA; IMPORTS OF DRUGS AND CHEMICALS, INCLUDING OILS AND PAINTS INTO —.

*Foreign Office Annual Series, No. 3315.*

British manufactures represent only 8 per cent of the total imports of these products.

The United Kingdom supplies 15 per cent. of the opium, 35 per cent. of the paints and colours, 25 per cent. of the chemical products, 45 per cent. of the vegetable oils (such as linseed but not counting olive oil) and 21 per cent. of the mineral waters. The United Kingdom has little or no share in the importation of varnishes, medicines and pharmaceutical preparations, candles, soap, or perfumery, the consumption of which in the aggregate represents over £300,000 a year.

#### VII.—ACIDS, ALKALIS, Etc.

##### MAGNESITE IN THE TRANSVAAL.

*Eng. and Mining J., Dec. 8, 1904.*

In the expectation that the deposit of magnesite recently discovered in the Barberton district will yield profitably, a company with £200,000 capital has been formed at Pretoria to work it. According to the analyses of the engineer, the mineral carries an average of 46.44 per cent. magnesia, and 49.66 per cent. carbonic acid, which is nearly the same as the Grecian magnesite. Development work has proved the existence of a large vein of good mineral. The inauguration of this new industry in the Transvaal will show whether or not a low-priced mineral, paying a heavy ocean freight, can be marketed at a profit.

#### VIII.—GLASS, POTTERY AND EARTHENWARE.

##### CORUNDUM DISCOVERY IN CANADA.

*U.S. Cons. Rep., No. 2124, Dec. 5, 1904.*

A rich deposit of corundum has been found on a farm in Methuan Township, county of Peterboro. A sample



f the deposit was assayed by the government geological survey, and pronounced very rich. Its specific gravity is 3.90, while that of good corundum is 3.85. The value of the mineral is placed at \$390 per ton. The feldspar in which the corundum is found is also very valuable.

### X.—METALLURGY.

#### RARE MINERALS IN AUSTRALIA.

*Eng. and Mining J., Dec. 8, 1904.*

Two of the principal ores of tungsten (wolfram and scheelite) occur in several localities in Western Australia. According to the assistant government geologist, wolfram occurs in small quantities near Roebourne, and in other parts of the Pilbarra district, and also in the Geraldton district. Scheelite has been found in small quantities in Fraser's mine, Southern Cross; Lindsay's mine, Coolgardie, and Hannan's Hill, Kalgoorlie. Its occurrence has also been noted in association with the tin of Greenbushes. There is no record of the minerals having been obtained commercially in any of these instances, but, as far as can be judged at present, the occurrence of wolfram in the Pilbarra district seems to hold out the best chances for investigation.

In North Queensland, the principal source of tungsten in Australia, the majority of the producing claims lie along a fairly continuous reef of quartz, the granite for some distance on either side being intersected by an irregular system of smaller quartz veins and offshoots, from which the wolfram is chiefly obtained. The output of the Queensland fields from 1894 to the end of 1903 is estimated at 947.5 tons. About the middle of last year wolfram was selling on the field in North Queensland at £29 per ton, and at the end of 1903 it was £50, since which time it has risen to £140. It is there chiefly purchased by agents, who visit the field. The demand for wolfram is comparatively small and somewhat irregular, and any large output would demoralise the market.

Molybdenite, containing when pure 60 per cent. of metal, occurs in Queensland, and in Western Australia, at Clackline, Coolgardie, Southern Cross and Buldania. In 1903, Queensland produced 11 tons, valued at £1,321.

Occurrences of vanadinite (chloro-vanadate of lead) have been recorded in Western Australia at Mulline (North Coolgardie), Pinyalling (Yalgoo) and Coolgardie. Uranium minerals have not so far been noted in Western Australia.

#### MINERAL RESOURCES OF CANADA.

*Board of Trade J., Dec. 22, 1904.*

In a recent issue, the *Monetary Times* (Toronto), alluding to the mineral resources of the Lake St. John region, north of Roberval, Quebec, says that recent explorations show that this part of the country is likely to yield large quantities of gold, copper and asbestos. Last year rich beds of asbestos, copper and gold quartz were found in the neighbourhood of Lake Chabugamooc. Some samples of gold quartz and copper show that the former will yield 64 dols. to the ton, and the latter 53 dols. The breadth of the vein is said to be 30 feet, with a depth of 2,000 feet. Vast quantities of iron ore are also said to exist in the same vicinity, some mounds of iron ore being 200 feet high. A company has been formed to develop these and any other mineral areas which may be discovered.

According to a report by the Ontario Bureau of Mines, important deposits of high-grade hematite have been discovered in the lower levels of the Williams iron mine on the Algoma Central Railway. This is an entirely new iron area, and if the deposits prove to be continuous, may develop into an important field. North of Temagami, there are two promising prospects, one for iron pyrites and the other for arsenical pyrites. There are also a number of other iron pyrites and arsenical properties in the district.

#### PORTUGAL; MINERAL PRODUCTION OF—

*Eng. and Mining J., Dec. 8, 1904.*

Subjoined is a detailed statement of the mineral output in the Kingdom of Portugal during the year 1903. Com-

pared with the figures for 1902, all the important items show a marked decrease, as given below, in metric tons.

	1902.	1903.
Athracite .....	11,000	8,063
Cupiferous iron pyrites .....	413,714	376,177
Gold ore .....	kg 2,261	1,363
Iron ore .....	10,914	15,200
Lead ore .....	1,651	830

Other products of less magnitude were, in metric tons: White arsenic, 698; copper precipitate, 2,448; copper pyrites, 527; gold and antimony concentrate, 83; manganese ore, 30; wolfram, 228; zinc, copper and lead ore, 1,974. The mineral output for the year has an estimated value of £117,000 in all.

The whole number of persons employed in and around mines was 4,547, of whom 192 were females working above ground. Four fatalities occurred during the year.

#### IRON AND STEEL INDUSTRY OF SOUTHERN RUSSIA.

*Board of Trade J., Dec. 29, 1904.*

The iron and steel foundries of Southern Russia, during the year ended 30th June, 1904, produced 100,600,000 pounds of pig iron (an increase of 30.55 per cent.); 85,729 pounds of ingots (an increase of 21.5 per cent.), and 72,257,000 pounds of finished iron and steel (an increase of 25.87 per cent.).

The output of iron ore from Krivoi-Rog and Kertch during the same period amounted to 176,844,000 pounds (an increase of 32.6 per cent.); of manganese ore to 3,327,000 pounds (an increase of 30.1 per cent.).

### XII.—FATTY OILS, FATS, Etc.

#### PALM OIL AND RUBBER IN FRENCH GUINEA.

*Foreign Office Annual Series, No. 3313.*

The export of palm oil and kernels from French Guinea increased from £20,280 to £24,104, the great bulk going to Germany where the market is more favourable. Sesame was exported to the value of £4,951, and groundnuts increased from £5,906 to £10,584. These two latter articles of export show that the efforts of the Government to induce the cultivation of other products are beginning to bear fruit, but the chief export of the colony continues to be rubber, which has almost doubled, having risen from £230,978 in 1902 to £455,551 in 1903, the United Kingdom taking £245,863, or more than the total export of the previous year. The rubber all comes from Upper Guinea and the Soudan, and has to be carried several hundred miles by hand to the coast.

#### OIL SEEDS AND SEED OILS IN FRANCE.

*U.S. Cons. Rep., No. 2134, Dec. 16, 1904.*

The imports of cotton-seed oil into France for consumption, from all countries, during 1903 were 21,606 tons, against 28,338 tons in 1902, a decrease of 6,732 tons, and a decrease of 20,994 tons from the imports of 1901. Of the receipts the United States furnished, in the three years named, 19,496 tons, 26,426 tons, and 40,456 tons, respectively; most of the remainder came from Great Britain.

The total imports, however, during the first eight months of 1904 from the United States, as well as from other countries, show an increase over the imports of the same periods of the two previous years; but the oil has not been consumed very freely, so that the quantities on which duties have been paid, and which have passed into consumption, are less than one year ago.

The imports of oleaginous seeds of all kinds into France in 1903 were the largest ever known. They reached a total of 827,000 tons, against 757,000 tons in 1902 and 677,000 tons in 1901. A slight falling off has taken place during the first eight months of 1904, the figures being 578,000 tons, against 618,000 tons in 1903 and 545,000 tons in 1902, but this decrease is not sufficient to offset

the unusual receipts of 1903, and the large stocks of all kinds of oils which are still on hand.

A feature in connection with the manufacture of vegetable oils in France is the falling off in the production of cotton-seed oil. The importations of cotton seed, notwithstanding the bountiful cotton crop in Egypt, amounted to only 30,000 tons in 1903, against 48,000 tons in 1902 and 45,000 tons in 1901; and in the first eight months of 1904 to 13,800 tons, against 25,000 tons in the first eight months of 1903 and 35,000 tons in the same period of 1902. The few French manufacturers who, in former days, made a specialty of high-grade cotton-seed oils probably do not find it easy to compete with the fine qualities of American oils. Besides, they are handicapped by the difficulty of disposing of their cake, which, unlike the American product, being in an undecorticated condition, does not find a ready sale to the French cattle feeder.

The last advices from India point to a somewhat reduced supply of oleaginous seeds from that country, but the stocks of all kinds of oil, both for edible and for manufacturing purposes, are so large that sellers are willing to contract for deliveries over the whole of next year at the present low prices.

The olive crops were abundant last season, and the production of olive oil exceeded the consumption to such an extent that large stocks have been carried over not only in France, but in all producing countries. The extreme heat and drought of the past summer are reported to have injured the prospects of the next crop, but with the abundance of oil on hand there seems to be but little danger of a scarcity during the coming season.

A bill for imposing duties on foreign oil seeds which are now on the free list, and increasing those on foreign oils, has been before the French Parliament for a long time. The committee has passed a vote in favour of a duty of 3 francs per 100 kilos, on colza seeds, and a corresponding duty, according to their yield in oil, on all other oleaginous seeds. At the same time the existing duties on vegetable oils, including cotton-seed oil, were raised to 12 francs per 100 kilograms. The duties on copra and palm kernels, as well as their oils, were not changed.

Shortly after this decision of the tariff committee Parliament adjourned, and the bill will be reported back to the tariff committee, and then sent up to the Chamber of Deputies for discussion during the present session. It will certainly meet with much opposition from the French oil manufacturers, whose interests are seriously menaced by it, from those who are engaged in the oil-seed trade with British India, and from the importers of American cotton-seed oil.

#### OLIVE-OIL OUTPUT OF SPAIN.

*U.S. Cons. Rep., No. 2128, Dec. 9, 1904.*

After two successive seasons of almost unprecedented yields of olives in Andalusia, the crop of this province and of the surrounding provinces has resumed ordinary proportions. There has been a corresponding falling off in the exportation of olive oil, though but 10 per cent. of a season's yield finds its way into foreign markets.

The crop of 1902 was the largest yield of the past decade, it being estimated that 40,000,000 arrobas (178,520,000 gallons) of oil were pressed in the provinces of Cordoba, Jaen, Seville, Granada, and Malaga. Dry weather during the period in 1903 when the olive was ripening caused much of the fruit to mature early and fall from the trees. In this manner a considerable amount of the crop was ruined, with the result that the quantity of oil pressed in the latter part of the year was approximately one-third less than that of the previous year. The exports to the United States for the nine months ended September 30, 1903 and 1904, have been as follows: 1903, 21,084 barrels, valued at \$494,633; 1904, 14,253 barrels, valued at \$323,387.

Prices vary but little from one year to another, £30 per ton being the usual figure. The olive oil exported from Malaga is of the class used for manufacturing purposes and never for table use.

It is anticipated that the coming crop, to be pressed in December, will be to some extent smaller than the past

one. Hot and dry weather, in excess of previous years, is given as the primary cause for this condition.

#### XIII. A.—PIGMENTS, PAINTS, Etc.

##### MINERAL PAINT PRODUCTION IN THE UNITED STATES.

*U.S. Geological Survey, 1904.*

The total production during 1903, consisting of metallic paint, ochre, umber, sienna, Venetian red, zinc white, slate graphite and carbonaceous shales and schists amounted to 126,649 short tons, valued at \$5,437,275, as compared with the production of 125,694 short tons, valued at \$4,960,831, in 1902. The increase in value is due to the increase in the production of the higher priced pigments.

*Ochre, UMBER and SIENNA.*—During 1903, the production of ochre in the United States amounted to 12,524 short tons, valued at \$111,625, as compared with the production in 1902 of 16,565 short tons, valued at \$145,708. The seven States contributing to this output in order of importance of production were Georgia, Pennsylvania, Arkansas, Iowa, California, Vermont and Virginia. Missouri and Illinois, which were numbered among the producers of ochre in 1902, reported no production during 1903.

Of the 1903 production, Georgia produced 41.6 per cent. of the total output, while Pennsylvania, which had the largest output, 59 per cent. in 1902, produced only 39 per cent. of the 1903 output. The production from Pennsylvania was 4,937 short tons, valued at \$34,782 in 1903, as against 9,818 short tons, valued at \$80,259 in 1902.

Pennsylvania was the only State reporting any production of umber or sienna during 1903. The combined production of these two mineral paints was 666 short tons, valued at \$15,367, as compared with 669 short tons, valued at \$15,546 in 1902. In 1902 there were three other States, Illinois, Georgia and New York, which reported a production of these mineral paints.

*Metallic Paint.*—The minerals used in the manufacture of metallic paint are hematite and limonite. Although these two minerals occur in a great many places in the United States, and in enormous deposits, the quantity of these ores that are suitable for making a good metallic paint is very small, and there are but a few localities that can furnish it.

The production of metallic paints in 1903 was obtained from Pennsylvania, New York, Ohio, Tennessee, Wisconsin, Alabama, Maryland, New Jersey and Virginia, named in the order of the importance of their production. The output amounted to 35,966 short tons, valued at \$314,901; the production in 1902 was 27,375 short tons, valued at \$412,119. Of the production of 1903, 25,103 tons, valued at \$213,109, was of metallic paint, exclusive of mortar colours, as compared with 19,020 short tons, valued at \$313,390 in 1902. The production of mortar colours in 1903 was 10,863 short tons, valued at \$101,792, as compared with 8,355 short tons, valued at \$98,729 in 1902.

*Venetian Red.*—During 1903 the production was 7425 short tons, valued at \$134,635, as compared with 11,758 short tons, valued at \$196,905 in 1902.

*Slate Ground for Pigment.*—Mineral black is the name applied to the product of the dark coloured shales and shales that are ground for paint, and in 1903 the total quantity of these materials that were used for this purpose amounted to 7,106 short tons, valued at \$59,029, as compared with the production of 4071 short tons, valued at \$39,401 in 1902. This does not include the production of the graphitic or carbonaceous shale or schist of Michigan, which is known as "Barafa graphite," nor the graphitic material obtained from Rhode Island. Both are used to some extent in the manufacture of graphite paints, as are also the purer forms of graphite from New York and Pennsylvania, the statistics of the production and value of which are included in those of graphite.

*Lead Paints.*—The lead pigments included here are white lead, sublimed lead, zinc lead, red lead, litharge and orange mineral. During 1903 the aggregate production of all lead pigments amounted to 141,486 short tons, valued at \$15,711,595, an increase of 18,095 short tons in quantity, and of \$3,058,810 in value, as compared with



the production of 123,391 short tons, valued at \$12,652,785 in 1902. The imports of these lead pigments in 1903 amounted to 1203 short tons, valued at \$103,312, as against 1334 short tons, valued at \$114,671 in 1902. This makes the total amount of lead pigments consumed in the United States in 1903 equal to 142,689 short tons, valued at \$15,814,907, as against 124,725 short tons, valued at \$12,767,456 in 1902.

**White Lead.**—The total production in 1903 amounted to 112,886 short tons, valued at \$12,837,647, as compared with the production of 114,658 short tons, valued at \$11,978,174 in 1902. Of the 1903 production, the quantity of white lead in oil was 62,674 short tons, valued at \$7,482,487, and the quantity of dry white lead and white oxide was 50,212 short tons, valued at \$5,355,160.

The import of white lead during 1903 amounted to only 227 short tons, valued at \$21,495, which indicates the gradual displacing of the imported pigments by those of domestic production.

**Sublimed Lead.**—Another lead pigment, known as sublimed lead, is obtained as a by-product in the oxidising smelting of galena ores; it consists essentially of lead sulphate and lead oxide. The output of this pigment in 1903 produced by the Picher Lead Co., of Joplin, Mo., amounted to 8,592,000 lbs., valued at \$386,640, as against 9,465,500 lbs., valued at \$449,611, in 1902.

**Zinc Lead.**—There is manufactured at Canyon, Cal., a product known as zinc lead, which consists of a mixture of zinc and lead oxides, obtained by an oxidising-smelting treatment of lead in zinc ores in a furnace of special design. The production of this pigment in 1903 amounted to 4500 short tons, valued at \$247,500, as against 4000 short tons, valued at \$225,000 in 1902, and 2500 short tons valued at \$150,000 in 1901.

**Red Lead, Litharge and Orange Mineral.**—The production of red lead during 1903 shows a considerable decrease from that of 1902, being 8832 short tons, valued at \$1,022,754, as compared with 11,669 short tons, valued at \$1,263,112 in 1902. The combined production of litharge and orange mineral during 1903 was 10,792 short tons, valued at \$1,217,054, as compared with 13,742 short tons, valued at \$1,437,692 in 1902.

There is still a considerable quantity of red lead and orange mineral imported into the United States, and in 1903 this amounted to 1,152,715 lbs. of red lead and 756,742 lbs. of orange mineral. Of the litharge, 42,756 lbs. were imported during 1903.

**Zinc White.**—The production of zinc white has increased steadily for the last ten years, and during 1903 it amounted to 62,962 short tons, valued at \$4,801,718, as compared with 52,730 short tons, valued at \$4,023,299 in 1902.

### XIII. B.—RESINS, VARNISHES, Etc.

#### AMBER.

*Eng. and Mining J.*, Dec. 15, 1904.

The Prussian Government collects over £76,000 annually as revenue from the amber mines at Palmnicken. From 1803 to 1811, the industry had to receive a subsidy from the Government; now it is self-supporting. In the 20 years from 1883 to 1902, the Palmnicken mines produced 8457 metric tons of amber, the record being established in the last three years. The value of amber used in America in 1903 was \$210,709, making it the second largest consumer in the world.

### XVI.—SUGAR, STARCH, Etc.

#### DENATURED SUGAR (CATTLE FOOD).

*N. Nerinx. Bull. Assoc. Chim. Sucr. Dist.*, 1904, 22, 380—389.

From the official statistics of the consumption of sugar in Belgium denatured for cattle feeding, it appears that the consumption of molasses is stationary, while that of denatured sugar is increasing.—L. J. DE W.

#### SUGAR INDUSTRY OF CUBA.

*Foreign Office Annual Series*, No. 3315.

The following table shows the total production and exportation of Cuban sugar during the past three crop

years, as taken from the brokers' reports published in Havana:—

Crop.	Quantity.	
	Produced.	Exported.
	Tons.	Tons.
1900-01 .....	635,856	560,570
1901-02 .....	850,181	761,077
1902-03 .....	998,878	879,200
Estimate for 1903-04 .....	1,050,000	..

The difference between the amount produced and that exported represents the local consumption, plus the stock on hand at the end of each year. The above figures represent the results of the crop year commencing on December 1, for which reason they do not coincide exactly as regards the amount exported with those published in the annual returns of imports and exports.

The production of sugar is now as large as in the best year before the insurrection.

### XVII.—BREWING, WINES, SPIRITS, Etc.

#### ALCOHOL INDUSTRY OF ITALY.

*Board of Trade J.*, Dec. 22, 1904.

According to *Il Sole* (Milan) of 2nd December, 22,279,633 litres of alcohol were made in Italy during the financial year 1903-04, and the tax on the distillation thereof received by the State amounted to 31,330,658 lire. In the previous year the output was 17,627,627 litres and the tax 24,259,716 lire.

The development which is taking place in the production of denatured alcohol is satisfactory. Denatured alcohol is exempt from taxation if it is made from the refuse of grapes, &c. ("vinasse"), or from wine, but it pays 10 lire per hectolitre if it is produced from non-vinous matter. During the last year the quantity of denatured or industrial alcohol made from wine or the refuse of the cellars was 258,437 litres, and that of denatured alcohol from other substances was 1,420,547 litres.

Prior to the introduction of the existing law on alcohol the production thereof for industrial purposes was insignificant in Italy, but it is considered that the consumption of denatured alcohol would be far greater than it is at present if industrial firms were to introduce simple and cheap apparatus for lighting and heating purposes.

#### SPIRIT: PROPOSED TAX ON DENATURED —, IN SWITZERLAND.

*Chemist and Druggist*, Dec. 24, 1904.

It is reported that the Swiss Government proposes to impose a tax on denatured spirit for trade and industrial purposes. The Soc. pour l'Industrie Chimique à Basle has already lodged a petition with the Federal Council protesting against the abolition of free imports of denatured spirit. The petition points out that the Swiss chemical industry employs over 15,000 workers, and that exports are worth £1,268,000 per annum, the imports being £1,540,000. The severity of German competition is attributed to industrial spirit being free from duty in Germany.

#### GALEICAN SPIRIT INDUSTRY IN 1903.

*Z. Spiritusind.*, 1904, 27, 507.

During the year 1903 a strong demand prevailed in the spirit market, and, in consequence of the poor potato harvest, advanced prices resulted. In the distilling season, from September, 1902, to April, 1903, the 750 distilleries in Galicia produced 785,000 hectol., of which 295,000 hl. were refined in the country. The consumption in the province was 230,000 hl.; 125,000 hl. were exported, chiefly to Italy and the Levant. The total production of spirit in Austria was 1,017,000 hl.—J. F. B.

## Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

### I.—PLANT, APPARATUS, AND MACHINERY.

- [A.] 27,063. Pudney. Heating receptacles. Dec. 12.  
 .. 27,073. Wedge. *See under X.*  
 .. 27,118. Cudlipp. Hydro-extractors.\* Dec. 13.  
 .. 27,329. Kunick. Drying machines and drying process. Dec. 15.  
 .. 27,392. Ransford (Michelin et Cie). Apparatus for compressing gases.\* Dec. 15.  
 .. 27,406. Webb. Vacuum and filter tilting press for extracting liquids from finely-crushed minerals or the like. Dec. 15.  
 .. 27,407. Webb. Vacuum filtering apparatus for extracting liquids from finely-crushed minerals or the like. Dec. 15.  
 .. 27,408. Hesketh and Brier. Apparatus for removing moisture from air. Dec. 15.  
 .. 27,570. Smallwood. Crucible furnaces. Dec. 17.  
 .. 27,579. Wertenbruch. Means for and method of concentrating liquids and separating solid matter by evaporation of the liquid. Dec. 17.  
 .. 27,820. Creeke. Rotary washers or scrubbers for purifying gases. Dec. 20.  
 .. 27,875. Aktiebolaget Separator. Centrifugal separators for liquids. [Appl. in Sweden, Dec. 21, 1903.]\* Dec. 20.  
 .. 27,876. Aktiebolaget Separator. Centrifugal separators for liquids. [Appl. in Sweden, Dec. 21, 1903.]\* Dec. 20.  
 .. 28,107. Trotman and Hackford. Apparatus for automatically regulating the temperature of ovens, dyeing vats, &c. Dec. 22.  
 .. 28,250. Kunick. Process of making liquid or semi-liquid substances composed of various constituents more homogeneous. Dec. 23.  
 [C.S.] 25,458 (1903). Theisen. Centrifugal apparatus for evaporating, cooling, heating, absorbing, gas purifying, &c. Dec. 30.  
 .. 28,602 (1903). Mackenzie (Fas). *See under IX.*  
 .. 2792 (1904). Haylock. Centrifugal separators. Dec. 21.  
 .. 3859 (1904). Von Rittershausen. Filters. Dec. 30.  
 .. 4560 (1904). Leaker. *See under XVII.*  
 .. 17,532 (1904). Hinkson and Hey. *See under XI.*  
 .. 24,587 (1904). Thompson (Best). Furnaces. Dec. 21.  
 .. 24,870 (1904). Southworth. Apparatus for concentrating liquids, especially adapted for removing the albuminous matter from serum and like liquids. Dec. 30.  
 .. 25,307 (1904). Boulton (Jefferson). Vomiting kiers. Dec. 30.  
 .. 25,310 (1904). Ruppel. Protected earthenware cocks for use with acids, lyes, and the like. Dec. 30.  
 [A.] 27,267. Krebs. *See under XXI.*  
 .. 27,268. Krebs. *See under XXI.*  
 .. 27,276. Dury and Piette. Coke furnaces.\* Dec. 14.  
 .. 27,307. Izzett. *See under X.*  
 .. 27,342. Akester. Manufacture of mantles for incandescent gas burners. Dec. 15.  
 .. 27,359. Akester. Mantles for incandescent gas burners.  
 .. 27,365. Talbot. Purifying and cleaning producer gases. Dec. 15.  
 .. 27,397. Central Torfkohlen Ges. Manufacture of peat fuel. [Ger. Appl., Dec. 17, 1903.]\* Dec. 15.  
 .. 27,465. Lüttke, Arndt and Löwengard. *See under XXI.*  
 .. 27,466. Lüttke, Arndt and Löwengard. *See under XXI.*  
 .. 27,473. Clay and Goodall. *See under III.*  
 .. 27,519. Viarmé. Apparatus for the manufacture of producer gas. [Ger. Appl., Dec. 19, 1903.]\* Dec. 16.  
 .. 27,524. Hulin. Method for the utilisation of blast furnace gas. Dec. 16.  
 .. 27,571. Hall-Brown. Gas producers. Dec. 17.  
 .. 27,589. Morgan. *See under XXI.*  
 .. 27,632. Davies. Method of and means for utilising the waste heat of furnace gases. Dec. 17.  
 .. 27,707. Michaud and Delasson. Manufacture of an indestructible filament for gas and electric lamps for lighting and heating purposes. Dec. 19.  
 .. 27,713. Thompson (Deuts. Gasglühlicht Akt.-Ges.). Formation of incandescence bodies for electric incandescence lamps.\* Dec. 19.  
 .. 27,771. Young and Milne. Process of condensing coal gas for the more perfect removal of naphthalene. Dec. 19.  
 .. 27,839. Bayot. *See under X.*  
 .. 28,062. British Thomson-Houston Co., Ltd. (General Electric Co.). Treated carbon and methods of producing same. Dec. 21.  
 .. 28,126. Bromhead (Cie. des Charbons et Briquettes de Blanzay et de l'Ouest). Smokeless fuel.\* Dec. 22.  
 .. 28,152. Kline. Gas enriching machines.\* Dec. 22.  
 .. 28,154. Kuzel. Manufacture of light-emitting bodies for electric incandescent lamps. Dec. 22.  
 .. 28,295. Thornycroft, and J. I. Thornycroft & Co., Ltd. Method of and apparatus for purifying the gas from gas producers, blast furnaces, &c. Dec. 23.  
 [C.S.] 25,458. (1903). Theisen. *See under I.*  
 .. 25,706 (1903). Cunningham. Apparatus applicable for burning liquid fuel. Dec. 21.  
 .. 28,031 (1903). Mond. Gas producers. Dec. 21.  
 .. 3721 (1904). Clapham. Condensers for use in the manufacture of illuminating and other gases. Dec. 21.  
 .. 4134 (1904). Levis (General Electric Co.). Arc lamp electrodes. Dec. 30.  
 .. 4401 (1904). Macgregor and Pearson. Process and apparatus for the manufacture and stacking of peat fuel. Dec. 30.  
 .. 23,184 (1904). Russell and Russell. Means for producing inflammable gas and utilising same. Dec. 30.  
 .. 24,293 (1904). Breckon. Method of producing superior coke in connection with gas works and the like. Dec. 21.  
 .. 24,333 (1904). Desgraz. Process and apparatus for obtaining producer gas free of tar and of high calorific value. Dec. 21.



### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [A.] 27,308. Ward. *See under IX.*  
 „ 27,309. Ward. *See under IX.*  
 „ 27,473. Clay and Goodall. Production of combustible petrol mixture for use in internal combustion engines, or petrol from heavy or crude mineral oils. Dec. 16.  
 „ 27,596. Vesely and Votoček. Process for obtaining pure anthracene from crude anthracene.\* Dec. 17.  
 „ 28,243. Macalpinc. Refining mineral or petroleum oils. Dec. 23.

### IV.—COLOURING MATTERS AND DYESTUFFS.

- „ 27,091. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new sulphurised dyestuffs. Dec. 12.  
 „ 27,092. Abel (Act.-Ges. f. Anilinfabr.). *See under XIII.A.*  
 „ 27,093. Abel (Act.-Ges. f. Anilinfabr.). *See under XIII.A.*  
 „ 27,094. Abel (Act. Ges. f. Anilinfabr.). *See under XIII.A.*  
 „ 27,292. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of sulphurised dyestuffs and a parent material therefor. Dec. 14.  
 „ 27,373. Newton (Bayer und Co.). Manufacture of a new derivative of the anthracene series, and of oxyanthraquinones therefrom. Dec. 15.  
 „ 27,374. Newton (Bayer und Co.). Production of oxyanthraquinones. Dec. 15.  
 „ 27,496. Abel (Act.-Ges. f. Anilinfabr.). *See under XIII.A.*  
 „ 27,497. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of ortho-nitro and ortho-amido derivatives of certain aromatic bases. Dec. 16.  
 „ 27,498. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of para-amidophenolsulphonic acid. Dec. 16.  
 „ 27,499. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of indophenols. Dec. 16.  
 „ 27,703. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of nitro- and amido-derivatives of certain aromatic bases. Dec. 19.  
 „ 27,843. Newton (Bayer und Co.). Manufacture of new azo dyestuffs and of intermediate products for use therein. Dec. 20.  
 [C.S.] 27,372 (1903). Johnson (Badische Anilin und Soda Fabrik.) Manufacture of hydroxyazo colouring matters. Dec. 21.  
 „ 4377 (1904). Newton (Bayer und Co.). Manufacture of anthraquinone derivatives. Dec. 30.  
 „ 5303 (1904). Imray (Bask Chemical Works). Manufacture of indoxyl, its homologues and their derivatives. Dec. 30.  
 „ 7398 (1904). Johnson (Badische Anilin und Soda Fabrik.) Manufacture of alizarine. Dec. 30.

### V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 26,145a. Hodgkinson. *See under XVIII. C.*  
 „ 27,533. Marks (Goldman). Apparatus for treating fibrous materials. Dec. 16.  
 „ 27,565. Crespin. Process of and apparatus for the manufacture of artificial silk, horse hair, straw, &c. [Fr. Appl., April 11, 1904.]\* Dec. 17.

- [A.] 27,871. Imray (Meister, Lucius und Brüning). Method of and apparatus for distributing liquids, especially dyestuffs, on fabrics, &c. Dec. 20.  
 „ 28,003. Ollagnier. Treatment of cocoanut fibre and its application for the manufacture of brushes. [Fr. Appl., Dec. 5, 1904.]\* Dec. 21.  
 „ 28,089. Craven. Process and machinery for glazing, polishing and finishing textile fabrics. Dec. 22.  
 „ 28,107. Trotman and Hackford. *See under I.*  
 „ 28,110. Hill. Treatment of cellulose fabrics for embossing purposes. Dec. 22.  
 [C.S.] 1930 (1904). Murray. Waterproofed textile fabrics and other materials and methods and means employed in waterproofing them. Dec. 21.

### VI.—COLOURING WOOD, PAPER, LEATHER, ETC.

- [A.] 27,870. Imray (Meister, Lucius und Brüning). Manufacture of irregularly coloured paper. Dec. 20.

### VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 27,171. Gutensohn. Obtaining oxide of zinc. Dec. 13.  
 „ 27,258. Wallis and Wallis. *See under IX.*  
 „ 27,358. Coulter. Method of saving carbonic acid gas in the manufacture of aerated waters. Dec. 15.  
 „ 27,396. Stead and Palmer. *See under XVII.*  
 „ 27,644. Watson and Taylor. *See under X.*  
 „ 27,857. Gerster, and H. Freund und Soehne. *See under IX.*  
 „ 27,907. Blackmore. Process of making sulphur trioxide.\* Dec. 20.  
 „ 28,128. Hirtz. Method of eliminating iron from solutions. Dec. 22.  
 „ 28,277. Todtenhaupt and Wolff. Method of producing red phosphorus. Dec. 23.  
 „ 28,297. Oudin. Apparatus for the production of ozone. Dec. 23.  
 [C.S.] 3018 (1904). Davis. Manufacture of hydrocyanic acid and cyanides. Dec. 21.  
 „ 4295 (1904). Marlier. Manufacture of sulphide of zinc. Dec. 30.  
 „ 4433 (1904). Williams and Tomkins. *See under IX.*  
 „ 7074 (1904). Kauffmann. Catalytic process for making anhydrous sulphuric acid. Dec. 21.  
 „ 18,710 (1904). Stead. Manufacture of carbon dioxide. Dec. 30.  
 „ 24,885 (1904). Simons. Apparatus for treating pyrites for the recovery of sulphur fumes. Dec. 30.  
 „ 25,394 (1904). Watson. Means for obtaining a dissolution of sodium silicate. Dec. 30.

### VIII.—GLASS, POTTERY, AND ENAMELS.

- [A.] 27,864. Farnival. Manufacture of pottery saggers. Dec. 20.  
 „ 28,078. Stanley. Apparatus for burning or fixing the colours upon printed or decorated tiles, glass, porcelain and ceramic ware. Dec. 22.

### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 27,258. Wallis and Wallis. Method of producing lime suitable for lime-sand and the like, and apparatus therefor. Dec. 14.

- [A.] 27,308. Ward. Tar paving. Dec. 15.  
 „ 27,309. Ward. Manufacture of tar or like paving. Dec. 15.  
 „ 27,350. Mohn. Non-conductors of heat. Dec. 15.  
 „ 27,857. Gerster and H. Freund und Soehne. Manufacture of bricks from magnesite. Dec. 20.  
 „ 27,888. Barham. Kilns for drying and burning bricks. Dec. 20.  
 „ 27,890. Whitcomb and Hasley. Process for making cement.\* Dec. 20.  
 „ 27,991. Williams and Stauffer. Process for treating clays.\* Dec. 21.  
 „ 27,992. Williams and Stauffer. Clay product and process therefor.\* Dec. 21.  
 [C.S.] 27,834 (1903). Lee. Kilns for burning bricks, tiles, and other clay goods, and lime and cement. Dec. 30.  
 „ 28,602 (1903). Mackenzie (Fas). Cupolas or kilns applicable for treating materials used in the production of basic linings for converters, furnaces, &c. Dec. 30.  
 „ 1400 (1904). Eymer, and Eymer Ges. Fire-proof coatings. Dec. 30.  
 „ 4391 (1904). Weber. Preparation of clay for the casting of clay-ware. Dec. 30.  
 „ 4433 (1904). Williams and Tomkins. Products of silica as a refractory material. Dec. 21.  
 „ 6635 (1904) Gröndal. Kiln for burning cement, or reducing or calcining ores. Dec. 21.  
 „ 25,128 (1904). Marga. Fireproof, acid-proof, and electrically insulating material. Dec. 30.

## X.—METALLURGY.

- [A.] 27,073. Wedge. Furnaces for roasting and smelting and analogous uses.\* Dec. 12.  
 „ 27,187. Proctor and Morgan. Case-hardening, cementation, and similar processes. Dec. 13.  
 „ 27,214. Mitchell and The Briquette (Minerals Binding) Co., Ltd. Briquetting compositions. Dec. 13.  
 „ 27,252. Marandon. Process for the reduction of refractory metallic oxides and cupola smelting furnaces therefor. Dec. 14.  
 „ 27,273. Allen and Darby. Metal finishing processes. Dec. 14.  
 „ 27,307. Izzett. Regenerative gas furnaces for melting steel, &c. Dec. 15.  
 „ 27,340. Jarvis. Smelting and heating iron, steel, and other metals. Dec. 15.  
 „ 27,406. Webb. *See under I.*  
 „ 27,407. Webb. *See under I.*  
 „ 27,457. Thomas and Thomas. Apparatus used in the manufacture of tin plates or sheets, and other like metal coated plates or sheets. Dec. 16.  
 „ 27,644. Watson and Taylor. Pickling tank, adapted for the recovery of the hydrogen evolved in pickling iron sheets with acid prior to galvanising. Dec. 19.  
 „ 27,839. Bayot. Recuperating burner for the gases of smelting apparatus.\* Dec. 20.  
 „ 27,865. Blackmore. Process of reducing aluminium and other metals.\* Dec. 20.  
 „ 27,872. Kaiser. Process for extracting metals or their compounds from ores, furnace products, or the like. Dec. 20.  
 „ 27,894. Vande-Velde. Manufacture of steel.\* Dec. 20.  
 „ 27,977. James. Extraction of precious metals from their ores. Dec. 21.  
 „ 28,019. Schumacher. Process for agglomerating pulverulent iron ores. Dec. 21.

- [A.] 28,127. Uthmann. Means for protecting tubes and the like made of copper alloys from deterioration by salt water. Dec. 22.  
 [C.S.] 28,736 (1903). Gannon and Phillips. Process for toughening and hardening steel. Dec. 30.  
 „ 4058 (1904). Simm, Simm, Storey and Sellers. Process for treating zinc blende and other substances containing zinc and apparatus therefor. Dec. 30.  
 „ 6635 (1904). Gröndal. *See under IX.*  
 „ 7367 (1904). Simmersbach. Process and apparatus for smelting ores, more particularly iron ore. Dec. 21.  
 „ 10,007 (1904). Kugel. Heating furnace for the continuous heating of metals without oxidation. Dec. 30.  
 „ 23,380 (1904). Soc. Electro-Metallurgique Française. *See under XI.*

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- [A.] 27,260. Betteridge. Apparatus for electrodeposition. Dec. 14.  
 „ 27,773. Mason. Electro-deposition of metals or alloys on aluminium. Dec. 20.  
 „ 28,129. Hirtz. Permeable diaphragms for use in electrolytic cells, filtering apparatus, and like purposes. Dec. 22.  
 [C.S.] 4059 (1904). Simm, Simm, Storey and Sellers. Electric furnaces. Dec. 30.  
 „ 17,532 (1904). Hinkson and Hey. Electric filters. Dec. 30.  
 „ 19,266 (1904). Ziegenberg. Galvanic cell. Dec. 30.  
 „ 23,380 (1904). Soc. Electro-Metallurgique Française. Process for smelting nickel ores in an electric furnace, and crucible therefor. Dec. 30.  
 „ 25,114 (1904). De la Croix and Joel. Electric accumulators. Dec. 30.  
 „ 25,128 (1904). Marga. *See under IX.*

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

- [A.] 27,105. Loebell. Process for the preparation of oils and fats containing iodine and sulphur.\* Dec. 12.  
 „ 28,008. Down. Treatment of beef suet and other fats. Dec. 21.  
 „ 28,077. Gregory and Williams. Oilene. Dec. 22.  
 „ 28,132. Bamberg. Purification of oils, fats and waxes. Dec. 22.  
 [C.S.] 24,100 (1904). Garrigues. Processes for the recovery of glycerine from spent soap lye and apparatus therefor. Dec. 30.

## XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

## (A.)—PIGMENTS, PAINTS.

- [A.] 27,092. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of orange or yellow-red colour lakes. Dec. 12.  
 „ 27,093. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new colour lakes. Dec. 12.  
 „ 27,094. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of red colour lakes. Dec. 12.  
 „ 27,496. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of colour lakes. Dec. 16.



- [A.] 27,757. Giband and Bang. White pigment. [Fr. Appl., March 25, 1904.]\* Dec. 19.  
 „ 28,150. Newton (Bayer and Co.). Manufacture of new colour lakes. Dec. 22.  
 „ 28,259. Inaray (Meister, Lucius und Brüning). Manufacture of yellow and orange pigment colours. Dec. 23.  
 „ 28,271. Surtees and Milburn. Anti-corrosive paints or compounds. Dec. 23.  
 [C.S.] 24,989 (1904). Schobert. Antifouling and preservative paint. Dec. 30.

## (B).—RESINS, VARNISHES.

- [C.S.] 23,173 (1904). Staeding. Manufacture of linoleum. Dec. 30.

## (C).—INDIA-RUBBER.

- [A.] 27,603. Frost. Vulcanising apparatus. Dec. 17.  
 „ 27,722. Ephraim. *See under XVI.*  
 „ 28,051. Marx. Production of caoutchouc. [Ger. Appl., Sept. 21, 1904.]\* Dec. 21.  
 „ 28,294. Petersen. Process for reclaiming and regenerating rubber. [U.S. Appl., June 24, 1904.]\* Dec. 23.

## XIV.—TANNING; LEATHER, GLUE, SIZE, Etc.

- [A.] 27,425. Hilbert. Process of and apparatus for manufacturing glue and gelatine. Dec. 16.  
 [C.S.] 3981 (1904). Boulton (Trenckmann). Manufacture of leather. Dec. 21.  
 „ 24,870 (1904). Southworth. *See under I.*

## XVI.—SUGAR, STARCH, GUM, Etc.

- [A.] 27,289. Kollrepp and Wohl. Purification of sugar solutions. [Ger. Appl., Dec. 16, 1903.]\* Dec. 14.  
 „ 27,722. Ephraim. Process and apparatus for the separation and recovery of gum from rubber plants.\* Dec. 19.  
 [C.S.] 28,296 (1903). Shaw. Treatment or preparation of sugar. Dec. 30.  
 „ 28,297 (1903). Shaw. Treatment or preparation of sugar. Dec. 30.  
 „ 11,103 (1904). Wheatley. (Int. Spiritus-Ind.) *See under XVII.*

## XVII.—BREWING, WINES, SPIRITS, Etc.

- [A.] 27,396. Stead and Palmer. Means and apparatus for collecting carbonic acid gas from fermentation backs, &c., and sterilising same. Dec. 15.  
 „ 27,626. Livingstone. Method of desiccating and preserving yeast and apparatus therefor. Dec. 17.  
 „ 27,657. Squire, Squire and Squire. *See under XVIII. A.*  
 [C.S.] 4294 (1904). Krueger. Malting apparatus. Dec. 30.  
 „ 4560 (1904). Leaker. Brewing, distilling and like processes, and apparatus therefor. Dec. 30.  
 „ 11,103 (1904). Wheatley (Int. Spiritus-Ind. G. m. b. H.). Method of preparing must for the manufacture of spirits of wine, the feeding of cattle, and the manufacture of dextrose. Dec. 30.  
 „ 20,534 (1904). Nathan. Brewing beer. Dec. 21.  
 „ 24,994 (1904). Van de Kerckhove and Lebbe. Fermentation and clarification of alcoholic liquids. Dec. 30.

## XVIII.—FOODS; SANITATION, WATER PURIFICATION; &amp; DISINFECTANTS.

## (A).—FOODS.

- [A.] 27,266. Aufberg. Process for preparing food products containing iron.\* Dec. 14.  
 „ 27,390. Williams and Hutchins. Preparation of leguminous proteids. Dec. 15.  
 „ 27,391. Williams and Hutchins. Non-alcoholic aerated beverages. Dec. 15.  
 „ 27,516. Jung. Method of preserving milk and milk compounds. Dec. 16.  
 „ 27,657. Squire, Squire and Squire. Manufacture of yeast for bakers' use. Dec. 19.  
 [C.S.] 2065 (1904). Hatmaker. Dry milk and process for obtaining same. Dec. 21.  
 „ 11,103 (1904). Wheatley (Int. Spiritus-Ind. G. m. b. H.). *See under XVII.*  
 „ 20,292 (1904). Taylor. Cream product. Dec. 21.

## (B).—SANITATION; WATER PURIFICATION.

- [A.] 28,239. Howatson and Boby. Apparatus for mixing and distributing chemicals for purposes of purifying and sterilising water and impure effluents.\* Dec. 23.  
 [C.S.] 27,968 (1903). Swan. Process and apparatus for purifying air. Dec. 21.  
 „ 16,931 (1904). Dorling. Sterilisation of water. Dec. 30.

## (C).—DISINFECTANTS.

- [A.] 26,145A. Hodgkinson. Means for rendering bags, sacks, cloth and other fabrics, and yarns antiseptic. Dec. 16.  
 [C.S.] 3669 (1904). Harris. Insecticides. Dec. 21.

## XIX.—PAPER, PASTEBOARD, Etc.

- [A.] 27,389. Barker. Blotting paper and the manufacture thereof. Dec. 15.  
 „ 28,283. Boulton (A. Molling und Co., Kommandit, Ges.). Process for preparing picture or like drawing surfaces.\* Dec. 23.  
 [C.S.] 27,587 (1903). Pfeifer. Process and apparatus for the manufacture of paper stock or pulp. Dec. 30.  
 „ 28,611 (1903). Milne. Paper and pulp-making machines. Dec. 21.  
 „ 9277 (1903). Woodward. Process for the production of non-inflammable celluloid. Dec. 30.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 28,035. Johnson (Boehringer und Soehne.). Manufacture of camphor from isoborneol.\* Dec. 21.  
 „ 28,144. Wellcome, Jowett and Barger. Manufacture of pyocatechol derivatives. Dec. 22.  
 „ 28,149. Newton (Bayer und Co.). Manufacture of pyrimidine derivatives. Dec. 22.  
 [C.S.] 710 (1904). Weichardt. Anti-toxins. Dec. 21.  
 „ 7875 (1904). Johnson (R. Koepp und Co.). Manufacture of formates. Dec. 30.  
 „ 18,602 (1904). Askenasy and Mugdan. Process for producing acetylene tetrachloride. Dec. 30.  
 „ 23,569 (1904). Lauch and Voswinkel. Process for manufacturing condensation products from tannin-like substances and urea by means of formaldehyde. Dec. 21.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 27,141. Dahl. Colour photography. Dec. 13.  
.. 27,267. Krebs. Compositions for use in artificial lighting for photographic purposes.\* Dec. 14.  
.. 27,268. Krebs. Compositions for use in artificial lighting especially for photographic purposes.\* Dec. 14.  
.. 27,465. Lüttke, Arndt and Löwengard. Flash powder for producing artificial light for photographic and other purposes.\* Dec. 16.  
.. 27,466. Lüttke, Arndt and Löwengard. Flash light cartridges for producing artificial light for photographic and other purposes.\* Dec. 16.  
.. 27,589. Morgan. Artificial light for photographic purposes. Dec. 17.  
[C.S.] 23,098 (1904). Gärtner. Process of and means for the production of relief photographs or the like. Dec. 30.

## XXII.—EXPLOSIVES, MATCHES, Etc.

- [A.] 27,162. Allison. (Muller-Jacobs.) Explosive compound and method of manufacturing same.\* Dec. 13.  
.. 27,166. Lheure. Manufacture of explosives.\* Dec. 13.  
.. 27,459. Lheure. Explosives. Dec. 16.  
.. 27,460. Lheure. Explosives and priming same. Dec. 16.  
.. 27,706. Mikolajczak. Manufacture of nitro-glycerine. [Ger. Appl., March 19, 1904].\* Dec. 19.  
.. 28,256. Ceipek. Manufacture of safety explosives. Dec. 23.  
[C.S.] 4028 (1904). Hargreaves, and Curtis's and Harvey, Ltd. Blasting compounds. Dec. 21.  
.. 6353 (1904). Hargreaves, and Curtis's and Harvey, Ltd. Blasting compounds. Dec. 21.  
.. 24,782 (1904). Duttonhofer. Manufacture of explosives. Dec. 21.



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### Deaths.

Carson, Archibald, The Cedars, Cranford, Middlesex, December 25th.  
 Coward, Percy, Sewage Disposal Works, Beighton, Eddersfield, Nov. 30.  
 Mercer, F. M., 34, Camomile Street, London, E.C. Jan. 7.  
 Pirie, A. G., Stoneywood Works, Bucksburn, Aberdeen-shire.  
 Shaw, Wm. Ratcliffe, Oak Lea, Gadley, near Hyde, Cheshire.  
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 Weber, Carl Otto, of Middleton Road, Crumpsall, Manchester, January 14th.



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#### PART III.

### INFLUENCE OF VARIOUS CONTACT SUBSTANCES ON THE INTERACTION OF STEAM AND HYDROCYANIC ACID

(Both in Presence and in Absence of Sulphuretted Hydrogen and Air).

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We present below the continuation of our work on the above subject, the first stages of which were described in our previous paper (Journal, 1904, pp. 581-6). As mentioned in the discussion following that paper, we saw reason to modify the apparatus then used in order that not only might the percentage conversion into ammonia be measured, but an estimation be also made of the gaseous reaction products passing from the ammonia catch.

The volume of the experimental Claus kiln used in the earlier experiments was large compared to that of the reacting mixture, and, in addition, from the presence of joints in the apparatus, diffusion inwards of products of combustion from the heating jacket was more or less liable to occur.

In the present research an attempt is made to follow more closely the nature of the reactions that occur by estimating all the reaction products, and, in addition, to accumulate the data necessary to decide the various factors controlling a high yield of ammonia. For this end the iron kiln then in use was replaced by a combustion tube of glass, the contact material was presented to the reacting mixture in a long column of small sectional area, and the acid receivers and water seals were reduced in size to facilitate collection of the gaseous products. The following is a brief description of the arrangement finally adopted:—

By use of a gasholder of special construction a known volume of gas of uniform composition and at any desired rate and pressure could be delivered to a generating flask through a small Drechsel's bottle, serving as water seal. In the first series of experiments carbon dioxide alone was used, in the later carbon dioxide, sulphuretted hydrogen and air. The generating flask consisted of a 300 c.c. distilling flask containing excess of dilute sulphuric acid (1 of acid to 10 of water) maintained at a temperature somewhat above 100° C. by a bath of glycerine and water. The desired proportion of hydrocyanic acid was added to the gaseous current by admitting a concentrated solution of potassium cyanide (25 c.c., containing 3 grams potassium cyanide) of determined strength through a small bore tube coupled to a pipette. An approximate estimate of the weight of steam present in the gaseous mixture leaving the flask was deduced from the weights of reacting solutions before and after passage of the gas, due allowance being made for the weight of hydrocyanic acid liberated by the acid, and for the weight of steam resulting from oxidation of sulphuretted hydrogen.

The volume and composition of the reacting mixture and its rate of flow varied somewhat throughout the series, as exact adjustment of the working of the various parts of the apparatus was not easy to ensure, but in general the volume of gas entering the generator from the gasholder was  $2\frac{1}{2}$  to 3 litres, and that of the hydrocyanic acid resulting from interaction of potassium cyanide and acid about 900 c.c., yielding a reacting mixture containing 20 to 30 volumes of hydrocyanic acid per 100 volumes of permanent gas. The weight of steam present in the reaction was always maintained in large excess of that theoretically required for decomposition of the hydro-

cyanic acid—from 5 to 15 molecules  $H_2O$  per molecule HCN. Each experiment lasted from 80 to 90 minutes, the last 20 of which were occupied in driving the reaction products forward to the terminal receiver after reaction in the generating flask had completed itself. Further details are given in the paper and in the appendix.

**Contact Tube and Furnace.**—The contact material was in each case reduced to fragments about the size of a pea, carefully sieved to remove dust, and dried by heating. In the case of broken brick and oxide of iron pre-ignition was carried to a red heat to ensure expulsion of water; with Weldon mud gentle heat was used to avoid risk of loss of oxygen. The length of the contact column throughout was 22 inches, with a diameter of  $\frac{7}{8}$ th inch; it was contained in a combustion tube of Jena glass 29 inches long, slightly inclined downwards from the inlet end to minimise creeping of the gases along the upper side of the tube. Plugs of asbestos fibre were placed at each end to retain the column in position and minimise risk of fracture from direct contact of condensed water with the hot glass. The asbestos plug at the exit end served the further purpose of a filter, and its examination for oxidised sulphur compounds of ammonia, *e.g.*, sulphate, thiosulphate, pentathionate, &c., in the later series of experiments, when sulphuretted hydrogen and air were present in the reacting mixture, affords data of considerable interest (see p. 68).

The combustion tube was shielded from direct contact with the furnace gases by an enclosing jacket of  $\frac{1}{4}$ th inch steel, and from the jacket itself by a thin plate of earthenware. The jacket was heated by an Erlenmeyer furnace, by which it was readily maintained at any desired temperature within a range from 150° C. to 700° C. Temperatures throughout were determined by the Siemens copper bolt calorimeter, checked at lower temperatures by direct comparison with a mercurial thermometer. The copper bolt was placed in a small platinum crucible supported in a short iron collar brazed to the upper side of the jacket, the crucible bottom projecting through a hole in the jacket to a point just above the combustion tube within, the whole being enclosed within the roof of furnace tiles above. Special precautions were taken to guard against loss of heat by radiation from the bolt when the covering tile was removed for a temperature determination. The figures so obtained have no absolute value, as the temperature attained by the bolt would be neither that of the iron jacket itself nor of the contact material it enclosed. Attempts to ascertain the exact temperature of the latter were made by inserting a mercurial thermometer into the contact material, but proved unsuccessful as the mercury column parted. In one experiment, however, a thermometer reading was obtained of the iron jacket below the combustion tube. The result showed that the difference between the upper and lower sides of the jacket is not great. Thus:—

Upper side by thermometer .. ..	423° F.
" by Siemens Calorimeter ..	417° F.
Under side by thermometer .. ..	487° F.

**Acid Catch.**—In the earlier experiments on broken brick (p. 64) a 500 c.c. retort was used; this was replaced in the later experiments by one of 250 c.c., the smaller capacity of the latter being better adapted for work involving the collection and analysis of gaseous products. A sufficient volume (50 to 70 c.c.) of half-normal acid was used in the catch to fix and retain the ammonium carbonate entering, final traces being absorbed by an acid scrubbing tube on the exit. The residual gases, freed by this means from steam and ammonia, passed through a water seal to a large stoneware aspirator containing oil-covered water. Suitable connections enabled an average sample of the residual gas to be withdrawn on its way to the aspirator at any period of the run, by means of a cylinder filled with mercury or oil-covered water.

#### Methods of Analysis.

The analysis of the acid retort catch liquors and contents of asbestos filter is considered later (p. 64). Analysis of the inlet and exit gases was made with a Stead's gas apparatus, supplemented by Bunte burette. Carbon monoxide and hydrogen were determined by

exclusion with excess of cyanide, followed by absorption in caustic soda solution, the solution being analysed as an ammoniacal liquor. In the case where the excess failed to explode, only very negligible traces of carbon monoxide could be detected in the latter reagent. In every case the gas is held for in the next tubes by shaking with caustic soda and then the resulting solution with  $\text{Na}_2\text{O}$  or veratrate.

#### Methods of Calculation.

The amounts of the various reaction products,  $\text{CO}_2$ ,  $\text{H}_2\text{N}$ , are calculated from the volume and composition of the residual gases, due allowance being made for nitrogen present in the reacting mixture. No direct estimation of the  $\text{CO}_2$  proved possible, owing to the solubility of this gas in water and to the separation of solid carbonate of ammonium in the neck of the retort each during certain stages. The limitations imposed by having to operate with large volumes of gas and the difficulty of excluding adventitious air from the apparatus before the experiment commenced, and of completely displacing the reaction product at its close, render it necessary to regard the gas analysis figures with some reserve, but we consider, nevertheless, that they afford valuable indication of the nature of the reactions that occur, especially the figures for nitrogen. Three examples may be given here to illustrate the extent to which the latter varies with altered conditions of working.

#### 1. Brick Contact.

Low yield of Ammonia = 4.2 per cent. of  $\text{NH}_3$  as HCN taken.  
Decomposed hydrocyanic acid,  
by difference = 95.8 (much HCN in catch).

RESIDUAL GAS—			
Calculated.	$\text{CO}_2 = 97.8$	Found.	$= 97.6$
	$\text{O} = .9$		$= .9$
	$\text{N} = 1.3$		$= 1.5$

#### 2. Oxide of Iron Contact. (See Appendix, pp. 68 and 69 for calculation.)

High yield of Ammonia = 85.3 per cent.  
Decomposed to free nitrogen,  
by difference = 14.7 (no HCN in catch).

RESIDUAL GAS—			
Calculated.	$\text{CO}_2 = 94.1$	Found.	$= 93.2$
	$\text{O} \text{ \&c.} = 4.3$		$= 4.3$
	$\text{N} = 2.6$		$= 2.5$

#### 3. Oxide of Iron Contact.

Low yield of Ammonia = 51.5 per cent.  
Decomposed to free nitrogen,  
by difference = 48.5 (no HCN in catch).

RESIDUAL GAS—			
Calculated.	$\text{CO}_2 = 92.6$	Found.	$= 92.8$
	$\text{O} \text{ \&c.} = .3$		$= .3$
	$\text{N} = 7.1$		$= 6.9$

#### Experimental Results.

The research naturally divided itself into an inquiry under two heads:—

(A.) INTERACTION OF STEAM AND HYDROCYANIC ACID IN ABSENCE OF SULPHURETTED HYDROGEN AND AIR.

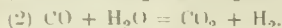
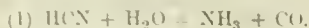
(B.) *Iditto*, IN PRESENCE OF THOSE BODIES.

Section A formed a necessary preliminary to B.

(A.) *Sulphuretted Hydrogen and Air Absent.*

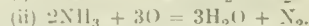
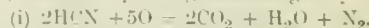
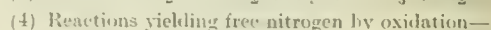
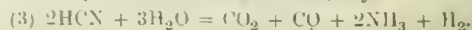
Three contact materials were tried—broken brick, oxide of iron, and Weldon mud. Each of these was reduced to fragments of approximately the same size, and presented to the gas under similar conditions (see ante, p. 63). It should, however, be pointed out that the experiments with broken brick preceded the others, and were subject to minor irregularities of procedure and defects of apparatus that were eliminated in the later experiments, and whose removal facilitated collection of the gaseous reaction products. These remarks do not apply to the collection and estimation of ammonia, which is regarded as accurate throughout.

Before discussing the results in detail, attention is directed to some of the more important reactions indicated by theory as likely to occur within the range of conditions observed:—



Kramers (quoting Naumann and Pistor) states that no reaction occurs between steam and carbon monoxide between  $530^\circ \text{C}$ . and  $585^\circ \text{C}$ ., but begins between  $602^\circ \text{C}$ . and  $634^\circ \text{C}$ . (*vide Journal of Gas Lighting*, May, 1902, p. 1417).

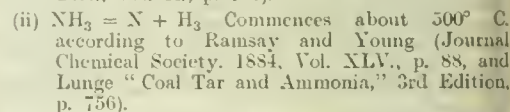
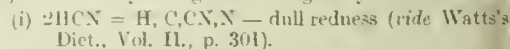
We shall show, however, in the present work that reactions (1) and (2) occur simultaneously at equal or varying rates, yielding carbon dioxide and free hydrogen at a much lower temperature than this. Thus, say,



These reactions require the presence of oxygen in the contact material, and cannot, therefore, occur with a brick contact in absence of air.

As regards the velocity of reaction (ii) at various temperatures with oxide of iron, interesting results were published (*Journal*, 1900, p. 28) by Messrs. Carrick Anderson and George Lean. The conclusion was there reached that the action of soft brown haematite ore upon ammonia "begins at temperatures between  $140^\circ \text{C}$ . and  $150^\circ \text{C}$ ., and "that the physical condition of the peroxide as it exists in its various natural and artificial forms, materially influences its activity in the oxidation process." The restraining influence of steam upon the reaction was not investigated. We have set out some of the results obtained by the authors in graphical form on p. 69 for comparison with our own.

(5) Reactions yielding free nitrogen by dissociation.



Formic acid has not been identified by us with certainty among the products of reaction in any experiment.

(7) Reactions of carbon monoxide and hydrogen with oxide of iron and manganese dioxide.

1. *Carbon monoxide*.—Cleveland iron stone, according to Lowthian Bell "Principles of the Manufacture of Iron and Steel," p. 183, begins to act appreciably on the gas only at temperatures over  $200^\circ \text{C}$ . (*vide* also Watts's Dict., Vol. III., p. 62). Manganese dioxide begins to oxidise CO about  $87^\circ \text{C}$ . (*Ibid.*, p. 183).

2. *Hydrogen*.—Oxidation commences with Cleveland ore at, or about, the same temperature as with carbon monoxide according to Lowthian Bell (also see Watts's, Vol. III., p. 62). Manganese dioxide commences to oxidise H about  $190^\circ \text{C}$ . (*Ibid.*, p. 183).

We now proceed to discuss the results given in Table I and graphically on p. 68. They are arranged in order of temperature throughout, this being the most important of the controlling factors for any given contact material:—

#### Broken Brick.

Appearance as charged dull red: as withdrawn, black. Volumes of reacting mixture (excluding steam) varied from 3580 c.c. to 4465 c.c. measured at  $0^\circ \text{C}$ ., 760 m.m.; Duration of experiments from 42 to 106 minutes. The gas analyses are approximate only except in expt. 6, the last of the series in point of time, when apparatus and procedure was identical with that in the case of oxide of iron and Weldon mud contacts.

The conclusions drawn are as follows:—

1. That within a range of temperature from  $465^\circ$ —



TABLE I.

*Reaction of Steam upon Hydrocyanic Acid (in absence of sulphuretted hydrogen and air).*

Contact Material.				Gaseous Products.						Efficiency.				Remarks.		
Length 55.9 c.m. (22" : Diam. 2.22 c.m. (7.8") : Volume 210.5 c.c.m. (17.23 cubic inches).						c.c. per 100 c.c. of HCN entering (excluding Ammonia).						Per 100 parts of HCN taken.				
Nature.	Temperature of Iron Jacket (upper side).		HCN. Volume per 100 Volumes of Reacting Mixture (excluding steam).	Steam. Molecules of H <sub>2</sub> O per 1 Molecule of HCN.	Rate of Flow. (°C. 760 m.m. c.c. per minute per 1 c.c. of contact material (including steam)).	CO <sub>2</sub> (by difference).	CO.	H.	N (Nitrogen entering with reacting mixture exclusive H).	Recovered as NH <sub>3</sub> .	Lost.					
	°C.	°F.									As HCN undecomposed.	As N (calculated from gas analysis).				
A. Broken Brick (wt. as with-drawn 193 grms.)															Experiments throughout are arranged in order of temperatures, not in chronological sequence.	
1. Blank .....	555	1030	nil	excess.	1.00	—	nil	nil	trace	nil	—	—	—	—	Iron jacket dark. No crystals of ammonium bicarbonate.	
2.	200	390	23.1	14.7	.95	—	nil	nil	1	4	over 80	2	—			
3.	465—470	870—880	23.8	10.5	.70	—	9	34	9	81	"	7	18	—	Iron jacket dark	
4.	505	940	26.5	9.5	1.45	—	—	—	—	71	"	8	—	—	Iron jacket dark. Iron jacket just beginning to show red. Crystals.	
5.			23.8	8.2	.50	—	14	29	10	87	"	2	20			
6.	555	1030	21.3	9.2	.70	—	13	27	—	78	"	4	—	—	Iron jacket red hot. Iron jacket red hot. No crystals.	
7.			25.8	7.5	1.15	—	—	—	—	77	"	1	—			
8.	565	1050	22.9	39.0	4.25	—	—	—	—	66	"	14	—	—	Iron jacket red hot. Crystals	
9.	590	1095	26.5	14.7	.94	—	—	—	—	81	nil	—	—	—	Iron jacket red hot. Crystals	
9a.	625	1160	23.8	—	—	—	5	30	9	80	over 7	18	—	—	Iron jacket full red heat.	
B. Oxide of Iron (wt. as with-drawn 210 grms.)																
10. Blank 1 .....	490	915	nil	excess.	.50	—	nil	nil	1	1.4	—	—	—	—	Recovered NH <sub>3</sub> calculated per 100 parts of average HCN used below, for comparison.	
Blank 2 .....	535	995	nil	excess.	1.05	—	nil	nil	2	0.4	—	—	—	—		
11.	195	385	24.5	11.7	.80	—	36	14	6	77	over 3	12	—	—	Crystals of ammonium bicarbonate.	
12.	285	545	29.8	8.2	.60	89	11	31	4	96.5	nil	8	—	—	Crystals of ammonium bicarbonate.	
13.	355	670	23.7	10.9	.75	85	15	2	6	85	nil	12	—	—	Crystals of ammonium bicarbonate.	
14.	495	925	27.5	8.6	.65	100	nil	nil	23	51	nil	46	—	—	No crystals.	
15.	500	930	22.8	9.5	.65	100	nil	nil	28	23	nil	56	—	—	No crystals.	
C. Weldon Mud (wt. as with-drawn 99 grms.)																
16.	145	295	25.9	7.1	.55	—	nil	nil	2	73	over 11	4	—	—	Crystals of ammonium bicarbonate.	
17.	210	410	25.7	6.9	.55	100	nil	nil	12	74	nil	24	—	—	Crystals of ammonium bicarbonate.	
18.	350	660	26.4	8.0	.60	100	nil	nil	45	0.4	nil	90	—	—	No crystals.	

The following conclusions are drawn:—

1. That the yield of ammonia reaches a maximum (96.5 per cent.) at about 280° C., then rapidly falls.

2. That results are characterised by absence of undecomposed hydrocyanic acid.

3. That carbon monoxide and hydrogen are products of the reaction below 350° C.; at higher temperatures, e.g. 500° C., both these bodies suffer oxidation by interaction with the contact material.

That oxidation of ammonia (or hydrocyanic acid) to free nitrogen is not marked below 350° C., but very pronounced above 500° C.

The results indicate that reactions (1) and (2), above, both occur within a range of temperature 200° C. to 350° C.; at 500° C. the sole products are nitrogen, carbon dioxide and ammonia.

NOTE.—The two blank experiments 1, 2, followed expt. 14. The small amounts of ammonia obtained indicate that nitrogen is not sensibly retained by the oxide of iron in any form recoverable as ammonia by treatment with steam.

#### Weldon Mud.

Physical condition, as used for gas purification, dried by gentle ignition.

Appearance when charged, black; as withdrawn, reduced to lower oxide at the inlet end, 7 inches of the column being pale brown, the remaining 15 inches quite black.

Volumes of reacting mixture, about 3,800 c.c., through-out 0° C., 760 m.m.

Duration of experiments, 90 minutes throughout.

The conclusions drawn are as follows:—

1. That the yield of ammonia never exceeds 75 per cent.

2. That results are characterised by hydrocyanic acid escaping undecomposed below 150° C., and by appearance of free nitrogen above 200° C.

3. That carbon monoxide and hydrogen do not appear among the products at any temperature within the observed range 150°–200° C.

The results indicate that Weldon mud exerts a much more powerful oxidising action upon the reaction products than oxide of iron, no carbon monoxide or hydrogen surviving to indicate the occurrence of reactions (1) and (2) above.

#### (B.) Sulphuretted Hydrogen and Air Present.

The apparatus and procedure remained as before, the sole difference being the addition of sulphuretted hydrogen and air to the reacting mixture. The proportion of air was adjusted to be in moderate excess of that required for exact decomposition to sulphur and water (2.5 air to 1 H<sub>2</sub>S).

Three contact materials were tried, under similar conditions, as before. The results are set out in Table 2 and are graphically presented on p. 68. Less importance is attached to the nitrogen figures in these experiments on account of the large proportion of air present in the reacting mixture, the nitrogen in which has to be deducted before that produced in the reactions can be arrived at. The figures for carbon monoxide and hydrogen, on the other hand, not being subject to such correction, are regarded as substantially correct. To avoid complicating

TABLE II.  
*Action of Steam on Hydrocyanic Acid (in presence of sulphuretted hydrogen and air).*

Contact Material.										Gaseous Products.			Efficiency.			Remarks.
Length 55.9 c.m. (22"); Diameter 2.22 c.m. (7 s"); Volume 216.5 c.c.m. (13.23 cubic inches).										e.c. produced per 100 c.c. of HCN entering (excluding Carbon Dioxide and Ammonia).			Per 100 parts of HCN taken.			
Nature.	Temperature of Iron Jacket (upper side).		Reacting Mixture, per 100 Volumes (excluding steam).				Steam, Molecules of H <sub>2</sub> O per 1 Molecule of HCN (including H <sub>2</sub> O from oxidation of H <sub>2</sub> S).	Rate of Flow, (6°C. 760 m.m.) e.c. per minute per 1 c.c. of Contact Material (including steam).	CO.	H.	N (Nitrogen in air entering deducted).	Recovered as NH <sub>3</sub> in Acid Catch and Asbestos Plug.	Lost.			
	°C.	°F.	CO <sub>2</sub> .	H <sub>2</sub> S.	Air.	HCN.							As HCN undecomposed.	As N (calculated from gas analysis).		
A. Broken Brick (wt. 193 grms.) Relation Air : H <sub>2</sub> S															Experiments throughout are arranged in order of temperatures, not in chronological sequence. Crystals of ammonium bicarbonate in expt. 20. A few crystals.	
19.	2.5 : 1															
20.	3.2 : 1	565	1050	37.6 (37.3)	10.3 8.6	26.1 27.1	26.0 27.0	4.7 7.8	.45 .55	10 13	17 36	— 4	79 95	.5 nil		— 8
21.	6.0 : 1	580	1075	3.3	10.4	62.6	23.7	4.9	.45	nil	nil	18	65	—		36
B. Oxide of Iron (sulphided) (wt. 188 grms.)															No crystals. A few crystals. No crystals.	
22.	3.1 : 1	480	895	37.0	8.2	25.3	29.5	9.4	.65	nil	nil	—	72	—		—
23.	3.8 : 1	500	930	37.1	7.2	27.1	28.6	6.4	.50	nil	nil	24	56	—		48
24.	3.2 : 1	520	965	35.3	9.2	29.1	26.4	7.4	.55	nil	nil	27	47	—		54
C. Weldon Mud (sulphided) (wt. 127 grms.)															Crystals. Crystals. Crystals.	
25.	2.9 : 1	220	430	31.4	10.4	30.4	27.7	12.3	.80	1	17	nil	46	large amount		nil
26.	4.1 : 1	360	680	34.1	7.4	30.5	28.0	11.5	.75	3	.5	1	93	nil		2
27.	2.7 : 1	380	715	39.7	8.9	24.1	27.3	7.5	.55	10	13	1	101	nil	2	



he statement, the production of oxidised sulphur derivatives of ammonia is considered later (p. 68).

#### Broken brick.

Condition.—As withdrawn from use in (A) above.

Volumes of reacting mixture (excluding steam) varied from 3670 to 1165 c.c., 0° C., 760 m.m.

Duration of experiments, 90 to 93 minutes.

The conclusions drawn are as follows:—

1. That the presence of sulphuretted hydrogen and air in moderate excess favours a high yield of ammonia, without sensibly modifying the character of the products.
2. That the proportion of air favourable to maximum yield is 3·2 air to 1 H<sub>2</sub>S.
3. That results are characterised by absence of nitrogen and undecomposed hydrocyanic acid, and by presence of both carbon monoxide and hydrogen when the proportion of air does not exceed 3·2 : 1 H<sub>2</sub>S. With a much higher proportion of air (6·0 : 1 H<sub>2</sub>S) free nitrogen, ammonia, carbon dioxide and water are the sole products.

#### Oxide of iron (sulphided).

Condition.—Sample used was that withdrawn after use in the small laboratory kiln for Claus kiln experiments See Alkali Report 1899, pp. 181—184). For analysis before and after use in the present series, see Table 4.

Appearance as charged, dull red and grey; as withdrawn, black.

Volumes of reacting mixture varied from 3270 c.c. to 3615 c.c., 0° C., 760 m.m.

Duration of experiments, 86 to 90 minutes.

The following conclusions are drawn:—

1. That the presence of sulphuretted hydrogen and air favours a high yield of ammonia.
2. That results are characterised by absence of undecomposed hydrocyanic acid, and of carbon monoxide and hydrogen.

#### Weldon Mud (sulphided).

Condition.—Sample used was that withdrawn from the laboratory kiln in 1899, and similar to that used in the Claus reaction tube experiments. (Journal, 1903, p. 460, where the full analysis is given, see also Table 5.)

Appearance as charged, light brown; as withdrawn, ditto.

Volumes of reacting mixture about 3150 c.c. 0° C., 760 m.m. throughout.

Duration of experiments from 86 to 92 minutes.

The following conclusions are drawn:—

1. That the presence of sulphuretted hydrogen and air favours a high yield of ammonia, and greatly modifies the nature of the products.

2. That the proportion of air favourable to the maximum yield of ammonia is 2·7 : 1 H<sub>2</sub>S, with a temperature of 380° C.

3. That results are characterised by presence of carbon monoxide and hydrogen, and by absence of nitrogen over a range of temperature from 220° C. to 380° C.

#### Distribution of Recovered Ammonia.

The presence of ammonium sulphate in the sulphur recovered from Claus kilns in gas liquor works, and its relation to the nitrogen entering with the saturator gases in the form of hydrocyanic acid was fully discussed in our previous paper. We then stated (Journal, 1901, p. 586)—

“Whatever its previous history, however, ammonia is undoubtedly present in the exit kiln gases, mainly in combination with sulphuric acid as ammonium sulphate, but in lesser degree also with sulphurous acid as ammonium sulphite; \* the latter body would, of course, rapidly suffer oxidation to sulphate when the recovered product is exposed to the air on opening the chambers.”

The question was regarded as one of importance, both practical and theoretical, and attention was therefore specially directed in the present research to the estimation of the various oxidised sulphur compounds of ammonia present in the residual gases resulting from interaction of steam and hydrocyanic acid in presence of sulphuretted hydrogen under conditions approximating to those existing in the Claus kiln itself. For this end the residual gases from the contact material were made to pass through a layer of asbestos fibre before leaving the combustion tube for the acid catch, with a view of filtering out any solid bodies that might be induced to separate by contact with a porous material at a comparatively low temperature (100° to 200° C.) before reaching the acid catch, where such products would be subject, not only to large dilution, but also to decomposition by secondary reaction with the half-normal acid present to retain ammonia. The asbestos fibre was extracted with cold water at the end of each experiment, and the filtered extract submitted to separate examination. The quantitative results are fully set out in tabular form in Table 3 with the analyses

\* The iodine-reducing properties of the neutral salt, separating in the sampling tube on this occasion, was attributed to the presence of ammonium sulphite; it is now believed that it should have been properly ascribed to ammonium thiosulphate.

TABLE III.

Distribution of Recovered Ammonia (Steam and Hydrocyanic Acid in presence of sulphuretted hydrogen and air).

	Weldon Mud (Sulphided).		Oxide of Iron (Sulphided).				Broken Brick.	
	Expt. 25.	Expt. 27.	Expt. 22.	Expt. 23.	Expt. 24.	Expt. 19.	Expt. 20.	Expt. 21.
Temperature, °C	220	380	480	500	520	565	565	580
°F	430	715	895	930	965	1050	1050	1075
Reacting Mixture— Relation Air : H <sub>2</sub> S (x = 2·5 : 1 for reaction H <sub>2</sub> S + O = H <sub>2</sub> O + S)	2·9 : 1	2·7 : 1	3·1 : 1	3·8 : 1	3·2 : 1	2·5 : 1	3·2 : 1	6·0 : 1
Ammonia— 1. Recovered, per 100 parts entering as hydrocyanic acid								
(a) In asbestos plug	2·5	1·7	7·9	3·3	3·7	trace	trace	·2
(b) In acid catch	43·5 = 46·0	99·2 = 100·9	64·0 = 71·9	53·2 = 56·5	43·6 = 47·3	79·1 = 79·1	95·0 = 95·0	64·0 = 64·2
2. Distribution, per 100 parts of total recovered								
(a) In asbestos plug— as sulphite .....	absent	absent	absent	absent	absent			
as pentathionate				nil	nil			
as sulphate .....	4·8	·6	7·0	2·9	3·6	= trace	= trace	0·4
as thiosulphate ..	·6 = 5·4	1·1 = 1·7	3·9 = 10·9	3·0 = 5·9	4·2 = 7·8			
(b) In acid catch as thiosulphate ..	6·0	3·6	28·4	12·6	10·4	trace	1·3	trace
as acid sulphite	nil	2·0	nil	nil	nil		nil	11·5
as carbonate (neutralised by N <sub>2</sub> H <sub>2</sub> SO <sub>4</sub> present)	87·1	92·8	37·7	72·4	81·6	99·3	98·2	87·9
as pentathionate	absent	absent	absent	absent	absent	absent	absent	absent
Other forms, including sulphate, by difference	1·5 = 94·6	·1 = 98·3	23·0 = 89·1	9·1 = 94·1	·2 = 92·2	·7 = 100·0	·5 = 100·0	·2 = 99·6
	100·0	100·0	100·0	100·0	100·0		100·0	100·0

of the corresponding catch liquors. Ammonia as sulphate and thiosulphate was determined by Richardson and Aikroyd's joint iodine and acidimetric method; a united figure for ammonia as pentathionate and sulphate was arrived at by difference, the presence of these bodies being identified qualitatively by ammonium molybdate and barium chloride respectively. Similar methods were employed for the analysis of the acid retort catch liquors.

We regard the analyses of the asbestos fibre extracts as affording undoubted evidence of the presence of oxidised ammonium sulphur compounds as direct products of the combustion tube reaction.

On the other hand, the thiosulphate and sulphate found in the acid catch liquors are undoubtedly derived in some measure from secondary reactions, and little or no significance can be attached to these figures. Those for ammonia as carbonate and sulphate are less open to objection, and are regarded as approximately correct. We summarise the conclusions briefly as follows:—

### 1. Weldon Mud (sulphided).

Temperature low, not exceeding 380° C.

Results characterised by presence of small traces of oxidised sulphur compounds in the asbestos filter; and by absence of sulphate in the catch, the bulk of the ammonia appearing as carbonate.

### 2. Oxide of Iron (sulphided).

Temperature high 480° to 520° C.

No conclusions as to the yield of ammonium sulphate can be drawn from the results obtained in experiments Nos. 22 and 23, as the contact material on charging contained a considerable proportion of ferric and ferrous sulphates, bodies which yield sulphur trioxide on ignition; these bodies were absent when the material was withdrawn for analysis at the end of experiment No. 24, the last of this series. Confining attention to No. 24, we see that results are characterised by the presence of oxidised sulphur compounds of ammonia in the asbestos filter, and by the absence of sulphate in the catch.

### 3. Broken Brick.

Temperature high, 565° to 580° C.

Results are characterised by absence of pentathionate, sulphate, and thiosulphate in both asbestos filter and acid catch; and by the large proportion of ammonium carbonate.

For comparative purposes, we have presented in graphical form below some of the more important features of Tables 1 and 2. In Fig. 1 the yields of ammonia per cent. of the maximum attainable by theory are represented as ordinates with corresponding temperatures as abscissae, each observation being denoted by a small circle. The circles are connected by lines, thick black lines indicating results with Weldon mud, thin lines results with oxide of iron, and dotted lines those with broken brick. The character of the reaction products is indicated by the usual symbols placed beside the circle to which they correspond, thus, " $\text{CO}, \text{H}, \text{HCy}$ " denotes that carbon monoxide, hydrogen, and undecomposed hydrocyanic acid are present in the residual gases, while " $\text{N}$ " denotes the absence of those bodies and the presence of free nitrogen. In Fig. 2 the amounts of ammonia (or hydrocyanic acid) decomposed to free nitrogen per cent. of total hydrocyanic acid taken are represented as ordinates with the corresponding temperatures as abscissae. The lines and lettering for the same materials are as in Fig. 1. In some cases, results found in the tables have had to be excluded, owing to the rates of flow being abnormal; in others, results are averaged where temperatures and rates of flow approximate. In addition, we have given, in graphical form on the extreme left of Fig. 2, the results obtained by Messrs. Carrick Anderson and George Lean in their experiments on the oxidation of ammonia (in presence of dry nitrogen gas) by haematite ore. (Journal, 1900, p. 28.)

## APPENDIX.

### Example.—TABLE 1. No. 13.

Conversion = 85.3 per cent.; Temperature = 355°C (= 670°F);

HCy absent in catch.

Volume of iron oxide = 216.5 c.c.; Time 90 minutes.

Volume of permanent gas entering decomposer from gas holder = 2,640 c.c. 0°C., 760 m.m.

## YIELD OF AMMONIA AND CHARACTER OF PRODUCTS.

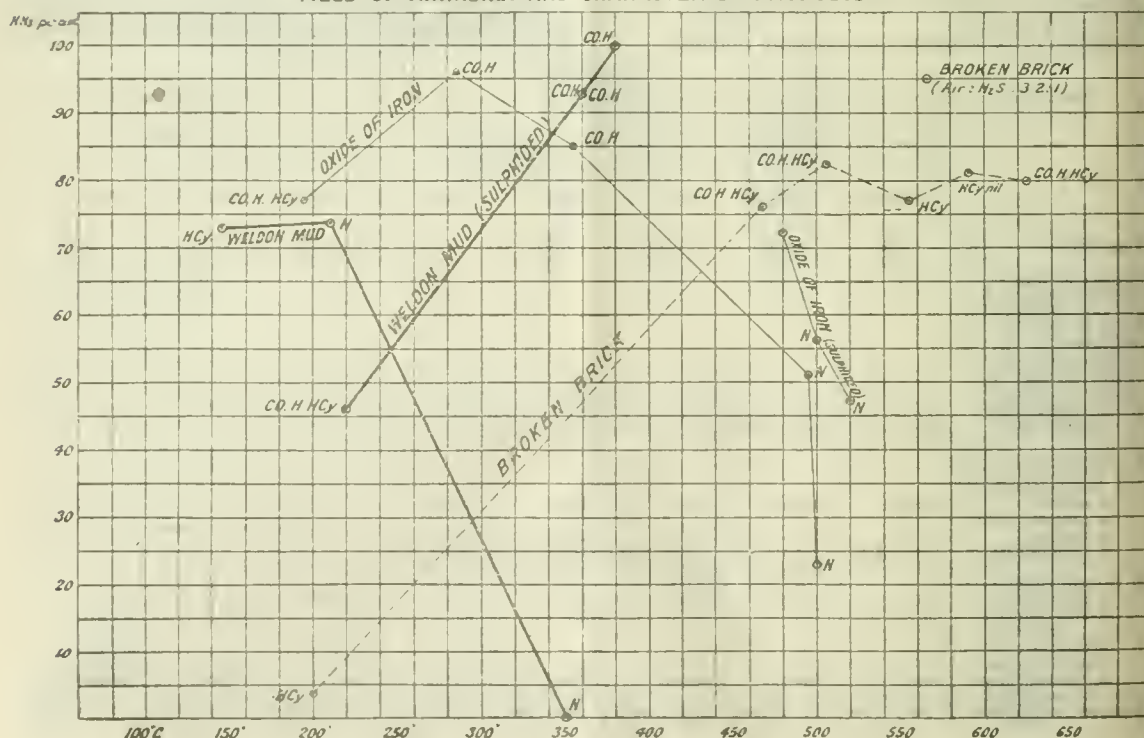


FIG. 1.





TABLE IV.

*Analysis of Oxide of Iron Contact before and after Interaction with Hydrocyanic Acid and Steam.*

	Oxide of Iron (Air and H <sub>2</sub> S Absent).		Sulphided Oxide of Iron (Air and H <sub>2</sub> S Present).	
	Before Use. Non Magnetic.	After Use. Slightly Magnetic.	Before Use. Non Magnetic.	After Use. Magnetic.
Combined water and moisture .....	16.9	3.0	11.8	0.8
Sulphur—				
Free by carbon bisulphide .....	—	—	2.0	—
Sulphates, extracted by dilute acid—				
Ferrous Sulphate, calculated as SO <sub>3</sub> .....	absent	absent	present	absent
Ferric .. ..	absent	absent	present	absent
Calcium .. ..	traces	traces	present	present
Sulphides—				
Ferrous sulphide, calculated as FeS .....	—	—	nil	0.2
Iron disulphide .. ..	—	—	9.0	11.4
Ferrous oxide .. ..	nil	nil	17.8	42.9
Ferric oxide .. ..	63.5	75.5	32.0	20.4
Alumina .. ..	—	—	17.0	21.3
Insoluble in acid (SiO <sub>2</sub> , some Al <sub>2</sub> O <sub>3</sub> , &c.) .....	14.3	12.4	—	—
Calcium oxide .. ..	—	—	—	1.1
calculated as CaO .....	—	—	—	1.4
Magnesium oxide .. ..	—	—	by diff.	1.2
calculated as MgO .....	—	—	—	—
Alkalis .. ..	—	—	—	—
	—	—	100.0	100.0

TABLE V.

*Analysis of Sulphided Weldon Mud before and after interaction with HCN and steam (air and H<sub>2</sub>S present).*

	Before.	After.
Manganous sulphate .....	2.32	
Calcium sulphate .....	21.28	
Magnesium sulphate .....	0.30	
Alkalis, as sulphate .....	3.95	
Manganese monoxide, MnO .....	21.69	
dioxide, MnO <sub>2</sub> .....	11.91	
sulphide, MnS .....	absent	4.3
Calcium oxide CaO .....	62	
Alumina and ferric oxide .....	traces	
Sulphur, free (by carbon bisulphide) .....	21.26	6.0
Silica, &c. ....	0.81	

NOTE.—On heating the sulphided mud in carbon dioxide, sulphur dioxide was freely evolved, indicating interaction between the free sulphur and manganese dioxide. This rapid evolution of SO<sub>2</sub> ceased when experiment No. 26, Table II (the first of this series), was half completed. It was not met with in the two following experiments, Nos. 25, 27, when traces only of SO<sub>2</sub> were found in the residual gases.

## DISCUSSION.

Mr. COLEMAN inquired whether Mr. Carpenter considered that the protecting effect of the diluting gases was due to the proportion of the gases present or to their specific nature—whether any kind of gas would have a protecting effect.

Mr. MAX MESSPRATT said that the influence which sulphuretted hydrogen seemed to have upon the reactions described by Mr. Carpenter was very striking. Had Mr. Carpenter made any experiments upon the condition of the surface of the contact material after the experiments in which sulphuretted hydrogen was used? Had the sulphuretted hydrogen actually formed a sulphide coating upon the contact material, so that approximately neutral results were obtained as with brick, or did the gas, as such, in some way modify the reaction?

The CHAIRMAN asked what Mr. Carpenter thought ought to be done in practice to increase the yield of the valuable products that could be obtained, and which exist in those gases, or whether he intended to leave it to the practical men to draw their lesson from the experiments which he had made and reported? He noticed that some of the experiments at least were conducted with pure materials and in glass tubes. Many years ago the late Dr. Hurter, in the course of some experiments on the well-known Deacon chlorine process, found that in the laboratory, working with a glass tube and with materials im-

pregnated with a salt of copper, one could pass hydrochloric acid and air through the tube at the requisite temperature, and get unlimited quantities of chlorine, without damaging the copper in the slightest degree. They therefore then jumped to the conclusion that all that was necessary was to build a large piece of apparatus and get a similar result in the works to that which they had obtained in the laboratory, but, unfortunately, such was not the case. Various impurities were present with the hydrochloric acid, such as arsenic and sulphuric acid, and also the impurities resulting from the furnaces themselves; thus it came to pass that, instead of obtaining an unlimited quantity of chlorine from a given amount of the copper salt, they obtained a limited amount, and it resulted, as was well known, in the necessity for small but continuous replacements of the contact material for the carrying out of the process. Had Mr. Carpenter any idea whether the practical results on the large scale would be different from the results that he had obtained in the laboratory? He had been very pleased indeed to hear of the success of the copper calorimeter. Evidently it was very accurate when carefully managed, and he believed that it was about the best calorimeter which could be used for high temperatures, and he thought Mr. Carpenter agreed with him. Of course, some other material, such as a platinum bolt, which was equally good from a practical point of view could be used. In the Dean process they usually used iron bolts, which they thought were quite near enough.

Mr. CARPENTER in reply, said that he certainly considered that the protecting effect of the diluting gases in the second series of experiments was due to their specific nature, because in the first series of experiments they had practically the same volume of permanent gas accompanying the hydrocyanic acid, viz., carbonic acid from the cylinder, and the only other neutral gases in addition to carbonic acid were small quantities of oxygen and nitrogen. As compared with the small Claus kiln of the last paper they got their carbonic acid generally on passing through that apparatus within 2.5 to 3 per cent. of that entering. This exit gas contained about 95 per cent. CO<sub>2</sub>, as against 98 going in. In the present series, inlet and outlet tests gave practically identical figure. They had done some experiments at different rates in order to see the effect of increasing speed on the yield. Such experiments were especially made for the purpose of seeing how hard the pressure could be driven without decreasing the yield, but as a rule they tried to run through the same quantity in the same time, so as to maintain speed as a constant in studying effects of variations of temperature. In answer to Mr. Messpratt, the oxide of iron contact material was analysed in the first



ries of experiments as regards certain substances that they looked for, and also the sulphided material, before and after use. Before use the oxide was such as was used in the Claus kiln, and there was no ferric sulphate, the same was the case after use; there was no ferric sulphate, and only a trace of calcium sulphate; the ferric oxide was estimated before and after, and it had maintained its character throughout. In the sulphided material, as he had explained in the paper, the previous experiments with that material had been conducted at low temperatures, so that some ferrous and ferric sulphate were present in the material; these had nearly disappeared in the course of the early present experiments. In the sulphided Weldon mud there was no manganese sulphide present before use, but they found 1.3 per cent. after use. In the paper they described a certain amount of superficial darkening of the broken brick material, which they attributed to the separation of the carbon from some decomposition of hydrocyanic acid. Mr. Carey had asked him a difficult question as to the practical considerations that arose out of the work. He looked upon it rather as a warning to technologists than as suggestions to be followed, because the hydrocyanic acid was so much more valuable than ammonia that all the aims of technologists had been to produce hydrocyanic acid from ammonia rather than ammonia from hydrocyanic acid. This decomposition of hydrocyanic acid was found to occur in the manufacture of cyanide in Germany from the "schlempe," where they got considerable quantities of ammonia as well as hydrocyanic acid; the operations there being conducted at a red heat in brick retorts, and the products passed through highly-calcinated pigeon-hole brick work, so that if they got a yield of ammonia accompanied by nitrogen it was not to be wondered at. Then Mr. Carey had asked a question as regards the practical suggestions that seemed to arise from the research that had been conducted with a view to the examination of the products from the Claus kilns used in gas works. At the April meeting, when he previously dealt with the subject, a member had indicated he would choose a contact material that would destroy the ammonia, and asked had such experiments been made? The work of the present paper then sketched out the answer, and Mr. H. Morris's remark was one natural practical suggestion that would occur to a sulphuric acid manufacturer using such sulphur. He thought the suggestion would occur to the practical man as he read the paper that it indicated more what to avoid than directly how to obtain what he wanted. Then, as regarded the materials used, the potassium cyanide did contain small quantities of some other salts, chiefly potassium carbonate. In their gas analyses they had to allow for a certain amount of carbonic acid from this source—it was a very small amount. The analyses of the contact materials used were given in the paper. They confined their research purely and strictly to the hydrocyanic acid, not complicating it with any other product except those which accompanied it on a large scale—the sulphuretted hydrogen and carbonic acid in gas works practice. Mr. Clayton had been kind enough to make a suggestion at the last meeting as to whether the methods of analysis of Walther Feld, who had given some extremely useful methods of analysing crude cyanide compounds, had been found satisfactory in such work as Mr. Linder and himself had described in their previous paper. Feld's process for estimation of hydrocyanic acid in presence of sulphides was a simplification of the process that Mr. Linder had independently devised. On the addition of lead nitrate to the cyanide before distillation the solution did become acid by hydrolysis, so that there was no necessity to add an acid like tartaric. He might say that the presence of other than traces of cyanide in gas liquors was a decidedly unusual thing; there were so many other bodies waiting to combine with ammonium cyanide in its passage from the retort to the cooling and scrubbing apparatus that to find it in notable amount in a gas liquor was not in their experience a common thing. He had not been prepared for the almost complete accuracy in estimations by Feld's methods, which they found from various materials used. He hoped some day to hear a paper connected with the cyanide industry on the point under notice.

## London Section.

Meeting held at Burlington House, on Monday,  
January 9th, 1905.

MR. A. GORDON SALAMON IN THE CHAIR.

### SOME CHEMICAL ASPECTS OF THE ST. LOUIS EXHIBITION.

BY WALTER F. REID, F.I.C., F.C.S.

The Great Exhibition at St. Louis which has recently closed, contained so much that was novel and suggestive to the chemist that a description of some of the more important points may be of interest. The task of selection is not an easy one, for many of the numerous exhibits were sprinkled over the whole of the exhibition, rendering the work of personal inspection difficult and lengthy. For much valuable assistance in connection with the exhibits I am indebted to my colleague on the International Jury, Mr. H. J. Helm, I.S.O., whose wide experience of chemical products contributed materially to a full appreciation of the merits of our exhibits by our colleagues on the Jury. Mr. C. T. Tyrer rendered valuable assistance in the arrangement of the exhibits, a matter which is too often neglected by British exhibitors who have a tendency to rely solely on the quality of the goods themselves. The British Chemical Section was in charge of Mr. H. Wernicke who possessed the qualification of being an excellent linguist. Particulars about the general arrangement of the exhibition will be found in the *Journal of the Society of Arts*, Dec. 9th, 1904.

There can be no question that the Low Temperature Research Plant of the British Royal Commission was the most important exhibit in group 23. It was a happy thought of the Committee to exhibit in full operation processes which have been worked out in Great Britain for the production of the lowest temperatures hitherto attained. Mr. J. E. Petavel, who was in charge of the apparatus, gave interesting lectures on liquid hydrogen and liquid air at frequent intervals, and large quantities of liquid hydrogen were produced regularly. On the occasion of the inspection of the plant by the International Jury, the largest quantity of liquid and solid hydrogen that had ever been made at one time was exhibited. The plant was erected in a separate building near the Liberal Arts Palace, while the lectures were delivered in the palace itself.

The greater part of the British exhibits in this section were arranged in octagonal show-cases, which not only enabled the articles to be seen to full advantage; but also gave an individuality to each exhibit which was sometimes lacking in the case of other nations. In mentioning some of the chief British exhibitors, I need scarcely enter into details as to the goods, because most of the firms are thoroughly familiar to us all. Heavy chemicals were represented by the British Cyanides Co., Ltd., The Gas Light and Coke Co., Ltd., who showed a fine collection of derivatives of coal gas, tar and liquors; the United Alkali Co., Ltd., with a very complete series of products relating to the alkali industry, ultramarine and recovered sulphur; Peter Spence and Sons had practically two exhibits, one of titanium compounds, now extensively used as a mordant in dyeing, and the other of alums and other aluminous compounds. Among the latter were some remarkably fine specimens of rubidium, thallium and caesium alums, which attracted much attention. The Anglo-Sicilian Sulphur Co., Ltd., the Cassell Gold Extracting Co., Ltd., the Castner-Kellner Alkali Co., Ltd., Chance and Hunt, Ltd., Spencer Chapman and Messel, Ltd., McDougall Brothers, the South Metropolitan Gas Co., and Jno. and Jas. White were all well represented, and obtained high awards. Pharmaceutical and fine chemicals fully maintained the high standard to which we are accustomed in this country, the chief exhibits being those of Burroughs, Wellcome and Co., Evans Sons, Lescher and Webb, Ltd., Hopkin and Williams, Ltd.,

Howards and Sons, Ltd., Corbyn, Stacey and Co., Ltd., May and Baker, Ltd., T. Morson and Son, and Thos. Tyrer and Co., Ltd.

As is usually the case in British exhibits, soap and allied products were very prominent, there being good displays by Edward Cook and Co., Ltd., Joseph Crossfield and Sons, Ltd., J. C. and F. J. Ltd., Price's Patent Candle Co., Ltd., Burnish Oil Co., Ltd., and Wood and Bedford. Perfumery and essential oils were shown by Stafford Allen and Sons, Ltd., and Boake, Roberts and Co., Ltd. A good assortment of apparatus was exhibited by Baird and Tatlock, Ltd., John J. Griffin and Sons, Ltd., and Townson and Mercer. Among the scientific exhibits may be mentioned those of Sir William Ramsay, F.R.S., who sent some unique specimens of helium, argon, neon, krypton and xenon, also helium formed by the spontaneous decomposition of the radium emanation; and Sir Jos. W. Swan, F.R.S., and Mr. J. A. Kendall showed cyanides made from atmospheric nitrogen by the process upon which they have been working with great perseverance for several years. Dr. Ludwig Mond's gas producer was represented by a model, and Sir H. E. Roscoe's original preparations of vanadium attracted many chemists. A very striking exhibit was that of Levinstein, Ltd., in which a large number of dyed samples were arranged in book form. Brooke, Simpson and Spiller, Ltd., and Read Holliday and Sons, Ltd., had exhibits of dyes of various kinds.

I have purposely refrained from entering into minute details of our British exhibits, not only because they have been fully described in the official catalogue issued by the British Royal Commission, but also because there have been many notices in the press in this country. In the case of some of the foreign firms, however, it may be of interest to give particulars of individual exhibits.

France occupied a site adjoining our own in the Palace of Liberal Arts. The exhibits were housed in tasteful showcases, all arranged on the same pattern. A special case was occupied by an important collective exhibit of the Société Chimique de Paris, containing products discovered by the members of that Society since 1900. Many of these were of great scientific interest, illustrating the recent researches of eminent chemists, such as Moissan, Mouren, Sabatier, Haller, Gautier, Bailhache, Réhal, Bertrand, Bouveault and many others. M. A. Béhal, professor of toxicology at the Paris Ecole supérieure de Pharmacie, also had a separate exhibit full of interesting organic preparations, especially in the campholinic series, and a small library of works of which he is the author. Among the commercial exhibits, perfumery predominated, there being nine firms represented. The firm of Pinaud had a fine collection of natural perfumes and toilet preparations, and M. L. Roure of Grasse, Alpes Maritimes, exhibited large quantities of extracts and pomades as used by perfumers. A new method of extracting the perfumes from flowers by means of a hydrocarbon solvent, instead of the usual process of enfleurage, was illustrated by models. One firm exhibited synthetic perfumes as such, but in most cases these appeared under the name of some natural perfume, or some special trade name. Pharmaceutical preparations were very well represented. The Pharmacie Centrale de France, represented by Chas. Buchet and Co., had a large selection of preparations of various kinds, about 700 tons per annum being given as the output from their various works. Among other firms showing similar products may be mentioned P. Astier, Chassaing and Co., G. Chevrier, Comar et Fils et Cie., E. Landrin, whose ibogaine is said to possess properties intermediate between those of kola and coca. It is prepared from the iboga root, grown in the Congo district. Among the synthetic remedies exhibited, "stovaine," made by Poulenc Frères, appears to possess valuable properties as an anæsthetic. It is said to be a chlorhydrate of dimethylaminobenzoyl-pentanol, and to be much less poisonous than cocaine. The same firm exhibited a series of radio-active products derived from carnotite, and a fine collection of porcelain colours. The Société des Produits chimiques de Marseilles-l'Estaque decompose salt by means of the gases from pyrites kilns; the residues from the pyrites are lixiviated, and about 4000 tons of sulphate of copper are

produced annually, while the sodium sulphate is converted into soda, or used as such by glass-works.

Glues and gelatines were well represented by six firms, of whom Rousselot et Cie., Laprêvotte et Cie., P. Collette and G. L. Borrel et Fils obtained the highest awards. An article made from gelatine, and well worth the attention of our manufacturers, is the sponges now used largely for dress decorative purposes. They are in increasing demand, and the quantities produced in France are very considerable. Among the special articles shown by manufacturers may be mentioned L. Bourdeau's fluorides and fluosilicates, Deschamps Frères' ultramarines, Lorilleux and Co.'s printing inks and D. A. Bloche's barium compounds.

Although heavy chemicals were not so well represented as in the British section, several large firms had good displays. Among them may be mentioned Corbin and Co., with a number of electrolytic chemicals, especially chlorates and perchlorates, together with wood pulp, Poulenc Frères, who had a large number of general and photographic chemicals, and Schloesing Frères and Co., with a display of sulphur and its derivatives. In the Palace of Machinery, Paul Kestner exhibited a number of models and drawings of chemical plant, especially evaporators and elevators.

In modern industry there is a great deal of make-believe, either artificial substitutes for natural products or new materials intended to take the place of older ones to which the public has become accustomed. Sometimes there is very little difference between the new product and the older one, and this was specially noticeable in an excellent exhibit of artificial rubies by P. A. Paquier. The appearance and colour of these brilliant gems were equal to those of the natural stones, and as the chemical composition is identical in both cases, the imitation can only be distinguished by optical methods. For watch-making purposes, these artificial rubies are being largely used.

Artificial silk is another material that imitates nature very closely in appearance, if not in chemical composition. The Société Anonyme pour la Fabrication de la Soie de Chardonnêt had a brilliant display of artificial silk goods indistinguishable in appearance from real silk. Exhibited for the first time in 1889, the Chardonnêt silk did not at first meet with much encouragement, owing to its inflammability, but when the denitration process had been worked out, progress became more rapid, until to-day the production of the Besançon factory is 3600 pounds daily. The number of employees is 1500, and the consumption of alcohol as a solvent is 25,000 hectolitres (550,000 gallons) annually. The collodion solution is filtered under a pressure of 60 to 80 atmospheres, and under the same pressure is driven through spinning nozzles 0.06 mm. in diameter. It is to be hoped that increased facilities for the industrial use of alcohol may enable this highly remunerative industry to be re-introduced into this country.

Germany also had a fine exhibit of artificial silk by the Vereinigte Glanzstoff-fabriken, of Elberfeld, who work according to Pauly's process, in which the cellulose is dissolved direct without previous nitration.

The German chemical exhibit was in the main a collective one, and the whole subject was treated more from the educational than the commercial point of view. The chief collection was installed in the Palace of Electricity; but other exhibits were dispersed throughout various buildings in a way that rendered it somewhat difficult to obtain a general impression of this section. Several fully-equipped laboratories were fitted up in a way that reflects great credit upon the organisers. The oldest was that of an alchemist showing the conditions under which men like Glauber, Scheele, Kunkel and Böttger worked, and the apparatus with which they laid the foundation of modern chemistry. Another reproduction showed Liebig's laboratory at Giessen, as it existed in 1835, and in the emporiums were many of the great master's original preparations. In view of the great interest aroused by such relics, one cannot but deplore the absence in this country of any organisation for preserving objects of interest to chemists. Apparatus and preparations that would be priceless to future generations may be had now for the



asking, and the cost of preserving them would not be great. Biologists carefully preserve their type specimens, and engineers are proud of the first efforts of a Watt or an Arkwright; chemists alone appear to forget that chemistry is no longer the despised handmaid of other sciences; but an independent branch of knowledge with a powerful influence on human progress. It ought to be possible for the chemical societies of the greatest City in the world to provide a room where relics that might easily be obtained from their members could be stored. Near the Liebig laboratory was a fully fitted up table of the Berlin University laboratory for inorganic chemistry, equipped with the most modern appliances. Among the mass of apparatus exhibited may be mentioned those for gas analysis of Winkler, Hempel, Bunte, Ferd. Fischer, Wöhl, Gückel and Viktor Meyer, among the latter the original Berlin porcelain vessel in which the density of gases was tested up to 1800° C. The Berlin porcelain manufactory had a large exhibit of chemical vessels of all kinds, and Schott and Genossen an equally interesting collection of their well-known glass ware. Heraeus showed some fine platinum and iridium apparatus; but what attracted most attention was a number of quartz vessels of considerable size, one exceeding 250 c.c. Practical demonstrations were given of the fact that these quartz vessels could be heated red-hot and plunged into cold water without cracking. It is evident that this new material, upon which so much pioneer work has been done in England, will in the future play an important part in technical as well as in scientific chemistry, and it is to be hoped that our manufacturers will take steps to secure their share of so promising an industry.

The collection of German scientific apparatus in the electrical building was large, and was supplemented by another in the Palace of Agriculture having special reference to the teaching of agricultural chemistry and research work connected with it. The greater part of this collection was from the Vereinigte Fabriken für Laboratoriumsbedarf, who had about 180 exhibits. There were also special laboratories for pyro-chemistry, electro-chemistry, dyeing, physiological chemistry and fermentation and general and inorganic chemistry. In the Liberal Arts Palace was an exhibit of perfumery and cosmetics, organised by six firms collectively. The greater part of the large German manufacturers, especially of dyes and organic products, had combined to form a collective exhibit in which the individuality of each separate firm was merged. The collection was certainly an excellent one; but one could not help thinking that on the whole these exhibits did not do full justice to a trade employing 161,000 hands and producing goods valued at £50,000,000.

An excellent description of the German chemical exhibits at St. Louis was published in the *Chemiker Zeitung* of May 4th, 1904, by Dr. Walter Vieweg. To him and to Dr. O. Zwingenberger, who was in charge of the chief chemical collection, I am indebted for much useful information. Dr. C. Harries, of the First Chemical Laboratory at the University of Berlin, who was the general secretary of the German Chemical Exhibit, was kind enough to send me some of the photographs shown at this meeting.

Of two materials nature has granted a practical monopoly to Germany, namely, potash salts and amber. The former were well represented by the Stassfurter Chemische Fabrik, who exhibited a large number of potash compounds, both natural and artificial, together with bromine and magnesium chloride and sulphate. The firm employs about 500 hands. Amber mining is a monopoly of the Prussian Government, and as but little is known about it here, a few particulars may be of interest, especially as it is the raw material for the best varnish known.

Nearly the whole of the amber now produced is obtained by mining, the amber being contained in a layer of blue clay which yields on an average 3-25 kilos. of amber per cubic metre. The value of the product in 1902 was £79,962. America imported in that year raw amber to the value of £41,726, England only £2,416. A new industry has arisen having for its object the utilisation of the smaller pieces of amber. These are carefully cleaned, warmed to about 180° C., and forced through a fine strainer,

when they unite and form a homogeneous mass. In order to facilitate the use of the material for varnish the Government factories melt the amber by heating it to about 375° C. This melted amber was sold to the amount of £13,872 in 1903.

Some excellent specimens of copal were exhibited from German East Africa; but it is to be feared that the population of that colony is at present too small to develop a trade in such a product.

The United States chemical exhibits did not occupy the important position which her chemical industries might have led us to expect. The exhibits were also sprinkled over different buildings, so that it was a work of much labour to find them. The only display that could be called a collective one was that of the United States Government, who had an analytical laboratory for food products in actual work. The experimental stations of the different States of the Union showed special laboratories and analytical results, chiefly in connection with agriculture; for instance, Louisiana had a sugar laboratory, and Wisconsin a dairy laboratory. There appears to be a very large business in chemicals used for spraying fruit trees and crops, a practice which is now so general in the United States, that most of the insect enemies of the agriculturist can be kept under control. The American horticulturist does not confine himself to grumbling at the insect pests which are so numerous in his country; he fights them energetically, and, with the help of the chemist, he generally succeeds in securing the safety of his crops for a very small expenditure per annum. In most modern books on fruit culture in America regular spraying of the trees is recommended. There were several exhibits of starch and glucose products; in fact, almost every article made from cereals was represented. The Californian wine industry appears to have reached the limits of the home demand, and considerable prizes are being offered by the associated grape growers for new uses for grape juice. Large quantities of unfermented grape and apple juice are now being sold in sterilised bottles, and the industry appears to be growing rapidly. There should be a good sale for apple juice in this country if properly prepared. California had a good display of olive oil and, of course, cottonseed oil was represented by many samples. Connected with the Forestry department was an exhibit showing a new method of collecting turpentine, which is said to produce larger quantities with less injury to the trees than the old method. The supply of turpentine from the long-leaf pine appears to be falling off, and other sources are being utilised. Considerable quantities are now made by distilling wood, and especially the roots of the pine trees, but the turpentine thus obtained differs in important particulars from that produced by distilling the exuded resin.

In this department were numerous displays of wax and honey; but as these have been dealt with fully in a paper published in the *British Bee Journal* of Jan. 5th, I need only mention them here.

Coming to chemicals generally, the best collection was undoubtedly that of the Mallinckrodt Chemical Works of St. Louis. Large masses of morphine, cocaine, strychnine, caffeine, and many other preparations to the value of thousands of pounds were tastefully arranged in a large show-case of special design. Another exhibit of the same firm showed the various alkaloids extracted from opium. The Roessler-Hasslacher Co. also had a large exhibit containing many sodium compounds, acetone, chloroform, formaldehyde and ceramic colours. Perfumery was represented by several firms, such as the Mellier Drug Co., the Sanitol Chemical Laboratory Co., the Allan-Pfeiffer Chemical Co., and W. R. Warner and Co.

Of special importance were the electrolytic products most of which were shown in the Palace of Mines and Metallurgy. The Castner Electrolytic Alkali Co. showed caustic soda and bleaching powder, and the Niagara Electro-Chemical Co. peroxide of sodium and metallic sodium. The Union Carbide Co. had a large quantity of calcium carbide and the Carborundum Co. not only showed a striking trophy of carborundum, but also a full-sized furnace as used in their works. The production of this material for 1903 was 2,125 tons. Fine samples of graphite made electrically were shown by the International Acheson

Graphite Co. In the same building was a very complete collection of mineral oils, paraffin, &c., by the Standard Oil Co., and a large exhibit by the Trinidad Asphalt Manufacturing Co. Of considerable interest was the sulphur from Calcasieu in Louisiana, the average monthly production of which is between 15,000 and 16,500 tons, the whole of which is melted underground and brought to the surface through boreholes, the heating agent being superheated steam. Mr. Eustace Carey has given some interesting details of this deposit in his address to the Liverpool Section of our Society. In the same building was a very complete collection of most of the radio-active minerals known, and the search for others is being actively prosecuted in the United States. A walk through the Mines and Metallurgy Building could not fail to impress the observer with the enormous mineral wealth of the United States, of which only a small fraction has yet been developed.

Brazil played an important part at St. Louis; her exhibits in group 23, for instance, ranking second in point of number. One must admit, however, that most of these were indicative of industries in the stage of development and fostered by high import duties. Most of the products were medical and pharmaceutical, with perfumes and toilet preparations. Glue, matches, soaps and oils were also shown by several firms.

Belgium was represented by 18 firms, among whom may be mentioned Les Anciens Etablissements, F. Mommen and Co., who had a good exhibit of paints, and Les Agglomérés réunis du Bassin de Charleroy who showed distillation products of coal. The five candle factories of Belgium were represented by two firms, and of the 18 match factories, which produce  $5\frac{1}{2}$  million gross of boxes annually, but one sent samples.

Sweden made a better show in matches, which was her only exhibit in this section. The production of the Jönköping Company is 5 million boxes daily. As showing the enormous quantity of materials that this apparently insignificant chemical industry consumes, it may be mentioned that the production of this one firm in 24 hours would encircle the earth.

Japan also exhibited a number of matches, of which she produces about 27,000,000 gross of boxes annually. Lacquer and fireworks were the other chief exhibits in this section. One firm exhibited chemical apparatus in porcelain, and although the articles were not yet equal to the products of Europe, we may look forward to a rapid development of this industry in the future. In group 24 Japan had three times as many exhibits of paper as any other nation. A very interesting class in which there were many exhibits was that including sea-weed products. The vegetable gelatine known as kanten is made in large quantities, and is used not only as a food, but also as a stiffening agent.

Bulgaria had a good exhibit of otto of roses, which was shown by seven producers.

Italy was chiefly represented by alcohols, pharmaceutical preparations and a good display of sulphur by the Roman Society for Sulphur.

A few other countries might be included in the list, but I must pass on to some of the independent out-door exhibits, some of which were of considerable importance. As we have seen, the lowest known temperatures were produced by Great Britain and the highest temperature hitherto known was also developed at St. Louis by Professor M. A. G. Hinalaya, of Portugal, one of our colleagues on the International Jury. He erected a large parabolic reflector for concentrating the sun's rays, and succeeded in obtaining temperatures far exceeding those of the electric arc. In fact, the exceedingly high temperature has limited Professor Hinalaya's researches, as every known substance is volatilised. The whole structure was about 40 ft. in height, the framework being V-shaped. There were 6,000 mirrors of silvered glass, each about 5 in. by 4 in., and the whole was mounted on a universal joint so that it could be turned towards the sun. Although such an apparatus might be seldom available in our climate, yet it was very effective in that of St. Louis, and might be useful in some of our Colonies.

Throughout the grounds of the Exhibition were numerous practical demonstrations of various manufacturing operations, especially those relating to metallurgy.

There was also a fully equipped laboratory of the American Cement Union, in which tests of cement were made daily. A very elaborate and complete series of tests were also made with different kinds of coal, a carload being used in each case.

The last installation to which I will refer was a large one for the manufacture of hydrogen gas for the purpose of inflating the balloons which took part in the aeronautical competitions. The process employed consisted in decomposing steam by red-hot iron turnings, which were then de-oxidised by means of producer gas. Partly owing to defective design, and partly to the lack of careful analytical supervision, the working of the apparatus was unsatisfactory, although ultimately a number of balloons were inflated.

In conclusion, I wish to thank the British Royal Commission, and especially Colonel C. M. Watson, C.B., C.M.G., the British Commissioner at St. Louis, for enabling me to obtain some of the information which I have summarised in the foregoing remarks.

#### DISCUSSION.

Sir JOSEPH SWAN said that the position occupied by England in the Exhibition was a great gratification to him. He confessed to having at one time entertained fears that they would look very small indeed as exhibitors. They owed very much to the energy and patriotism of the chemical members of the Commission and the assisting committee. In the last Report of the Commission there was given a telegram from the President of the United States to the King, wherein the President spoke of the British exhibits in the most complimentary terms, and he could not help thinking that he must have derived his impression of their excellence very largely from the Chemical Section. Many of the things referred to in the paper one would like to hear more about. For example, there was that curious apparatus for concentrating the heat of the sun, and he would ask Mr. Reid if he saw it in operation, and if he thought that the apparatus had any practical utility. He should also like to hear what his impression was of the uses of some of the novel exhibits he had referred to, such as artificial graphite, and if there was anything remarkable shown in that exhibit in size or form. In connection with the chemical uses of electricity at Niagara, did the Exhibition show any progress in the economical production of nitrates from atmospheric nitrogen, or other electrically produced chemicals of importance?

Mr. DAVID HOWARD said they had heard from many quarters that the exhibit was worthy of English industry, but whether it would ever pay any of those who took part in it in £ s. d. he did not know. He did feel, however, that it was of high importance just now, when they so often found people decrying all English industry and English efforts, and when in influential circles it was supposed that if a particular thing was foreign it must be better than if it were English. There was no doubt that it was of the greatest importance to watch most carefully all that was going on. Many of these new processes of which they had heard might prove to be of the greatest interest, and it was only by constantly watching what was going on that they could possibly keep abreast of the times.

Mr. HELM said he could thoroughly confirm Mr. Reid's statement that the English exhibit, as far as it went, was a splendid one. There were some articles there from other nations which he should like to see exhibited by England on other occasions, and he hoped that the duty-free alcohol Committee, of which they had heard so much, might lead to English manufacturers being in a position to exhibit artificial silk, and also some of the finer chemicals in which at present they did not show to much advantage. Mr. Reid had mentioned that the low temperature apparatus was the best of the British exhibits, but he had heard it said by many that it was the best exhibit in the entire Exhibition. Mr. Howard had raised the question whether exhibits of this kind paid an exhibitor. It was his firm opinion, from what he saw there, and what he had seen at Paris, that it would pay, not only the British exhibitor, but the British nation,



for going to the expense incurred. He only hoped it would lead to greater liberality on the part of the Government in the future. The British nation had no reason to be dissatisfied with what had been done, but the St. Louis Exhibition showed that there were still heights to which they might attain, and which he hoped they might reach in the future.

Mr. R. J. FRISWELL said that he should like to hear a little more about the apparatus for concentrating the sun's heat. Mr. Reid had spoken of a heat greater than that of the electric arc being obtained there. It was his lot some years ago to be engaged in an investigation of the sun and solar physics generally, and it was pretty generally held then, that the temperature of the surface of the sun was not greatly hotter than the temperature of the electric arc, and, therefore, it was difficult to see how such an excessive temperature could be obtained. He thought the explanation lay in another direction. In the electric arc the focus—the actual heated point—was extremely small, and radiation from it, of course, prevented maximum effects being seen in any kind of apparatus where the products could be obtained, and the reactions studied; whereas in the case of this vast reflector the focus was so large that losses due to radiation were comparatively small, and they got the real effects of a temperature such as that given by the electric arc.

Mr. T. TYRER said he should like to supplement from actual observation, one or two of the points to which Mr. Reid had referred. Mr. Reid had had a very difficult task before him in trying to give them an adequate idea of the vast Exhibition, which was far too big for anyone to master who went in any other capacity than that in which he and his colleague went, as jurymen. He must say with confidence that all the exhibits were adequate both to the position of the nation and of the individual exhibitors. There was fault found, however, not with the way the exhibit was put up, not with the extent of it, but it was called by some, old-fashioned. The range of British chemical industries, he admitted, was not quite as wide as some hoped for, and there was a conspicuous absence of organic products. There were many reasons for that. He was not going to anticipate the Report of the Industrial Alcohol Committee, but he had no hesitation in saying that if ever the details, the evidence, and the questionings of that Committee were printed, it would be one of the most interesting volumes which had been published for many a day. It would not show the inadequacy of the British chemists or analysts to tackle the questions before them, or the impossibility of conducting a wide class of industries under British conditions. Conditions considerably altered cases. A great deal had also been said about want of alcohol, and on that question he had on two occasions, in that place, given his views so strongly, that he had been called an agitator; but he had not modified his views in the slightest. There was no doubt whatever, that the so-called agitation about the defects of even the latest Patent Law was perfectly justified; even more than that upon the alcohol question, and education, both secondary and technical, had a good deal to do with the question of progress. He quite agreed with what Mr. Reid had said about the British, French, and American exhibits. In the German department there was the usual collectivity, without any marked indication of individuality. He had perused the German Educational Exhibition catalogue, and he found page after page full of the particular exhibits of the chemical products of the laboratories of the professors in the various towns. These exhibits covered a wide range of synthetic, pharmaceutical, dyes, intermediary and other products. He had studied the catalogue, and as germane to the great question in which some took an interest, he might say that his impression was that, in four-tenths of the whole, whether looked at as scientific products, or as coming near to, and in many cases being, technical products, alcohols, ethyl and methyl, were at some stage an absolute necessity. He again made this statement publicly, because it had been stated in print that the statement that alcohol was so largely necessary was not correct. He would conclude by saying that two pieces of literature would well repay study by any member of the Society, namely, the German

Chemical Catalogue, translated into English, and the Catalogue of English chemical exhibits, with its admirable introduction. In these would be found much of interest, which would amplify very largely and usefully, the description which Mr. Reid had given them.

Dr. J. LEWKOWITSCH said he was surprised that the author had not mentioned the Society of Chemical Industry, as without that Society there would have been no chemical exhibition at all. He asked whether the author was in a position to state who was the designer of the octagonal cases which showed off the chemical exhibits to such great advantage. As he (the speaker) had been in St. Louis, he might be allowed to touch on some points with a view to eliciting further information. Thus they might be glad to hear something about the art exhibits in the Agricultural Department in the shape of frozen butter. One of the novelties at St. Louis was the Cowper-Hewitt light. He was told the Westinghouse people employed it extensively in their drawing offices. Use of this light was also made at the Exhibition by photographers, but the photographs were not very pleasing. He did not agree with the frequently expressed view that visiting an exhibition was a waste of time; he thought that an enormous amount of information could be gained thereby. The bottles in the Chemical Department spoke their own silent language, which became very eloquent if one had an interpreter like Mr. Reid to explain. He should have liked to hear something about the question of power. Those who had visited the Paris Exhibition of 1889, would remember the great machinery hall, which was filled with reciprocating steam engines. A great revolution was observed at the Paris Exhibition of 1900, all the machinery being worked by electricity, and there were not wanting people who predicted that the steam engine would soon be put into a museum. But threatened people live long, and in St. Louis one saw as the latest development of the steam engine the turbo-generator. Those who had been on the round trip with the Society had seen the anatomy of the Parsons' turbo-engine in the Westinghouse works at Pittsburgh. In the Exhibition itself he had observed the great machines exhibited by the Westinghouse Company, and the turbo-generators made by Curtis. This was very important to chemical manufacturers, as these engines were the latest development in the generation of power, again bringing forward the steam engine in a modified form to its old rank. Rumours would have it that there would be an exhibition in Paris in about 10 years. Might one hope to see there a further development in the turbo-generator, namely, a reversible one—a consummation which had not as yet been reached?

Mr. OSCAR GUTTMANN said that the manufacture of what was now called block amber, namely, a substance resembling amber and made by pressing the leavings and cuttings, was really devised with his advice. He was consulted about it 12 years ago by the firm of Stantien and Becker, the predecessors of the Prussian Government in the ownership of the mines, and he remembered the first specimen made looking almost like tortoise shell, the cloudy part being burnt brown. The great difficulty was to produce the cloudiness since all amber, when compressed hot, became uniformly translucent. They first tried to do it by means of precipitated magnesia. Then they took ambers of varying hardness, with and without other resins of different melting points, and thereby obtained finally the optical effect on which the cloudiness depended.

The CHAIRMAN said with regard to the question of whether or no it paid manufacturers to exhibit, he thought it would sufficiently have paid if they had succeeded, as they might claim to have done, in demonstrating that Great Britain had not got behindhand in chemical industry, but still held a foremost position notwithstanding all that had been suggested to the contrary. The exhibit which had been made might possibly not be as full or as comprehensive as it was possible for this country to make, but undoubtedly it was one of which they need not feel ashamed. How was it that with the American tariffs against them, and with the feeling of opposition against

exhibitions in general, they were able to get that collection together, and how would it be possible to improve in the future? An appeal was made by the Royal Commission to the patriotism of all manufacturers, requesting them to put forth their best efforts to make a display worthy of this country. They commenced working on these lines, but they found it practically useless without one important addition. There was plenty of patriotism, but it was necessary to subsidise it; and when the Government consented to make them, through the intervention of the Royal Commission, a sufficient grant to cover the necessary expenses of exhibiting, imitating in this respect the example of Continental countries, without unduly taxing the pockets of the exhibitors then and then only did success become possible. Without that sufficient grant they would never have succeeded as they had done. If that lesson could be taken to heart, and improved upon in the future, he was perfectly sure no one would say that England was not efficiently represented, either in chemistry or in any other branch of industry. But in addition to this, once having obtained the means and having got several willing helpers, it was necessary to pay personal visits to the manufacturers in the districts in which they resided, and fully explain the scheme of the exhibit. Manufacturers with few exceptions would not come up to London to inquire about the matter, nor would they attend to printed forms of application for space which were sent to them. It was necessary in addition to visit them, and bring pressure to bear on them to exert their energies. He would mention one other point in connection with a successful display. A most essential feature in connection with the display was to rehearse the exhibits previous to sending them over. That went to the root of the success of this exhibit. All the cases were filled in this country prior to being sent; there was a number to each bottle or specimen, and a photograph was taken of the exhibit as it was intended to be installed, so that after its arrival a competent man could fill the cases, and there was no difficulty whatever in re-producing the wishes of those who had contributed. A remark had been made respecting the display of the professorial establishments in Germany; but he thought if anyone would take the trouble to look into the catalogue of the British chemical display, they would find that on this occasion the professors of Chemistry in Great Britain were certainly well to the front, and exhibited many specimens, which were not only of historical interest, but also showed that they were well alive to the requirements of chemical industry. Finally, with regard to the remark of Dr. Lewkowitsch that reference should have been made to that Society, he would venture to point out that the whole country knew perfectly well that that Society was the backbone of chemical industry in this country, and that no exhibit of chemical products could have been made unless it had obtained the full and loyal support of its members. He did not think there was an exhibitor of chemicals who was not a member of the Society. It should, however, be remembered that the Society was not represented officially as such, but only through the members who took part in the work of organisation and the exhibitors who so materially advanced the interests of the industry by their invaluable co-operation.

Mr. W. F. REID, in reply, said he had forgotten to mention that there were 110 exhibitors in the British Chemical Section, 100 of whom obtained awards, which he thought was a highly satisfactory result. With regard to the question as to the solar concentration apparatus, he might say that Prof. Himalaya had told him that he had tested the temperature by all the means with which he was acquainted against the highest temperature he knew of in the electric arc, which he believed he put at 3500° C., but, of course, it was quite impossible at such temperatures to obtain the exact value. The results he had obtained were such as could not be produced in the best electric furnaces. With regard to the practical utility of such apparatus, it was very difficult to say how far it might be used for practical purposes. He believed some small solar mirrors were at work in which a boiler was placed in the focus, and in Algeria and other places where the sun was strong, they were useful. It had been worked at since 1896. Artificial graphite could now be obtained

in very large pieces, and he had worked with these as anodes for some time. With regard to the fixation of atmospheric nitrogen in the production of nitrates at Niagara, the nitrates were not exhibited to claim an award, but he heard that the apparatus was getting beyond the experimental stage, and that it was actually producing quantities which might be called commercial. Beyond that he could not go, because it was not yet on the market, and some very high authorities claimed that nitrates could not be made economically by this process. He had recently received a letter from St. Louis which might be interesting to traders as bearing on the question of the utility of such exhibits. The following was an extract:—

"All the representatives of the Government Institutions I have seen lately have said, Why do not your exhibitors send us their price lists and quotations, for instance, all our fine reagents we have to buy abroad from Germany, and we would rather trade with England. We are large consumers, good payers, and we have no duties to pay." Probably those in the trade might know more about it, but it seemed to him that to send circulars to those interested might be of some use. Mr. Helm's statement that the low temperature exhibit was the best chemical one in the whole exhibition was quite correct, although the Mallinckrodt exhibit was the best display of chemicals. He might say he cordially agreed with Mr. Tyrer on such questions as education, free alcohol, and most of the other points he mentioned. As to the German literature, that was very well done indeed. There was only one nation which worked out the literature more perfectly in some respects, and that was Great Britain. With regard to Dr. Lewkowitsch, he felt he must accept his reproof. He ought certainly to have mentioned, what the Chairman had now done, the part the Society played in the question, but perhaps it was so obvious that it was hardly necessary to refer to it. With regard to the octagon cases, the first idea he heard of them was from Mr. Tyrer long before they came into being, and he was told that the idea came from the form of an elevator on the Underground Railway. With regard to the butter statuary, it was really very beautiful, and as a member of the Jury he had an opportunity of ascertaining that it was really butter. Of course, precautions were taken to keep a sufficiently low temperature. The Cowper-Hewitt mercury light was used a great deal at St. Louis. With regard to power he certainly might have mentioned the latest advances in that direction, but he had already referred to the subject in the paper which he recently read before the Society of Arts. Mr. Guttman's name was not mentioned in connection with the amber, and he did not know that he had been associated with this development of the amber industry. He got the whole of his information from the official description of the industry, and he met the geologist in charge of it who told him that the cloudiness in the amber was attributed to the juice of the tree—the original sap—getting mixed with the resin at the time of exudation, and they had tried to put some kind of moisture into the amber in order to produce this cloudiness in compressing it.

## Sydney Section.

ERRATA.

### THE BACTERIAL ORIGIN OF VEGETABLE GUMS. PART II.

BY R. GREIG SMITH, D.Sc.

(This J., 1904, 972—975.)

#### DISCUSSION.

Page 975, col. 2, line 31, for "One could always infer," read "One could not always infer."

Page 975, col. 2, line 33, for "cell aggregates or higher plants," read "cell aggregates of higher plants."



# Journal and Patent Literature.

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## I.—PLANT, APPARATUS, MACHINERY.

### ENGLISH PATENTS.

*Superheating Steam; Apparatus for* —. A. Bolton. Manchester. Eng. Pat. 26,822, Dec. 8, 1903.

THE invention relates to the class of superheaters described in Eng. Pat. 6459, of March 17, 1902. An improvement is effected by dividing the superheating box into three compartments by means of an arched diaphragm, two of the compartments acting as inlet and outlet for the steam, whilst the third acts as an intermediate chamber. Holes are drilled through the arched diaphragm, and tubes open at both ends inserted in these corresponding holes, but of larger diameter, are drilled in the bottom of the box plate, and other tubes, closed at the bottom end, inserted through these to surround the first tubes. Each row consists of tubes of different diameters, the larger tubes being placed behind the smaller ones in a direct line, or in zig-zag fashion.—L. F. G.

*Semi-liquids; Means for Drying* —. A. J. Oxford. Walton-on-Trent, and S. H. Buxton, Burton-on-Trent. Eng. Pat. 28,087, Dec. 22, 1903.

INSIDE a closed heating chamber is placed a pan, into which the semi-liquid is conveyed from outside, and from which it is distributed to various troughs. Each of these troughs abuts against the exterior of a revolving cylinder which in revolving spreads out upon its surface the liquid, which soon dries up there. The surface of the cylinder has soon becomes encrusted, and the dried matter is subsequently scraped off and collected by suitable means. The top of the chamber enclosing the pan, drying cylinders, &c., is provided with a flue with regulating amper.—L. F. G.

*Drying and otherwise Treating Materials by Air and other Currents; Process and Apparatus for* —. H. H. Lake, London. From E. N. Trump, Syracuse, U.S.A. Eng. Pats. 28,594 and 28,595, Dec. 29, 1903.

SEE U.S. Pats. 748,894 and 748,893 of 1904; this J., 1904, 111.—T. F. B.

*Centrifugal Separators; Impts. in* —. R. H. Haylock, London. Eng. Pat. 2792, Feb. 4, 1904.

THE claim is for an improved type of separator for separating water, dust, soot or oil from air, or other gases. The gases are led tangentially into a vertical cylindrical

chamber provided with a conical bottom with the apex uppermost, and the solid particles separating are drawn off through an outlet placed at the circumference of the bottom. A vertical pipe passes through the top of the cylinder and projects some distance inside, and the purified gases escape through this. The sides of the chamber may be provided with spiral ribs, and liquid may be sprayed in to facilitate the settling of solid particles.—L. F. G.

*Filtering Liquids; Apparatus for* —. W. Reeves and B. Bramwell, Belfast. Eng. Pat. 3050, Feb. 8, 1904.

THE filtering apparatus consists of a spherical chamber mounted on two hollow trunnions. Through one trunnion passes the inlet-pipe for the liquid to be filtered, and projects to some suitable height inside the chamber. Through the other trunnion passes the delivery pipe, which communicates with the bottom of the chamber, and above which is placed a bed of filtering material. The liquid enters through the inlet-pipe, flows through the filtering material, and away through the delivery pipe. To clean the filter-bed, a cleansing liquid is admitted, and the chamber revolved on its trunnions, the particles of the filter-bed then fall through the liquid and get washed.—L. F. G.

*Filter Press Plate*. C. A. Allison, London. From the Niles-Bement-Pond Co., Jersey City, U.S.A. Eng. Pat. 23,942, Nov. 5, 1904.

SEE U.S. Pat. 776,024 of 1904; this J., 1905, 20.—T. F. B.

*Registering by Electrical Means; the Progress of Several Physical Processes; Apparatus for Automatically* —. Siemens Bros. and Co., Ltd., London. From Siemens and Halske, Berlin. Eng. Pat. 17,528, Aug. 11, 1904.

THE pointer of an electrical measuring instrument is provided with a marking style, which registers the position of the pointer upon a band of paper at certain regular intervals of time. By means of suitably arranged contact wheels, the electrical measuring instrument is connected successively to one of several circuits; the several physical processes being related to these separate circuits. The application of the apparatus to the case of electrical pyrometers registering the temperature of several furnaces is described.—E. S. H.

### UNITED STATES PATENTS.

*Heating Fluids; Apparatus for* —. B. W. Davis, Phillips, Wis. U.S. Pat. 777,083, Dec. 13, 1904.

A COIL or vertical series of communicating inclined

sections is so arranged that the highest part of one convolution or section is situated in a horizontal plane above the plane in which the lowest part of the convolution or section next above is situated. The whole is surrounded by a heating chamber. The liquid enters the coil at the top and is drawn off at the bottom, flowing in the opposite direction to that in which the heating medium flows.—W. H. C.

*Multiple-Effect Evaporating Apparatus.* S. M. Lillic, Philadelphia, Pa. U.S. Pat. 777,114, Dec. 13, 1904.

CLAIM is made for the combination of three or more horizontal and parallel units or "effects," which have the steam-chambers of adjacent "effects" at opposite ends, with valved passages between the steam and evaporation chambers of adjacent "effects." Valved pipes are arranged to supply the heating agent to the steam-chambers and the liquid to be evaporated to the vapour-chambers at either end of the series, and condensers for the evolved vapours, and valved outlets for the concentrated liquid are also placed at either end. The liquid flows through the series in one direction and the heating agent in the other. The vapour from one or more "effect" may be taken to the steam-chamber of the next. The arrangement in which the steam enters the hottest and the vapour leaves the coolest effect is also claimed.—W. H. C.

*Concentrator for Solutions.* J. U. Lloyd, Norwood, Ohio. U.S. Pat. 777,115, Dec. 13, 1904.

A CONCENTRATING tank has a heating coil therein, and a cooling coil situated beneath the heating coil, the supply of heating and cooling media for the heating and cooling coils respectively, being controlled by valves. A series of "steeping tanks" is combined with the concentrating tank and a condenser, vapour-pipes leading from the concentrator and steeping-tank to the condenser, and return liquor-pipes from the condenser to the concentrator and steeping-tank, and from the bottom of the steeping-tank to the concentrator. Steam is supplied to the coils of the concentrator and to the steeping-tank by independent connections, controlled by valves.—W. H. C.

*Drier.* J. Scott, Assignor to E. P. Mueller, Milwaukee, Wis. U.S. Pat. 777,225, Dec. 13, 1904.

IN a drying chamber are arranged vertical series of rows of horizontal, perforated pipes, closed at one end, the other ends extending beyond the chamber and opening into an adjacent chamber supplied with hot air. Through the walls of the drying chamber, rods extend, carrying at their ends reciprocating rakes, the teeth or blades of which hang down between the perforated pipes. The feed hopper has toothed feeding rolls which as well as the rods of the reciprocating rakes are worked by a system of gearing situated outside the chamber.—W. H. C.

#### FRENCH PATENTS.

*Carbon Tetrachloride and Analogous Liquids; Use of —, as Generators of Motive Power.* A. Verley. Fr. Pat. 339,134, Oct. 29, 1903.

ON account of the low boiling point, low latent heats of evaporation, high molecular weights and non-inflammability of carbon tetrachloride, chloroform, and carbon tetrabromide, it is proposed to employ these liquids instead of water in motive engines and vapour turbines.—L. F. G.

*Drying of Pasty and Liquid Substances; Apparatus for the Rapid —.* A. Huillard. Fr. Pat. 346,185, Aug. 30, 1904.

SEE Eng. Pat. 24,931 of 1904; this J., 1904, 1079.—T.F.B.

*Evaporating Apparatus; Vacuum —.* T. Suzuki. Fr. Pat. 346,078, Sept. 6, 1904.

SEE Eng. Pat. 19,186 of 1904; this J., 1904, 1202.—T.F.B.

*Gaseous Mixtures; Process for the Separation of —.* C. Clamond. Fr. Pat. 346,195, Sept. 12, 1904.

This method for the separation of gaseous mixtures consists essentially in passing the mixture under pressure through a tube, and then periodically interrupting the flow. The periodic interruptions throw the mixture into waves or zones, one zone being rich in one gas and a second rich in another gas. During the period of repose, or near to this period, each gas is extracted by taking it from the zones in the tube where it is separately accumulated. The separation is brought about by the different kinetic energies of the particles of the gas, caused by the different densities of the constituents. The form of apparatus is also claimed and consists of a first interrupter or tap, which is turned so as to bring about the periodic interruptions in the principal column of the gas. One or more interrupters or taps are also turned and act alternately with the first, that is to say, while the first is open the others are closed and alternatively. The latter taps permit of the escape of the gases from the zones of the pipes where they have accumulated, and a separation of the gases is thus effected.—B. N.

## II.—FUEL, GAS, LIGHT.

*Gasification of Vegetable Combustible Matters and Generation of Economical Motive Power for Agricultural Purposes.* L. Bordenave. Comptes rend., 1904, 139, 1046–1048.

THE author has carried out experiments at Menier's works in Noisiel, on the utilisation of various vegetable substances; such as straw, leaves, sawdust, &c., in the production of gas for use in motors for weak gas. Farmers as a rule obtain the power they require from coal, consumed in locomobiles or fixed motors, the quantity of fuel required, and the net cost, being respectively 3.4 kilos. and 20.30 centimes per effective horse-power-hour. The author finds that a great saving in cost would result if the coal were replaced by the said waste vegetable substances, gasified in a generator provided with a reducing column of vegetable charcoal or coke (compare Eng. Pat. 27,533 of 1902, this J., 1903, 411). The weak gas generated being consumed in suitable motors; and the favourable results obtained in his experiments point to the advisability of establishing central power-stations, each capable of meeting the requirements of a certain number of farmers, using 40.50 h.p. or more. In the experiments, a 70 h.p. installation, comprising a generator and a motor of the kinds mentioned above, was employed, the results being as follows:—(1) Inferior hay, from marshy meadows. Consumption per h.p. hour, 1.02 kilos. Calculated net cost per h.p. hour, 5.6 centimes. (2) Wheat straw. Consumption, 1.05 kilos. Net cost, 6.3 centimes. The net cost, using oat straw, was 5.7 centimes. (3) Fallen beech leaves. Consumption, 0.59 kilo. Net cost, 4.3 centimes. Chestnut and plane-tree leaves gave practically the same remarkable results. (4) Sawdust and shavings. The net cost per h.p. hour was about 5 centimes, the consumption being 1.80 kilos. in the case of sawdust, and 1.35 kilos. in the case of shavings.—H. B.

*Sulphur in Gas; Determination of —.* W. B. Calkins. XXIII., page 108.

*Dyeing; Economies in —.* [Illuminating Gas from Waste Soap Baths]. E. Harter. V., page 85.

#### ENGLISH PATENTS.

*Fuel, Artificial; Manufacture of —.* W. B. Hartridge, Croydon, Surrey. Eng. Pat. 26,974, Dec. 9, 1903.

IN making briquettes from coal, resins, lime, and liquid hydrocarbons, the lime is permitted to act on the last-named, and/or the resins only in presence of the coal and under the conjoint influence of heat and agitation, the reaction then occurring increasing the binding properties of the mixture. The ingredients are preferably heated separately, the coal to about 200° F., and the hydrocarbons to about 300° F., the lime being slaked with boiling water; and the whole is kneaded together in a mixer until thoroughly incorporated (6–8 minutes), and pressed while hot.—C. S.



*Fuel Blocks or Briquettes; Manufacture of* —. H. S. Gerdes, junr., Bremen, Germany. Eng. Pat. 14,389, June 25, 1904.

SEE Fr. Pat. 344,225 of 1904; this J., 1904, 1141.—T. F. B.

*Coke and Gas; Manufacture of —, the Construction of Coke-Ovens and Gas-Retorts, and the Recovery of By-Products from same.* J. T. Key, Fencehouses, Durham. Eng. Pat. 576, Jan. 9, 1904.

THE coke-ovens are constructed upon iron foundations supported upon columns, and are provided with removable bottoms, which can be lowered upon carriages, running on rails, and pushed aside when the ovens are to be discharged. The ovens may be otherwise of the beehive type; or they may be surrounded by a space in the brickwork, into which the gases liberated are led and burned along with air to maintain an intense heat within the oven; or, again, the products of the distillation may be led off for the recovery of ammonia, &c., and the washed gas led back to be burned with air in the heating space, as just described. The arrangement may be used as a gas retort, by reducing the height of the carbonising chamber and using producer gas as the combustible in the heating space. —H. B.

*Coke; Method of Producing Superior —, in Connection with Gas Works and the like.* J. R. Breckon, Sunderland. Eng. Pat. 24,293, Nov. 10, 1904.

COAL is placed in suitable ovens provided with flues in the sides, through which a burning mixture of gas and air circulates. The gas given off during coking is led to the main gas-pipe of the works, and the ordinary means are provided for charging and for drawing the coke.—L. F. G.

*Liquid Hydrocarbons; Burning of* —. P. and F. P. Davies, Southfields, Surrey. Eng. Pat. 27,361, Dec. 14, 1903.

ONE or more atomising burners discharge the liquid fuel into the larger end of an open truncated cone, wherein it is ignited, the flame issuing from the further end of the cone in the form of a tongue. For certain purposes, where a gentle flame is required, an attachment is fitted on the narrow end of the cone, consisting of a hollow bulb terminating outwardly in a short open cylinder and fitted with an internal cone serving as a deflector, the point of this cone being turned towards the burner nozzle. —C. S.

*Liquid Fuel; Apparatus for Burning* —. P. and F. P. Davies, Southfields, Surrey. Eng. Pat. 27,362, Dec. 14, 1903.

THE invention comprises an initial starter, formed of a steam generator enclosed in a casing, which serves as a combustion chamber, and heated by a burner or feeder connected with the steam space of the generator. Similar connections lead from this steam space to the main burner. Air for supplying the starter is pumped into the water space in the generator and passes through the connections leading to the starting burner, where it atomises the liquid fuel.—C. S.

*Burning Liquid Fuel; Apparatus for* —. W. Cunningham. Eng. Pat. 25,706, Dec. 18, 1903 (under Sect. 2 of Pat. Act., 1888).

AN oil-supply pipe is led through an annular chamber, and is connected by a U-joint to a vertical tube leading downwards and through the chamber, the lower end of this tube being furnished with a cap, for cleaning purposes. A horizontal pipe leads from this tube to another U-tube, which again passes downwards into the annular chamber, and is also capped. Another horizontal pipe leads from this to a similar U-tube, which terminates with an open end in the chamber. Air is forced through the central hole of the box, and passes through another U-tube into the chamber. The mixture of oil gas and air escapes from the annular chamber through a series of holes arranged round the central hole, becomes ignited, and heats the U-tubes so as to vapourise the oil contained in them. The apparatus is started by making a small fire in the centre among the

tubes by means of petroleum spirit or shavings. Regulating devices are provided, and the apparatus can be adapted to a furnace. It is claimed that the apparatus can be very easily cleaned on becoming choked.—L. F. G.

*Carbonic Acid; Production of* — [from Gases of Combustion]. G. A. Schütz, Wurzen, Saxony. Eng. Pat. 25,867, Nov. 26, 1903.

A STEAM boiler containing water, as pure as can be obtained, is heated by a coke fire, and the steam is employed to drive a non-condensing engine. The gases of combustion of the coke fire, pass first into a scrubber, filled with coke and sprayed with cold water, whence they are pumped into a similar tower, down which warm water trickles. The heated and moistened gases then enter the bottom of an "absorption tower" filled with coke, on to which a cold solution ("lye") of sodium or potassium carbonate trickles, and absorbs the carbon dioxide and moisture in the gases. On subsequently heating the alkaline liquid by the exhaust steam from the engine, carbon dioxide is set free and collected, and the steam is condensed, and thus "the whole of the necessary purified water for the steam boiler, is continuously produced by the apparatus itself." (Compare Fr. Pat. 323,554 of Aug. 7, 1902; this J., 1903, 495.)—E. S.

*Gas; Manufacture of —, and Producers therefor.* E. Schweich, London. Eng. Pat. 26,596, Dec. 4, 1903.

IN working a gas producer by downward draught, a supplementary supply of fuel and a supplementary air-, or air- and steam-blast is introduced into the lower part of the producer, for the purpose of maintaining a lower zone of combustion in which there will always be ample fuel present to combine with the oxygen of the air admitted thereto. The producer described, comprises a large central chamber and two small side chambers, the former extending above the side chambers and opening at its lower end into a space common to the three chambers. All three chambers are provided with fuel hoppers and blast inlets. The central chamber acts as the downward draught producer.—H. B.

*Gas Producers.* L. Mond, London. Eng. Pat. 28,031, Dec. 21, 1903.

THE producer described in Eng. Pat. 12,440 of 1893 (this J., 1894, 938), in which an "iron cylinder in the form of a truncated cone" extends downwards from the fuel hopper into the producer, is modified by providing openings in the cylinder, through which gases and vapours may pass without descending into the incandescent fuel. The openings may be fitted with adjustable slides or flaps, to permit of varying their size at will. The wider the openings, the more fluid is the tar obtained from the producer, and *vice versa*.—H. B.

*Coal Gas; Manufacture of* —. J. Y. Johnson, London. From the Deutsche Continental Gas-Ges., and J. Bueh, Dessau, Germany. Eng. Pat. 1393, Jan. 19, 1904.

SEE Fr. Pat. 339,534 of 1904; this J., 1904, 709.—T. F. B.

*Water Gas; Manufacture of* —. L. Guénot, Paris. Eng. Pat. 11,105, May 13, 1904. Under Internat. Conv., May 14, 1903.

IN the process described, the changes from the "make" to the blast periods, and *vice versa*, are effected automatically by the rise and fall of the gas-holder. The producer is provided at its lower portion with two air-inlet pipes, and at the top with an outlet pipe leading the waste gases to a chimney, these three pipes being controlled by water-sealed bells attached to a frame which is suspended from one end of a balance-lever. When the lever rises, the air inlets and the waste-gas outlet are opened simultaneously, and the draught of the chimney draws air through the fuel. In the upper part of the producer is arranged checker-work which is heated by the waste gases, and at the bottom is an outlet for water-gas, communicating with a gas-holder. When the balance-lever falls, the three pipes mentioned above are closed, water is admitted from above on to the hot checker-work, and the steam generated, on passing down through

the fuel, produces water-gas which flows out at the bottom to the gas-holder. From the other end of the balance-lever is suspended a small tank, connected by flexible tubing with a small tank on the top of the gas-holder. When the latter rises, water flows from the small tank into that suspended from the lever until at a certain point the lever is caused to swing down, stopping the water supply to the producer and opening the air inlets and waste-gas outlet. The successive periods are thus controlled by the movement of the gas-holder, and the quantity of water-gas produced is regulated by the consumption. To prevent excessive prolongation of the blast period, a thermostatic device is connected to a damper in the chimney, and closes it more or less completely if the temperature of the waste gases rises too far.—H. B.

*Producer Gas Free of Tar, and of High Burning or Colorific Value: Process and Apparatus for obtaining —.* A. Desgraz, Hanover, Germany. Eng. Pat. 24,333, Nov. 10, 1904

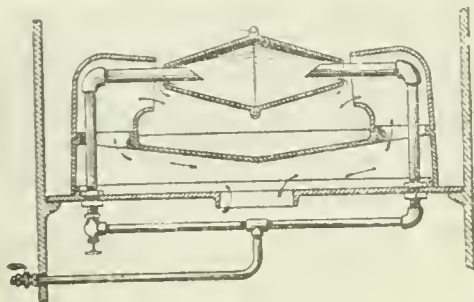
INTO the space above the fuel in a down-draught producer there is led a mixture of producer gas (or other combustible gas) with an excess of heated air, the combustion of which generates the heat for starting and maintaining the combustion of the fuel fed into the producer. The apparatus used may consist of a main producer and an auxiliary producer, the latter furnishing the gas required for admission to the main producer, the wall which separates the two producers being provided with passages through which the air supply flows and becomes heated.—H. B.

#### UNITED STATES PATENTS.

*Coal Briquettes: Process of Making —.* J. W. Barnes. Assignor to C. G. Hobson, Philadelphia, Pa. U.S. Pat. 778,096, Dec. 20, 1904.

GRANULATED coal, molasses and water are mixed together in certain proportions, formed into briquettes, and dried at a temperature of 280°–300° F. They are then sprinkled with a mixture of paraffin and hot water, and again dried.—L. F. G.

*Hydrocarbon Furnace.* E. W. Jackson, Sansalito, Cal. U.S. Pat. 777,789, Dec. 20, 1904.



THE furnace (see figure) consists of a hollow base provided with upturned hollow hoods, through which pass oil-supply pipes ending in horizontal extensions. A revolving retort is loosely mounted on these extensions, its extremities being of larger diameter than the extensions so as to permit the vapours to escape. Air enters the hollow base through an opening in the bottom, and is blown through the hoods against the escaping vapours.—L. F. G.

*Gas-Generating Apparatus.* W. H. and G. E. Russell, Jersey City, N.J., Assignors to Internat. Gas Power Co., New York. U.S. Pat. 777,545, Dec. 13, 1904.

THE apparatus consists of a generator, in which a mixture of hydrogen and air is produced, a carburetter through which the gaseous mixture passes, a pump and reservoir for the supply of carburetting liquid, a filter for the carburetted gas, and a gasholder. The hydrogen generator comprises a reciprocating bell, working in an annular water-seal in an open double-walled tank, an open-topped copper vessel standing in the tank under the bell, a per-

forated copper holder suspended from and insulated from the crown of the bell and depending into the open-topped vessel, a spring contact between the latter vessel and the copper holder, a pipe for admitting air to the generator when the bell ascends, and an outlet pipe leading the gaseous mixture to the carburetter.—H. B.

*Gas: Apparatus for the Manufacture of —.* H. S. Elworthy, Assignor to E. H. Williamson, London. U.S. Pat. 777,848, Dec. 20, 1904.

SEE Eng. Pat. 12,461 of 1902; this J., 1903, 900.—T. F. B.

*Hydrogen Generator [for Gas Manufacture].* H. S. Elworthy, Assignor to E. H. Williamson, London. U.S. Pat. 778,182, Dec. 20, 1904.

SEE Eng. Pat. 12,461 of 1902; this J., 1903, 900.—T. F. B.

*Water Gas Generator.* A. G. Glasgow, London, Assignor to United Gas Improvement Co., Philadelphia. U.S. Pat. 778,778, Dec. 27, 1904.

SEE Eng. Pat. 6311 of 1903; this J., 1903, 860.—T. F. B.

#### FRENCH PATENTS.

*Alcohol: Manufacture of —, for Illuminating Purpose.* B. Plehn. Fr. Pat. 345,777, Aug. 23, 1904.

A SUITABLE spirit is obtained by mixing 70–95 parts of 90 per cent. alcohol with 30–35 parts of higher benzene hydrocarbons of boiling point 160°–180° C.—L. F. G.

*Alcohol: Process for Denaturing —.* T. Heidlberg. Fr. Pat. 346,152, Sept. 9, 1904. XVII., page 101.

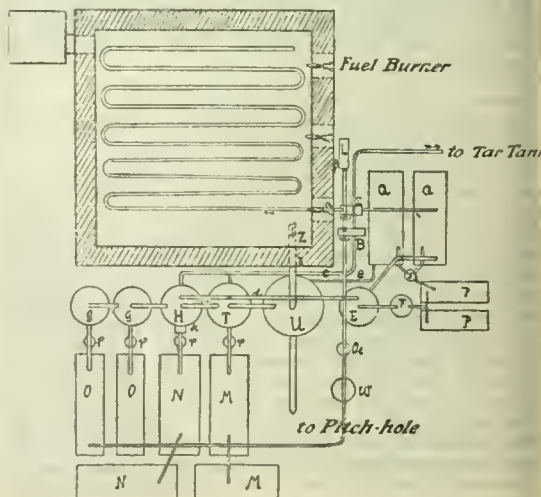
*Oil Gas: Process for the Production of —.* F. G. C. Rincker and L. Wolter. Fr. Pat. 346,092, Sept. 6, 1904.

SEE Eng. Pat. 20,371 of 1904; this J., 1904, 1141.—T. F. B.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

*Tar: Continuous Distillation of —.* O. Löw-Beer. Z. angew. Chem., 1905, 18, 8–11.

THE author states, as the result of practical experience, that the Lennard continuous tar-distilling plant has been so improved, that it differs in many respects from the apparatus originally patented (Eng. Pat. 844 of 1891; this J., 1892, 151). A diagrammatic plan of the process is shown in the figure. The cold tar is forced by means of the pump B first through a sieve which retains solid impurities, and then through the tube c into the condensers T and H, where it serves as a cooling liquid, and becomes heated to





a sufficient degree to give off the ammoniacal water it contains and a portion of the light naphtha. The heated tar passes next through the tube d into the "tar scrubber" E, which consists of a tower packed with fire-brick rings. At the beginning of the process, before the condensers T and H are in operation, the scrubber E is heated by means of superheated steam. The ammoniacal water and light naphtha from E are condensed in F, and pass to the tanks P P. The dehydrated tar then passes to the hot tar reservoirs Q Q, any volatile products escaping being condensed in the cooling-coil s. From Q Q the tar is forced by the pump r into the distillation apparatus, consisting of two rows of coils of cast-iron piping arranged in a furnace. The tar enters at the coolest part a, in the upper row of coils, and leaves at the hottest part Z in the lower row, about 460 mm. below a. The diameter of the pipe is larger at Z than at a, to allow for the expansion of the tar. The furnace is heated by means of liquid fuel or generator gas. The tar leaves the still at a temperature of about 300° C., and passes to the "pitch-scrubber" U, where it meets a current of superheated steam at a temperature of about 300° C., whereby all volatile products are expelled; the residual pitch flows from the bottom of the scrubber to the pitch-hole. The volatile products pass in succession first through the condensers T and H, cooled by the cold tar, as mentioned above, and then through the water-cooled coils g g. The anthracene oil is condensed in T, and the cresote oils in H, and in the condenser k surrounded by warm water; the condensed oils pass to the tanks M M and N N respectively. The light oils are condensed in g g and are collected in the tanks O O. It is stated that the condensing action of the tar in T and H can be so regulated, that products of constant sp. gr. can be obtained during several months. The whole system is worked under a vacuum of about 550 mm., and in order to avoid loss of volatile products, a water-tower w, and an oil-tower Oe are interposed between the vacuum-pump L and the condensers. Siphon-tubes pp are provided, by means of which samples can be taken without disturbing the vacuum. It is stated that the whole apparatus can be worked by one man.—A. S.

*Dimethylantracenes*; Three —, obtained by the Reaction of Methylene Chloride and Aluminium Chloride on Toluene. J. Lavaux. Comptes rend., 1904, 140, 44–45.

By the reaction of methylene chloride and aluminium chloride on toluene, the author has produced and isolated three dimethylantracenes. As their constitution is not yet determined, he provisionally designates them A, B and C. Their respective melting-points are 240°, 244·5 and 86° C. In applying Friedel and Crafts' reaction, the yield is greatly increased if the temperature be so regulated as to be always just below that at which a rapid evolution of hydrochloric acid gas occurs; the gas should, in fact, be evolved only on agitation, and this agitation should be almost continuous. Another point is, that instead of distilling the whole of the mass obtained by treating the product of the reaction with water, it is better to separate any solid substance by decantation and filtration with the pump, recovering by distillation only the small amount dissolved in the water.—J. T. D.

*Dibromoanthracene tetrabromide*. P. Kaufler and M. Imhoff. Ber., 1904, 37, 4706–4709.

On heating dibromoanthracene tetrabromide to 206° C. until the liberation of bromine and hydrogen bromide ceases, and crystallising the product from hot benzene, the authors obtained tetrabromoanthracene melting at 298–300° C., whilst from the mother liquor tribromoanthracene melting at 171° C. was separated. On oxidation, ditromoanthraquinone (m. pt. 289°–290° C.) was obtained from the tetrabromo derivative and bromoanthraquinone (m. pt. 201°–202° C.) from the tribromo compound. Experiments made to establish the constitution of the new dibromoanthraquinone have shown it to be identical with 2,6-dibromoanthraquinone obtained by the bromination of 2,6-diaminoanthraquinone.—D. B.

*Petroleum Residues [Mazut]; Possibility of Ascertaining Yield and Quality of Lubricating Oils from the Quality*

of —. K. Charitschkow. Westnik shirov.weshtsch, 1904, 5, 150; Chem.-Zeit., 1904, 28, Rep., 392.

Grosny petroleum residue is deeper in colour and more viscous than that from Baku oil, the viscosity ratio at 50° C. being 12.5 : 5.2, and belongs to the group ("Kaukasit") arranged by the author, and comprising residues which are easily decolorised by sulphuric acid as a consequence of the decomposition of their resinous constituents. The solution in benzene, when treated with sulphuric acid, clarifies and exhibits dichroism. To determine whether any definite connection exists between the high density and viscosity of these residues and their high percentage of resins, the author employed a method of hot purification, the usual methods of eliminating the resins being difficult of application. The residue is heated to 70–80° C., and is treated with small successive portions of sulphuric acid until the resin-free hydrocarbons have a greenish colour, the viscous black deposit of resins being easily removed. Provided no acid reaction products are present, the purified oil does not emulsify in the subsequent alkali treatment and washing. A sample of residue, treated in this way, had the sp. gr. 0.944 at 15° C., and the viscosity (Engler) 14' 20" at 50° C. After treatment with 30 per cent. of sulphuric acid, the product consisted of 67.5 per cent. of acid resin ("goudron") and 60 per cent. of a greenish brown oil of sp. gr. 0.912 at 15° C., and the viscosity 5' 15" at 50° C. This shows that the residue from Grosny petroleum is similar, when refined, to that from Baku oil, and that its specific properties are due to the large proportion of contained resins. When freed from the "solar oil" fractions, the oil has about the same viscosity as engine oil. By means of the method specified it is possible to ascertain the suitability of a residue for the production of lubricating oils, but the resulting oils will need to be rectified by steam or *in vacuo*. It is also applicable to the refining of highly viscous oils and where the acid residue is intended as an asphaltum substitute.—C. S.

*Wood-Tar Pitch; Behaviour of —, with certain Organic Solvents*. B. M. Margosches. XXIII., page 107.

#### ENGLISH PATENTS.

*Hydrocyanic Acid and Cyanides; Manufacture of — [from Gas Liquor]*. G. E. Davis. Eng. Pat. 3018, Feb. 6, 1904. VII., page 90.

*Sulphate of Ammonia Saturators*. K. Zimpell, Stettin, Germany. Eng. Pat. 23,379, Oct. 29, 1904. Under Internat. Conv., March 30, 1904.

IMPROVEMENTS are claimed in the saturator described in Eng. Pat. 6891 of 1904 (this J., 1904, 660). In the saturator tank is suspended a bell, the top of which forms the base of the auxiliary saturator tank; this latter is open at the top, and has a short central pipe extending upwards from its base, and connecting it with the bell. This pipe is covered by a small bell, the lower edge of which is serrated, and which passes below the acid level of the auxiliary saturator tank; this bell is fixed to the vertical pipe which conveys the ammoniacal gases to the main saturator. A third bell covers the former (small) bell, and is likewise fixed to the vertical pipe; it is provided with a gas outlet and an acid funnel, and extends to the bottom of the auxiliary saturator, openings being provided near the base, so that the acid within and without the bell may maintain the same composition, thus allowing the progress of the reaction to be easily examined, and also ensuring a continuous and regular overflow of acid through the pipe which is provided in the side of the auxiliary saturator.—T. F. B.

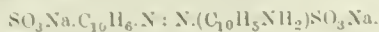
#### IV.—COLOURING MATTERS AND DYE STUFFS.

*Ammonium Nitrite (or nascent Nitrogen) and Ammonium Nitrate (or nascent Nitrous Oxide); Reaction of —, on Aromatic Compounds*. W. Vaucl. Chem.-Zeit., 1904, 28, 1245–1246.

When to an aqueous solution of a mixture of sodium nitrite and ammonium chloride at 60°–70° C. are added various aromatic compounds, the final result of the reactions occurring depends on the particular compound used; but the initial stage seems to be in all cases the formation of a nitroso-compound by substitution of NO for a hydrogen atom.

Aniline forms besides aminoazobenzene, other decomposition products, but no diazo-compounds could be recognised as intermediate products.

*Sodium naphthionate*: A dyestuff is formed with the formula:—



Dimethyl-aniline and the phenols yield nitroso-compounds.

Pyrogallol absorbs nitrous oxide gas, though without losing its power of absorbing oxygen—a fact of importance in gas-analysis.—I. T. D.

*Dibromo-1.5-diaminoanthraquinone; Constitution of* —.

R. Scholl and A. Krieger. Ber. 1904, 37 4681–4686.

CRUDE dibromo-1.5-diaminoanthraquinone was converted by means of cold nitric acid of sp. gr. 1.50–1.52 into the corresponding dinitrodinitramine. By treatment with alcoholic hydrochloric acid the admixed nitrated nitramine from unbrominated diaminoanthraquinone was converted into the diamino compound, which was separated from the brominated nitramines by its insolubility in ammonia solution, in which the latter were dissolved. On standing, the ammonium salt of 4.8-dinitro-2.6-dibromo-1.5-dinitraminoanthraquinone separated out leaving a similar tetrabrominated compound in solution. It was "denitrated" by the action of phenol in sulphuric acid, forming 2.6-dibromo-4.8-dinitro-1.5-diaminoanthraquinone, which on reduction with potassium sulphide yielded 2.6-dibromo-1.4.5.8-tetramino-anthraquinone. The same substance is obtained directly from 2.6-dibromo-4.8-dinitro-1.5-dinitraminoanthraquinone by reducing the ammonium salt by means of hot aqueous hydrogen sulphide or by phenylhydrazine. The product forms blue crystals with a bronzy lustre very similar in appearance to indigo; it is almost insoluble in ordinary solvents, which can be crystallised from aniline or quinoline. As it does not react with phenanthrene, the constitution given is deduced by the authors, from which it follows that the product from which they start is 2.6-dibromo-1.5-diaminoanthraquinone. Cotton fabrics are dyed in pure indigo shades by immersion in a solution of the ammonium salt of 2.6-dibromo-1.5-dinitramino-4.8-dinitroanthraquinone and subsequent exposure to an atmosphere of hydrogen sulphide, 2.6-dibromo-1.4.5.8-tetraminoanthraquinone being formed on the fibre.

—E. F.

2.6-Dibromo-4.8-dinitro-1.5-dinitramino-anthraquinone; Behaviour of the Nitramine Group during the action of Aromatic Bases on —. R. Scholl and A. Krieger. Ber., 1904, 37, 4686–4692.

On boiling 2.6-dibromo-4.8-dinitro-1.5-dinitramino-anthraquinone with aniline for some hours and cooling, crystals of azophenine and of a blue dyestuff separate out. The latter is more soluble in nitrobenzene than azophenine, and hence they can easily be separated. After removing small quantities of a green dyestuff by washing with benzene, the product was recrystallised from nitrobenzene. It was found to be 2.6-dibromo-1.5-diamino-4.8-dianilinoanthraquinone. With 100 per cent. sulphuric acid at 40° C. it forms a sulphonic acid, soluble in water, which dyes wool in fast, greenish-blue shades. On warming 2.6-dibromo-4.8-dinitro-1.5-dinitramino-anthraquinone to 100° C. with aniline for half an hour, a green solution is obtained, from which a green dyestuff and aminoazobenzene can be separated. The green dyestuff has the composition  $\text{C}_{38}\text{H}_{26}\text{O}_2\text{N}_8\text{Br}_2$  and is probably 2.6-dibromo-4.8-dianilido-anthraquinone-1.5-bisazo-anilide

$$(\text{C}_6\text{H}_5\text{NH}) (\text{Br}) (\text{C}_6\text{H}_5\text{NH.N}_2\text{C}_6\text{H}) \begin{matrix} \text{CO} \\ \diagup \quad \diagdown \\ \text{C}_6\text{H} \end{matrix} \text{C}_6\text{H} (\text{C}_6\text{H}_5\text{NH})$$

(Br) (C<sub>6</sub>H<sub>5</sub>NH.N<sub>2</sub>). By heating on the water-bath it melts, but soon solidifies again to form a blue dye-

stuff, differing from the blue dyestuff obtained with boiling aniline by being very soluble in cold aniline. By the action of boiling *p*-toluidine on 2.6-dibromo-4.8-dinitro-1.5-dinitramino-anthraquinone a blue dyestuff is obtained which is 2.6-dibromo-1.5-diamino-4.8-di-*p*-toluidino-anthraquinone. Dimethyl-aniline reacts with the free nitramine with formation of so much heat that the nitramine may explode, but if the ammonium salt is used the reaction is quite quiet. The product, which is 2.6-dibromo-4.8-dinitro-anthraquinone-1.5-bisazoxydimethylaniline is a blue-black, finely crystalline substance, which can be crystallised from boiling quinoline. Its solutions are blue. On heating alone, or more smoothly in nitrobenzene solution, it forms 2.6-dibromo-4.8-dinitro-1.5-diamino-anthraquinone.—E. F.

*p-Diphenyldimethylmethane; Nitro Derivatives of* —. T. Székely. Ber. d. med.-naturw. Sektion d. siebenbürg. Musevereins, 1904, 1–13. Chem. Centr., 1904, 2, 1737.

DINITRO-*p*-DIPHENYLDIMETHYLMETHANE, when reduced with tin and hydrochloric acid, gives the corresponding diamino compound,  $(\text{CH}_3)_2\text{C}[\text{C}_6\text{H}_3(\text{OH})(\text{NH}_2)]_2$ . When the solution of the tetrazolide of this diamine is poured into an alkaline  $\beta$ -naphthol solution, the sodium salt of *p*-diphenyldimethylmethanebisazodi- $\beta$ -naphthol,  $(\text{CH}_3)_2\text{C}[\text{C}_6\text{H}_3(\text{OH})\text{N}:\text{N}:\text{C}_{10}\text{H}_6(\text{OH})]_2$ , is formed as a dark blue amorphous substance. The dyestuff has a green reflex resembling that of Magenta; it dissolves in alcohol with a red colour and dyes silk a brilliant red.—A. S.

*Diazo-Reaction in the Diphenyl Series; The* —. II. Ethoxybenzidine. J. C. Cain. Chem. Soc. Proc., 1904, 20, 249.

If the solution of the diazonium salt prepared from ethoxybenzidine be heated, one diazonium group is replaced by hydroxyl as usual, but the other remains intact. The diazonium group adjacent to the ethoxy group appears to be the one not acted upon, since the diazonium salt of dianisidine when subjected to similar treatment is much more stable than that of benzidine. The hydroxy-diazonium sulphate can be recrystallised from boiling dilute sulphuric acid; it forms long, acicular, brown crystals, easily soluble in water, and having the composition  $(\text{OH})\text{C}_6\text{H}_4\text{C}_6\text{H}_3(\text{OC}_2\text{H}_5)\text{N}(\text{N})\text{HSO}_4$ . The free diazonium hydroxide is precipitated by sodium carbonate as a lilac-coloured mass, which dissolves in acids forming the corresponding salts.—A. S.

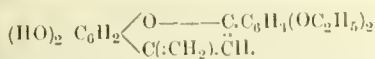
*Aminoazo Compounds; Method for the Direct Production of Certain* —. R. Meldola and L. Eynon. Chem. Soc. Proc., 1904, 20, 250–251.

If a strong solution of sodium bichromate be added to aqueous solutions of diazotised amines, in most cases a crystalline precipitate of the diazonium chromate is produced, which can be isolated and used in the solid condition. The application of this reaction to diamines allows of the direct production of aminoazo compounds. For example, diazotised *p*-phenylenediamine gives a chromate of the composition,  $\text{NH}_2\text{C}_6\text{H}_4\text{N}_2\text{HCrO}_4$ , which combines directly with phenols and amines to form aminoazo compounds. The authors have prepared *p*-aminobenzenazo- $\beta$ -naphthol by this method. *p*-Aminophenol forms a normal diazonium bichromate,  $[\text{HO}\text{C}_6\text{H}_4\text{N}_2]_2\text{Cr}_2\text{O}_7$ . The solid diazonium chromates are all more or less explosive when dry, and some of them may be capable of technical application. In discussion, the author stated that he had not been able to isolate chromates of the tetrazo derivatives of simple diamines.—A. S.

*Resazurin; Three Isomeric Hydroxyl-Homologues of* —. C. Bülow and C. Sautermeister. Ber., 1904, 37, 4715–4723.

EQUIMOLECULAR proportions of 2.4-diethoxybenzoyl-acetone and phloroglucinol were condensed by means of dry gaseous hydrochloric acid in glacial acetic acid solution. The product forms orange-red needles and is the hydrochloride of 2.(2'.4'-diethoxyphenyl)-4-anhydromethyl-5.7-dihydroxy[1.4-benzopyranol]:





From pyrogallol and 2,4-diethoxybenzoylacetone 2-[2',4'-diethoxyphenyl]-4-anhydromethyl-7,8-dihydroxy-1,4-benzopyranol] was obtained, as a hydrochloride, in the same manner. This substance forms dark-red needles. It can be converted into the base by sodium acetate. The base dissolves in alcohol to a bluish-violet liquid. The product possesses all the properties of a true mordant dyestuff. On chrome-mordant it gives olive-green shades, which would compete with Coerulein, being equally fast as regards bleeding on to white, but it is not so fast as the latter to boiling acids, changing its shade and bleeding on to white under this treatment. The alumina lake shows similar properties. Both alumina and chrome lakes are decidedly duller, greyer and more yellow than those obtained from Coerulein-A paste, and could therefore not compete with the latter. The dyeing properties of the corresponding compound from resorcinol are also described. It gives similar shades to Alizarin Brown, fairly fast to alkali, but bleeding much more than the latter on to white.

Hydroxyhydroquinone and 2,4-diethoxybenzoylacetone condense in presence of hydrochloric acid in acetic acid solution to form the hydrochloride of 2-[2',4'-diethoxyphenyl]-4-anhydromethyl-6,7-dihydroxy-1,4-benzopyranol. This forms golden yellow crystals. The base dissolves in organic solvents with yellowish-red colour.—E. F.

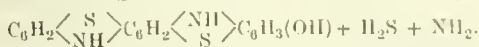
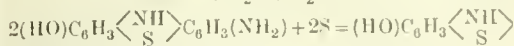
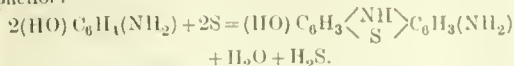
*Crystal Violet; Action of Benzyl-magnesium Chloride on —.* M. Freund and H. Beck. Ber., 1904, 37, 4679—4680.

The reaction was carried out in solution in dry ether. Only one molecular proportion of benzyl-magnesium chloride reacts, forming hexamethyltriaminotriphenylbenzylmethane  $[(\text{CH}_3)_2\text{N} \cdot \text{C}_6\text{H}_4]_3\text{C} \cdot \text{CH}_2 \cdot \text{C}_6\text{H}_5$ . The product forms grey crystals and yields no dyestuff with oxidising agents.—E. F.

*Sulphide Dyestuffs; Existence and Function of Mercaptan Groups in Direct —.* R. Vidal. Monit. Scient., 1905, 19, 25—27.

The solubility of "direct" sulphide dyestuffs in alkali sulphide solutions has been attributed to the presence of mercaptan groups. That this is not the correct view is shown by the fact that, when *p*-aminophenol is heated with a quantity of sulphur just sufficient for the formation of the thiazine groups, a product is obtained which is soluble in alkali sulphides, the solutions dyeing blue-black to blue shades; when this product is heated with alkali sulphide to a high temperature, a greenish dyestuff is obtained, identical with that produced on heating *p*-aminophenol with sulphur and alkali sulphide; oxidation of this greenish dyestuff re-converts it into the blue-black or blue dyestuff, whence it would appear that the mercaptan group had only the effect of modifying the shade of the dyestuff. By a comparison of the three black dyestuffs obtained by heating mono-, di-, and tri-aminohydroxydiphenylamine with sulphur, it is found that the more mercaptan groups are introduced (by heating with alkali sulphide), the greener will be the resulting dyestuff. It is also found that any reagent which will remove the mercaptan group will convert the greenish dyestuffs into the bluish ones. In the case of dyestuffs obtained from diphenylamine derivatives (or their equivalents) and sulphur alone, with the exception of those in which some highly basic grouping necessitates the presence of a mercaptan group to render them soluble in alkali sulphide, those dyestuffs containing hydroxy groups are all directly soluble, the solubility depending on the number of hydroxy groups present. It thus follows that the mercaptan groups are not essential for sulphide dyestuffs, and that their introduction is due to the action of alkali sulphide at high temperatures. It is said to be erroneous to attribute variations of shade to different substituents in the primary compounds. With regard to the mechanism of the formation of sulphide dyestuffs, the following reactions are considered to

represent it in the case of that obtained from *p*-aminophenol:—



—T. F. B.

#### ENGLISH PATENTS.

*Hydroxyazo Colouring Matters [Azo Dyestuffs]; Manufacture of —.* J. Y. Johnson, London. From Badische Anilin- und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 27,372, Dec. 14, 1903.

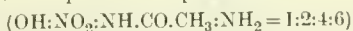
SEE Fr. Pat. 338,819 of 1903; this J., 1904, 820.—T. F. B.

*Azo Colouring Matter [Dyestuff], especially suitable for the Preparation of Colouring Matter Lakes; Manufacture of —, and of Intermediate Products relating thereto.* J. Y. Johnson, London. From Badische Anilin- und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 2469, Feb. 1, 1904.

SEE U.S. Pat. 759,716 of 1904; this J., 1904, 604.—T. F. B.

*Azo Dyestuffs; Manufacture of —.* R. B. Ransford, Upper Norwood. From L. Cassella and Co., Frankfurt-on-Maine, Germany. Eng. Pat. 3096, Feb. 8, 1904.

*o*-NITRO-*o*-amino-*p*-acetaminophenol:



obtained as described in Eng. Pat. 24,409 of 1903 (see this J., 1904, 1025) is diazotised and coupled with naphtholsulphonic acids. The dyestuffs obtained, give shades which are scarcely modified on chroming, and the chromed dyeings are perfectly fast to milling and light. The dyestuff obtained from 1,4-naphtholsulphonic acid gives violet-blue shades on wool.—T. F. B.

*Dye Compound; A New —.* J. G. Lorrain, London. From M. K. Bell, Knoxville, U.S.A. Eng. Pat. 14,566, June 28, 1904.

A SUITABLE aniline dyestuff is dissolved in water to which is added white curd soap and alum in such proportions that, after straining, the compound sets to a semi-solid jelly.—F. D. T.

#### UNITED STATES PATENTS.

*Anthraquinone Dye and Process of making same.* E. Hepp, Frankfurt-on-Maine, and R. Uhlenhuth, Höchst-on-Maine. Assignors to Farb. vorm. Meister, Lucius and Brüning, Höchst-on-Maine, Germany. U.S. Pat. 778,036, Dec. 20, 1904.

1,4-DIALPHYLAMINO - 5 - hydroxyanthraquinones, for example 1,4-di-*p*-toluidino-5-hydroxyanthraquinone, are treated with sulphonating agents. The resulting dyestuffs dye unmordanted and chrome-mordanted wool and chrome-mordanted cotton in green shades, said to be very fast to light, alkalis and acids.—E. F.

*Sulphur Dye [Sulphide Dyestuff]; Violet—, and Process of making same.* A. Schmidt, Assignor to Farb. vorm. Meister, Lucius and Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 778,713, Dec. 27, 1904.

"SAFRANINON" is heated with sulphur to a high temperature. The product is a violet-black powder, insoluble in water, but soluble in alkali sulphides with a violet-red colour.—E. F.

*Dye; Compound —.* L. H. Dehoff, Mannheim, and G. Wessbecher, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 778,175, Dec. 20, 1904.

SEE Fr. Pat. 342,026 of 1904; this J., 1904, 899.—T. F. B.

**Acid Nitrides** [*ω*-Cyanomethylaniline Derivatives]. *Process of Making* —. O. J. Graul, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 778,656, Dec. 27, 1904.

SEE Fr. Pat. 338,818 of 1903; this J., 1904, 820. —T. F. B.

**Indryl**: *Acetyl* I —, and *Process of Making same*. D. Verlander and B. Drescher, Halle i Saale, and P. Seidel, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 778,725, Dec. 27, 1904.

SEE Fr. Pat. 311,562 of 1901; this J., 1902, 38. —T. F. B.

**Indigo**: *Process of Making* —. R. Knietzsch, P. Seidel and O. J. Graul, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 778,752, Dec. 27, 1904.

SEE Eng. Pat. 26,372 of 1903; this J., 1903, 1289. —T. F. B.

**Hydroxyalkylanilines**: *Process of making* —. W. Behagbel and G. C. Schumann, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 778,772, Dec. 27, 1904.

HYDROXYALKYLANILINES are obtained by heating a glycolhalogenhydrin with an aromatic amine in presence of water. A substance capable of neutralising mineral acids, such as sodium acetate, may also be added. The application of the process to the production of hydroxyethylaniline from glycolchlorhydrin and aniline is specially claimed. —E. F.

**β-tetanaphthol Dye** [*Azo Dye-stuffs*] and *Process of making same*. K. Elbel, Assignor to Kalle and Co., Biebrich, Germany. U.S. Pat. 778,476, Dec. 27, 1904.

**DIAZO-DERIVATIVES** of 1,2-aminonaphtholsulphonic acids, such as 1,2-aminonaphthol-3,6-disulphonic acid are combined with β-naphthol in highly concentrated solutions and in presence of an excess of alkali. The products dye wool directly from a bath acidified with sulphuric acid in bluish-red to violet shades, convertible into violet to blue-blacks on subsequent treatment with bichromates. The product obtained with 1,2-aminonaphthol-3,6-disulphonic acid dyes wool in Bordeaux red shades which change to bright bluish-black on chroming. —E. F.

**Monochloro-α-phanaphthol** and *Process of making same*. K. Elbel, Assignor to Kalle and Co., Biebrich, Germany. U.S. Pat. 778,477, Dec. 27, 1904.

**MONOCHLORO-α-NAPHTHOL** is made by acting on solutions of alkali salts of α-naphthol with hypochlorites in molecular proportion, and subsequently acidifying the reaction product. It consists of white crystals, melting at 64.5°C., having a pungent smell and readily soluble in benzene, alcohol and ether. —E. F.

**Sulphur Dye** [*Sulphide Dye-stuffs*]; *Blue* —, and *Process of Making same*. K. Elbel, Assignor to Kalle and Co., Biebrich, Germany. U.S. Pat. 778,478, Dec. 27, 1904.

THE indophenols or phenylnaphthylamine derivatives obtained by simultaneous oxidation of monochloro-α-naphthol and of a *p*-diamine of the benzene series are heated with alkali polysulphides. For instance, monochloro-α-naphthol is oxidised together with dimethyl-*p*-phenylenediamine, and the product is heated with alkali polysulphide either directly or after transforming it into the colourless phenylnaphthylamine derivative. The products are easily soluble in aqueous sodium sulphide solution and dye un mordanted cotton from such solutions in violet to greenish-blue shades. The product obtained from dimethyl-*p*-phenylenediamine dyes in fast greenish-indigo shades. —E. F.

**Ortho-dicyanthraquinone Sulpho Acid**, and *Process of Making same* [*Anthracene Dye-stuff*]. M. Hjnsky, Krefeld, Germany. U.S. Pat. 778,670, Dec. 27, 1904.

SEE Fr. Pat. 336,938 of 1903; this J., 1904, 438. —T. F. B.

## FRENCH PATENTS.

**Monazo Mordant Dye-stuffs**. [*Azo Dye-stuffs*]; *Preparation of* —. Kalle and Co. Fr. Pat. 346,005, Sept. 2, 1904.

AMINO-*p*-CRESOL sulphonic acid [ $\text{CH}_3 : \text{NH}_2 : \text{OH} : \text{SO}_3\text{H} = 1 : 3 : 4 : 5$ ] is acetylated, nitrated and saponified. The resulting nitroamino-*p*-cresolsulphonic acid is diazotised and combined with β-naphthol. The dyestuff so obtained dyes wool from an acid bath in reddish-orange shades, which are transformed on subsequent treatment with chromium salts into violet-black shades which are extremely fast. If *p*-toluidine-*o*-sulphonic acid is acetylated and then nitrated, a nitro-acetyl-*p*-toluidine-*o*-sulphonic acid is obtained. When this is boiled with dilute alkalis it is converted into a nitro-*p*-cresolsulphonic acid, the acetyl amino group being replaced by a hydroxyl group. This is reduced by means of zinc dust to the corresponding amino-compound and then nitrated, thus forming a nitro-amino-*p*-cresolsulphonic acid. On diazotisation and combination with β-naphthol this forms a dyestuff which dyes wool in violet shades, which on subsequent chroming turn to a rather bluish violet-black which is said to be absolutely fast. —E. F.

**Monazo Dye-stuffs** [*Azo Dye-stuffs*], especially suitable for the *Manufacture of Lakes*; *Production of Orange* —. Badische Anilin- und Soda-Fabrik. Fr. Pat. 346,007, Sept. 2, 1904.

3,4-DICHLORO-1-NITROBENZENE is treated with fuming sulphuric acid and the sulphonic acid so formed is reduced with iron and acetic acid. The resulting compound is probably 3,4-dichloroaniline-5-sulphonic acid. 3,4-Dichloro-aniline-6-sulphonic acid is obtained either by sulphonating 3,4-dichloro-aniline with fuming sulphuric acid or by nitrating and subsequently reducing 3,4-dichlorobenzene-1-sulphonic acid. The dyestuffs are obtained by diazotising 3,4-dichloro-aniline-5- or 6-sulphonic acid and combining with β-naphthol. They are very insoluble, and form lakes which are said to be very fast to water and to lime and perfectly fast to light. —E. F.

**Mono-azo Dye-stuff** [*Azo Dye-stuffs*], especially suitable for the *Manufacture of Lakes*; *Production of Red* —. Badische Anilin- und Soda-Fabrik. Fr. Pat. 346,008, Sept. 2, 1904.

3,4-DICHLOROANILINE is diazotised and combined with β-naphtholdisulphonic acid R. The dyestuff forms lake which are said to be distinguished by slight solubility in water, brilliancy, and exceptional fastness to light. —E. F.

## V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

**Flax**; *Water-Retting of* —. K. Störmer. Centr.-Bl. f. Bakter., u. Parasitenk., 1904, 13, 35–45, 171–185 306–326. Chem. Centr., 1905, 1, 41.

THE water-retting of flax is a biological process induced by the action of definite organisms, the chief of which is an anaerobic *Plectridium*, which, in the absence of air ferments the pectin substances of the cellular material uniting the parenchymatous tissues, and thus causes loosening of the bast fibres. The absolute exclusion of oxygen, which is necessary in order that the fermentation may be set up, is brought about by numerous oxygen consuming bacteria and fungi. The products formed by the fermentation of the pectin substances are hydrogen and carbon dioxide, and organic acids, especially acetic and butyric acid and small quantities of valeric and lactic acids. The injurious action of the acids produced especially butyric acid, may be considerably diminished by adding alkali or lime to the retting liquid. It is advantageous to inoculate the liquid at the beginning of the retting with pure cultures of the anaerobic *Plectridium* (See also this J., 1900, 143; 1904, 249). —A. S.



*Dyeing, Economics in* —. E. Harter. *Färber-Zeit.*, 1905, 15, 3-4.

The soap baths from dyeworks are collected in suitable vessels and heated by direct steam to from 75° to 90° C. Milk of lime is then added, from 15 to 20 kilos, of lime being required for 1 cbm. of soap water. The precipitate is collected in filter-presses, dried, and used for making illuminating gas.—D. B.

*Fastness to Perspiration of Dyed Goods.* E. Davidis. *Färber-Zeit.*, 1904, 15, 373-377.

The usual method of testing the fastness of a colour to perspiration by means of acetic acid is quite unsuitable, as copious perspiration has usually an alkaline reaction. The following is a good test.

Make a solution containing 5 grms. of Marseilles soap and 3 c.c. of ammonia in one litre of water, and soak the pattern to be tested for ten minutes in this. Squeeze well, wrap the pattern tightly round a glass rod with a piece of calico, and leave at about 50° C. until quite dry. The amount of "bleeding" is a good measure of the fastness to perspiration.

In dyeing with acid dyestuffs, the fastness is improved by increasing the amount of acid added to the bath. As sulphuric acid tenders any cotton present, it can be replaced with great advantage by formic acid when dyeing mixed goods.—A. B. S.

*Paper Pulp: Yarn from* —. E. Hanausek und R. Zalzowiecki. XI. X., page 101.

*Bleaching Solutions [Sodium Hypochlorite]; Apparatus for the Electrolytic Preparation of* —. G. Jargle. XI. A., page 94.

*Hydrosulphites; Formation of* —. M. Prud'homme. VII., page 89.

#### ENGLISH PATENTS.

*Oxidation Black on Animal Fibres, Mixtures of Animal and Vegetable Fibres, and Fabrics made from the same. Production of* —. F. Köntzer. Zittau, Saxony. Eng. Pat. 21,634, Oct. 8, 1904.

COTTON and wool unions and all-wool fabrics can be satisfactorily dyed with aniline black by the ageing and after-chrome method, provided the material be treated, either before or after the oxidation, with some cyanogen compound, such as Prussian blue.—F. D. T.

*Discharging Dyeings; Means for* —. R. B. Ransford. Upper Norwood. From L. Cassella and Co., Frankfort-on-Maine, Germany. Eng. Pat. 2573, Feb. 2, 1904.

It is found that perfect discharges, even on dyed wool, can be obtained with formaldehyde-hydrosulphite mixed with a metallic oxide or carbonate, such as zinc oxide or magnesium carbonate. For example, the wool is printed with a mixture of zinc oxide, 250 parts; formaldehyde-hydrosulphite, 300 parts; gum mucilage, 350 parts; water, 100 parts; dried, steamed for 15 minutes, "soured" and rinsed.—T. F. B.

*Waterproofed Textile Fabrics and other Materials, and the Method and Means Employed in Waterproofing them.* G. Murray, Glasgow. Eng. Pat. 1930, Jan. 26, 1904.

FABRICS, paper, and other materials are waterproofed by first immersing them in hot linsed oil, and raising the oil to about its boiling point. The material is then dried

and treated with turpentine to soften it and prevent the formation of a hard skin, and finally coated with a suitable varnish, and dusted with powdered chalk or similar substance. Two or more sheets waterproofed as above may be fastened together by pressure. This process is adapted to be particularly applicable to waterproofing rope, &c., and for the production of roofing materials.—T. F. B.

*Calendar Bools or Rollers for Finishing Textile Goods, Paper and other Fabrics; Manufacture of* —. J. Hübner and W. J. Pope, Manchester. Eng. Pat. 2759, Feb. 4, 1904.

Loose cotton or paper, previously treated by immersion in a mercerising or shrinking agent, e.g., caustic soda lye of 55° Tw., is compressed around the roller shaft, whereby the roller acquires greater superficial elasticity and wearing power.—F. D. T.

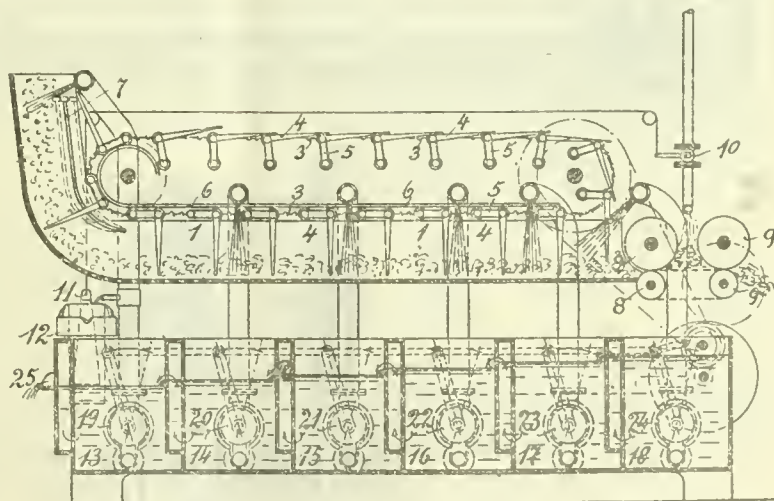
#### FRENCH PATENTS.

*Artificial Silk; Treating Cellulose for the Manufacture of* —. J. Foltzer. Fr. Pat. 345,687, July 15, 1904.

CELLULOSE, e.g., wood or cotton, is boiled under pressure with a solution of sodium carbonate and caustic soda. The product, which, to be properly acted upon by the solvent, should contain at least 12-15 per cent. of moisture, dissolves, it is claimed, at the ordinary temperature and in less than 24 hours' time, to the extent of 8-10 per cent. in a "direct" solvent.—E. B.

*Wool Washing Machine.* F. Bernhardt. Fr. Pat. 345,718, June 9, 1904.

Raw wool, in the loose state, is conveyed along the perforated bottom of a continuous washing machine (see figure) by means of forks 4, fixed at regular intervals in two parallel, endless chains 3, running during part of their course between guide frames 6. During its passage through the machine it is treated, on the counter current principle, with solutions of the potash salts, &c., extracted from the wool, contained in the several compartments



13-18 of a tank underneath the machine, which are pumped upon the wool and then return to the compartments whence they have been drawn, and which pass through overflow pipes or chambers from one compartment to another. Clean water is supplied at the exit end of the machine from a pipe 10, which delivers it between two pairs of squeezing rollers 8, 8, and 9, 9, upon the wool as it is withdrawn from the machine, in amount regulated by an automatic float 11, to the end that the solution of the potash salts, &c., as it leaves the tank, shall be sufficiently concentrated to render its evaporation profitable.—E. B.

*Silk and other Fibres; Process and Apparatus for the Conditioning of —*, Soc. Anon. Co-operativa per la Stagionatura E l'Assaggio Delle Sete ed Affini. Fr. Pat. 345,757, Aug. 22, 1904.

THE silk or other fibre is placed in a basket, which rests in a wide pipe, arranged over the air-inlet pipe of the conditioning apparatus, so that the hot air is made to pass directly through the fabrics, instead of, as is usually the case, merely passing over their surface.—F. D. T.

*Dyeing Machine for Yarns in the form of Hanks.* P. Aubry. Fr. Pat. 345,668, Aug. 18, 1904.

THE mechanism in question is mounted upon a framework, composed of four uprights A (see figures) connected together by cross-stays, above and between two dye-vessels or two rows of dye-vessels, and consists essentially of shafting and gearing for rotating two series of reels 3, two drums 20 for supporting, or when required, winding

or unwinding chains from which a platform B, carrying the reels, is suspended, and apparatus for automatically arresting the platform as it is being raised or lowered and for rotating the reels. Motive power is supplied from an engine by a strap stretched upon a pulley 5 upon a shaft 4, and is conveyed from this, by means of a double coupling 6, to one or other of two pinion wheels which engage with a pinion wheel upon a vertical shaft 9, and cause this to turn either in the one or the opposite direction. This shaft by means of a clutch 10, can be made to turn either an endless screw 11 or a vertical shaft 12. Hanks being placed upon the reels, and the dye-vessels being filled with dye-liquors, the double coupling is brought by means of a handle 22 into gear with the wheel 7, and the endless screw is set in motion. The drums 15 and 20 which carry the chains supporting the platform are unwound, and the platform is thus caused to descend. As soon as the lower parts of the hanks are immersed in

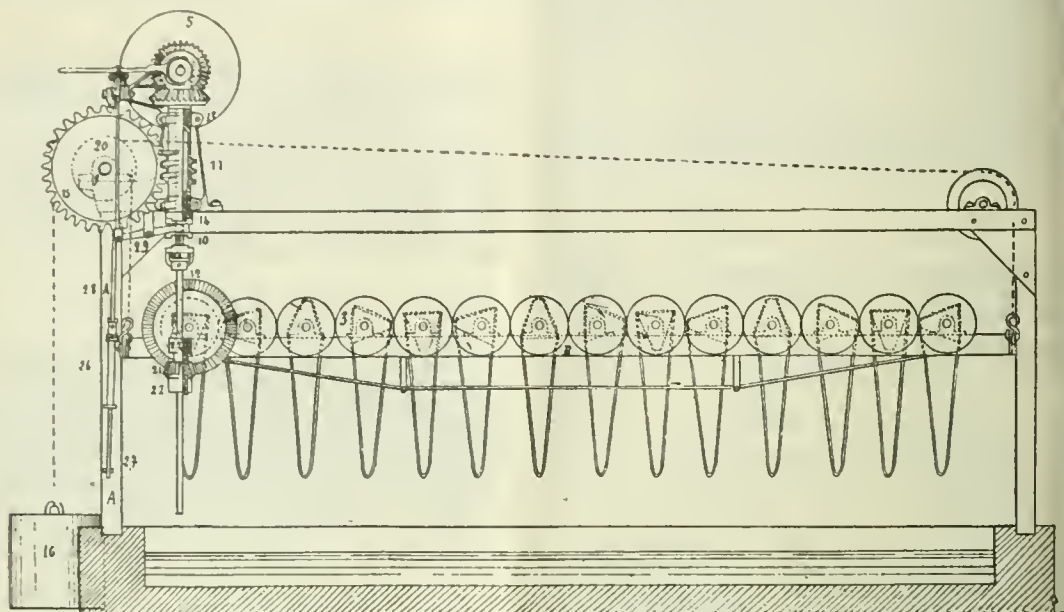


FIG. 1.

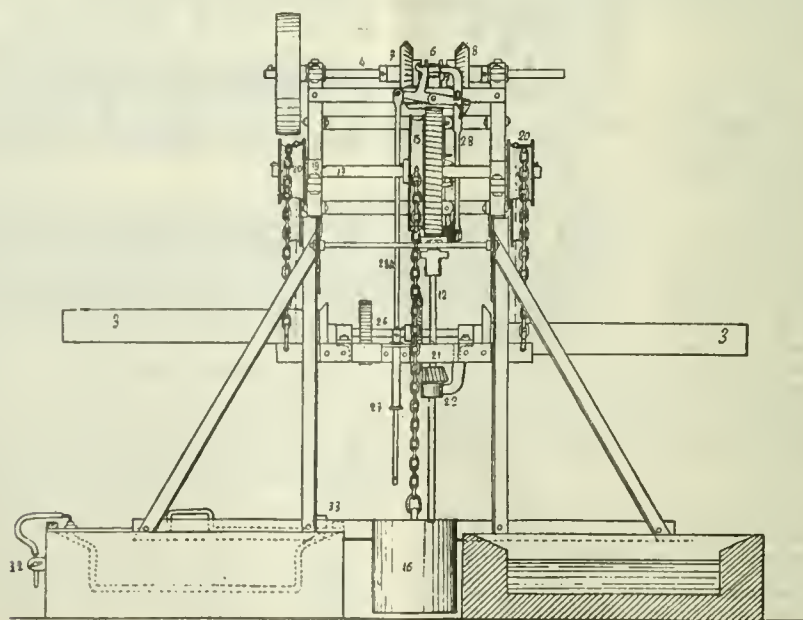


FIG. 2.



the dye-baths, the clutch 10 is automatically moved by means of a rod 28, acting in connection with a lever 29, a rod 28A and mechanism attached to the coupling 6. The descent of the platform is thus arrested, and the reels are made to rotate. The handle 22 is next moved, to bring the wheel 8 into gear. The endless screw is then again brought into operation, and the drums are turned in the opposite direction to that in which they were previously revolved. The platform and the counterpoise are thus raised. When the platform reaches a certain height, the sleeve 26 upon the rod 28A comes into contact with a pin 30, and pushes upwards the rod, which, acting upon the coupling mechanism disengages the wheel 8, and automatically stops the machine. The hanks may then be removed and replaced.

A second claim relates to a method of dividing a dye-vessel into two or more parts by means of tightly fitting partitions, with the object of enabling a number of hanks to be simultaneously dyed in the same machine in as many different colours as there are separate compartments thus formed. To this end, flexible tubing is attached to the sides and bottom of the partitions, which are made to fit closely across the dye-vessel, against the sides and bottom. Water or a gas under pressure is then admitted through a valve 32 (Fig. 2), the excess being allowed to escape through a valve 33. A perfect joint is, it is stated, thus obtained.—E. B.

*Textile Fabrics; Apparatus for the Dyeing, Cleaning, Bleaching, &c. of —.* Soc. Obermaier. Fr. Pat. 345,945, Aug. 30, 1904.

The liquors, with which the fabrics are to be treated, are made to circulate by means of the combined action of a slight pressure and a partial vacuum produced by an air-pump communicating with two closed tanks for holding the liquors. The machine described consists of a closed vessel for receiving the goods, communicating at the bottom and top with the liquor-tanks, in each of which is a float. A box arrangement with an inlet is placed under a false bottom in the dyeing vessel, and communicates with one of the liquor-tanks by means of a pipe whereby the liquor can enter the vessel under the false bottom. Another pipe connected with the second liquor-tank passes directly through the box having its outlet at the top of the dyeing vessel. The floats, above mentioned, interact with levers, placed in air-tight domes above the liquor tanks, which automatically work a specially constructed valve which alternately distributes the pressure and vacuum necessary for the proper circulation of the liquors.—F. D. T.

*Metallic Pigments; New Composition for the Application of —.* to Fabrics. L. Paul. Fr. Pat. 339,167, Nov. 13, 1903.

The following mixture is recommended for printing fabrics:—Gelatin, 15 grms.; glycerin, 50 grms.; water, 835 grms.; metallic pigment, 100 grms.—F. D. T.

*Hydrosulphites; Producing Discharges [Tissue Printing] by means of —.* Soc. Badische Anilin- und Soda-Fabrik. Addition, dated Aug. 8, 1904 (date claimed under International Convention June 23, 1904), to Fr. Pat. 297,370 of Feb. 19, 1900.

THE process of discharging with printing mixtures prepared from solid hydrosulphite compounds, which forms the subject of the main patent, is not wholly successful, owing to the printing mixtures, especially when they contain soluble sodium or zinc salts, not keeping sufficiently well. This defect disappears, it is now found, when

an excess of caustic alkali is present in the mixtures. Discharge effects, which it has not been possible to produce hitherto, can be obtained with such mixtures. Thus a white discharge upon Naphthylamine (Claret is obtained by printing 40 parts of a mixture of 60 kilos. of hydrosulphite B.A.S.F. in powder (Fr. Pat. 341,718, this J., 1904, 900), 35 kilos. of glycerin, and 5 kilos. of caustic soda-lye at 40° B., admixed with 60 parts of an alkaline thickening prepared from 320 grms. of British gum, 320 c.c. of water, and 1 litre of caustic soda-lye at 45° B. A blue discharge may be produced by adding Indanthrene S to a similar mixture. The discharges are effected by steaming the printed tissues.—E. B.

*Waterproof Compositions; Machine for Applying —, to Tissues.* C. Lichtenstadt. Fr. Pat. 345,612, Aug. 16, 1904.

Tissues are brought by means of a system of rollers into contact with strips of waterproofing composition, which are pressed upwards against one or both sides of them by adjustable mechanism, the ends of the strips overlapping the sides of the tissues being removed by a fluted roller. They are then passed between steam-heated cylinders to cause the composition to become more perfectly attached to or united with them.—E. B.

*Drying Tissues after Washing, Dyeing or Finishing; Apparatus for —.* G. Masurel-Leclercq. Fr. Pat. 345,281, Aug. 2, 1904.

Tissues, which have been washed, dyed or passed through a finishing-mixture, are dried at full width and in a continuous manner, in a vertical hot-air chamber containing steam pipes, fans, and boards or plates, the last-named placed at an angle for the purpose of directing the ascending current of hot air upon the tissues. (See also Fr. Pat. 341,281; this J., 1904, 864.)—E. B.

## VII.—ACIDS, ALKALIS, AND SALTS.

*Nitric and Sulphuric Acids; Properties of Mixtures of —.* A. Saposchnikow. Z. physik. Chem., 1904, 49, 697–708.

THE author has made determinations of the vapour pressure, sp. gr., and electric conductivity of mixtures of nitric and sulphuric acid. For the vapour pressure determinations, nitric acid of sp. gr. 1.5144 at 15° C., containing 98.95 per cent. of nitric acid monohydrate (HNO<sub>3</sub>) and 0.88 per cent. of nitrogen peroxide, and sulphuric acid of sp. gr. 1.841 at 15° C., containing 98 per cent. of sulphuric acid monohydrate (H<sub>2</sub>SO<sub>4</sub>) were used. The results obtained are given in the following table:—

Percentage of Sulphuric Acid.	Vapour Pressure in mm. at 25° C.	Percentage of Sulphuric Acid.	Vapour Pressure in mm. at 25° C.
0.00	46.20	49.72	30.30
2.77	41.24	59.90	25.30
9.05	40.80	69.80	19.38
18.79	40.87	79.77	12.50
29.94	39.10	89.53	5.00
39.76	34.48		

For the determinations of sp. gr. and electric conductivity, nitric acid of sp. gr. 1.52, containing 94.85 per cent. of nitric acid monohydrate, 2.48 per cent. of oxides of nitrogen and 2.67 per cent. of water, and pure 100 per cent. sulphuric acid were used. The following results were obtained:—

Percentage of Sulphuric Acid.	Sp. Gr. at 25° 25° C.	Electric Conductivity at 25° C.	Percentage of Sulphuric Acid.	Sp. Gr. at 25° 25° C.	Electric Conductivity at 25° C.
		Mhos.			Mhos.
0	1.5100	479.7-10. <sup>-4</sup>	59.33	1.7898	714.5-10. <sup>-4</sup>
1	1.5131	422.7 "	69.36	1.8213	761.7 "
2.05	1.5211	379.0 "	79.06	1.8595	807.9 "
5.12	1.5397	433.0 "	87.46	1.8807	905.2 "
9.69	1.5670	517.5 "	89.32	1.8810	954.7 "
19.40	1.6192	619.5 "	92.20	1.8734	1013.0 "
29.31	1.6608	559.2 "	94.75	1.8638	974.1 "
38.66	1.7087	670.1 "	97.21	1.8514	787.9 "
50.36	1.7506	681.7 "	100	1.8380	145.8 "

(See also this J., 1904, 865, 935).—A. S.

**Nitric Oxide, Reaction of —, with Oxygen.** — *Atmospheric Air.* G. Lange und E. Bern. *Chem.-Zeit.* 1904, 28, 1243—1245.

MEASURED quantities of the reacting gases were admitted into a capillary exhausted flask, with varying amounts of water, and allowed to react for definite periods of time. Concentrated sulphuric acid was then added to dissolve the nitrous compounds, and in aliquot portions of this the total nitrogen was determined by the nitrate method, the "nitric acid" being precipitated. The experiments showed that: 1. The conversion of nitric oxide by excess of oxygen into nitric acid is increased slightly by the amount of water present. With the most favourable proportion the conversion is practically complete, but as the proportion of water increases exceedingly so does the proportion of nitric oxide which is oxidized only as far as nitrous acid. 2. The presence of free nitrogen along with the oxygen does not assist in the substitution of air for oxygen—has no influence upon the reaction; here, too, the conversion into nitric acid is complete when the optimum proportion of water is present. 3. The conversion of nitric oxide into nitric acid under these circumstances is not instantaneous, but gradual—a "time-reaction." 4. Concentrated sulphuric acid is preferable to alkali hydroxide as absorbent of mixtures of oxides of nitrogen; for the latter produces at once stable compounds, whilst the latter forms substances (not stable) the influence of the water present, which are yet capable of reaction (e.g., the reaction  $3\text{NO}_2 + \text{H}_2\text{O} + \text{HNO}_3 + \text{H}_2\text{O}$  may occur involving too low a value for the total nitrogen, and too high a relative value for the nitric acid).—J. T. D.

**Carbon Dioxide, Reaction of —, with Hydrides and Carbonates of Alkali and Alkaline-Earth Metals.** P. N. Raikow. *Chem.-Zeit.* 1904, 28, 1247—1252.

CARBON dioxide was led through solutions of the various hydrides or carbonates till no further increase of weight occurred, and the amount absorbed, less that absorbed by an amount of water equal to that in the solution, was assumed to be chemically combined. The amount so combined corresponded, in the cases of sodium, rubidium, caesium and calcium, almost exactly with the formation of bicarbonate,  $\text{MHCO}_3$ ; whilst in the cases of lithium and potassium there was combined, indicating a mixture of bicarbonate with a higher carbonate, possibly  $\text{MH}_2\text{CO}_3$ . In the cases of barium and strontium the amount combined is less than corresponds to bicarbonate, and the mode of experiment does not allow conclusions to be drawn as to the formation of a substance of the form  $\text{M}_2\text{CO}_3$ . The tendency to the formation of bicarbonate seems in both series to decrease as the atomic weight rises. When a stream of air is led through these solutions saturated with carbon dioxide, a few minutes is enough to drive out completely the uncombined carbon dioxide; but the decomposition of the higher carbonate and expulsion of its carbon dioxide is very much slower, and in some cases never complete. Probably, therefore, the experiments do not allow this to be certainly stated, in the case of these carbonates, sesquicarbonate forms an intermediate stage in the process of carbonation.—J. T. D.

**Alkaline-earth Carbonates; Decomposition of —, by Alkali Chlorides in Presence of Water.** H. Cantoni and G. Goguelia. *Bull. Soc. Chim.* 1905, 33, 13—27.

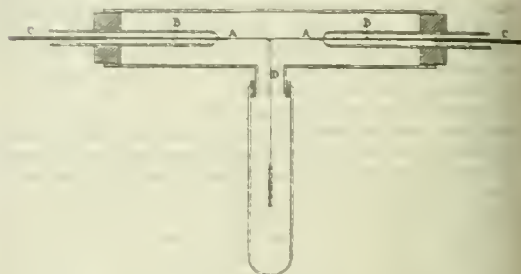
TABLES are given showing the amounts of barium, strontium, and calcium carbonates which are dissolved by standard solutions of potassium, sodium and ammonium chlorides, for various concentrations and temperatures, and during various periods of time. The effect of temperature may be represented by the following equation in which  $g$  and  $g^1$  are the quantities of carbonate dissolved at the temperatures  $t$  and  $t^1$  respectively.

$$g = g^1(1 + \alpha(t - t^1))$$

For the action of potassium chloride (10 per cent. solution) on barium carbonate  $\alpha = 0.002443$ , for sodium chloride (10 per cent. solution)  $\alpha = 0.00047144$ , thus showing that the action of sodium chloride is much less affected by temperature than that of potassium chloride.

The action of ammonium chloride solution on barium carbonate is enormously greater than that of potassium or sodium chloride.—B. J. S.

**Sodium Borates; Some Physical Characters of —, with a New and Rapid Method for the Determination of Melting Points.** C. H. Burgess and A. Holt, Jun. *Roy. Soc. Proc.* 1904, 74, 285—295.



WHEN ordinary pure borax glass is heated at a temperature which imparts to it about the consistency of a thick syrup, it gradually changes to a crystalline mass composed of dense, matted clusters of very minute colourless needles. The development of the crystals proceeds rapidly at first, but afterwards becomes slower and slower, many hours elapsing before the conversion of the glass into crystals is complete. The crystals are not hygroscopic; they are about as soluble in water as, and melt at a higher temperature than, the glass, into which they are reconverted by melting and subsequent rapid cooling. All glasses prepared from mixtures of boric anhydride and sodium carbonate in molecular proportions varying from 6:1 to 8:5 behave in a similar manner. Mixtures in which the ratio is greater than 6:1 yield glasses which change only incompletely, and with difficulty into crystals on prolonged heating, whilst, when the ratio is 40:1, crystals cannot be obtained at all. Mixtures in which the proportion of boric anhydride is less than 8:5 yield nearly opaque, white, apparently micro-crystalline masses, which, however, can be converted into unstable glasses by heating to a high temperature and chilling suddenly by pouring into mercury. The authors determined the melting points of crystals and glasses of varying composition, using an apparatus (see figure) somewhat similar to Joly's "mel-dimeter" (this J., 1889, 306). This consists of a piece of platinum wire AA, about 4 cm. long, welded to two stouter pieces of the same metal, BB which are sealed into two thin glass tubes and connected to two thick copper wires CC. The whole is fixed by means of two rubber stoppers in a glass tube, with an opening at D. A small bead of the material, the melting point of which is to be determined, is made on one end of a very thin platinum wire, to which a weight of about 1 gm. is attached. A current of 4—6 ampères is passed through the wire AA, and the wire with the bead on is inserted through D: when the bead touches the wire AA it becomes fused, then, on switching off the current, it solidifies again and remains attached to AA. Air currents are prevented by closing D with a test-tube. The melting point is taken as the temperature at which the wire with attached weight falls into the test-tube, this temperature being calculated from the voltage between the ends of the wire and the ampères passing through it, at the moment when the bead melts. The apparatus is calibrated by means of beads of pure potassium nitrate, lithium chloride and potassium chloride. The results of melting-point determinations indicate that ordinary borax ( $\text{Na}_2\text{O} \cdot 2\text{B}_2\text{O}_3$ ) is not a definite compound when in the crystalline condition described above, but is almost a eutectic mixture of the two borates,  $5\text{Na}_2\text{O} \cdot 4\text{B}_2\text{O}_3$  and  $\text{Na}_2\text{O} \cdot 4\text{B}_2\text{O}_3$ , respectively. Analyses of various mixtures showed that in the case of those between  $\text{Na}_2\text{O} \cdot 4\text{B}_2\text{O}_3$  and  $\text{Na}_2\text{O} \cdot 2\text{B}_2\text{O}_3$ , the crystals and glass have the same composition, but with mixtures containing more boric anhydride than  $\text{Na}_2\text{O} \cdot 4\text{B}_2\text{O}_3$ , only a portion (decreasing in quantity as



the amount of boric anhydride present increases) crystallises, and this portion has approximately the composition  $\text{Na}_2\text{O} \cdot 0.6\text{B}_2\text{O}_3$ . The results can be best explained regarding the glass as a superfused, and therefore metastable form of the crystals. Mixtures containing mols. or more of boric anhydride per mol. of sodium oxide probably consist of a borate of approximately the composition  $\text{Na}_2\text{O} \cdot 0.5\text{B}_2\text{O}_3$ , dissolved in boric anhydride. At some point between  $\text{Na}_2\text{O} \cdot 0.6\text{B}_2\text{O}_3$  and  $\text{Na}_2\text{O} \cdot 0.4\text{B}_2\text{O}_3$ , no free boric anhydride remains, and the whole mass will crystallise for the first time. With mixtures richer in sodium oxide, another borate of composition near  $\text{Na}_2\text{O} \cdot 0.4\text{B}_2\text{O}_3$  begins to be formed, and homogeneous mixed crystals separate, the glass being merely the super-fused form of the solid solution.

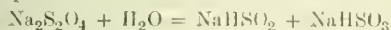
For the analysis of the mixtures, a weighed quantity of the substance in very fine powder was treated with strong hydrochloric acid, and the solution evaporated to dryness. These operations being repeated, to convert the whole of the sodium into chloride. The residue was then repeatedly treated with small quantities of methyl alcohol and the mixture evaporated to dryness, whereby hydrochloric acid and boric acid were removed. The sodium chloride remaining was dissolved in water and determined by titration with  $\text{N}/_{10}$  silver nitrate solution.—A. S.

*Hydrosulphites; Formation of* —. M. Prud'homme. Rev. Gén. Mat. Col., 1905, 9, 1-2.

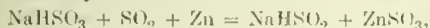
By the action of sulphur dioxide on sodium hydride, a white salt is obtained according to the following equation:—



On crystallisation from a little water two kinds of crystals are obtained. The aqueous solution, acidified with a few drops of hydrochloric acid, reduces silver nitrate and ammoniacal copper solutions similarly to the alkali hydrosulphites. It is probable that the salt  $\text{Na}_2\text{S}_2\text{O}_4$  is hydrolysed by water into a mixture of bihydrosulphite and bisulphite.



This would account for the two crystalline forms. The compound  $\text{Na}_2\text{S}_2\text{O}_4$  is probably an intermediate product in the preparation of hydrosulphite, for if not, we could suppress one molecule of  $\text{NaHSO}_3$  in the equation  $2\text{NaHSO}_3 + \text{SO}_2 + \text{Zn} = \text{Na}_2\text{S}_2\text{O}_4 + \text{ZnSO}_3 + \text{H}_2\text{O}$ , and use the equation



and so obtain the same yield of  $\text{NaHSO}_2$  from half the amount of  $\text{NaHSO}_3$ , which is not the actual case.—A. B. S.

*Lead Acetate; Manufacture of* —. C. Bauer. Chem.-Zeit., 1905, 29, 1-5.

In order to avoid the loss of acetic acid consequent on the evaporation of large quantities of liquor, lead acetate should always be prepared with acid of 60 per cent. strength. The litharge should be of 99 per cent. purity, and free from iron and alumina. 3000 kilos. of 60 per cent. acetic acid are pumped into a covered wooden vat of about 5 cub. metres capacity. The vat is fitted with a wooden stirrer, a reflux condenser and a wooden hopper with feed-roll, a copper steam-coil is also provided. The litharge (3090 kilos.) is introduced in quantities of 100 kilos. at a time, which require 50-60 minutes for complete solution at a temperature not exceeding  $65^\circ\text{C}$ . When the whole of the litharge is dissolved, the liquor is made slightly acid and should have a density of  $70^\circ\text{--}72^\circ\text{B}$ . at  $65^\circ\text{C}$ .; it is pumped over into two covered wooden clearing vats, each of 5 cub. metres capacity and fitted with reflux condensers. These vats are previously partly filled with mother liquors from a previous crystallisation at a density of  $35^\circ\text{--}37^\circ\text{B}$ ., so that the mixture has a density of about  $50^\circ\text{--}52^\circ\text{B}$ . Strips of lead are suspended in these clearing vats in order to precipitate any dissolved copper. Clarification is effected by standing for 6 hours at  $60^\circ\text{--}63^\circ\text{C}$ .; the solution is then passed through a filter-press with wooden plates, whence it flows to the crystallising vessels. It remains in these for 7-10 days, after which the mother liquors are run off, the salt is drained in centrifugal machines and dried in a vacuum chamber

at  $30^\circ\text{C}$ . Solutions at  $56^\circ\text{B}$ . yield only small crystals; if large crystals be desired they must be deposited from concentrated solutions having a density of  $70^\circ\text{--}72^\circ\text{B}$ . The crystallising vessels have a capacity of 3.5 cub. metres; they are covered and well insulated, and each is provided with a steam coil. The solution is run at a temperature of  $66^\circ\text{C}$ ., and is cooled at the rate of  $3^\circ\text{C}$ . in 24 hours; crystallisation requires about 14 days. All undissolved residues from the vats, drying frames, &c., are extracted with water; the resulting liquors are the only ones in the whole process which require to be evaporated.—J. F. B.

*Sulphides of Manganese; Composition of the Four* —.

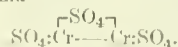
J. C. Olsen and W. S. Rapalje. J. Amer. Chem. Soc., 1904, 26, 1615-1622.

The authors find that three distinct modifications of manganese sulphide exist, two of which, the red and the green, are anhydrous, whilst the grey sulphide, which appears to have been overlooked by most investigators, contains a considerable amount of water. The ordinary pink or flesh-coloured sulphide is a mixture of varying proportions of the grey and red sulphides. The authors consider that the difference in colour between the red and green sulphides is due to a difference in molecular structure, and that the green modification is probably the more complex, since: (1) The pink or red sulphide is invariably first formed by precipitation, the green being a transformation product of one of these modifications. (2) The green sulphide is more distinctly crystalline and larger-grained, and also by far the most stable substance.—A. S.

*Chromic Sulphate; Existence of a green Normal* —.

A. Colson. Comptes rend., 1905, 140, 12-14.

By reducing, at the freezing point of water, a solution of chromic acid by the exact quantity of sulphur dioxide necessary for the purpose, and evaporating and drying *in vacuo*, the author has obtained a green chromic sulphate of formula  $\text{Cr}_2(\text{SO}_4)_3 \cdot 10\text{H}_2\text{O}$ , to which he attributes the constitutional formula



The molecular weight was determined cryoscopically, and agrees with the molecular formula just given.

—J. T. D.

*Aluminium; Double Silicides of* —. W. Manchot und A. Kieser. Annalen, 1904, 337, 353-361.

A mixture of metallic chromium or potassium bichromate, with potassium silicofluoride and metallic aluminium, heated to the highest temperature of a Perrot furnace, gives a regulus, which leaves, after successive treatment with hot hydrochloric acid and dilute solution of sodium hydroxide, a substance of formula  $\text{Cr}_2\text{AlSi}_3$ . It forms brilliant hexagonal crystals, opaque, greyish-white, with metallic lustre; hardness above 5, density 4.7. It is unaffected by mineral acids, except hydrofluoric, which rapidly dissolves it—still more rapidly when mixed with nitric acid. Sodium hydroxide solution does not dissolve it, but the melted hydroxide does so rapidly. Melted sodium carbonate, chlorate, or bisulphate does not affect it. When heated in oxygen it is not attacked; heated chlorine attacks it rapidly, the other halogens less so. If in the original fusion the proportion of silicofluoride be increased, mixtures are obtained of  $\text{Cr}_2\text{AlSi}_3$  and  $\text{Cr}_2\text{AlSi}_4$ . This latter substance is harder and denser than the former, but the two are generally similar in their properties. At the temperature of its formation, the higher silicide tends to dissociate into the lower and silicon.

Similar double silicides have been obtained of aluminium with iron, cobalt, nickel, manganese, molybdenum and tungsten, but the first four have not been satisfactorily isolated from the regulus containing them, and the others have not been accurately analysed. The tungsten compound has a density of 9.5, contains 12 per cent. of silicon and very little aluminium. Chemically, it resembles the chromium compound.—J. T. D.

*Sulphur; Heat of Combustion of* —. H. Guan. Comptes rend., 1904, 139, 1219-1221.

The author has determined the heat of formation of

sulphur dioxide by burning sulphur in oxygen under pressure in the calorimetric bomb, determining at the same time the proportion of sulphur which is converted into sulphuric anhydride. The tabulated results show that the heat of formation of sulphur dioxide (gas) from sulphur (octahedral modification) increases with the pressure, the value for 2.5 atmospheres being 70.43 cal., and that for 45 atmospheres, 81.13 cal. The proportion of sulphur converted into sulphuric anhydride also increases with the pressure. The increase of the heat of formation of sulphur dioxide is strictly proportional to the increase of pressure up to 35 atmospheres, above which point the heat evolved increases more gradually. This increase in the heat of combustion is attributed to the production of increasing quantities of persulphuric anhydride as the pressure rises.—J. F. B.

*Sulphuric Acid; Determination of —, by Benzidine Hydrochloride. Determination of Sulphur in Pyrites.* G. von Knorre. XXIII., page 106.

*Persulphuric Acid; Catalytic Phenomena in the Preparation of —.* G. Petrenko. XI. A., page 91.

*Ammonium Chloride; Dissociation of —, regarded from the Analytical Standpoint.* L. Santi. XXIII., page 105.

*Bleaching Solutions [Sodium Hypochlorite]; Apparatus for the Electrolytic Preparation of —.* G. Jaeglé. XI. A., page 94.

*Boron; Reduction of Manganese Oxides by —. A New Manganese Boride.* B. du Jassonneix. XI. A., page 94.

#### ENGLISH PATENTS.

*Sulphuric Acid; Catalytic Process for Making Anhydrous —.* W. Kauffmann, Kalk, Germany. Eng. Pat. 7074, March 24, 1904.

SEE Fr. Pat. 337,423 of 1903; this J., 1904, 489.—T. F. B.

*Hydrocyanic Acid and Cyanides; Manufacture of — [from Thiocyanates].* G. E. Davis, Knutsford, Cheshire. Eng. Pat. 3018, Feb. 6, 1904.

To obtain hydrocyanic acid, a solution containing a thiocyanate (sulphocyanide), such as the spent water from the distillation of gas liquor, or mother liquor from the preparation of ferrocyanides, &c., from coal gas, is heated with a mixture of sulphuric acid and a manganese oxide, such as Weldon mud (but in any case containing available oxygen), in specified proportion, and the vapours are condensed in a suitable receiver. The apparatus used for carrying out the process is preferably that described in Eng. Pat. 26,996 of 1903 (this J., 1904, 1088). To obtain an alkali cyanide, the vapours are passed into a solution of an alkali hydroxide. (Compare Eng. Pat. 20,069 of 1903; this J., 1904, 787.)—E. S.

*Carbonic Acid; Production of — [from Gases of Combustion].* G. A. Schütz. Eng. Pat. 25,867, Nov. 26, 1903. II., page 79.

*Sulphate of Ammonia Saturators.* K. Zimpell. Eng. Pat. 23,379, Oct. 29, 1904. III., page 81.

*Electrolytic Hydrogen and Oxygen; Apparatus for Collecting, Separating, Drying or Similarly Treating —.* P. Garuti and C. R. Pompili. Eng. Pat. 27,249, Dec. 12, 1903. XI. A., page 94.

*Chlorine; Manufacture of —, by Electrolysing Sodium Chloride, and Apparatus therefor.* S. Leatham, York, and E. G. P. Bonfield, Hendon, Middlesex. Eng. Pat. 456, Jan. 7, 1904.

That part of the cell where sodium hydroxide is produced is supplied with some compound of chlorine, such as hydrochloric acid, capable of reacting to reproduce sodium chloride. The compound may be introduced through a hollow and perforated cathode.—R. S. II.

#### UNITED STATES PATENTS.

*Sulphur Trioxide; Process of Making —.* H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 778,099, Dec. 20, 1904.

SULPHUR dioxide, together with "a gaseous substance

capable of producing an endothermic reaction" therewith, is passed through a heated compartment, and the application of heat is so controlled that the temperature is kept below the dissociating point of sulphur trioxide, by "chemical refrigeration" in some cases. The sulphur trioxide thus produced is condensed, and the gaseous by-product is oxidised, mixed with more sulphur dioxide and the process continued. One of the claims is for treating a mixture of sulphur dioxide with carbon dioxide in the manner described. Another of the claims is for "the process of making compounds of sulphur and oxygen which evolve heat on their formation" by "uniting substances forming the same, and simultaneously producing a substance capable of absorbing heat during its formation, and apportioning and disposing the ingredient so that the heat which would be evolved in the formation of one is absorbed by the other to such a degree that the generation of a temperature sufficient to dissociate the sulphur-oxygen compound is avoided." (Compare U.S. Pat. 724,251 of 1903; and U.S. Pat. 769,585 of 1904, this J., 1903, 554; and 1904, 936.)—E. S.

*Pyrites; Apparatus for Treating —.* W. B. Simons. Charleston, S.C. U.S. Pat. 778,149, Dec. 20, 1904.

In a pyrites furnace, two or more rows of hollow bars horizontally arranged with spaces between, are superposed, each row being at a certain distance from the one next above or below, with a connected series of stirrers over each row, whereby the pyrites may be caused to descend while burning, from range to range.—E. S.

#### FRENCH PATENTS

*Ammonia and Caustic Alkali; Method of Production of —, by Electrolysis.* G. E. Cassel. Fr. Pat. 346,060, Sept. 3, 1904. XI. A., page 95.

*Copper, Zinc, Cadmium, Silver, Nickel, Cobalt, and Tungsten; Obtaining Hydroxides of —, in the Wet Way, by Direct Extraction.* D. Lance. Fr. Pat. 342,865, May 4, 1904 (See this J., 1904, 1032).

In attacking silicious nickel ores, nitrous sulphuric acid to which a decomposable chloride or concentrated sea water is added, is used, and the attacking acid maintained at a stated density, by addition of water, and towards the end of the operation, of sodium bisulphate solution in order to hydrate the salts formed.

Plant for the manufacture of sulphuric acid by the chamber process is shown, but instead of the usual Glover tower, an apparatus of the "Alsing" type is provided in which the ore is agitated with nitrous sulphuric acid, chloride and sodium bisulphate resulting from the manufacture of nitric acid, the mixture being heated by injection of hot air, whilst the escaping nitrous gas are led back to the lead chambers. The function of the "Alsing" apparatus is stated to be wholly analogous to that of the Glover tower which it replaces, except that the sulphuric acid is discharged as sulphate of the metal dissolved. The nitrous and chloro-nitrous products are thus continuously regenerated. Instead of heating the "Alsing" apparatus by hot air, the sulphuric acid may be formed in the cylinders of the apparatus itself as in ordinary lead chambers, by passing in hot sulphur dioxide gas with the usual oxidising agents.—E. S.

#### VIII.—GLASS, POTTERY, AND ENAMELS.

*Sodium Borates; Some Physical Characters of the — with a New and Rapid Method for the Determination of Melting Points.* C. H. Burgess and A. Holt, Jr. VII., page 88.

#### ENGLISH PATENTS.

*Glass; Apparatus for use in the Manufacture of Sheet and of other Articles, of —.* E. Gobbe, June Belgium. Eng. Pat. 2470, Feb. 1, 1904.

A CYLINDRICAL steel or cast-iron vessel to receive the



molten glass is provided with an opening at its lower end closed by a slide, and, at its upper end, with pipes and cocks for creating a vacuum in, or supplying compressed air to, the interior of the vessel. The vessel is filled with glass by exhausting it, whilst its lower end dips into the molten glass, and it is emptied by forcing compressed air into it. The parts of the vessel in contact with the glass may be water-cooled or protected by a refractory lining, which last may extend further downwards than the metal casing of the vessel. A sight tube may also be provided. In order to make sheet glass by means of this apparatus, the opening at the bottom is made in the form of a long narrow slot, through which the glass issues slowly, being at the same time rapidly cooled by air-jets on both sides. By making the vessel in two halves it may also be used as a mould for bottles, &c. In this case it is filled with glass as usual, and the glass forced out, leaving the water-cooled walls of the vessel covered with a layer of glass. The glass left in the lower opening is then finished into the bottom of the bottle by a tool introduced through the opening.

—A. G. L.

*Glass Melting Furnaces.* E. Baudoux, Genappe, Belginm. Eng. Pat. 19,067, Sept. 3, 1904.

A NUMBER of small "monolithic" tanks are set in a furnace divided by a wall with openings for the tanks into a larger melting and a smaller working compartment. By means of two transverse partitions, each tank is divided into a working, a refining, and a melting compartment. The arrangement enables different products to be produced continuously and simultaneously with only one furnace.

—A. G. L.

*Filter-Presses [Potters' "Slip" Presses]; Trays for —.* T. Lawrence, Colwyn Bay, Wales. Eng. Pat. 2211, Jan. 29, 1904.

THE claim is for a light rectangular tray for use with potters' slip presses, consisting of two sheets of galvanised wire gauze clamped to each side of a flat sheet of galvanised metal, and secured by means of oak rails and screws. The metal sheet is pierced by a circular hole at a suitable distance from one edge, and guide tubes are fixed at the side to support the trays upon the framework of the "slip" presses.—L. F. G.

*Ceramic Printing and the like.* R. Marzin, Eichwald, Austria. Eng. Pat. 1933, Jan. 26, 1904.

THE paste for ceramic printing processes is made by heating and working together the pulverised underglazing colour, such as cobalt blue, with a mixture of extract of aloe or other sticky plant substance, glycerin, syrup and an alkali carbonate. A small quantity of citric, tartaric, or similar acid may be advantageously added.—A. G. L.

#### UNITED STATES PATENTS.

*Refractory Material [Fused Quartz]; Manipulation of—.* E. Thomson, Assignor to General Electric Co. U.S. Pat. 778,286, Dec. 27, 1904. XI. A., page 95.

*Vitreous Ware; Art of Decorating —.* R. K. Duncan, Washington Pa. U.S. Pat. 772,876, Oct. 18, 1904.

To produce letters and designs on vitreous ware, a material called "lead sub-borate" is used. This is made by melting together, at a low red heat, either 111.5 parts of litharge, or 113.8 of red lead, or 165.5 of lead nitrate, together with 31 parts of crystallised, or 17.5 of fused, boric acid. If lead nitrate is used, a somewhat better colour is obtained than with the oxide of lead; a mixture of 17.5 parts of lead nitrate, 100 of litharge and 31 of crystallised boric acid may be used with advantage. The material forms an almost colourless mass, which, in the fused condition, readily dissolves colouring matters, such as metallic oxides. The material is rendered opaque by the addition of oxides of antimony, arsenic, tin, &c., or by very careful heating. The fused material is granulated in all cases by pouring it into water, and then powdered in an agate mortar, or between agate rollers. It is applied by means of stencil-plates to the articles as

these are taken, whilst barely red-hot, from the moulds. If the temperature of the articles at this stage, however, should be too high, the fusibility of the material must be diminished, which may be done either by increasing the proportion of boric acid used, or, preferably, by adding a substance such as baryta, to it, which raises its melting point. (See also U.S. Pat., 748,850, Jan. 5, 1904; this J., 1904, 116.)—A. G. L.

#### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

*Portland Cement; Russian Standards for —.* Riga Ind.-Zeit., 1904, 30, 189. Chem.-Zeit., 1904, 28, Rep. 391—392.

THE term "Portland Cement" shall apply to products obtained from natural marl or artificial mixtures of clay and calcium carbonate, kilned until sintering occurs, and then ground to the fineness of flour. The hydraulic modulus, i.e., ratio of lime and alkalis to silica, alumina and ferric oxide must not be less than 1.7, or more than 2.2, and the proportion of sulphur trioxide should not exceed 1.75 per cent., magnesia 3.0 per cent., and foreign substances 2.0 per cent.

*Sampling.*—In parcels of more than 3000 casks, a sample of 15 lb. shall be drawn for every ton in 0.3 per cent. of the total weight of each 3000 casks. Between 2000 and 1000 casks the latter figure shall form the basis of division, the samples being taken from 0.5 per cent. of the tonnage, whilst below 1000 casks, three casks shall be sampled; but if the parcel is less than 500 casks it need only be tested for sp. gr. and constancy of volume. All tests to be made at a temperature of 16°—18° C., all the materials being brought to this temperature; if this is impracticable, the report must be endorsed to that effect. Not more than six test samples to be prepared from the same cement paste, the blocks to be finished before hardening has commenced. The paste must be manipulated, without interruption, for 5 minutes after adding the water. The specific gravity is to be determined with the volumometer of Schumann or Le Chatelier-Candlot, and the sp. gr. of the paste dried at about 120° C. must not fall below 3.05.

*Setting Test.*—Hardening must not commence sooner than a quarter of an hour after the addition of the (pure, fresh) water, and must not be complete sooner than 1 hour or later than 12 hours. The test samples must be of normal consistence, this property being determined by mixing 400 grms. of the cement with sufficient water to make a stiff paste, and gently placing the latter in a small cylinder, 4 cm. high and 8 cm. wide, resting on a glass plate. A cylindrical shaft, 1 cm. in diameter and weighing 330 grms., is carefully lowered into the paste until the pointer on the attached scale is opposite the mark 40, and is then allowed to sink down by its own weight. The standard consistence corresponds to mark 5½—6½ on the scale, and is generally obtained by the use of 22—30 per cent. of water. The setting test is performed on quantities of 400 grms. of cement in the Vicat apparatus (load 300 grms.), at intervals of 5 minutes, the commencement of setting being indicated when the needle stops at ½ mm. from the bottom, and the end being reached when the needle does not penetrate deeper than ½ mm. below the surface. The preliminary tests can be performed on blocks 8—10 cm. in diameter and 1 cm. thick.

*Constancy of Volume.*—Cakes made from normal paste should not exhibit curvature or radial cracks at the edges when warmed, or when left in water for 27 days. In the hot test the cakes are placed, 24 hours after setting, in an air oven, and heated to 120° C., for at least 1½ hours.

*Fineness.*—The dry cement must not leave more than 50 per cent. of residue when passed through a sieve with 4900 meshes (of 0.05 mm. wire) per sq. cm., or more than 15 per cent. on a 900-mesh sieve of 0.1 mm. wire.

*Tensile Strength.*—The test blocks must be uniformly prepared from normal mortar, and have a sectional area of 5 sq. cm. at the point of rupture, the mean of the four highest values furnished by six blocks in the Michal's tester being taken as representing the breaking strain.

In the case of cement-sand mixtures, the amount of water necessary to produce normal consistence is determined with the rammer, or stated by the maker; otherwise, about 10 per cent. of the weight of the mixture is employed, until a workable paste is formed. This paste is rammed in the mould by the exercise of mechanical force represented by 1 kg./m. per 10 grms. of dry substance, and under this treatment the block should exude a milky liquid. The weight per unit volume of the freshly made block is the sp. gr. of the normal mortar (1.3), and ramming must be continued until this weight coincides with the above-mentioned sp. gr. With sample blocks of pure cement the paste is placed in the mould, and the marble base is tapped several times against the table before stroking off the excess. The minimum tensile strength of these blocks is fixed at 20 kilos. per sq. cm. at the end of the first 7 days, and 25 kilos. after 28 days, but if the value at the first test is 23 kilos., no second test need be made. The sand used for the cement-sand mixtures is quartz sand that has been passed through sieves with 64, 144 and 225 meshes respectively per sq. cm., the residues left on the two latter being mixed in equal proportions and used as normal sand. The thickness of the wire in the three sieves shall be 0.4, 0.3 and 0.2 m.m. respectively. The minimum tensile strength of the blocks shall be 7 kilos. per sq. cm. at the end of 7 days, and 10 kilos. after 28 days.

*Packing and Tare.*—Casks must have a uniform weight of 10<sup>3</sup> pood nett, and about 11 pood gross [1 pood = 36.1 lb.], and payment shall be made on the nett weight, without any allowance for leakage. The casks must be marked "Portland Cement," with the maker's name, a number indicating to which delivery it belongs, and the year of manufacture. Delivery in bags allowed only by consent. Loss by leakage not to exceed 2 per cent., unless otherwise agreed. [1 kilo. = 1000 grms., = 2.2 lb.; 1 sq. cm. = 0.155 sq. in. • 1 cm. = 0.39 in.]—C. S.

#### ENGLISH PATENTS.

*Cellular and Fibrous Substances; Treatment by Impregnation of Porous*—, and *Apparatus for the Purpose.* The Electric Timber-Seasoning and Preservation Co., Ltd., and J. H. West, London. Eng. Pat. 26,899, Dec. 8, 1903.

THE material to be impregnated, such as wood, is almost completely immersed in a bath of the liquid with which it is to be charged, so that the uppermost surface is maintained practically parallel with the top surface of the bath. The upper and lower surfaces of the material bear upon metallic electrodes, from which a current traverses the body under treatment. A special form of tank suitable for the process is described. The upper electrode is provided with a pad of absorbent material which can be wetted for maintaining moist contact with the upper, unimmersed, surface of the material.—R. S. H.

*Fire-proof Paint or Coating; Composition of Matter for*—, W. Fairweather, Glasgow and London, from A. B. Nettleton, Chicago, Ill. Eng. Pat. 22,423, Oct. 18, 1904.

POWDERED silicon carbide is gradually added to an equal weight of semi-liquid water glass, preferably sodium, not potassium silicate. Unless the paint can be applied immediately after mixing, from 3 to 10 per cent. of calcium carbonate is also added to it, to prevent an effervescence which otherwise takes place shortly after mixing.—A. G. L.

*Kilns or Furnaces; Impts. in*—, especially applicable to *Kilns for Burning Lime, Cement or the like.* B. Blount and R. E. Middleton, London. Eng. Pat. 26,778, Dec. 7, 1903.

THE material to be burnt is continuously fed on to the bottom of a substantially annular kiln or furnace, which bottom is caused to travel on a circular track or itself forms part of a disc rotating on suitable bearings. Fuel is injected by one or more nozzles, preferably placed near the discharge end of the kiln, in a direction opposed to that of rotation. The burnt material is removed from the kiln before it has travelled through an angle of 360°.

—A. G. L.

*Kiln for Burning Cement or Reducing or Calcining Ores.* G. Gröndal, Djursholm, Sweden. Eng. Pat. 6635, March 18, 1904.

SEE Fr. Pat. 341,382 of 1901; this J., 1904, 867.—T. F. B.

*Emery, Artificial; Manufacture of*—, A. Gacon, Marly le Roi, France. Eng. Pat. 23,492, Oct. 31, 1904.

A MIXTURE is made under a jet of water of 769 kilos. of bauxite (preferably ferruginous), 513 kilos. of coke, 50 kilos. of sodium nitrate, and 250 kilos. of sawdust. The firm pasty mass produced is suitably moulded, stacked in a furnace and fired, the product obtained being afterwards pulverised.—A. G. L.

#### UNITED STATES PATENTS.

*Fire-Brick Composition.* J. Anderson, Monaca, Pa. U.S. Pat. 777,995, Dec. 20, 1904.

THE composition consists of silica-sand 90 per cent., asbestos 5 per cent., and fireclay 5 per cent., and is mixed with a sufficient quantity of salt water.—B. N.

*Kiln [for Lime, &c.].* R. Booth, London, and F. Crosland, Egremont, Cheshire. U.S. Pat. 777,936, Dec. 20, 1904.

SEE Eng. Pat. 9437 of 1901; this J., 1902, 707.—T. F. B.

#### X.—METALLURGY.

*Iron Metallurgy; The Forselles Process of*—, Teknisk Tidskrift, 1904, 34, 88. Chem.-Zeit. 1904, 28, Rep. 394.

EXPERIMENTS were made on a large scale with this process, at the Rendsburg works, the charge consisting of 40 tons of scrap iron (Martin material with 0.2 per cent. of carbon); 40 tons of Kragerö ore (containing 58.29 per cent. of tribasic calcium phosphate (26.7 per cent. of phosphoric acid), 8.48 per cent. of alumina, 1.16 per cent. of ferric oxide, 3.37 per cent. of chlorine, 1.86 per cent. of hygroscopic moisture and 26.48 per cent. of residue insoluble in acid; together with 40 tons of blast-furnace coke and a sufficiency of lime and quartz. The slags gave on analysis 6.61—17.23 per cent. of total phosphoric acid, and 2.92—6.89 per cent. of phosphoric acid soluble in citric acid, and were all on this account suitable as fertilisers. The characteristic feature of the process, however, is that it enables scrap ingot iron to be worked up into pig iron, which can then be reconverted into ingot iron.—C. S.

*Iron Oxides; Influence of Water Vapour on the Reduction of*—, by *Oxides of Carbon.* O. Boudouard. Comptes rend., 1905, 140, 40-42.

IN view of Gayley's results, when using a dry air blast in the manufacture of iron (this J., 1904, 1148), the author has made laboratory experiments on the effect of passing the gases from oxalic acid over ferric oxide, and also carbon monoxide over ferrous oxide, each series being carried out with the gas dry in one case, and saturated with moisture at the ordinary temperature in another. The results show that the reducing action of the gas is stronger when it is dry than when moist; but the difference, which is very marked when the temperature is 400°—500°C., lessens as the temperature rises, and practically vanishes at 1050°C. In the cooler regions of the furnace there will be more complete reduction of the oxide of iron by carbon monoxide when dry, and as the carbon dioxide formed has at this lower temperature less tendency to react on the coke and re-form carbon monoxide, there will be an economy of fuel. Near the tuyères, however, the water of the moist gas decomposes, forming hydrogen and oxygen, and we have no exact knowledge of the subsequent behaviour of this hydrogen, which, in presence of carbon dioxide, may regenerate the monoxide and water vapour.—J. T. D.

*Steels; Brittleness of certain*—, A. Perot and H. M. Lévy. Comptes rend., 1904, 139, 1198—1200.



THE authors have examined, by means of an apparatus designed by themselves, specimens of steel. They find very variable results for the brittleness under apparently identical conditions, and conclude that it varies at different parts of the steel. The brittleness varies, too, with the rapidity of the shock; for the same steel which suffers a considerable permanent deformation before breaking with a force slowly applied, breaks with much less previous deformation as the speed of shock is increased, and at a sufficient speed of shock is perfectly brittle, that is to say, suffers no permanent deformation before breaking. —J. T. D.

*Calcium; Metallic* —. Part I. K. Arndt. Ber., 1904, 37, 4733–4738.

THE author made a careful examination of the calcium which can now be obtained commercially. The usual impurities are silicon (0.2 to 0.5 per cent.) and aluminium (0.25 to 0.3 per cent.), together with traces of iron. The metal does not contain oxide or chloride in solution, but in the sticks cavities containing these substances were occasionally found. The specific gravity of pure calcium is 1.52; in the samples examined, however, this was often as high as 1.59, owing to the presence of silicon. When melted under potassium chloride, a portion of the potassium is displaced, and is obtained as a crust on the metal-point when cold. It was not possible to observe the melting of calcium owing to the formation of a film of oxide, but the point at which it softens is 800° C. *In vacuo* the metal sublimes without melting and the sublimate consists of pure calcium. The vapour readily combines with the oxygen and nitrogen of the air, thus affording a means of obtaining high vacua. —B. J. S.

*Sulphur [in Iron]; The Wiborgh Test for* —, using a Filter. Ax. Silverling. XXIII., page 106.

*Chromium in Steel; Note on the Determination of* —. F. Ibbotson and R. Howden. XXIII., page 106.

*Lead Ores; Complete Analysis of* —. J. A. Muller. XXIII., page 107.

#### ENGLISH PATENTS.

*Ores, more particularly Iron Ore; Process and Apparatus for Smelting* —. O. Simmersbach, Crefeld, Germany. Eng. Pat. 7367, March 28, 1904.

SEE Fr. Pat. 341,788 of 1904; this J., 1904, 903.—T. F. B.

*Chrome-Nickel Steel; Manufacture of Case-hardened Articles of* —. A. de Dion and G. Bouton, Puteaux, France. Eng. Pat. 23,331, Oct. 29, 1904. Under Internat. Conv., April 23, 1904.

SEE Fr. Pat. 342,591 of 1904; this J., 1904, 940.—T. F. B.

*Copper; Coating Metals with* —. S. Cowper-Coles and Sherard Cowper-Coles and Co., Ltd., London. Eng. Pat. 28,590, Dec. 29, 1903.

THE articles to be treated, after being properly cleansed, are placed in a suitable receptacle, from which preferably the air has been exhausted, together with cuprous oxide or finely-divided metallic copper, and rotated or oscillated for an hour or more while being maintained at a dull red heat.—J. H. C.

*Zinc and other Sulphides; Apparatus for Recovering from their Ores by the Wet or Chemical Process* —. J. H. Gillies, Melbourne. Eng. Pat. 20,160, Sept. 19, 1904.

THE stream of tailings containing the mineral sulphides is made to flow down the slope of a funnel-shaped receptacle which contains the liquid chemical employed. The apparatus is so arranged that the incoming and outgoing cold liquid does not materially affect the temperature of the chemical liquid in the upper portion of the apparatus, which is heated by a steam jacket or other convenient

means. The waste particles escape by pipes placed at the bottom of the funnel.—J. H. C.

#### UNITED STATES PATENTS.

*Precious Metals; Apparatus for Recovering* —. V. Tunbridge, Newark, N.J. (Administratrix of J. Tunbridge, deceased). U.S. Pat. 777,159, Dec. 13, 1904.

THE apparatus consists of a supply channel having a backwardly-inclined screen at its discharge end, from which the pulp passes to a separator consisting of several sediment-collecting hoppers, the overflows of which are progressively higher towards the outlet, thence to a forwardly-inclined screen provided with means for holding soap, and finally to a filtering tank adapted to contain oil at its receiving end and filtering material between the oil and the outlet.—J. H. C.

*Precious Metals; Method of Recovering* —, from [Cyanide] Solutions. I. Anderson, Prescott, Ariz., Assignor to M. Scanlon, Whitehills, Ariz. U.S. Pat. 778,348, Dec. 27, 1904.

PRECIOUS metals are recovered from their cyanide solutions by adding soluble chlorides and sulphides, and then a mineral acid, such as sulphuric acid. The insoluble compounds of the precious metals formed are separated, and the cyanide solution is regenerated by the addition of lime, the latter process being applicable to any solution containing potassium sulphate and hydrocyanic acid. —E. S.

*Metals; Precipitating* —, from Cyanide Solutions, and Regenerating the Solutions. L. E. Porter, Camp Rochester, Cal. U.S. Pat. 778,547, Dec. 27, 1904.

ALKALINE cyanide solutions of metals are treated with zinc shavings, calcium hydroxide, and an ammonium salt; and after separation of the metals precipitated, the solution is regenerated by addition of an alkaline carbonate to precipitate part of the zinc as a double carbonate of calcium and zinc. Ores containing gold, silver and copper are leached with a cyanide solution, from which the gold and silver are precipitated by zinc; the copper is subsequently precipitated by adding ammonia and zinc dust, and the cleared solution is regenerated for re-use. —E. S.

*Blast-Furnace*. J. Coyne, Allegheny, Pa. U.S. Pat. 777,498, Dec. 13, 1904.

THE furnace has an outlet for the normal escape of gas, an explosion chamber connected thereto, and means for washing the gases as they pass through the chamber, and for separating dust. The explosion chamber has two compartments, and is provided with a water-seal to prevent the passage of gases from one to the other under normal pressure. Connected with the explosion chamber is a dust-collecting chamber, which is usually closed, but may be opened for cleaning when required.—J. H. C.

*Furnace for Roasting, Smelting, &c.* U. Wedge, Ardmore, Pa. U.S. Pat. 777,577, Dec. 13, 1904.

THE furnace is circular, and has a central hollow shaft open at the top and provided with one or more stirrer arms projecting therefrom into the treating chamber, the fastenings of the arms being accessible from the interior of the shaft. The shaft is surrounded by a refractory or non-conducting shell, which is closed by a flange at the top. The arms are provided with passages for the flow of cooling liquid.—J. H. C.

*Brazing; Process of* —, and Brazing Compound. L. R. Schaap, Loveland, Colo., Assignor to the National Brazing Compound Co., Denver, Colo. U.S. Pat. 777,546 and 777,547, Dec. 13, 1904.

THE parts to be united are sufficiently heated while applying a mixture of 2 oz. each of "prussiate of potash" and plaster of Paris,  $\frac{1}{2}$  oz. of charcoal, 1 oz. of citric acid and 2 oz. of borax, and finally applying the brazing metal.—J. H. C.

*Aluminium or Aluminium Alloys; Solder for —.* R. Fortun and E. Sempun, Madrid. U.S. Pat. 778,025, Dec. 20, 1904.

SEE Eng. Pat. 13,328 of 1904; this J., 1904, 986.—T. F. B.

*Aluminium or other Metals; Art of Reducing —.* H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 778,100, Dec. 20, 1904.

THE process consists, in general terms, in exposing oxy-compounds of metals "to the action of a reducing agent capable of liberating heat during reduction and utilising the heat so liberated by the employment of reducing agents absorbing heat during reduction, the said endothermic and exothermic reduction processes being so proportioned that the heat evolved by exothermic reduction will be sufficient or in excess of that required to maintain the endothermic reduction." Specifically, aluminium is reduced from aluminium oxide by exposing the latter to the action of magnesium and acetylene at a reacting temperature. (Compare U.S. Pat. 775,060 of 1904; this J., 1904, 1225.)—E. S.

*Metallic Oxides; Process of Reducing —, with Metallic Aluminium.* F. C. Weber, Chicago, Ill. U.S. Pat. 778,345, Dec. 27, 1904.

THE metallic oxide is mixed with aluminium, both in fine powder, and the mixture is "strongly dried by steam heat," "thereby completely and absolutely dehydrating the material and dissociating the oxide and sulphide molecules from the to-be-treated charge in one operation." The hot, dry mixture is then briquetted, and the briquettes are "hermetically sealed" preparatory to reduction of the charge. (Compare U.S. Pat. 705,727; and Fr. Pat. 324,534, both of 1902; this J., 1902, 1142; and 1903, 559.)—E. S.

*Sulphides from their Ores; Apparatus for Separating —.* J. H. Gillies, Melbourne. U.S. Pat. 778,747, Dec. 27, 1904.

SEE Eng. Pat. 20,159 of 1904; this J., 1904, 1150.—T. F. B.

*Alloy.* C. H. Bierbaum, Buffalo, N.Y. U.S. Pat. 778,398, Dec. 27, 1904.

THE alloy is composed of zinc (86 per cent.), copper (9.9 per cent.), aluminium (4 per cent.), and magnesium (0.1 per cent.).—E. S.

#### FRENCH PATENT.

*Iron and Steel; Furnace for Treating Sheet —.* H. H. Goodsell. Fr. Pat. 345,974, Sept. 1, 1904.

SEE Eng. Pat. 18,746 of 1904; this J., 1904, 1094.—T. F. B.

*Gold [Ore] Separators and Classifiers.* E. J. Swyny and S. G. Plucknett. Fr. Pat. 346,151, Sept. 9, 1904.

SEE Eng. Pat. 19,140 of 1904; this J., 1904, 1150.—T. F. B.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A.)—ELECTRO-CHEMISTRY.

*Persulphuric Acid; Catalytic Phenomena in the Preparation of —.* G. Petrenko. J. russ. phys.-chem. Ges., 1904, 38, 1081–1088. Chem. Centr., 1905, 1, 6–7.

IN the electrolysis of sulphuric acid, the yield of persulphuric acid depends upon the platinum anode; this is oxidised and thus acquires catalytic properties, in consequence of which the amount of persulphuric acid is diminished. In presence of hydrochloric acid, the yield of persulphuric acid is nearly doubled. Iridium, when used as anode, is dissolved to a greater extent and gives distinctly lower yields of persulphuric acid than platinum.—A. S.

*Bleaching Solutions [Sodium Hypochlorite]; Apparatus for the Electrolytic Preparation of —.* G. Jaegle. Bull. Soc. Ind. Mulhouse, 1904, 74, 327–333.

THE apparatus consists of a rectangular vat, divided into a number of narrow compartments by glass partitions.

When working with an E.M.F. of 110 volts, two such vats may be used, each divided into 9 compartments. Each compartment is provided with a coil for cooling purposes, the temperature of the liquid being maintained at from 35° to 40° C. Carbon cathodes and platinum anodes are used. The electrolyte consists of a 10 per cent. solution of sodium chloride, to which is added a small quantity of rosin soap (200 to 400 grms. per cb. m.) and calcium chloride, the former to prevent reduction of the hypochlorite at the cathode. In a battery of 42 such vats, the power consumption has been found to average 6.4 kilowatt-hours per kilo. of available chlorine produced, the consumption of sodium chloride being 6.5 kilos. A series of trials extending over 9 months gave an average strength of hypochlorite solution of 16.56 grms. of available chlorine per litre, falling to 14.46 grms. per litre after 24 hours on the average. The current employed, at 110 volts, averaged 45.42 ampères, and the temperature was maintained at 38° C. The cost of the bleaching liquor thus produced works out at approximately the same as that of bleaching powder, calculating on the basis of available chlorine, viz., 0.4M. per kilo. of available chlorine.—T. F. B.

*Boron; Reduction of Manganese Oxides by —.* A new Manganese Boride. B. du Jassonneix. Comptes rend., 1904, 139, 1209–1211.

IN the electric furnace, manganese oxides are rapidly reduced by amorphous boron. With excess of oxide, the fused mass may contain as much as 97 per cent. of manganese, and can be filed, but with excess of boron, more granular and harder substances are obtained, containing up to 20 per cent. of boron. From these the author has isolated a definite boride, MnB, as a crystalline metallic powder of sp. gr. 6.2. Halogens and oxygen attack it at high temperatures; water (or steam) slowly decomposes it, evolving hydrogen, and acids attack it rapidly. Alkali hydroxides or carbonates at a red heat attack it, forming manganates and borates.—J. T. D.

*Rotating Anode in Electro-Analysis; Use of the —.* E. F. Smith, G. H. West and L. G. Kollock. XXIII., page 107.

*Metals; Electrolytic Deposition of —, with Rapid Stirring of the Electrolyte.* A. Fischer and R. J. Bodaert. XXIII., page 107.

### ENGLISH PATENTS.

*Electrodes for Accumulators with invariable Electrolyte.* E. W. Jungner, of Norrköpping, Sweden. Eng. Pat. 21,402, Oct. 5, 1904. Under Internat. Conv., Oct. 7, 1903.

THE active mass of the electrode consists of non-conductive oxides or hydroxides, mixed with graphite which has been coated by electrolysis with a thin sheet of some conductive metal, such as nickel, which is indifferent to the electrolyte; the object being the lowering of the conductive resistance of the active mass.—R. S. H.

*Galvanic Batteries.* P. Möllmann, Berlin. Eng. Pat. 23,622, Nov. 1, 1904.

THE electrolyte is filled into the battery in a dry, non-active condition, so that the battery can be subjected to long storage without any premature corrosion of the electrodes; when required for use water is added. To prevent the hygroscopic dry electrolyte from taking up moisture, it is mixed with finely-powdered gum tragacanth.—R. S. H.

*Cellular and Fibrous Substances; Treatment, by Impregnation, of —, and Apparatus for the Purpose.* The Electric Timber-Seasoning and Preservation Co., Ltd., and J. H. West. Eng. Pat. 26,899, Dec. 8, 1903. IX., page 92

*Electrolytic Hydrogen and Oxygen; Apparatus for Collecting, Separating, Drying or similarly treating —.* P. Garuti and C. R. Pompili, Rome. Eng. Pat. 27,249, Dec. 12, 1903.

THE present invention is an improvement of the previously



described apparatus of the same inventors (this J., 1902, 778). A water-trap serves to retain the spray carried over by each of the separate gases, and to allow of the electrolyte running back into the cell. The gases afterwards pass through tubes in which heated coils of platinum wire serve to remove traces of oxygen or hydrogen from the respective gases.—R. S. H.

*Chlorine; Manufacture of* —, by *Electrolysing Sodium Chloride, and Apparatus therefor*. S. Leetham and E. G. P. Bousfield. Eng. Pat. 456, Jan. 7, 1904. VII., page 90.

*Registering by Electrical Means the Progress of Several Physical Processes; Apparatus for Automatically* —. Siemens and Co. Eng. Pat., 17,528, Aug. 11, 1904. I., page 77.

*Electrolytic Process and Apparatus therefor [Alkali, &c., Manufacture]*. C. P. Townsend, Washington, U.S.A. Eng. Pat. 18,403, Aug. 25, 1904.

SEE FR. PAT. 345,871 OF 1904; this J., 1905, 33.—T. F. B.

#### UNITED STATES PATENTS.

*Furnace; Electric* —. H. M. Howe, New York, Assignor to Elmer and Amend, N.Y. U.S. Pat. 778,194, Dec. 20, 1904.

THIS INVENTION consists of a split cylinder, which is hollowed to form a heating chamber, and in the inner face of the walls of the chamber is a spiral groove carrying a heating wire, U-shaped in cross-section. A crucible fits inside the chamber. The furnace has a cover carrying a plug, through which pass wires connected to a resistance element, the latter being placed in grooves made internally in two blocks inside the crucible. (See also Eng. Pats. 28,780 and 28,782, 1903; this J., 1904, 666.)—B. N.

*Hydrosulphurous Acid; [Electrolytic] Process of Producing Salts of* —. A. Frank, Charlottenburg, Germany. U.S. Pat. 777,669, Dec. 20, 1904.

SEE GER. PAT. 125,207 OF 1899; this J., 1902, 51.—T. F. B.

*Gases; [Electrical] Apparatus for the Treatment of* —. E. E. Werner, St. Louis, Mo., Assignor to Electrical Purifying Co., Kansas. U.S. Pat. 777,987, Dec. 20, 1904.

IN AN ENCLOSED chamber, with suitable inlet and outlets, are a pair of electric terminals, between which an arc is established. Compressed air is led into the chamber and is allowed to expand in the gap between the terminals, so that the arc is deflected and elongated transversely without being broken. The volume of compressed air which is introduced, and the extent of deflection and elongation of the arc, are regulated by the volume of the gases escaping from the chamber.—B. N.

*Gases from Air; [Electrical] Process of Generating* —. E. E. Werner, St. Louis, Mo., Assignor to Electrical Purifying Co., Stafford, Kansas. U.S. Pat. 777,988, Dec. 20, 1904.

THE PROCESS is claimed, as described in the preceding abstract (U.S. Pat. 777,987), of "generating gases from air" by projecting compressed air in a transverse direction into the path of an arc, and regulating the extent of deflection and elongation of the arc, proportionately to the volume of air introduced, by varying the outflow of the treated gases.—B. N.

*Gases; [Electrical] Apparatus for the Treatment of* —. E. E. Werner, St. Louis, Mo., Assignor to Electrical Purifying Co., Stafford, Kansas. U.S. Pat. 777,989, Dec. 20, 1904.

THE APPARATUS is similar to the one described in U.S. Pat. 777,987 (see above). The terminals are in connection with the secondary of an induction coil, and the chamber communicates with a cylinder provided with a piston working against a spring. The movements of the piston, which are controlled by the gas pressure, vary the amount

of the secondary in circuit, and therefore vary the supply of current proportionately to the supply of gas to the arc.—B. N.

*Gases; [Electrical] Apparatus for the Treatment of* —. E. E. Werner, St. Louis, Mo., Assignor to Electrical Purifying Co., Stafford, Kansas. U.S. Pat. 777,990, Dec. 20, 1904.

THE APPARATUS is similar to that described in U.S. Pat. 777,987 (see above), the air being compressed and cooled before being delivered to the arc, and the current for producing the latter is supplied from a transformer placed in a storage chamber for the gases. The transformer is cooled by the compressed gas, before the latter is discharged into the arc by a suitable pipe leading from the storage chamber.—B. N.

*Projecting Air against Electric Discharges; Device for* —. E. E. Werner, St. Louis, Mo., Assignor to Electrical Purifying Co., Stafford, Kansas. U.S. Pat. 777,991, Dec. 20, 1904.

THE COMPRESSED air to be treated, as described in U.S. Pat. 777,987 (see above), is injected, by means of a suitable device, in a number of divided streams or jets against the side of the arc and against the terminals.—B. N.

*Refractory Material [Electrical]; Manipulation of* —. E. Thomson, Swampscott, Mass., Assignor to General Electric Co., New York. U.S. Pat. 778,286, Dec. 27, 1904.

THIS INVENTION relates to a method of producing tubes, plates, or other articles, from quartz or other analogous refractory material in a finely-divided state. A refractory conducting body, having the desired contour, is surrounded entirely or partially with a quantity of the divided material, and the conducting body is heated by passing through it a current of sufficient strength, in order to produce fusion of the portions of the refractory material in contact with the conducting body. The fused material is separated from the conducting body, without destroying the form imparted to the mass by the latter.—B. N.

#### FRENCH PATENTS.

*Galvanic Element, Zinc and Peroxide of Lead, with Positive Electrode Insoluble in Acid*. R. Ziegenberg. Fr. Pat. 346,104, Sept. 7, 1904.

THE INVENTION consists essentially in the replacement of ordinary zinc, as a galvanic element, by an alloy containing over 90 per cent. of zinc, with small quantities of pure English tin, pure lead and mercury. The proportions recommended are the following:—94 per cent. of zinc, 2.5 per cent. of tin, 1.5 per cent. of lead and 2 per cent. of mercury, this alloy resisting the action of the acid except when the cell is in use.—B. N.

*Ammonia and Caustic Alkali; Method of Production of* —, by *Electrolysis*. G. E. Cassel. Fr. Pat. 346,066, Sept. 3, 1904.

THE GASES, produced by the action of an electric discharge on air, are absorbed in caustic alkali so as to form nitrites or nitrates, and the solution is electrolysed using insoluble electrodes without a diaphragm. Ammonia is liberated as a gas, and the caustic alkali is re-formed. The yield is improved by addition of 5 per cent. of lead nitrate, and nitrites must be present in sufficient quantity, but these additions may be dispensed with if a small current density is used at the cathode. Lime or calcium carbonate may be used instead of caustic alkali as the absorbent, and the calcium nitrite or nitrate is afterwards treated with a salt of an alkali metal. The nitrite or nitrate of the alkali metal is then treated electrolytically to obtain pure caustic alkali.—B. N.

#### (B.)—ELECTRO-METALLURGY.

*Aluminium Alloys; Thermo-Electricity of* —. H. Pécheux. Comptes rend., 1904, 139, 1202—1204.

THE AUTHOR has determined the thermo-E.M.F. of the

various aluminium alloys prepared by him as compared with copper, the cold junction being always at 17.5° C., the hot junction at 100°, 180°, and 380° C. All the metals,

single and alloyed, were employed cast into rods, without any mechanical treatment. The following are the results expressed in microvolts:—

TIN-ALUMINIUM :—				Al.	Sn <sub>2</sub> Al.	Sn <sub>3</sub> Al.	SnAl <sub>3</sub> .	SnAl <sub>2</sub> .	Sn.					
100°	..	..	..	162.75	181.68	196.82	208.18	223.31	227.10					
180°	..	..	..	359.08	366.72	416.38	458.40	462.22	477.50					
LEAD-ALUMINIUM :—				92 %	94 %	96 %	Al.	Pb.						
100°	..	..	..	94.63	113.55	151.40	162.75	211.96						
180°	..	..	..	181.68	219.53	363.36	359.08	416.35						
BISMUTH-ALUMINIUM :—				75 %	85 %	94 %	88 %	Al	Bi.					
100°	..	..	..	98.41	121.12	155.19	159.18	162.75	5916.0					
180°	..	..	..	204.39	280.09	302.80	325.51	359.08	9955.0					
MAGNESIUM-ALUMINIUM :—				68 %	77 %	85 %	66 %	Mg.	Al.	73 %				
100°	..	..	..	83.27	105.98	121.12	128.69	136.26	162.75	181.68				
180°	..	..	..	155.19	219.53	272.52	280.09	249.81	359.08	423.92				
380°	..	..	..	151.40	249.81	295.23	340.65	458.40	404.90	531.30				
ANTIMONY-ALUMINIUM :—				Sb.	SbAl <sub>3</sub> s.	SbAl <sub>3</sub> o.	SbAl <sub>4</sub> o.	SbAl <sub>3</sub> s.	Al.					
100°	..	..	..	2920.50	45.42	64.35	87.05	98.41	162.75					
180°	..	..	..	5459.65	105.98	151.40	177.90	211.96	359.08					
380°	..	..	..	7217.95	151.40	211.96	249.81	317.94	404.90					
ZINC-ALUMINIUM :—				Zn.	Zn <sub>3</sub> Al.	Zn <sub>2</sub> Al.	ZnAl.	ZnAl <sub>2</sub> .	ZnAl <sub>3</sub> .	ZnAl <sub>4</sub> .	ZnAl <sub>6</sub> .	ZnAl <sub>10</sub> .	ZnAl <sub>12</sub> .	Al.
100°	..	..	..	18.92	49.21	64.35	113.55	166.54	151.40	161.47	174.12	181.68	166.54	177.90
180°	..	..	..	26.95	94.63	128.69	246.03	340.65	314.16	348.22	404.92	389.64	382.00	382.00
380°	..	..	..	41.64	113.55	162.75	352.00	621.20	460.31	523.34	679.96	719.95	595.92	443.12

—J. T. D.

*Copper Galvanoplastic Process without Stirring and Heating.* S. von Maximowitsch. *Elektrochem. Zeits.*, 1904, 11, 165–166. *Chem. Centr.*, 1904, 2, 1773.

THE author, in order to avoid heating or stirring the electrolyte, arranges the electrodes horizontally, the anode above the cathode, so that the concentrated solution of copper sulphate flows directly from the former to the latter. A net of silk gauze is suspended between the electrodes to retain the anode mud. In the author's experiments, the electrolyte consisted of a solution containing 220 grms. of copper sulphate crystals and 25 grms. of sulphuric acid per litre, the current density was 6–10 amperes per sq. decm., the E.M.F. 0.8 volt. per ampere of current-density, and the distance between the electrodes, 8 cm. The deposit was smooth, bright and tough. The method is not patented.—A. S.

*Metals; Electrolytic Deposition of —, with Rapid Stirring of the Electrolyte.* A. Fischer and R. J. Bodaert. *XXIII.*, page 107.

#### ENGLISH PATENTS.

*Magnetic Separators for Ores or the like.* J. T. Dawes. *Prespatyn*, Flintshire. *Eng. Pat.* 27,298, Dec. 14, 1903.

THE material to be sorted is delivered on to a moving surface, such as the periphery of a rotating drum, immediately above which is a revolving disc rendered magnetic by a magnet arranged above it. Another magnet has its poles arranged within the drum opposite to the upper magnet poles, and of opposite polarity, so that an intense magnetic field is provided. The upper magnet poles have projections extending over the disc and over the sides of the drum, above shields kept in close contact with the sides of the drum by springs or other devices, in such a manner that the shield is between the drum and outer extremity of the magnet pole, so that the magnetic particles collecting on the underside of the disc at the outer extremity of the magnet projections, are kept

from rubbing against the drum, and from being carried away with it, and are constrained to fall into the hopper provided to receive them.—E. S.

*Amalgamating and Coating Metal Surfaces with Metals by the aid of Electricity; Apparatus for —.* H. M. W. P. Johnson, Blackheath, Kent. *Eng. Pat.* 3087, Feb. 8, 1904.

A MOVABLE electrode is provided with a covering of some absorbent material on the face next to the object to be coated, and is supplied with a fluid electrolyte. The arrangement has a casing or shield at its edges for preventing the escape of the electrolyte.—R. S. H.

*Copper Articles; Method of Treating [Coating] —.* S. Richart, Mainz, Germany. *Eng. Pat.* 22,623, Oct. 20, 1904.

THE articles to be treated are highly polished, and then electro-coated with arsenic or antimony in a bath composed of 5 kilos. of sodium arsenate or of an antimony salt, and 5 kilos. of potassium cyanide dissolved in about 80 litres of water, to which 2½ kilos. of ferric chloride are added. They are then heated to "incandescence or glowing" and again polished, when the surfaces have an enamelled appearance, well adapted to resist physical and mechanical influences, and present shades of colour from red to violet.—J. H. C.

#### UNITED STATES PATENT.

*Magnesium; [Electrolytic] Production of Metallic —.* I. L. Roberts, Assignor to J. T. Morehead, both of New York. *U.S. Pat.* 778,270, Dec. 27, 1904.

THIS invention consists in fusing magnesium fluoride, or the fluoride and another compound of magnesium, such as the chloride, together with one, two or more chlorides of the alkali metals, such as lithium. The fused mixture is electrolysed in an atmosphere composed of the gases produced by the electrolysis.—B. N.



## FRENCH PATENT.

*Sulphides, Arsenides and Antimonides; Treatment [Reduction] of Metallic ——. N. Dekker. Fr. Pat. 345,834, Aug. 13, 1904.*

Nascent hydrogen produced particularly by the electrolysis of water, is employed for the reduction of the natural sulphides, arsenides, and antimonides. In each case a thin layer of the material containing the sulphide particles is brought into sufficiently prolonged contact with the nascent hydrogen produced at the surface of the negative electrode. The electrolyte employed is a 10 per cent. solution of sulphuric acid or a similar solution of a hydrated alkali; the electrodes may be of graphite, lead, or platinum.—J. H. C.

*Reduction or Oxidation of Solid Bodies [Ores, &c.] by means of an Electric Furnace; Process for the ——. K. Birkeland and S. Eyde. Fr. Pat. 345,969, Sept. 1, 1904. Under Internat. Conv., Sept. 19, 1903.*

SEE Eng. Pat. 29,003 of 1904; this J. 1905, 34.—T. F. B.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*Δ<sup>o</sup>-Oleic Acid. H. R. Le Sueur. Chem. Soc. Trans., 1904, 85. 1708—1713.*

Δ<sup>o</sup>-OLEIC acid is produced together with α-hydroxystearic acid by boiling α-bromostearic acid with 30 per cent. alcoholic potash. The α-hydroxystearic acid is separated by crystallisation from light petroleum, and the Δ<sup>o</sup>-oleic acid is isolated from the mother-liquor by fractional crystallisation, first from ethyl acetate and then from light petroleum. Δ<sup>o</sup>-Oleic acid has the structural formula  $C_{15}H_{31}.CH:CH.CO_2H$ ; it melts at 58°—59° C., and solidifies at 56°—55° C. When oxidised in hot alkaline solution with a 1½ per cent. solution of potassium permanganate, it yields palmitic acid, but by careful oxidation with a 1 per cent. solution of the reagent at 0° C., α-β-dihydroxystearic acid,  $C_{15}H_{31}.CH(OH).CH(OH).CO_2H$ , is produced. This last-named acid melts at 126° C., and solidifies at 124°—123° C.; it is appreciably soluble in boiling water. The author discusses the *iso*-oleic acid of M. C. and A. Saytzeff (J. pr. Chem., 1888, 37, 269), and agrees with Ponzio (this J., 1904, 942) that this acid has not the double linking between the α- and β- carbon atoms, and that therefore, the Saytzeffs' formula for oleic acid, based entirely upon their view as to the constitution of *iso*-oleic acid, is incorrect. The elimination of the Saytzeffs' formula, as also the work of Baruch (Ber., 1894, 27, 172) and others, appears to render it certain that oleic acid has the constitution  $CH_3(CH_2)_7.CH:CH(CH_2)_7.CO_2H$ .—A. S.

*Tobacco Seed Oil. G. Ampola and F. Scurti. Gaz. chim. ital., 1904, 34. 315—321. Chem. Centr., 1905, 1. 35—36.*

FROM the seeds of *Nicotiana tabacum* there is obtained, by pressure, 9—10 per cent., and by extraction, 30—32 per cent. of a yellow oil with a pleasant odour, different from that of tobacco. The oil has the sp. gr. 0.9232 at 15° C., m.p. —25° C., is soluble in 31 parts of absolute alcohol, and mixes in all proportions with ether, chloroform, carbon bisulphide and oil of turpentine. It begins to distil at 150° C. It has the iodine value 118.6; free fatty acids (as oleic acid), 3.49 per cent.; saponification value, 190; saponification value of non-volatile fatty acids, 203 (by Tortelli and Pergami's method, mean molecular weight being calculated as 275.8; this J., 1902, 1187); Hehner value, 94.73; Maumené test in Tortelli's apparatus (this J., 1904, 668), 100. In Livache's test, the oil absorbed 5.01 per cent. of oxygen in 2 days, 5.61 in 3, 5.84 in 4, and 6.84 per cent. in 14 days. In the elaidin test, the oil remained liquid and a whitish precipitate was produced. The fatty acids of the oil are chiefly oleic acid (about 25 per cent.), linolic acid (about 15 per cent.) and palmitic acid (about 32 per cent.), together with small quantities of stearic acid.—A. S.

*Sesame Oil; Detection of —, in presence of Dyestuffs that give a Red Coloration with Hydrochloric Acid. G. Fendler. XXIII., page 108.*

*Rosin and Fish Oils; Detection of —, in Boiled Linseed Oil. W. Lippert. XXIII., page 108.*

## ENGLISH PATENT.

*Centrifugal Machines [Oil Separators]. H. H. Lake, London. From Oil and Waste Saving Machine Co., New York. Eng. Pat. 22,968, Oct. 25, 1904.*

SEE U.S. Pat. 773,220 of 1904; this J., 1901, 1079.—T. F. B.

## UNITED STATES PATENT.

*Wax Emulsion and Process of Producing same. H. H. Church, Bellows Falls, Vt., Assignor to Casein Co. of America, New Jersey. U.S. Pat. 778,445, Dec. 27, 1904.*

PARAFFIN wax (50 parts), stearic acid (50 parts) and Chinese vegetable tallow (50 parts) are melted in water with the aid of heat, a solution containing trisodium phosphate (5 parts) and caustic soda (5 parts) is added, and the mixture is boiled for half an hour or more, with continual agitation, until frothing has ceased.—A. S.

## FRENCH PATENT.

*Fat; Extraction of —, from Seeds or Oleaginous Fruits, by Diffusion. C. Tanquerel. Fr. Pat. 345,849, Aug. 25, 1904.*

IN this process, which is specially intended for the extraction of olive oil, claim is made for the use of a solution (sp. gr. 1.025—1.100) of the chloride of a metal of the alkali or alkaline-earth group. The paste-like mass of olives obtained by the usual methods is introduced into a tank containing a definite quantity of the saline solution, which is maintained at a temperature not exceeding 65° C., by means of a steam coil. Further quantities of the saline solution are continuously forced in through pipes at the bottom of the tank, and the mixture is agitated by means of currents of compressed air. The solid particles collect at the bottom, whilst the fat rises to the surface and falls through an outlet tube near the top of the tank.—C. A. M.

## XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

## (A).—PIGMENTS, PAINTS.

## UNITED STATES PATENT.

*Carbons [of Arc Lamps]; Process of Utilising [as Pigments] the Waste Ends of —. R. Peters, Heidelberg, Germany. U.S. Pat. 778,703, Dec. 27, 1904.*

SEE Fr. Pat. 335,795 of 1903; this J., 1904, 260.—T. F. B.

## FRENCH PATENTS.

*Mono-azo Dyestuffs [Azo Dyestuffs] especially suitable for the Manufacture of Lakes; Production of Orange —. Badische Anilin- und Soda-Fabrik. Fr. Pat. 346,007, Sept. 2, 1904. IV., page 84.*

*Mono-azo Dyestuff [Azo Dyestuff] especially suitable for the Manufacture of Lakes; Production of Red —. Badische Anilin- und Soda-Fabrik. Fr. Pat. 346,008, Sept. 2, 1904. IV., page 84.*

## (B).—RESINS, VARNISHES.

*Oil of Turpentine; Examination of —. H. Herzfeld. XXIII., page 108.*

*Rosin and Fish Oils; Detection of —, in Boiled Linseed Oil. W. Lippert. XXIII., page 108.*

## UNITED STATES PATENTS.

*Linoleum; Manufacture of* ——. F. O. Gripp, Bremen. Assignor to Bremer Linoleumwerke-Delmenhorst, Germany. U.S. Pat. 778,638, Dec. 27, 1904.

SEE Fr. Pat. 334,635 of 1903; this J., 1904, 69.—T. F. B.

*Linoleum; Process of Making* ——. L. W. Seeser, Assignor to Bremer Linoleumwerke-Delmenhorst, Germany. U.S. Pat. 778,715, Dec. 27, 1904.

SEE Fr. Pat. 323,485 of 1902; this J., 1903, 502.—T. F. B.

## (C).—INDIA-RUBBER, &amp;c.

*India-rubber; Grinding of Hard* ——. G. Springer. Gummi-Zeit., 1904, 19, 249—250.

HARD rubber in the form of powder is best obtained by passing the material to be treated through crushing and grinding rolls. The preliminary grinding is done on grooved friction rolls, the speed of the same being 7 to 8 and 21 to 24 revolutions per minute respectively. The resulting mass is ground to the necessary degree of fineness on smooth calendar rolls revolving 6 and 8 times per minute respectively. Previous to grinding, the rubber is freed from foreign materials, as far as possible, and washed in warm water. It is then placed in a metal tray and introduced into a vulcaniser to remove moisture, and to thoroughly soften it, when it is ready for the crushing and grinding process. It is advisable, after grinding, to remove any particles of iron by means of powerful magnets. The ground material is passed through cylindrical sieves, the coarse residue being returned to the mill. As the finished powder is liable to spontaneous ignition, it should be carefully cooled before being stored. Owing to the large proportion of hard rubber powder used in hard rubber mixings (up to 50 per cent.) the supply is not equal to the demand, and it is specially prepared by mixing soft floating waste rubber with 30 per cent. of sulphur, heating the mixture in thin layers in a vulcaniser for several hours at a temperature of 135°—140° C., grinding coarsely, and reheating for several hours at the same temperature.—J. K. B.

## XIV.—TANNING, LEATHER, GLUE, SIZE.

## ENGLISH PATENTS.

*Leather; Manufacture of* ——. A. J. Boulton, London. From B. Treckmann, Schöneberg, Germany. Eng. Pat. 3981, Feb. 17, 1904.

SEE Fr. Pat. 340,486 of 1904; this J., 1904, 830.—T. F. B.

*Skins; Machines for Mechanically Seasoning, Oiling and otherwise Treating* ——. H. F. Dougherty, Wilmington, U.S.A. Eng. Pat. 23,016, Oct. 25, 1904.

THE patent relates to a machine with a series of rubbing and pressing devices for mechanically applying seasoning, or other finishing compounds, to the grain side of tanned skins. The skins are held on a moving table in such a manner that wrinkling is prevented.—F. D. T.

## UNITED STATES PATENT.

*Tanning Process*. J. M. Brown and L. C. Smith, West-plains, Mo. U.S. Pat. 777,972, Dec. 13, 1904.

THIS process relates to the application of a mixture of extract of oak, extract of sumac, gum gambier and oil of cedar, with or without pulverised alum, to skins which have previously been washed with a solution of borax.—F. D. T.

## FRENCH PATENTS.

*Skins; Process for De-liming, Pickling and Tanning* ——. O. P. Amend. Fr. Pat. 346,061, Sept. 2, 1904. Under Internat. Conv., Sept. 3, 1903.

SEE U.S. Pats. 763,347 and 768,259 of 1904; this J., 1904, 756 and 906.—T. F. B.

*Hides and Skins; Process of Tanning* ——. I. Souoff and M. Zwerhoff. Fr. Pat. 346,098, Sept. 7, 1904.

THE hides or skins prepared ready for tanning are first immersed for two hours in a solution of common salt, and afterwards placed in a closed chamber and subjected to the fumes of burning straw, dried leaves or other vegetable matter for 10 to 20 hours; the goods are finally immersed in a dilute solution of sulphuric acid.—M. C. L.

## XV.—MANURES, Etc.

*Perchlorate in Commercial Sodium Nitrate*. H. Pellet and G. Fribourg. Bied. Centr., 1904, 33, 798—803; from Ann. Science Agron., 1902-3, 8, 199.

THE amounts of perchlorate generally present in commercial sodium nitrate vary from traces to 1.5 per cent. Some samples contained, however, 3.2 per cent., or even 6 per cent., reckoned as potassium salt.

According to P. de Caluwe vegetation is injured by less than 1 per cent. of sodium perchlorate, whilst potassium perchlorate and chlorate are much less injurious. Sodium nitrate which contains perchlorate seems to contain only a little chlorate. In analysing samples, it is desirable to determine the potassium as well as the perchlorate and chlorate.

The following method of Vincente and Lafitte for the detection of chlorates is given. The solution of sodium nitrate is treated successively with a few drops of a solution of aniline (1 c.c. in 40 c.c. of water), and an equal volume of hydrochloric acid of 22° B. In presence of the smallest traces of chlorate a reddish-violet coloration is produced which turns to an intense blue.—N. H. J. M.

*Gasification of Vegetable Combustible Matters and Generation of Economical Motive Power for Agricultural Purposes*. L. Bordenave. II., page 78.

*Dyeing; Economies in* ——. [Fertilisers from Waste Soap Baths]. E. Harter. V., page 85.

## XVI.—SUGAR, STARCH, GUM, Etc.

## ENGLISH PATENT.

*Centrifugal Machines [Sugar]*. J. W. Macfarlane, Glasgow. Eng. Pat. 27,763, Dec. 18, 1903.

IN a centrifugal machine, in which the effluents resulting from the draining of the massecuite and those from the washing and steaming of the sugar are collected separately, interlocking mechanism is provided which connects the discharge spout with the supply orifices in such a manner that the operator cannot charge the machine with massecuite until the discharge spout is in connection with the molasses conduit, and cannot wash or steam the sugar without at the same time moving the discharge spout over the pure-syrup conduit.—J. F. B.

## UNITED STATES PATENT.

*Starch; Soluble Product from* ——. and *Process of making same*. C. F. Cross, London, and J. Traquair, Assignors to W. Wotherspoon, Paisley. U.S. Pat. 778,173, Dec. 20, 1904.

SEE Fr. Pat. 334,154 of 1903; this J., 1904, 29.—T. F. B.

## XVII.—BREWING, WINES, SPIRITS, Etc.

*Barley Plant; Distribution of the Nitrogen in the* ——. E. Jalowetz. Woch. f. Brau. 1904, 21, 840—845.

PREVIOUS researches having shown that the proportion of nitrogen in the barley corn is greater at the basal end than at the point, and is greater at the point end than at the middle of the corn, the author has turned his attention to the distribution of nitrogen in corns from various parts of the same ear. The present experiments were made with the Hanna variety of barley; the selected ears were cut in



some cases longitudinally and in other cases transversely to equal halves. The proportion of moisture was the same in all parts of the ear, and different ears from the same field gave corns containing the same proportions of moisture. The proportions of nitrogen in the corns of the right and left halves of the same ear were identical; in the corns of the upper half of the ear always contained higher proportion of nitrogen than the corns from the lower half of the same ear. This difference, however, is solely due to the fact that the corns of the upper half are smaller than those of the lower half, and it was determined that the absolute quantity of nitrogen is the same in every corn of the ear, or, in other words, the percentage of nitrogen multiplied by the weight of the corn is constant for the same ear. The proportions of nitrogen in the corns of different ears in the same field vary between wide limits, consequently the method of valuation which depends on the percentage of nitrogen in a sample of barley is not invariably reliable; there is, however, a tendency to equalisation in samples taken from bulk as compared with those taken from individual ears. The ears of the main stems of a single plant contain the same percentage of nitrogen, but the ears of the side stems, which are generally scarcely ripe and are filled with undigested corns, contain a higher percentage of nitrogen than those of the main stems.—J. F. B.

*Arch; Diastatic Coagulation of* —, [*Amylo-coagulase*]. A. Fernbach and J. Wolff. *Comptes rend.*, 1904, **139**, 1217–1219.

In previous experiments potato starch-paste, prepared by heating under pressure at 120° C., was not always coagulated by infusions of certain raw grains, although these extracts undoubtedly contained the coagulating enzyme, amylo-coagulase. This anomaly is now explained by the observation that the starch must exist in definite condition of liquefaction before coagulation can be produced by the enzyme in question. If the starch be treated with a malt infusion which has been previously heated for 10 minutes at 75° C. in order to destroy the coagulating enzyme without destroying the liquefying diastase, coagulation can be readily effected by infusions of raw barley, wheat or rye, which by themselves are incapable of producing coagulation. Since, however, the process of heating at 75° C. does not completely destroy the saccharifying diastase of the malt, it is important that the quantity of heated malt infusion and the time of its action should be carefully regulated. An infusion of oats contains no amylo-coagulase, but it does contain a starch-liquefying diastase; such an infusion can therefore be employed in place of the heated malt extract for bringing the starch into a condition suitable for coagulation by infusions of raw barley, wheat and rye. This reaction may be utilised as a qualitative test for the presence of a liquefying diastase or a coagulating enzyme in plant-infusions. Further, it has been found that the liquefying action of the heated malt extract may be imitated by heating the starch-paste at 45° C. under pressure, and that a paste so liquefied is coagulated by the raw grain extracts directly.—J. F. B.

*Yeasts; Acclimatisation of* —, to *Antiseptics*. J. Effront. *Monit. Scient.*, 1905, **19**, 19–24.

On examining a series of brewery yeasts prepared in sterilised wort containing increasing amounts of ammonium fluoride, it was found that the nitrogen content remained practically constant, whilst the percentages of ash and lime in the yeasts increased with increasing amounts of fluoride. (For information on the properties of yeasts acclimatised to fluorides see this J., 1892, 50, and 1894, 968 and 1079.) It would thus appear that this acclimatisation to fluorides increases the affinity of the cells for mineral matter, and that this increased accumulation of lime renders the fluoride harmless by converting it into insoluble calcium fluoride. Brewery yeasts can be similarly acclimatised to considerable quantities of formaldehyde: top fermentation yeasts are less sensitive to the action of formaldehyde than bottom fermentation yeasts. The action of formaldehyde is manifested by a retardation in the commencement of

fermentation, and by a diminished growth of yeast. A wort containing 1.5 gm. of formaldehyde per litre, when allowed to stand with unacclimatised yeast at 30° C. will not ferment for some weeks: on prolonged contact, the fermentative power of the yeast is still further weakened, and finally the yeast is rendered incapable of inducing fermentation in a pure wort. The greater the extent to which a yeast has been acclimatised to formaldehyde, the more acid will be formed in the subsequent fermentation of a wort, the aldehyde being oxidised to formic acid. Acid ferments develop more rapidly in a wort in presence of yeasts acclimatised to formaldehyde; this contrasts strongly with the behaviour of yeast acclimatised to fluorides, the presence of which increases the resistance to acid ferments of worts containing a fluoride. The acclimatisation of yeasts to formaldehyde is attributed solely to the development of a special function which facilitates the rapid oxidation of the aldehyde, since it is experimentally demonstrated that this oxidation always precedes, and is quite independent of, the fermentation. In presence of a yeast which has been acclimatised to formaldehyde, the fermentation of a wort is found to be much more rapid than with a fresh yeast.—T. F. B.

*Yeast Enzymes*. K. Schiga. *Z. physiol. Chem.*, 1904, **42**, 503; *Woch. f. Brau.*, 1904, **21**, 834.

THE presence in yeast of an enzyme, nuclease, which is capable of splitting up nucleic acid, has already been recorded by various investigators. The author has studied it by digesting yeast cell-juice with guanine in presence of toluene for 40 hours in a warm chamber. The guanine was split up during the digestion with the formation of adenine and a little xanthine. He also studied the action of yeast juice upon arginine by digestion under similar conditions for four days. The quantity of arginine decreased during the digestion, whilst that of its decomposition products, ornithine and urea, increased. Yeast therefore secretes the enzyme arginase, which is an enzyme occurring in animal organs. Guanidine, of which substance arginine is a derivative, is not split up by arginase.—J. F. B.

*"Chinese Yeast"; A New Kind of* —. K. Saito. *Centr.-Bl. f. Bakter. u. Parasitenk.*, 1904, **13**, 153–161. *Chem. Centr.*, 1905, **1**, 40.

THE wheat-flour cake used in the preparation of the Chinese beverage "Shao-hing-Chew" contains, besides the ordinary mould fungi, two new kinds of *Rhizopus*, named *Rhizopus chinensis* and *R. tritici* respectively. The author describes the morphological and physiological properties of these mould fungi. They saccharify starch with the production of alcohol and esters, and also liquefy gelatin, *R. chinensis* more quickly than *R. tritici*. They cause an evolution of gas when sown in wort, but not in sugar solutions. (See also this J., 1900, 839; 1901, 377, 757.)—A. S.

*Mashing; Influence of Gypsum on Starch and Albumin Conversion in* —. W. Windisch und H. Boden. *Woch. f. Brau.*, 1904, **21**, 775–776, 787–789, 799–801, 823–827, 835–838.

THE addition of gypsum to the mashing water exerts a retarding influence on the diastatic power of the malt, which is more marked the more the diastase has been weakened by other causes, such as high curing and high mashing temperatures. This influence on the diastatic power involves a reduction of the attenuability of the wort, which reduction is the same with either Saaz or Froberg yeast; this is solely due to the modified conversion of the starch, and is not observed when the gypsum is added after mashing. The fungus *Amylomyces Rouzii* converts the unfermentable starch products, due to the gypsum, into readily fermentable products. No reduction in the attenuability of the wort is observed with very highly attenuating yeasts like *S. Pombe* when gypsum is used.

The presence of gypsum causes an increase in the nitrogen of the wort, depending on the quantity of gypsum and the temperature of mashing; this increase may amount to as much as one-fifth of the total nitrogen.

The increased quantity of nitrogen does not include albumin, but consists solely of decomposition products, chiefly amino-acids. Thus the gypsum favours the action of the malt peptase, making it more rapid and more profound. The increased quantity of nitrogen is, however, of no benefit to the yeast, since an excess of yeast-nutrients is always present. When gypsum is used the tendency is to coagulate more albumin in the wort copper than under ordinary conditions.

The authors' conclusions are not favourable to the artificial hardening of brewing waters by gypsum. The starch conversion products, obtained by the influence of gypsum on the diastase, are not of the slowly fermentable malt-o-dextrin type, but are unfermentable by brewer's yeast. In any case if limited attenuations are desired, they can be obtained much more surely by other means, e.g., the "spring" mashing process. Under ordinary brewing conditions the influence of gypsum is only very slight, and large quantities must be used to produce marked effects. The increase of the nitrogenous matters of the wort, which gypsum produces, is not required, and is perhaps even harmful. Gypsum also favours a secondary coagulation of albumin when the wort is re-boiled, or when the beer is pasteurised: it causes a tendency to gluten-turbidities, and does not improve the "break." The only points that can be urged in its favour are that it possibly improves the flavour of the beer and that it affords a supply of lime to the yeast, both of which effects would be obtainable if the gypsum were added to the wort in the copper instead of to the mashing liquor.—J. F. B.

*Alcoholic Fermentation; Behaviour of Albuminoids during* —. L. Iwanoff. Z. physiol. Chem., 1904, 42, 464. Woch. f. Brau., 1904, 21, 845–847.

In the fermentation of solutions of pure sugar, free from added nutrient matters, the author determined that the quantity of albumin introduced with the yeast was the same after fermentation as before, in spite of the fact that the yeast contained a sufficient supply of nitrogenous matters of a non-albuminoid nature. There was thus neither a breaking down nor a synthesis of albumin during the fermentation, although when the fermentations were conducted with the addition of asparagine, a considerable quantity of albumin was produced therefrom. Hence yeast is not capable of regenerating albumin from all of the products of the decomposition of the latter, and a continuous metabolism and catabolism of albumin cannot be maintained without the introduction of external nutrient. For instance, when yeast had been starved by storage under water until it contained a considerable proportion of nitrogenous metabolic products, it was found that on subsequent addition of sugar, the quantity of albumin regenerated from those products only amounted to 40–60 per cent. of the albumin originally present. From this fact it is concluded that the constancy of the quantity of albumin during alcoholic fermentation in pure sugar solutions can only be attributed to the total inactivity of the albumin portion of the system. According to the author's observations, the presence of fermentable carbohydrate exerts a great influence on the digestion of the yeast-albumin by the proteolytic enzyme. Yeast killed by pasteurisation, and subjected to conditions favourable to auto-digestion, immediately after it had been fermenting a solution of cane sugar, was digested with only one-half the rapidity as compared with yeast which did not contain any of the fermented liquid, and the former yeast was also found to be capable of retarding the auto-digestion of the latter when the two were mixed. Hence it is concluded that an "anti-proteolytic" substance is produced during the fermentation of sugar. This substance appears to be one of the volatile products of fermentation, since it is eliminated by boiling in the ordinary manner, but not by boiling under a reflux-condenser; probably it is an aldehyde or ester.—J. F. B.

*Brewing Vessels; Volumetric Method of Gauging* —. W. Windisch. Woch. f. Brau., 1905, 22, 1–4. (See this J., 1905, 38.)

The author defends the method for gauging large brewing vessels by making a solution of thiosulphate up to a certain

mark in the vessel and titrating this solution with iodine standardised against a solution of the same thiosulphate prepared carefully in the laboratory. In order, however, to obtain sufficiently accurate results, it is necessary to work with extreme care. It is best to add most of the iodine required in the form of a  $N/10$  solution, and complete the titration with  $N/100$  iodine solution from second burette. The solutions and measuring vessel must be free from grease, the temperature of the solution must be maintained constant, and 8 or 10 titrations of the same solution should be made. It is possible to gauge a large vessel with errors not exceeding 0.15 per cent. by this method, which is strongly recommended where the method of weighing the water-contents of the vessel is impracticable.—J. F. B.

*Saccharin in Wine; Qualitative Detection of* —. MacKay Chace. XXIII., page 105.

#### ENGLISH PATENTS.

*Drying Granular and other Materials [Brewers' Grain &c.]. Apparatus for* —. H. H. Lake, London. From C. H. Caspar, Wilkes-Barre, Pa., U.S.A. Ed. Pat. 23,066, Oct. 26, 1904.

THE apparatus is intended for drying brewers' grains and like loose materials. It consists of a drum mounted on trunnions and capable of revolving in an outer shell, and provided with "paddles or agitators" around its circumference. Through the drum passes a series of pipes through which are led hot gases coming from a furnace. Above this drum is mounted a similar smaller drum or shell, provided at one end with a screw conveyor, and with an inlet pipe for the hot gases issuing from the lower drum. The material to be dried is fed from a hopper through a screw conveyor into the upper drum, any adhering water being squeezed out. It then meets the comparatively cool gases from the lower drum, and dries without blistering. From the exit-end of the upper drum it then falls in the lower drum, and is completely dried whilst passing through, by the heat from the hot furnace gases. Suitable means for revolving the drums and for creating a draught for the gases are provided.—L. F. G.

*Mashing Apparatus and Filters for any Liquids.* Selg. New York. Eng. Pat. 3080, Feb. 8, 1904.

THE mash-tun or filtering vessel consists of a suitable shell with a perforated false bottom situated at some distance above the real bottom, so as to form a chamber beneath for the filtered liquid. The discharge pipe communicates with the bottom of this filtering chamber and carries a U-shaped trap with one leg much shorter than the other. The short leg branches out from the discharge pipe, whilst the long leg forms an external stand-pipe parallel with the wall of the shell. A second discharge cock is fitted to the U-shaped pipe at the same level as the false bottom, whilst the stand-pipe can be connected at will with the upper part of the interior of the shell. Filtration is thus effected with but very slight difference in pressure, thus avoiding the packing of the material against the false bottom.—J. F. B.

*Beer; Inpts. in Brewing* —. L. Nathan, Zurich. Eng. Pat. 20,534, Sept. 23, 1904. Under International Conv., Oct. 7, 1903.

STERILISED wort, which is agitated during fermentation, is supplied with a quantity of air less than that which would be spontaneously absorbed by the wort if allowed to cool under normal atmospheric conditions. The wort is run into a sterilised vessel and allowed to cool therein; when the temperature has fallen to about 50° C. the air supply is cut off and the upper part of the vessel is connected with a supply of sterilised carbon dioxide. When the fermentation temperature is reached a measured quantity of yeast, bearing the correct proportion to the volume of air supplied, is introduced. If the agitation of the wort during fermentation is effected by a stream of carbon dioxide, the quantity of air employed must be increased in order to overcome the retarding influence of the carbon dioxide.—J. F. B.



## UNITED STATES PATENT.

*Annulator and Regulator [for Alcohol Rectifying Apparatus].* E. Guillaume, Paris. U.S. Pat. 778,450, Dec. 27, 1904.

SEE Fr. Pat. 321,871 of 1902; this J., 1903, 313.—T. F. B.

## FRENCH PATENTS.

*Phlegms; Apparatus for Continuous Rectification of —.* L. A. Barbet. Second addition, dated Aug. 25, 1904. No Fr. Pat. 343,488, April 16, 1904. (See this J., 1904, 039.)

THE phlegms are treated in a separate column in the upper part of which the aldehydes and esters are mainly removed. The lower part of the column the phlegm is mixed with sufficient lime-water to give it a distinctly alkaline reaction. The remainder of the aldehydes and esters is decomposed together with the ammonia and basic compounds. Before entering the main rectifying column, the phlegm is subjected to the action of carbon dioxide in order to precipitate the lime and render the liquid neutral. —W. P. S.

*Alcohol; Manufacture of —, for Illuminating Purposes.* B. Plehn. Fr. Pat. 345,777, Aug. 23, 1904. II., page 80.

*Alcohol; Process for Denaturing —.* T. Heidberg. Fr. Pat. 346,152, Sept. 9, 1904.

ALCOHOL is denatured with an alcoholic solution of crude purified animal gall, either alone or in conjunction with other substances. If the alkaline residues of the gall be undesirable, the glycolic and taurocholic acids may be separated from the gall and used in the free state. —J. F. B.

## XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

## (A.)—FOODS.

*Wrapping Paper containing Boric Acid.* XIX., page 102.

## ENGLISH PATENTS.

*Milk; Dry —, and Process for Obtaining same.* J. R. Hatmaker, Paris. Eng. Pat. 2065, Jan. 27, 1904.

SEE Fr. Pat. 339,943 of 1904; this J., 1904, 757.—T. F. B.

*Cream Product or Preparation and Means for Making the same —.* C. M. Taylor, Philadelphia, U.S.A. Eng. Pat. 20,292, Sept. 20, 1904.

ORDINARY cream is deprived of its water by placing it on an absorbent material, such as cold-pressed, long-ple cotton-fibre paper. The resulting flocculent mass fatty globules remaining on the surface of the paper then removed and packed for keeping. For use, it is then mixed with a suitable quantity of water. Several forms apparatus are described in which the process may be carried out. One device consists of a shallow box, provided with a close-fitting lid. In this box is placed the paper tray containing the cream, the bottom of the tray being supported on a false corrugated bottom fitting in the box. Another form of apparatus is described in S. Pat. 776,745, 1904 (this J., 1905, 21). —W. P. S.

## UNITED STATES PATENTS.

*Milk; Apparatus for Treating —.* T. L. F. Stack, Drumquin, Ireland. U.S. Pat. 778,717, Dec. 27, 1904.

SEE Eng. Pat. 6882 of 1901; this J., 1902, 633.—T. F. B.

*Nutritive Substance from Blood; Process of Producing the same —.* J. Hofmeier, Assignor to Act.-Ges. f. Chem. Ind., Vienna. U.S. Pat. 778,783, Dec. 27, 1904.

SEE Eng. Pat. 15,606 of 1903; this J., 1904, 499.—T. F. B.

## FRENCH PATENT.

*Milk-Powder; Apparatus for Producing —.* M. Du Bois. Fr. Pat. 346,043, Sept. 5, 1904.

THE milk is contained in a hopper having at its bottom an adjustable slit extending the whole width of a steam-heated surface. The hopper is fixed to a sliding-rod which, by its movement, causes the hopper to travel backwards and forwards over the heated surface. Scrapers are also fixed to the rod on each side of the hopper to spread the milk over and remove the dried residue from the hot surface. The latter forms the top of a closed chamber, to which steam is admitted from a boiler. —W. P. S.

## (B.) SANITATION; WATER PURIFICATION.

## ENGLISH PATENTS.

*Air; Process and Apparatus for Purifying —.* A. P. Swan, Dundalk. Eng. Pat. 27,968, Dec. 21, 1903.

THE air is drawn or forced through a tower packed with spherical balls of porcelain, glass, metal or wood, coated with a suitable viscous liquid, such as glycerin, gelatin solution or the like. A flannel filter is placed at the entrance to the tower, and means are provided for flushing out the tower and supplying fresh viscous liquid to the same. Hair, wool, cotton and the like may be used in conjunction with the coated balls. —W. P. S.

*Water; Apparatus for Purifying —.* H. Wehner, Frankfurt-on-the-Maine, Germany. Eng. Pat. 5467, March 5, 1904.

WATER is purified from absorbed carbon dioxide by causing it to enter the upper part of a closed vessel, immediately above a sieve-like diaphragm, from which it drops as rain to the bottom of the vessel, and thence flows by gravity, through a pipe to a sunken reservoir, having an overflow by which the quantity of water passing into the chamber may be regulated. The air in the space in the chamber, together with the carbon dioxide set free, is withdrawn through a capped tube, communicating with a suction pump, causing a partial vacuum; and a valved air-inlet, containing a germ-arresting filter, is provided, whereby air may be admitted to the chamber as required. —E. S.

## (C.)—DISINFECTANTS.

## FRENCH PATENTS.

*Sulphur, Pulverulent; Treatment of —, to render it Miscible (Mouillable) [e.g., with Bauxite, &c., &c.; Bactericide].* First Addition, dated Aug. 19, 1904, to Fr. Pat. 320,627, of April 24, 1902 (See this J., 1903, 109).

ACCORDING to the present Addition, powdered bauxite is added to finely-divided sulphur, with a certain proportion of sodium carbonate and of rosin, and with or without a copper salt, to form a mixture suitable for application to plants suffering from cryptogamic maladies. —E. S.

*Insects, particularly Phylloxera; Means and Product for Destroying —, serving also as a Nutrient for Plants.* R. and M. Jenkner and J. Pleyl. Fr. Pat. 346,024, Sept. 3, 1904.

SEE Eng. Pat. 19,068 of 1904; this J., 1904, 1109.—T. F. B.

## XIX.—PAPER, PASTEBOARD, Etc.

*Paper Pulp; Yarn from —.* E. Hanansek und R. Zaloziecki. Chem.-Zeit., 1905, 39, 3—4.

PAPER-PULP (wood-cellulose) intended for the spinning of yarn, should be prepared in the beating engine in such a way that the fibres are not shortened, but merely drawn out and isolated from the fibre-bundles by a brushing or rubbing action. The authors have examined samples of yarn from two of the German mills. Under the

microscope these yarns were found to be prepared from pure, unbleached cellulose from coniferous wood, showing only traces of lignification. In one product the fibres were rather short with blunt ends, and had the appearance of having been subjected to rather severe beating; the shortening of the fibres might be partly attributable to the preliminary chemical treatment. The ultimate fibres were sufficiently isolated, and in many cases the longitudinal rows of pits on the tracheids were discernible. Certain typical modifications of the fibres were detected; a remarkable alteration was shown by the presence of large holes, like pores, in some of the places where the pits had been, some of the pits in the row being still unchanged; in side view these damaged fibres showed toothed edges. A few of the fibres had spiral net-work markings, like those of cotton fibres. The mechanical treatment due to the twisting of the yarn was found to have left its mark on the individual fibres; the pits and holes occurred in spiral rows, and the spiral deformation was visible, not only in the surface markings but also in the side contours, in proportion to the tightness of the twist. In addition to the spiral lines of deformation, transverse torsion lines were also observed. Between crossed Nicols the fibres appeared bluish-white, whilst the lines of deformation showed interference colours on a red ground.

In another make of yarn the fibres showed fibrillae, the pits were not easily discernible, there were no holes, and the spiral deformation of the rows of pits varied in degree.

—J. F. B.

*Rosin Size; Proportion of Alkali in Preparing* —. P. Klemm. *Wochenbl. f. Papierfab.*, 1904; through *Paper and Pulp*, 1905, 10, 18.

As rosin never consists of pure sylvic acid and always contains a certain quantity of moisture, it never requires the theoretical quantity of alkali for saponification (13.2 per cent. of caustic soda). In practice the most convenient proportion of alkali to employ is 11.2 per cent. of caustic soda, or its equivalent in carbonate. When this quantity has been used, and when the saponification is properly effected, the resulting size gives clear solutions in all proportions, provided the water be soft and free from carbon dioxide. There is no limit to the proportion of free rosin that can be taken up by the size, but until the introduction of Erfurt's process, the workable limit of free rosin was about one-third of the combined rosin. The following table shows the proportions of free and combined rosin when different proportions of caustic soda are employed:—

	For Saponification of 100 lb. of Rosin.	For every 1 lb. of Rosin—	
		Combined.	Free.
6 lb. of caustic soda	.....	364 lb.	636 lb.
7 "	" "	424 "	576 "
8 "	" "	485 "	515 "
9 "	" "	545 "	455 "
10 "	" "	606 "	394 "
11 "	" "	667 "	333 "
12 "	" "	727 "	273 "

—J. F. B.

*Blotting Papers; Manufacture of* —. C. Beadle and H. P. Stevens. *Paper and Pulp*, 1904, 9, 717–729.

THE authors show that the Charlottenburg method of testing blotting papers, by measuring the rapidity of the rise of water by capillary absorption in a strip, is not a sufficient guide to the value of a paper. They show that the capillary properties of a paper so determined are directly proportional to the volume of the air spaces between the fibres ("bulking properties"). But the value of a blotting paper depends also on the number of times it can be used whilst still retaining its bibulous qualities, and here the chemical nature of the ink comes into play. Blotting paper is best tested by dropping 1 c.c. of a ferro-tannic ink upon its surface in the form of a blot, drying the paper, and then testing the absorbent properties of the blot by drawing ink strokes across it in various directions. In many cases an external zone or

fringe is thus detected which is entirely incapable of absorbing a further quantity of ink, whilst the central portion of the blot is still absorbent. The diameter of this non-absorbent zone relatively to the diameter of the blot is inversely proportional to the value of the blotting paper; in a series of tests of different makes the diameters of the non-absorbent zones varied from 1.7 to 2.5 per cent. of the total diameter. This zone-forming property has no connection with the capacity of the paper for absorbing water as tested in the usual way. The authors have found that the cause of the non-absorbent zones lies in the basic residues contained in the paper, these basic matters include lime, iron oxide and alumina which neutralise the acidity of the ink, and are derived chiefly from the water, but also from the materials used in manufacture. A process has been devised whereby the basic constituents are removed and partially neutralised in the half-stuff hollander. It is important, however, that the treated pulp should subsequently be diluted and bleached with softened water and sodium hypochlorite. Many colouring matters, used in the manufacture of coloured blotting papers, have a great tendency to cause these non-absorbent zones, e.g., ultramarine, certain mineral colours and aniline dyestuffs. It has frequently been found that paper, which has been prepared so as to be free from zone-forming constituents, developed the property of forming zones after storage owing to secondary reactions and dissociations of residual chemicals.—J. F. B.

*Parchment Paper Containing Boric Acid*. *Papier-Zeitung*, 1904, 29, 3644.

K. FISCHER has found that boric acid is frequently employed for the preservation of parchmentised paper, and that such paper is in general use for wrapping butter, margarine and other foods (*Z. Unters. Nahr. u. Genusmittel*, 1904). Boric acid is an excellent antiseptic for preserving parchment paper from mildew, and, in the opinion of many experts, it is perfectly unobjectional since only a small proportion is necessary, and it is conceivable that more than a mere trace could be transferred to the articles of food round which the paper is wrapped. This preservative has, however, been forbidden by German law, and is not now employed in grease-proof papers manufactured in that country.—J. F. B.

#### ENGLISH PATENTS.

*Paper and Pulp Making Machines*. S. Milne, Edinburgh. Eng. Pat. 28,611, Dec. 30, 1903.

THE invention relates to the combination of two or three Fourdrinier wires, arranged to deliver their webs of paper in a single plane so that all the webs may be couched together to produce a single compound web of paper. In the simplest form, one or two Fourdrinier wires, each with independent shake and other fittings, are arranged above an ordinary Fourdrinier machine, and their delivery ends are brought down vertically or at an angle so as to coincide with the lowest web. In another form, the three webs are couched, one above the other, on a single overhead felt.—J. F. B.

*Calender Bowls or Rollers for Finishing Textile Goods, Paper and other Fabrics; Manufacture of* —. Hübner and W. J. Pope. Eng. Pat. 2758, Feb. 4, 1904, V., page 85.

#### UNITED STATES PATENT.

*Cementing Cloth, Wood, Leather, or other Substances; Composition for* —. C. Ellis, Boston, Mass. U. S. Pat. 778,232, Dec. 27, 1904.

THE composition consists of about 10 lb. of nitrocellulose and 4 lb. of camphor dissolved in a mixture of about 8 galls. of acetone, 1 gall. of amyl acetate and 1 qt. creosote.—A. S.

#### FRENCH PATENT.

*Solutions; Apparatus for Pouring uniformly any liquid on to a continuously moving table or surface* [*Paper Manufacture*]. R. Kron. Fr. Pat. 345,832, Aug. 12, 1904.



apparatus is devised for pouring out solutions of lead, casein, glue, clay, colours, gum, or similar substances on to paper, tissues or like materials. The solution flows from a chamber provided with a stirrer through a series of adjustable openings into a second vessel, in which any scum or air bubbles are destroyed by means of an injector apparatus. The solution then flows into a flat distributing vessel which is kept at a suitable inclination to the horizontal, so that on leaving the vessel solution has acquired a velocity equal to that of the moving surface on to which it is to be distributed. The distributing vessel is provided with an elastic bottom, with transverse vertical plates which can be screwed on so as to regulate the thickness of the stream of solution, and with a discharging weir.—L. F. G.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Alcoholic Potash Solution; Preparation of a Stable* —. Thiele and R. Marc. Z. öfentl. Chem., 1904, 10, 36—387. Chem. Centr., 1904, 2, 1756.

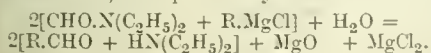
100 grms. of pure potassium sulphate are well mixed with 120 grms. of barium hydroxide in a platinum or porcelain dish, 100 c.c. of water are added, and the whole is weighed. The contents of the dish are then boiled for 15 minutes, with continuous stirring, and after cooling, water is added to make up the original weight. The solution is then rinsed into a bottle with 800 c.c. of alcohol, rather 100 c.c. of water is added, the bottle is closed and well shaken. 3-4 c.c. of a concentrated solution of potassium sulphate are added to ensure the complete precipitation of the baryta, and the whole is again well shaken, and allowed to settle. It is stated that the clear supernatant liquid will remain clear and colourless for six months.—A. S.

*Boric Acid Compounds of Organic Bases.* L. Spiegel and J. Spiegel. Ber. deutsch. pharm. Ges., 1904, 14, 350—355. Chem. Centr., 1904, 2, 1611.

ANILINE borate can be prepared by heating equimolecular amounts of aniline and of boric acid with absolute alcohol or ether, or by boiling finely-powdered boric acid with excess of aniline for a long time. Solid aniline borate is obtained on washing the product of the reaction with water; it is decomposed into its components by water. Boric acid compounds of piperidine, coniine, and tetrahydroquinoline are precipitated on mixing together ethereal solutions of boric acid and of the base. On adding two molecular proportions of boric acid to an aqueous solution of one molecular proportion of tetramethylammonium hydroxide, concentrating the solution to a syrup, and treating the residue with absolute alcohol, a crystalline mass separates.—A. S.

*Aldehydes; New Synthetic Preparation of* —. L. Bouveault. Bull. Soc. Chim., 1904, 31, 1322—1327.

THE magnesium-alkyl or magnesium-aryl halide ("Grignard's reagent") is first prepared, and into that is gradually dropped an ethereal solution of a mono- or substituted formamide or formanilide; the reaction is usually violent, and cooling must be resorted to. With some of the higher alkyl chlorides the formation of the magnesium compound is only complete after adding benzene and heating; but the mixture must then be cooled before adding the formamide. The product of the reaction is treated with water, and made just acid by gradually adding sulphuric acid (avoiding rise of temperature). The ethereal layer fractionally distilled, yields the aldehyde mingled with some of the original halide, from which it is purified by means of the bisulphite reaction. The aqueous layer, rendered alkaline and distilled regenerates the amine from which the formamide was originally prepared. The general reaction (using methylformamide) is expressed by



The substituted formamides are readily prepared, and with

good yields, by heating together acid and base—piperidyl-formamide at once, by simple distillation, diethylformamide after fractionating and distilling from quicklime. The dimethyl compound is less advantageous.

The author has thus prepared and examined valeric, isobutylic, nonylic (colourless, strong-smelling, boiling at 81° C. under 14 mm.), decylic (similar, b.p. 91° C. under 11 mm.), and, in very small quantities, trimethylacetic and ethyldimethylacetic aldehydes; also hexahydrobenzoic, benzoic, phenylacetic, and hydrocinnamic aldehydes.—J. T. D.

*Iodoform; Decomposition of* —, by the Combined Action of Light and Oxygen. E. van Aubel. Phys. Zeits., 1904, 5, 637. Science Abstracts, 1904, 7, A, 987—988.

It has been previously shown by Hardy and Willecock, that in presence of oxygen, iodine is liberated from solutions of iodoform by the action of light, of Röntgen rays, or of radium emanations. The author finds that under similar conditions, iodine is also liberated from the iodoform contained in a non-fluid mixture (e.g., iodoform and vaseline). A solution of iodoform in chloroform is not appreciably decomposed by winter sunlight, if the temperature of the solution be kept at -45° C.—A. S.

*Eucalyptus Oil; Adulterated* —. C. T. Bennett. Chem. and Drug., 1905, 66, 33—34.

It is stated that for some time past large consignments of eucalyptus oil, adulterated with castor oil, have been sold. The oil answers the characters and tests of the B. P., but has a rather high viscosity, and contains less cineol than is consistent with its sp. gr. Samples of the adulterated oil had sp. gr. 0.917—0.919, and optical rotation 0° to +2°, and contained from 38 to 45 per cent. of cineol. On fractional distillation under reduced pressure, a residue was left, agreeing in character with castor oil. One sample of the adulterated oil contained nearly 20 per cent. of castor oil, and others, from 12 to 15 per cent.—A. S.

*Antipyrine; Volumetric Determination of* —. P. Lemaire. XXIII., page 109.

*Lemon Oil; Determination of the Saponification Value and the Dry Residue of* —. E. Berté. XXIII., page 108.

### ENGLISH PATENT.

*Tannin-like Substances and Urca; Process for Manufacturing Condensation Products from* —, by means of Formaldehyde. R. Lauch and A. Voswinkel, Berlin. Eng. Pat. 23,569, Nov. 1, 1904.

TANNIN-LIKE substances may be condensed with urea and formaldehyde in aqueous solution, or in presence of a condensing agent, to form "methylene tannin ureas;" that obtained from tannin has the constitution  $\text{C}_{14}\text{H}_{20}\text{O}_9\text{CH}_2\text{NH.CO.NH}_2$ . These substances are soluble in alkalis, and reprecipitated by acid. Tanning agents other than tannin (e.g., rhatania tannic acid) give similar products, as do also the substitution derivatives of tannin. Monobromotannin gives a monobromoderivative soluble in alkali carbonates and borates, and sparingly soluble in alcohol. All these substances possess astringent properties, the bromoderivatives also possessing anti-septic properties.—T. F. B.

### UNITED STATES PATENTS.

*Halogen Tertiary Butyl Alcohol; Process of Making* —. T. B. Aldrich and C. P. Beckwith, Detroit, Mich. U.S. Pat. 777,712, Dec. 20, 1904.

A mixture of a halogen substitution product [of a ketone] with a considerable excess of ketone is caused to flow upwards through a rotating broken mass of "condensing agent," the temperature of the mixture introduced and of the reaction vessel being maintained at or below 0° C. The product is then neutralised, and the excess of uncombined ketone distilled off from the halogenated tertiary butyl alcohol. The distilled ketone is then mixed with more halogenated ketone, and the mixture again subjected to condensation, further amounts of ketone being added when the reaction becomes too vigorous. (Compare U.S. Pat. 761,188 of 1904; this J., 1904, 726.)—T. F. B.

*Iodory Compound [p-Iodoryphenol Ester]; and Process of Making same.* A. Liebrecht, Frankfurt, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 777,962, Dec. 20, 1904.

PARA-IODOPHENOL esters are converted by oxidation into the corresponding *p*-iodo-oxyphenol esters, which are generally soluble with difficulty in cold water, more easily in hot water, easily soluble in acetic or formic acid, and insoluble in alcohol or ether; *p*-iodo-oxyanisol, (C<sub>6</sub>H<sub>5</sub>O), C<sub>6</sub>H<sub>4</sub>O<sub>2</sub>I, obtained by oxidising iodo-anisol, melts, with simultaneous combustion, at about 225° C.—T. F. B.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*Metals: Action of —, on the Photographic Plate.* G. W. A. Kahlbaum, Naturforsch. Ges., Basel. Through Brit. J. Phot., 1904, 51, 1108–1109.

PIECES of aluminium, iron, zinc and lead were separated from two photographic plates, one placed above and the other below them, by a piece of cardboard and a sheet of waxed paper. The film of the upper plate was turned away from the metal. The whole was kept in a dark room for five days. Upon development, well defined and strong images of the four metals were found upon the lower plate, whilst the upper plate indicated a very faint image from the aluminium, and a slightly stronger one from the zinc. On exposing the metals between the two plates held vertically, the action was found to be similar on each plate, but weak, whilst when a strip of lead was placed diagonally between the two plates, a weak image, distorted into parabolic form, was produced. The intensity of the images produced appeared to vary inversely with the distance of the metal from the plate. The emanations thus appear to be influenced by gravity, and to traverse glass. The temperature and humidity of the air appear to have a considerable effect on this action, which has also been observed with copper, nickel and uranium.—T. F. B.

*Photographic Development; A Method of —, which permits the Production of Fine Grained Images.* Lumière and Seewetz, Bull. Soc. franc. de Phot., 1904, 422; Chem.-Zeit., 1904, 28, Rep. 380.

THE conditions necessary for the production of finely-grained images are slow development (obtained by using retarding agents or dilute solutions) and the presence of a body capable of dissolving silver bromide: too large an amount of this must not be used, however, as otherwise silver bromide would be dissolved before the image was developed. Ammonium chloride (15 to 20 grms. for 100 c.c. of developer) is recommended for this purpose. *p*-Phenylenediamine and *o*-aminophenol also yield finely-grained images because they possess only slight reducing power, and are also able to dissolve silver bromide. The following is a good developer: Water, 1000 c.c.; *p*-phenylenediamine, 10 grms.; anhydrous sodium sulphate, 60 grms.

According to Lüppo-Cramer (Phot. Korr., 1904, 41, 512) the above process is a purely physical one, as can be proved by the fact that a primarily fixed negative placed in the same bath is developed by the silver chloride or bromide dissolved from the unfixed plates. Highly sensitive plates require a longer exposure if treated in this way, and yield a strong dichroic fog. The solvent action of ammonium chloride on silver bromide is ascribed to the action of ammonia produced by the alkali of the developer; when ferrous oxalate developer is used it has no action.—A. G. L.

### ENGLISH PATENT.

*Colour Photography; Sensitised Plates for a Process of —.* La Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils, Lyon-Monplaisir, France. Eng. Pat. 22,988, Oct. 25, 1904. Under Internat. Conv., Dec. 17, 1903.

A SHEET of glass is coated with a suitable adhesive, and a layer of coloured, transparent grains is applied to it. The grains may be of starch, enamels, &c., and the colour used should also be transparent; three equal masses of the grains are coloured respectively red, yellow, and blue and are mixed as intimately as possible. The layer of grains should be so applied that the grains touch each other without being superimposed. This layer is covered with a second adhesive coating, a second layer of coloured grains applied, and the whole covered with varnish; the sensitive film is then applied to the prepared plate in the usual way. The varnish and the adhesive should have approximately the same refractive index as the transparent grains, in order that the light may not be deflected or diffused. The plate is exposed in the camera with its glass side to the lens, and is finished in the usual way, and "reversed"; on viewing the finished plate by transmitted light, a reproduction in colours of the original is obtained.—T. F. B.

### FRENCH PATENTS.

*Emulsions of Silver Salts; Process for Producing [Photographic] —.* J. Gaedicke, Fr. Pat. 345,872, Aug. 26, 1904. Under Internat. Conv., Sept. 5, 1903.

SEE Eng. Pat. 18,183 of 1904; this J., 1904, 1044.—T. F. B.

*Photographic Papers; Process for Making —.* P. von Garainow-Trautenberg and M. L. Fabian, Fr. Pat. 346,009, Sept. 2, 1904.

SEE Eng. Pat. 18,890 of 1904; this J., 1904, 1044.—T. F. B.

## XXII.—EXPLOSIVES, MATCHES, Etc.

*Freezing of Nitroglycerin and Nitroglycerin Explosives. Study of the Conditions of —.* S. Nauckhoff, Z. angew. Chem., 1905, 18, 11–22; 53–60.

MANY attempts have been made to prepare nitroglycerin explosives capable of withstanding comparatively low temperatures without freezing, but no satisfactory solution of the problem has yet been worked out. At the present time nitrobenzene, nitrotoluene, &c., are added to the nitroglycerin, but it has not been found possible to depress the freezing-point of the explosive considerably below 0° C., without at the same time greatly reducing its explosive power. As a contribution to the solution of the problem, the author gives the results of an investigation of the freezing of nitroglycerin, and of the lowering of its freezing-point by additions of various substances. Pure nitroglycerin can be cooled to temperatures (–40° to 50° C.) much below its true freezing-point, without becoming solid. When cooled by means of a mixture of solid carbon dioxide and ether, it sets to a glassy mass, without any perceptible crystallisation. The mass when warmed to 0° C. first rapidly liquefies and then begins to crystallise. The true freezing-point of pure nitroglycerin was found to be 12.3° C.; the technical product, owing to the presence of dinitroglycerin, freezes at 10.5° C.

According to Raoult's law, the lowering of the freezing-point caused by *m* grms. of a substance with the molecular weight *M*, when dissolved in 100 grms. of the solvent, is expressed by the formula:  $\Delta = E \cdot \frac{m}{M}$ , where *E* is a constant characteristic for the solvent in question. The value of *E* for nitroglycerin was found to be 70.5 when calculated, according to van t'Hoff's formula, from the melting-point and the latent heat of fusion of the substance. Determinations of the lowering of the freezing-point of nitroglycerin by additions of benzene, nitrobenzene, dinitrobenzene, trinitrobenzene, *p*-nitrotoluene, *o*-nitrotoluene, dinitrotoluene, naphthalene, nitronaphthalene, dinitronaphthalene, ethyl acetate, ethyl nitrate, and methyl alcohol, gave results agreeing fairly well with Raoult's formula except in the case of methyl alcohol, for which the calculated lowering of the freezing-point was greater than that observed, probably owing to the formation of complex molecules in the solution. The results show that, in general, the capacity of a substance to lower the freezing-point of nitroglycerin depends not



its freezing-point, or its chemical composition institution, but upon its molecular weight. Experiments with a number of samples of dynamite, and technical products and specimens specially prepared, gave results showing that by the aid of Raoult's rule, the freezing-point of a nitroglycerin explosive can be calculated with sufficient accuracy for practical purposes from its composition. The resistance of a nitroglycerin explosive to cold depends, however, not only upon its freezing-point, but also upon its power of undergoing change below its freezing-point without solidifying. The author has found that the more plastic the explosive is, the better it resists this supercooling. The plasticity of a dynamite depends not only upon the amount of nitrocellulose contained in it, but also upon the ready solubility and gelatinising properties of the same. A cartridge of dynamite freezes more rapidly than a shell; also the explosive does not freeze so easily at very low temperature as at one only a few degrees below the true freezing-point. A specimen of dynamite which has been frozen and then thawed does not resist supercooling so well as one that has not been frozen. In conclusion, the author states that a suitable substance dissolving in nitroglycerin in order to lower the freezing-point of the latter, must have a relatively low molecular weight, must not appreciably diminish the explosive power and stability of the explosive, and must be easily volatile at relatively high atmospheric temperatures; it should, if possible, be a solvent of nitrocellulose, and, in any case, must not have a prejudicial effect on the gelatinisation of the nitrocellulose. (See this J., 1904, 680.)—A. S.

*Carbide as an Explosive in Mines.* M. P. S. Juchéras. *Comptes rend.*, 1904, 139, 1225—1226.

Carbide is introduced into a metallic cartridge, separated by a diaphragm from the necessary water for its decomposition; the cartridge also contains an air-space in a cavity containing a detonator. The cartridge is introduced into the borehole, which is tamped with a wooden plug, and by striking a projecting rod the diaphragm is pierced. After 5 minutes the cartridge is exploded by firing the detonator. The rock is shattered, not projected, and can be easily hewn with the pick. The charge of carbide is 50 grms.—J. T. D.

#### ENGLISH PATENTS.

*Blasting Compounds.* A. F. Hargreaves, Roslin, Scotland, and Curtis's and Harvey, Ltd., London. Eng. Pat. 4028, Feb. 17, 1904.

Potassium chlorate (78 parts) is mixed with dinitrotoluene (22 parts). To 75 parts of this mixture are added 25 parts of blasting gelatin (nitroglycerin 90 per cent., collodion 10 per cent.). The addition of wood-meal (3 per cent.) improves the keeping qualities of the explosive. The resulting explosive is plastic and can be pressed into cartridges. It is claimed that the blasting gelatin is thus employed as a colloid vehicle for holding the particles of chlorate, protecting them from water and abrasive agents, reducing their sensitiveness and rendering the blasting compound safe.—G. W. McD.

*Blasting Compounds.* A. F. Hargreaves, Roslin, Scotland, and Curtis's and Harvey, Ltd., London. Eng. Pat. 333, March 16, 1904.

Potassium chlorate (78 per cent.) is mixed with dinitrotoluene (22 per cent.). To 75 parts of this mixture are added 25 parts of blasting gelatin (nitroglycerin 90 per cent., collodion 10 per cent.). The resulting explosive is plastic and can be pressed into cartridges. Wood-meal (3 per cent.) may also be added to improve the keeping qualities of the explosive and sodium, ammonium and potassium perchlorates can be used in place of sodium chlorate. (See also Eng. Pat. 4028 above.)—G. W. McD.

*Explosives; Manufacture of* ——. C. Duttenhofer, Hamburg, Germany. Eng. Pat. 24,782, Nov. 15, 1904. In order to prevent muzzle flame on firing a shot, an alkali carbonate is added to the explosive. It is said to have

no detrimental effect on the stability of the explosive, as is the case with the normal carbonate. An example given is nitrocellulose (75 parts), nitroglycerin (25 parts), vaseline (5 parts), sodium bicarbonate (2 parts).

—G. W. McD.

#### FRENCH PATENTS.

*Heat [Firing Explosives]; Means for Producing —, by Chemical Reaction.* L. Partl, G. Károlyi, and E. Paats. Fr. Pat. 345,751, Aug. 22, 1904.

A COMPOSITION which, on addition of water or of a dilute acid, will give out heat available for firing explosive bomb-shells, or which may itself be used to charge projectiles, is formed by mixing quicklime with one or more of the following substances, in proportions suited to the circumstances:—potassium carbonate, chlorate, chloride, or nitrate; sodium phosphite, nitrate or chloride; magnesium carbonate; calcium phosphate or chloride; lead carbonate; and sugar. —E. S.

*Explosive Compound; Method of Manufacture of* ——. H. Boyd. Fr. Pat. 346,135, Sept. 8, 1904.

THE composition consists of sodium nitrate (35 per cent.), rosin (10 per cent.), naphthalene (10 per cent.), petroleum shale (15 per cent.), sulphur (10 per cent.), other ingredients (20 per cent.). It is claimed that the sodium nitrate is thus rendered non-hygroscopic. The three first ingredients are kneaded together with addition of petroleum, the other ingredients being added subsequently, the resulting explosive being either granulated or compressed into cartridges as required.—G. W. McD.

### XXIII.—ANALYTICAL CHEMISTRY.

#### APPARATUS, ETC.

*Sodium Borates; Some Physical Characters of the —, with a New and Rapid Method for the Determination of Melting Points.* C. H. Burgess and A. Holt, Jun. VII., page 88.

#### UNITED STATES PATENT.

*Cupel.* J. C. Fox, Assignor to The Morgan Crucible Co., Ltd., London. U.S. Pat. 777,725, Dec. 20, 1904.

SEE Eng. Pat. 1695 of 1904; this J., 1904, 623.—T. F. B.

#### INORGANIC—QUALITATIVE.

*Perchlorate; Sodium Nitrate containing — [Detection of Chlorates].* H. Pellet and G. Fribourg. XV., page 98.

#### INORGANIC QUANTITATIVE.

*Ammonium Chloride; Dissociation of —, regarded from the Analytical Standpoint.* L. Santi. *Boll. Chim. Farm.*, 1904, 43, 673—681. *Chem. Centr.*, 1904, 2, 1625—1626.

IRON, in the form of cuttings, is readily attacked by a warm, concentrated solution of ammonium chloride, with evolution of hydrogen and ammonia, whilst magnesium powder is attacked even in the cold; a soluble, double chloride is formed in each case,  $\text{FeCl}_2 \cdot 2\text{NH}_4\text{Cl}$  and  $\text{MgCl}_2 \cdot 2\text{NH}_4\text{Cl}$ , respectively. Cadmium, zinc, chromium, manganese, and tin are also more or less readily attacked by ammonium chloride solution. Most metallic oxides are converted into the corresponding chlorides by heating with dry ammonium chloride, but nickel and cobalt oxides are reduced to the corresponding metals. Nickel oxide, manganese protoxide and ferrous oxide, as also calcium, magnesium, copper, cobalt and nickel carbonates are converted into the corresponding chlorides by ammonium chloride solution; sesquioxides are not acted upon. Tin and antimony sulphides are attacked by dry ammonium chloride, whilst manganese sulphide, and, less readily,

zinc sulphide are acted upon by ammonium chloride solution. Thiosulphates when boiled with excess of ammonium chloride solution, are decomposed according to the equation:  $\text{Na}_2\text{S}_2\text{O}_4 + 2\text{NH}_4\text{Cl} = 2\text{NaCl} + 2\text{NH}_3 + \text{H}_2\text{O} + \text{SO}_2 + \text{S}$ . Manganates are converted into permanganates in the cold by ammonium chloride; and chromates into bichromates, chromic acid being finally liberated from the latter. The reaction of barium peroxide with hot ammonium chloride solution affords a means of obtaining a regular supply of oxygen for laboratory purposes:  $\text{BaO}_2 + 2\text{NH}_4\text{Cl} = \text{BaCl}_2 + 2\text{NH}_3 + \text{H}_2\text{O} + \text{O}$ . Potassium persulphate when boiled with ammonium chloride solution, yields chlorine and nitrogen, whilst on distilling the reaction-products, hypochlorous acid can be detected.—A. S.

*Sulphuric Acid; Determination of —, by Benzidine Hydrochloride. Determination of Sulphur in Pyrites.*  
G. v. Knorre. Chem. Ind., 1905, 28, 2—13.

As a member of Sub-Committee IX. of the International Committee on Analysis, the author has examined the relative merits of Lunge's and Silberberger's methods of determining sulphur in pyrites. He concludes that Lunge's method (Taschenb. Sodafabr., 3rd Edit. 140), properly carried out, gives accurate results; and that though Silberberger's method (this J., 1903, 1149) may also give accurate results, yet it has many faults—the filtrates are turbid, the filtration very slow, the strontium sulphate contains considerable quantities of iron, the strontium sulphide formed during incineration of the filter re-oxidises very slowly, so that constancy of weight is long in being attained, and the large consumption of alcohol makes the process costly.

He has examined also the benzidine method of determining sulphates, as developed by Raschig (this J., 1903, 1066), confirming Raschig's results, and finds no difficulty in following his directions. In titrating, he usually heats the magma of water, benzidine sulphate, and filter paper to  $60^\circ$ — $100^\circ$  C., adds a drop of phenolphthalein and a distinct excess of  $\text{N}/_{10}$  sodium hydroxide solution and heats to boiling, to ensure complete decomposition of the benzidine sulphate. He then acidifies with  $\text{N}/_{10}$  hydrochloric acid, boils to expel any carbon dioxide, and titrates with the soda solution. In this way he has found that sulphuric acid can be accurately determined in presence of ferrous, cupric, nickel, cobalt, manganese, zinc, chromium, or aluminium salts, but that ferric salts react on the benzidine, forming oxidation products which render the method useless. Ferric sulphate acts less energetically than ferric chloride, but even in this case the removal or reduction of the iron is necessary, or no confidence can be placed in the results. The author confirms Raschig's statement that hydrazine hydrochloride can be used as a reducer; but he also finds that hydrogen sulphide acts satisfactorily in the same capacity. He has proved that no sulphuric acid is formed from the hydrogen sulphide, even when nitric acid is present in the solution, and he works as follows:—The cold iron solution is poured into a quantity of hydrogen sulphide water containing roughly double the amount needed for the reduction of the iron (100 c.c. of saturated solution at  $15^\circ$ — $17^\circ$  C. contain about 0.14 gm. of hydrogen sulphide), and after mixture, the liquid is heated till it ceases to smell of the gas. The liquid is made up to a known volume, filtered through a dry filter, and an aliquot part taken for the precipitation. Hydroxylamine was found by Raschig to be unsuitable as a reducer: the author finds that the acid formed during the reaction of the hydroxylamine is responsible for this, and that hydroxylamine can be used if the solution be rendered just alkaline by ammonia, so that a small permanent precipitate is formed, which goes completely into solution during the reduction. In the case of small amounts of ferric salt, such as are present in the analysis of pyrites, the addition of 0.5 gm. of hydroxylamine hydrochloride, though it may not completely reduce the iron, is enough to prevent it from reacting on the benzidine.

This method can be advantageously applied to pyrites: when it is used, the evaporation to dryness is not necessary, but the solution of the pyrites (according to Lunge's directions) is diluted with water, nearly neutralised with

ammonia, and made up to 250 c.c., of which 50 c.c. are used for a determination. The iron may be reduced by 10 c.c. of hydrogen sulphide water, and after expulsion of excess of the gas and cooling, the solution is poured into 320 c.c. of the benzidine solution; or in the benzidine solution there may be dissolved 0.5 gm. of hydroxylamine hydrochloride, and the solution of the pyrites is poured into this without reducing the iron. Or the solution, diluted with water, may be treated with excess of ammonia and digested for 10 minutes at  $60^\circ$ — $70^\circ$  C., then cooled and diluted to 250 c.c., filtered through a dry filter, and 50 c.c. taken for the benzidine precipitation (making it very slightly acid before precipitating). As no evaporation is needed, this method is exceedingly rapid. In using it for copper pyrites or other sulphides for the complete oxidation and solution of which large quantities of acid are needed, however, the evaporation of most of the excess of acid cannot be dispensed with; for otherwise the large amounts of alkaline salts formed in nearly neutralising the acid hinder the complete precipitation of the benzidine sulphate.

—J. T. D.

*Manganese; Determination of — as the Green Sulphide.*  
J. C. Olsen, E. S. Clowes and W. O. Weidmann. J. Amer. Chem. Soc., 1904, 26, 1622—1627. (See page 89).

For 150 mgrms. of manganese, 10 c.c. of a 5-N solution of ammonium chloride or 2.75 grms. of the dry salt, and five times the theoretical amount of ammonium sulphide are used. The concentrated solution of the manganese salt (10 c.c.) is poured into the boiling solution of the ammonium salts (90 c.c.), and the heating continued until the pink sulphide which is first precipitated is completely transformed into the green modification. The ammonium sulphide must be prepared immediately before use, be free from the yellow sulphide, and must be used in sufficient excess. The transformation of the pink precipitate into the green sulphide is generally complete in half an hour; if necessary 10 or 15 c.c. more of the ammonium sulphide solution are added after this time. The green sulphide is filtered off, washed with distilled water containing ammonium sulphide and chloride, dried and ignited in a current of dry hydrogen free from arsenic hydride.

—A. S.

*Chromium in Steel; Note on the Determination of —.*  
F. Ibbotson and R. Howden. Chem. News, 1905, 91, 3. CHROMIUM salts in nitric acid solution are completely oxidised to chromic acid by sodium bismuthate, but the oxidation proceeds so slowly in the cold that the presence of chromium does not interfere to any appreciable extent with the determination of manganese by Reddrop and Ramage's bismuthate method (this J., 1895, 305). For the determination of manganese and chromium in one and the same sample of steel, the manganese is determined as previously described (*loc. cit.*), and after titrating the permanganate, 50 c.c. of nitric acid of sp. gr. 1.2 and 10 grms. of sodium bismuthate are added, and the mixture is heated to boiling. When the oxidation of the chromium is complete, with production of a clear, red solution, a pinch of manganous sulphate is added, and the boiling is continued for a minute or two to decompose the permanganate formed. The small quantity of precipitated manganous oxide is filtered off, and the chromic acid in the filtrate is determined in the usual manner by means of ferrous sulphate and potassium permanganate.—A. S.

*Sulphur [In Iron]; The Wiborgh Test for —, using a Filter.* Ax. Silverling. Jern-Kontorets Annaler, 1904, 59, 114; Chem.-Zeit., 1904, 28, Rep., 368.

GRABE (Teknisk. Tidskrift., 1902, 32, 89) modified Wiborgh's method (Chem. News, 54, 158) by boiling the solution for a shorter time, but more vigorously. The author finds that by inserting a filter some little distance below the piece of cotton, which is soaked in cadmium acetate solution, any spray is caught, and the colours obtained are, in consequence, pure yellow without any brownish tinge.—A. G. L.

*Lead and Antimony; Determination of —, as Sulphides.*  
J. A. Muller. Bull. Soc. Chim., 1904, 31, 1300—1303.

THE warm solutions ( $35^\circ$  C.), that of lead acidified with



1 per cent. of nitric acid, that of antimony containing excess of hydrochloric acid and some tartaric acid, are made up with water to 300–500 c.c., and saturated with hydrogen sulphide. The precipitates are filtered off through tared filters, washed successively with water containing hydrogen sulphide, 95 per cent. alcohol, a mixture in equal volumes of 95 per cent. alcohol, ether, and carbon bisulphide, and finally with absolute ether; they are then dried *in vacuo* over sulphuric acid, and weighed. The filters are previously treated in pairs with the same solvents, dried, and one balanced against the other, the small difference in weight being determined and recorded; when weighing the precipitate, the second filter is again used as a counterpoise for the other. Trial determinations with lead nitrate, in quantities varying from 0.25 to 2.0 grms. of sulphide, gave from 99.7 to 100.1 per cent. of the actual amount of lead. Similar determinations with antimony sulphide gave from 99.8 to 100.6 per cent. of the actual amount of antimony.—J. T. D.

*Lead Ores; Complete Analysis of* —. J. A. Muller. Bull. Soc. Chim., 1904, 31, 1303–1306.

5 gm. of the finely-powdered ore is treated in a covered platinum capsule, with 10 c.c. of nitric acid of sp. gr. 1.33, added gradually, and kept warm for 12 hours. Extraction is effected with warm water, decanting through a small filter. To the filtrate 40 c.c. of 10 per cent. sodium acetate solution are added, the liquid boiled, filtering from any precipitated iron, and in the filtrate the silver is determined as chloride. The residue in the capsule is now treated with 60 c.c. of a mixture of equal volumes of fuming hydrochloric acid and water, and to this the solution, in hydrochloric acid, of the basic ferric acetate precipitate is added. After filtering and washing the filtrate is added to the filtrate from the silver precipitate, and the insoluble residue silica and barium sulphate are determined in the usual way. The combined filtrates (containing all the soluble constituents of the ore except the silver) are made up to 1½ litres, heated to 70° C., saturated with hydrogen sulphide, allowed to stand for a day, and filtered through a tared filter. After washing, the precipitate is detached as far as possible from the filter, and treated with 6 c.c. of concentrated yellow ammonium sulphide solution (or sodium sulphide in presence of copper) nearly at boiling temperature; after decanting through the filter, and washing three or four times with small quantities of hot water containing 0.5 c.c. of the yellow sulphide, the precipitate is rinsed on to the filter and washed there with pure water. The receiver is changed, and the washing continued first with alcohol, then with a mixture of alcohol, ether and carbon bisulphide, and finally with ether; the washed precipitate is dried *in vacuo* (see preceding abstract). Copper and silver must be looked for in aliquot parts of this precipitate, and, if found, determined. The ammonium sulphide solution contains arsenic and antimony: it is acidulated with hydrochloric acid, the solution filtered, the precipitate washed with water, alcohol, &c., as above, and dried. After boiling with 5 c.c. of a mixture of 2 vols. of fuming hydrochloric acid and 1 vol. of water, the liquid is filtered. The insoluble arsenic sulphide is next oxidised by means of nitric acid, and the arsenic determined as ammonium magnesium arsenate, examining the filtrates for arsenic and antimony, and determining any small amounts found. The solution of the antimony is diluted to a litre, and antimony determined as sulphide (see preceding abstract). In the filtrate from the hydrogen sulphide precipitate, iron, calcium, &c., are determined.—J. T. D.

*Metals; Electrolytic Deposition of* —, with Rapid Stirring of the Electrolyte. A. Fischer and R. J. Boddaert. Z. Elektrochem., 1904, 10, 945–953.

The authors retain as closely as possible the Classen method, employing a dish of platinum or other metal, as cathode, and a platinum disc or spiral as anode (with lead, *ce versa*). The stirring is effected by a rapid rotation of the anode. In nearly all the cases investigated a very marked acceleration of the deposition is possible, in some cases it was found advantageous to employ other electrolytes than those in general use for the electrolytic determination of metals. The following table shows the

time required for the complete deposition of 0.2 to 0.4 gm. of metal:—

Metal.	Time required without stirring A (Hours).	Time required with stirring B (Minutes).	Ratio A : B.
Nickel .....	3	40	4.5 : 1
Zinc .....	2	15	8 : 1
Copper .....	6	20	18 : 1
Cadmium .....	3	10	18 : 1
Lead .....	1	15	4 : 1
Silver .....	3	15	12 : 1
Mercury .....	1½	15	10 : 1
Antimony .....	1½	30	4 : 1
Tin .....	6	20	18 : 1

A special stand to hold both anode and cathode has been devised by the author.—R. S. H.

*Rotating Anode in Electro-Analysis; Use of the* —. E. F. Smith, G. H. West and L. G. Kollock. J. Amer. Chem. Soc., 1904, 26, 1595–1615.

The results are given in the form of tables and curve-diagrams of the determination of nickel and cobalt, and the separation of cobalt from the alkaline-earth metals. In all the experiments the volume of the electrolyte ranged from 100 to 125 c.c., representing a cathode surface of 100 sq. cm., whilst the anode was rotated at from 500 to 650 revolutions per minute. Satisfactory results were obtained with electrolytes of ammonium acetate, sodium acetate, ammonia and ammonium sulphate, ammonium formate, sodium formate, and ammonium lactate in the determination of nickel; with sodium formate, ammonium formate, ammonium acetate, sodium lactate, ammonium lactate, and ammonium succinate in the determination of cobalt; and with formate electrolytes in the separation of cobalt from calcium, strontium, barium and magnesium.

Some experiments with a rotating anode and mercury cathode indicate that under suitable conditions, it will be possible to deposit 0.5 gm. of copper and 0.25–0.5 gm. of nickel in 15 minutes. (See also this J., 1903, 1150; 1904, 1114, 1115.)—A. S.

*Sodium Borates; Some Physical Characters of the* —, with a New and Rapid Method for the Determination of Melting Points. C. H. Burgess and A. Holt, Jun. VII., page 88.

## ORGANIC—QUALITATIVE.

*Wood-Tar Pitch; Behaviour of* —, with Certain Organic Solvents. B. M. Margosches. Chem. Rev. Fett-u. Harz-Ind., 1905, 12, 5–9.

This is an extension of the investigation begun by Donath and the author (this J., 1904, 541). The samples of beech wood-tar pitch used in the experiments had the following elementary composition: Besnian pitch, carbon, 63.0, and hydrogen, 6.0 per cent.; Hungarian pitch, carbon, 66.0, and hydrogen, 10.0 per cent. The amount of oxygen in wood-tar pitch is thus much greater than in other artificial "asphaltums." In testing their behaviour with the different solvents, about 0.1 to 0.3 gm. was treated with about 10 to 15 c.c. of the liquid. In the case of carbon tetrachloride the solvent acquired a faint yellow tinge after about 24 hours, whilst at 30° C. the yellow coloration was more pronounced. Carbon bisulphide remained colourless for some minutes, and then acquired a faint yellow coloration, which reached its maximum intensity after about 15 minutes, and did not darken perceptibly after standing for 24 hours at the ordinary temperature or at 30° C. This test, therefore, affords another means of distinguishing between wood-tar pitch and other artificial "asphaltums." A still more characteristic test was given by petroleum spirit, which remained absolutely colourless after standing for 24 hours in contact with the pitch, although it dissolved about 2 per cent. of the samples. Experiments with other petroleum solvents (benzene and ligroin) gave the same results. In 1884 Davies (Chem. and Druggist, 25, 504), found that wood-tar pitch was much more soluble

in petroleum spirit (16.0 to 24.4 per cent.), and the author accounts for this by the fact that at that time, a smaller amount of tar oils was expelled from the pitch during the distillation. The pitches examined by the author were derived from wood-tars that had been distilled at about 270° C. A specimen of crude Bosnian tar was found to be slightly soluble in petroleum spirit (yellow coloration), and considerably soluble in ligroin (reddish-yellow coloration). Chloroform had the greatest solvent action on wood-tar pitch of any of the solvents tried, a dark brown solution being obtained. Alcohol dissolved only a small amount, the liquid becoming yellow after some time. Ether behaved in the same way, though its solvent action was somewhat greater. The two samples behaved differently with benzene. The Hungarian wood-tar pitch did not impart any coloration to the solvent for a long time, and after 12 hours the liquid had only a faint yellow tint. On the other hand the benzene, when shaken with the Bosnian pitch, became yellow in about 5 minutes, the colour changing to reddish-yellow after 30 minutes, and to red after about 12 hours. Successive extraction of this sample with petroleum spirit, benzene and carbon bisulphide showed that those portions that were soluble in carbon bisulphide were for the most part insoluble in benzene and petroleum spirit.—C. A. M.

*Sesame Oil; Detection of — in the presence of Colouring Matters that give a Red Coloration with Hydrochloric Acid.* G. Fendler. Chem. Rev. Fett- u. Harz-Ind., 1905, 12, 10—11.

BEING unable to identify sesame oil by Baudouin's test in a fat containing a colouring matter of the character described in the title, the author had recourse to Soltzien's test (this J., 1903, 1017), which was applied in the following manner:—The fat was mixed with twice its volume of benzene and half its volume of the stannous chloride solution, and the test tube placed in a water-bath at about 40° C., until the stannous chloride solution separated. The tube was then placed in water at 80° C., but so that the level of the water outside was not above that of the stannous chloride layer, and heated until the red coloration in that layer no longer increased. When sesame oil was not present, the coloration caused by the colouring matter in question soon disappeared, and the stannous chloride solution remained colourless after further heating.—C. A. M.

*Oil of Turpentine: Examination of —.* H. Herzfeld. Z. öfentl. Chem., 1904, 10, 382—384. Chem. Centr., 1904, 2, 1770.

THE oil obtained by the distillation of resinous wood has, within recent time, been refined to such a degree, that now neither odour, nor colour reaction with caustic soda and concentrated hydrochloric acid, can, as heretofore, be used for distinguishing it. This refined oil, however, when shaken with an equal volume of sulphurous acid solution, is coloured yellowish-green, and can be detected in this way, when present to the extent of 10 per cent. in oil of turpentine.—A. S.

*Rosin and Fish Oils; Detection of —, in Boiled Linseed Oil.* W. Lippert. Chem. Rev. Fett- u. Harz-Ind., 1905, 12, 4—5.

THE author's experiments to determine the value of the Storch-Morawski reaction for rosin and fish oil have shown that varnishes prepared by the old method of boiling linseed oil with lead or manganese oxides yield products which give only brown colorations in the test; whilst on the other hand, red or blue colorations are obtained when resins have been used, or when rosin oil or fish oils are present. Attention is called to the fact that maize oil gives a similar reaction. Samples of boiled linseed oil, adulterated with sardine oil, &c., examined by the author, gave the Storch-Morawski and other reactions for fish oil. After exposure to the light, however, the reactions given by the oil became fainter, and eventually, after a year, no colour reactions could be obtained. It was still possible to detect the adulteration by separating the cetyl alcohol (m. pt. 50° C.), and by other reactions. The kind of fish oil was not identified,

and various fish oils tried did not give the Storch reaction. The author's general conclusion is that the test should not be omitted in a qualitative examination of boiled linseed oil, although it is not a conclusive sign of purity when no coloration is obtained.—C. A. M.

*Saccharin in Wine; Qualitative Detection of —.* E. MacKay Chace. J. Amer. Chem. Soc., 1904, 26, 1627—1630.

MANY wines, especially French wines of the saunterne type, contain a substance or substances giving the salicylic acid test for saccharin, salicylic acid being actually formed from them on fusion with sodium hydrate. Permanganate is moreover ineffectual in the cold, in destroying salicylic acid. The following method is recommended:—50 c.c. of the wine are extracted with ether, and the extract, after evaporation of the ether, re-extracted with petroleum spirit (gasoline). The petroleum extract is tested for salicylic acid, then added to the portion of the ether extract insoluble in petroleum, the whole made up to 10 c.c., 1 c.c. of sulphuric acid (1 in 3) added, and the solution heated to boiling. An excess of a 5 per cent. solution of potassium permanganate is now added, and if salicylic acid be present, the boiling is continued for 1 minute. A small piece of sodium hydroxide is then added to the hot liquid, and after a few minutes, the alkaline solution is filtered, evaporated to dryness, and the residue heated to 210°—215° C. for 20 minutes. It is then dissolved in water, the solution acidified with sulphuric acid, extracted with ether, and the ether extract tested for salicylic acid with a 0.5 per cent. solution of ferric alum.—A. S.

*Lemon Oil; Determination of the Saponification Value and the Dry Residue (on the Water-Bath) of —.* E. Berté. Boll. Chim. Farm., 1904, 43, 709—713. Chem. Centr., 1904, 2, 1670.

FOR the detection of adulteration of lemon oil with fat, resin, or the like, determinations of the saponification value and of the dry residue are useful. The limiting numbers: Saponification value, 3.5; dry residue, 2—3.5 per cent., are exceeded, if such substances be present in the lemon oil. In the following table the constants are given of: (a) pure lemon oil; (b) the same oil after addition of 25 per cent. of terpenes and 2 per cent. of "ordinary oil"; and (c) after addition of 50 per cent. of terpenes and 4 per cent. of "oil."

	(a)	(b)	(c)
Direct rotation at 20°C. ....	60.4°	61.2°	61.5°
Rotation of distillate at 20°C. ....	61.5°	61.5°	61.2°
Rotation of residue at 20°C. ....	59.1°	60.5°	61.2°
Sp. gr. at 15°C. ....	0.8574	0.859	0.859
Dry residue .....	2.46%	5.59%	7.26%
Citral (or aldehydes) .....	7.10%	5.70%	3.8%

—A. S.

#### ORGANIC—QUANTITATIVE.

*Sulphur in Gas; Determination of —.* W. B. Calkins. Ann. Meeting Amer. Gaslight Assoc., 1904. J. Gas Lighting, 1905, 89, 37—38.

THE method is based on the fact that when sulphur compounds such as carbon bisulphide and mercaptan are mixed with free hydrogen and passed over heated platinised asbestos or punice, sulphuretted hydrogen is formed. A combustion tube of Jena glass, about 30 inches long, is filled loosely with platinised asbestos and placed in a combustion furnace; at one end it is connected to the meter, through which the sample of gas is to be drawn, and at the other to a train comprising two gas-washing bottles and a filter-pump. Each washing bottle consists of a glass cylinder about 9 inches high, of about 150 c.c. capacity, and contains 3 c.c. of a stock solution of cadmium chloride (prepared by dissolving "4 grains" of cadmium chloride in 100 c.c. of water and adding 100 c.c. of ammonia) mixed with 10 c.c. of strong ammonia and enough distilled water to bring the depth to about 7 inches. Before starting a test, the meter and combustion tube are filled



with the gas, the gas is shut off, and the tube heated to dull redness. The meter is now read, the gas is turned on, and drawn through the apparatus by means of the pump at a rate not exceeding 0.5 cb. ft. per hour, to avoid bubbling over of the washing liquid. A precipitate of cadmium sulphide, proportional to the sulphuretted hydrogen formed, is produced in the washing liquid. When the required volume of gas has been passed, the analysis is completed either by diluting the contents of the cylinders with a large volume of cold water, adding a large excess of concentrated hydrochloric acid to re-liberate the sulphuretted hydrogen, and titrating rapidly with iodine solution and starch, or by filtering off the cadmium sulphide precipitate, placing the filter and contents in a large volume of cold water, adding hydrochloric acid, and titrating. The reaction is:— $\text{H}_2\text{S} + 2\text{I} = 2\text{HI} + \text{S}$ . The results obtained agree closely with those given by the London Gas Referees' method.—H. B.

*Hydroxylamine; Volumetric Determination of —, with Trivalent Titanium.* A. Staehler. Ber., 1904, 37, 4732—4733.

THE author observed that titanium trichloride is decolorised without evolution of gas by the action of hydroxylamine hydrochloride, the latter being reduced to ammonia:— $\text{Ti}_2\text{O}_3 + \text{NH}_2\text{OH} = 2\text{TiO}_2 + \text{NH}_3$ . On this reaction he has based a method for the titration of hydroxylamine. To 21 c.c. of an approximately  $\text{N}/_{10}$  hydroxylamine sulphate solution diluted with 80 c.c. of boiling water, an excess of a standard solution of titanium trichloride—prepared by reducing titanium tetrachloride or titanium sulphuric acid in sulphuric acid solution with nascent hydrogen in a current of carbon dioxide—is added, the excess being determined by back-titration with  $\text{N}/_{10}$ -ferric chloride or permanganate solution. (See Knecht, this J., 1903, 762.) The method might also be applied to organic hydroxylamine compounds.—R. L.

*Antipyrine; Volumetric Determination of —.* P. Lemaire. Rép. Pharm., 1904, 16, 493. Pharm. J., 1905, 74, 13.

A KNOWN volume of the solution containing antipyrine is treated with a definite excess of a  $\text{N}/_{20}$  solution of picric acid and the sparingly soluble picrate is filtered off, and in an aliquot portion of the filtrate, the free picric acid is determined by titration with a  $\text{N}/_{10}$  solution of sodium hydroxide, using phenolphthalein as indicator. From the data obtained, the amount of antipyrine is calculated; 1 mol. of antipyrine combines with 1 mol. of picric acid. The free picric acid left after the precipitation, may be determined approximately by comparing the colour of the filtrate with that of a picric acid solution of known strength.—A. S.

## New Books.

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES. SUMMARY OF THE RESULTS ON THE CULTIVATION OF SEEDLING AND OTHER [SUGAR] CANES AT BARBADOES, 1904. Issued by the Commissioner of Agriculture. Price 4d. Pamphlet of 73 pages.

EISENUNG VON GRUNDWASSER. Von L. DARAPSKY. F. Leineweber's Verlag, Leipsic, 1905.

PAMPHLET of 102 pages, illustrated with three diagrams and five wood-cuts. The subject is subdivided into short chapters as follows:—I. Occurrence and Behaviour of Ferruginous waters. II. Origin of the Iron. III. Treatment of Ferruginous waters. IV. New experiments. V. Practical arrangement of the Continuous Process for removal of iron.

LABORATORY NOTES ON PRACTICAL METALLURGY. Being a Graduated Series of Exercises. Arranged by WALTER MACFARLANE, Assessor in Metallurgy, Glasgow and

West of Scotland Technical College. Longmans, Green and Co., 39, Paternoster Row, London, 1905. Price 2s. 6d.

SMALL 8vo volume, containing 130 pages of subject matter, with 28 illustrations, and an alphabetical index of subjects. A series of 127 practical exercises, with full descriptive explanations. Following these are some additional exercises in the proximate analysis of solid fuels—coal, coke, &c., and in the determination of sulphur in coal or coke.

## Trade Report.

### I.—GENERAL.

#### BRITISH TRADE DURING THE YEAR 1904.

Board of Trade J., Jan. 12, 1905.

The following table shows the value of certain imports from foreign countries and British possessions for the twelve months ended 31st December last, as compared with the corresponding periods of the two previous years:—

Imports from Foreign Countries and British Possessions.\*

	Year ended 31st December.		
	1902.	1903.	1904.
	£	£	£
Coal, coke and patent fuel	4,101	3,987	2,689
Iron ore, scrap iron and steel .....	5,091,972	4,887,793	4,598,938
Other metallic ores .....	5,414,737	5,915,491	6,598,921
Oil-seeds, nuts, oils, fats and gums .....	25,234,400	24,461,171	25,281,374
Hides and undressed skins	8,019,045	7,381,872	6,571,112
Materials for paper making	3,386,773	3,431,467	3,552,162
Iron and steel and manufactures thereof .....	7,909,925	8,662,481	8,215,555
Other metals and manufactures thereof .....	19,073,337	18,511,270	20,954,681
Chemicals, drugs, dyes and colours .....	9,026,584	8,848,292	9,301,980
Earthenware and glass ..	4,678,473	4,780,739	4,337,282
Paper .....	4,537,674	4,850,183	4,940,667

\* The values of the imports represent the cost, insurance and freight; or when goods are consigned for sale, the net sale value of such goods.

The value of exports of home, foreign and colonial produce during the twelve months of 1904, as compared with 1903 and 1902 include the following figures:—

#### Exports of British Produce.\*

	Year ended 31st December.		
	1902.	1903.	1904.
	£	£	£
Coal, coke and patent fuel	27,581,136	27,262,786	26,862,387
Iron ore, scrap iron and steel .....	336,763	453,946	499,831
Other metallic ores .....	68,469	134,843	130,806
Oil-seeds, nuts, oils, fats and gums .....	3,132,895	2,976,551	2,759,157
Hides and undressed skins	375,931	1,276,836	1,431,035
Materials for paper making	379,037	409,624	428,439
Iron and steel and manufactures thereof .....	28,877,337	30,399,261	28,082,692
Other metals and manufactures thereof .....	6,269,652	6,958,305	7,000,014
Chemicals, drugs, dyes and colours .....	12,757,292	13,544,552	13,651,973
Earthenware and glass ..	2,997,529	3,278,482	3,117,349
Paper .....	1,672,704	1,795,850	1,876,050

\* The values of the exports represent the "free on board" values.

## CHEMICAL TRADE IN 1904.

*J. C. Udney, Chamber of Commerce J., Jan., 1905.*

The year just closed has been in a sense a disappointing one as regards activity of business in the drug and chemical trade. Although demand has not been disturbed by abnormal conditions of weather as in 1903, there has been an absence of speculation in drugs and chemicals which has left a considerable mark. There have been no important fluctuations in the prices of heavy chemicals—the prices of citric and tartaric acids remaining at a fair level until the latter part of the year, when cream of tartar and tartaric acid prices were depressed as a result of heavy shortages in France and elsewhere. There have been fluctuations in the value of a few chemicals, arising to a considerable extent from the war in the Far East. The price of camphor advanced during the early months of the year to almost famine rates—influenced to some extent by the monopoly of Japanese camphor by the Government of Japan, which came into force on October 1st, 1903. The removal of Japanese competition in iodine resulted in a considerable advance in Peruvian and Scotch iodine and their derivatives. Finally, at the close of the year there has been much appreciation in value of antimony, and bismuth was advanced about 20 per cent. by the syndicate controlling its output. A very considerable reduction in the price of bromides took place in the autumn as a result of competition between European and American manufacturers, but higher prices ruled at the close of the year, and for the moment the American competition appears to be less active. The breaking-up of the arrangement regarding bleaching powder, which took place during 1902, has not been without its effect on all products prepared with that substance, and at the close of the year prices for chloroform fell in Great Britain to the lowest point on record. Speculation in quinine has not been so brisk as in previous years, and but little attention has been given during the past year to speculation in cocaine. The advance in the price of alcohol due, in a measure, to the shortage of the potato crop, has resulted in an increase in price of all substances prepared from it, namely, ether, chloral hydrate, &c., and at the present time the continental prices of spirit of wine remain so high as to leave British distillers in a most advantageous position.

## IMPORT AND EXPORT LISTS: ALTERATION IN —.

*Chem. and Druggist, Jan. 7, 1905.*

A General Order relative to alterations in the import and export lists has been issued by the Board of Customs. It includes the following, which are to take effect from January 1:—

## Import List.

Present Heading. Chemical Manufactures and Products, etc.:		Future Heading. Chemical Manufactures and Products, etc.:	
Borax.....	Cwt.	Boracite .....	Cwt.
		Borate of lime .....	Cwt.
		Borate of manganese ..	Cwt.
		Borax .....	Cwt.
Unenumerated .....	Value.	Sulphate of nickel .....	Cwt.
		Unenumerated .....	Value.
Oil, cocoa-nut .....	Cwt.	Oil, cocoa-nut, unrefined or raw .....	Cwt.
		Cocoa-nut, refined or edible .....	Cwt.
Olive .....	Tun.	Olive, unrefined or raw Olive, refined or edible Palm, unrefined or raw Palm, refined or edible (palm nut kernel oil) ..	Tun. Tun. Cwt. Cwt.
Oil, seed: Cottonseed oil .....	Ton.	Oil, seed: Cottonseed oil, unrefined or raw .....	Ton.
		Cottonseed oil, refined or edible .....	Ton.
Painters' colours and pigments, viz.:		Painters' colours and pig- ments:	
Other sorts .....	Cwt.	Nickel oxide .....	Cwt.
		Zinc oxide .....	Cwt.
		Other sorts .....	Cwt.
Not shown. Included with "Goods, un- manufactured, un- enumerated."		Kieselguhr and infusorial earth .....	Ton.

## Export List.

Present Heading. Oil, other than essential or medicinal, viz.:		Future Heading. Oil, other than essential or medicinal:	
Seed, viz.:		Seed:	
Cottonseed oil ....	Ton.	Cottonseed oil, unre- fined or raw .....	Ton.
		Cottonseed oil, refined or edible .....	Ton.
		Cocoa-nut, unrefined or raw .....	Cwt.
		Cocoa-nut, refined or edible .....	Cwt.
Other sorts, unenum- erated .....	Value.	Olive, unrefined or raw Olive, refined or edible Palm, unrefined or raw Palm, refined or edible (palm nut kernel oil)	Tun. Tun. Cwt. Cwt.
		Other sorts, unenum- erated .....	Value.
Painters' colours and materials, viz.:		Painters' colours and materials:	
Other sorts .....	Cwt.	Nickel oxide .....	Cwt.
		Zinc oxide .....	Cwt.
		Other sorts .....	Cwt.

## II.—FUEL, GAS, AND LIGHT.

PEAT: CANADIAN —.

*Eng. and Mining J., Dec. 22, 1904.*

A practical test of the commercial value of peat from the deposits at Beaverton, Ontario, was recently given in Winnipeg. The peat briquettes burned well, and, after the consumption of the volatile matter, there remained a dense mass of glowing charcoal, which held the fire and continued to throw off heat for a considerable time. The process of manufacture used at Beaverton is simple. After the surface vegetation is stripped off, the peat is dug up by machinery and separated into minute fragments, which are scattered over the ground to dry. When most of the moisture has evaporated it is collected and compressed in an ordinary brick machine. There is very little difference in character between the Beaverton peat deposits and those in the neighbourhood of Fort Frances, in the Rainy River district, and it is proposed to operate them both on the same lines. Manufactured peat from Fort Frances could be delivered at Winnipeg at a rate which would make it cheaper than coal at present prices.

## RETORT-COKE, GAS, AND BY-PRODUCTS IN THE UNITED STATES IN 1903.

*Board of Trade J., Jan. 12, 1905.*

The following particulars are taken from a report of the United States Geological Survey. Since 1893, when the first plant of by-product coke ovens in the United States was completed at Syracuse, New York, the quantity of coke produced in such ovens has increased so rapidly that in 1903 7.4 per cent. of the total coke product of the United States was thus manufactured. The development of this industry has been largely due to the profitable disposition made of the by-products obtained in the manufacturing process.

Reports were received in 1903 from 528 companies producing gas and coke from coal with the recovery of the tar and ammonia.

The total quantity of coal carbonised in 1903 was 5,843,538 short tons (of 2,000 lbs.). The 528 companies produced 33,483,430,989 cubic feet of gas, of which 2,433,969,478 cubic feet were lost or unaccounted for and 31,049,461,511 cubic feet were sold. Of this total 73.9 per cent. was sold for illuminating purposes and 26.1 per cent. for fuel. The average price per 1,000 cubic feet for all gas sold in 1903 was 97 cents. Prices are low in those States which have coal and natural gas among their resources. Such States are Illinois, Indiana, Kentucky, Ohio, Pennsylvania, West Virginia, and also Massachusetts, where a large portion of the coal gas made is a by-product from coke making in retort ovens.

The total production of coke amounted to 3,941,282 short tons, of which 1,882,394 short tons were obtained from by-product coke ovens, and 2,058,888 short tons were from the product of gas-houses.

The total quantity of coal tar produced in 1903 was 62,964,393 gallons, valued at \$2,199,969, or 3.49 cents a



gallon. The largest production of tar in both 1902 and 1903 was in Massachusetts, with New York second, Ohio third, Pennsylvania fourth, and Alabama fifth.

Only about 20 per cent. of the companies that manufacture coke and gas reported the recovery of ammonia, either in the form of ammoniacal liquor or sulphate. The total quantity of ammonia liquor produced and sold was 64,396,662 galls., which would be equivalent to 17,479,759 lb. of anhydrous ammonia, or 67,821,465 lb. of sulphate. The total quantity of sulphate of ammonia produced and sold in 1903 was 11,925,752 lb. The total production in 1903, reduced to its equivalent in sulphate, was 79,747,217 lb.

Comparatively little progress has been made in the United States in the manufacture of chemical products from coal tar. Although over 50,000,000 galls. of coal tar are produced annually, millions of dollars' worth of chemicals obtained from coal tar are imported every year.

(France), and other "pyroxylin silks" are stated to be produced at Spreitenbach and Zurich (Switzerland), Wolston (England), and Elberfeld. The Besançon factory is now producing about 3600 lb. daily. "Viscose silk" is manufactured at Lansdown, Pa., U.S.A., about 300 lbs. per day being produced. A factory near Stettin was, in October, 1903, producing 50 lb. per day, and had a capacity for 2000 lb. per day. Artificial silk fibre to the value of \$170,000 was imported into the United States during the year ended June 30, 1902, and in the succeeding year the value of the imports in question had risen to \$134,033.—T. F. B.

## VII.—ACIDS, ALKALIS, AND SALTS.

### NITRATE OF SODA STATISTICS.

W. Montgomery and Co., Dec. 31, 1904

*Shipments, Consumption, Stocks, and Prices, from 1902 to 1904.*

	1902.	1903.	1904.
Shipments from South American ports to all parts for the six months ending 31st December .....	765,000	885,000	879,000
Ditto do. for the twelve months ending 31st December .....	1,360,000	1,435,000	1,457,000
Afloat for Europe on 31st December .....	307,000	499,000	496,000
Stocks in U.K. ports:—			
	1902.	1903.	1904.
Liverpool Tons .....	6,500	4,500	6,000
London " .....	3,600	4,100	2,100
Out ports " .....	15,900	14,400	12,900
Stocks in Continental ports on 31st December .....	237,000	132,000	141,000
Consumption in U.K. for the 6 months ending 31st December .....	35,000	33,000	43,000
Do. in Continent do. do. ....	249,000	263,000	261,000
Do. in U.K. for the 12 months do. ....	111,000	110,000	121,000
Do. in Continent do. do. ....	917,000	1,017,000	1,010,000
Do. in United States do. do. ....	214,000	265,000	275,000
Do. in other Countries do. do. ....	17,000	20,000	41,000
Do. in the World do. do. ....	1,259,000	1,412,000	1,447,000
Visible supply on 31st December (including the quantity afloat for Europe and stocks in U.K. and Continent) .....	660,000	654,000	658,000
Price on 31st December .....	9/1½	9/7½	10/10½

A conservative estimate would place the total value of these products in the wholesale markets of the United States of America at \$12,000,000.

*Note*—United States gallon = .833 Imperial gallon.

## III.—TAR PRODUCTS, PETROLEUM, Etc.

### TAR DISTILLATION.

*Home Office, Jan., 1905.*

In October, 1903, a memorandum was issued by the Department calling attention to the risks incurred by persons employed in works in which is carried on the distillation of tar and the production of naphtha, light oil, creosote oil, and pitch (see this J., 1903, 1265). The precautions suggested therein have been generally adopted, but it has been found necessary to modify paragraph 5 (see p. 1266) to read as follows:—

"The inspecting foreman on first entering any tar still or tank, and all persons employed in tar stills or tanks in which there are no cross stays or obstructions likely to cause entanglement, should be provided with a belt securely fastened round the body, with a rope attached, the free end being left with two men outside whose whole duty should be to watch and draw out any person appearing to be affected by gas. The belt and rope should be adjusted and worn in such a manner that the wearer can be drawn up head foremost and through the man-hole, and not across it."

## V.—TEXTILES, YARNS, AND FIBRES.

### SILK: ARTIFICIAL —.

*Bull. of the Imperial Institute (Supplement to the Board of Trade J.), 1905, 2, 269.*

The de Chardonnet process is worked at Besançon

### AMMONIUM SULPHATE STATISTICS.

*Bradbury and Hirsch, Jan., 1905.*

The total production of ammonia, calculated as sulphate (including that used in the ammonia-soda and other chemical processes) from all sources in the United Kingdom during 1904, is estimated as below, figures for the preceding three years being given for comparison:

	1901.	1902.	1903.	1904.
	Tons.	Tons.	Tons.	Tons.
Gasworks .....	143,000	150,000	150,000	154,000
Iron .....	16,500	18,500	19,000	19,000
Shale .....	40,000	37,000	37,500	39,500
Coke and carbonising works and producer gas .....	18,000	23,500	27,500	32,000
	217,500	229,000	234,000	244,500

Of the 1904 production, England contributed 162,400 tons, Scotland 79,500 tons, and Ireland 2,600 tons.

The exports during 1904 amounted to 177,000 tons, and home consumption 68,500 tons, leaving stocks on hand on Jan. 1 of about 11,000 tons. Average prices for good grey 24 per cent. sulphate, f.o.b. Hull, fell from £12 14s. 3d. per ton in January to a minimum of £11 13s. 1½d. in August, but rose again from October, reaching £12 14s. 9d. in December.

### POTASH SYNDICATE: GERMAN —.

*Chem. and Druggist, Jan. 7, 1905.*

The general director of the German Potash Syndicate states that the total turnover of the combination in clear

potash will probably amount to 416,500 tons for 1904, or an increase of 54,900 tons over the previous year. After deducting expenses, it is estimated that the year will close with total receipts amounting to over £3,650,000 or £450,000 in excess of the income earned in 1903. It is hoped to counteract to some extent the competition of outstanding potash-works and any possible reduction in prices next year by further increasing the sales of the syndicate.

### VIII.—GLASS, POTTERY, AND EARTHENWARE.

#### EMERY TRADE AND INDUSTRY OF NAXOS.

*Foreign Office Annual Series, No. 3179.*

Emery is found almost exclusively in Greek territory. Of a total production of about 30,000 tons, 20,000 come from the vilayet of Smyrna, 5,500 from the island of Naxos, and 4,500 from the United States, where the working of emery mines dates only from 1871. Apart from American emery, of which the prime cost is still too high to enable it to compete, it is stated that the emery of Naxos, is both superior in quality, and less costly than the similar product of Asia Minor, where the cost of mining, to which must be added the cost of transport to Smyrna, is greater than in the Archipelago. The Greek Government has reserved the monopoly of it since 1824. The right of raising the mineral is reserved to the native peasants of the mining districts who have to transport the emery to one of the bays for loading. There the fiscal authorities take delivery at a fixed price of 43 dr. 20 c. per ton, and transport it to the depôts at Syra, whence it is exported to foreign countries. The cost of transport from Naxos to Syra brings the cost of production up to about 52 dr.; the fiscal authorities, on their part, sell at the fixed price of 106 fr. 50 c. per ton, the difference between these two figures representing the value of the monopoly, which is one of the revenues assigned to the service of the public debt. In recent years the exploitation of emery has been the object of several reforms. More care has been given to selecting the product mined, which has led to an improvement in the quality; the State has constructed depôts at Syra, which have facilitated the development of the exportation by rendering loading easier, and by assuring more regularity in the trade. Hence the exports of emery which amounted in 1897 to 3,125 tons, value £13,515, reached in 1903, 5,813 tons, value £24,763. But in spite of the progress which has been achieved, the emery does not afford to the Government such returns as might reasonably be expected. Beyond the fact that more perfect processes might be employed in its extraction by the Naxiotes, cargoes composed of three parts of Smyrna emery are often completed at the depôts at Syra, and then sold to consumers as solely Naxos produce. The danger of American competition consists not merely in an increase of production in the United States, and consequently a lowering of the price of natural emery, but also in the invention of certain artificial substitutes such as carborundum and "steel emery." Such competition would be very serious as more than half the world's production (16,500 tons out of a total of about 30,000 tons) is consumed annually in America.

### X.—METALLURGY.

#### MERCURY IN 1904; BRITISH TRADE IN —

*A. S. Pickering, Jan., 1905.*

It will be observed from the table below that while

	Imports. Bottles.	Exports. Bottles.	Price.	
			Highest.	Lowest.
			£ s. d.	£ s. d.
1904	33,218	27,277	8 5 0	7 14 0
1903	34,806	18,846	8 15 0	8 5 0
1902	33,192	19,519	8 17 6	8 14 6
1901	35,341	26,863	9 2 6	8 17 6
1900	32,725	25,869	9 12 6	9 2 6
1895	49,654	36,827	7 8 6	6 7 6

the exports during 1904 were 27,277 bottles, which are larger than the last four years, the imports remain about normal; while the present price of £7 15s. being the lowest officially for six years, rather points to higher rates presently prevailing. The demand for home consumption keeps up to the average, with the result that stocks are diminishing.

#### IRON ORE TRADE; BELGIAN —.

*Eng. and Mining J., Dec. 29, 1904.*

In the ten months ending October 31, imports of iron ore into Belgium were 2,823,266 tons, an increase of 240,341 tons over last year. The exports of iron ore—chiefly to Luxemburg—were 345,080 tons in 1903, and 380,775 tons in 1904, showing an increase of 35,695 tons.

### XII.—FATS, FATTY OILS, Etc.

#### OILS; EXPORTS OF —, FROM MARSEILLES TO THE UNITED STATES.

*U.S. Cons. Rep. No. 2141, Dec. 24, 1904.*

Exports of Marseille oils to the United States were heavier in 1904 than usual, the declared value of such exports during the fiscal year ended June 30, 1904, having been as follows:—

Oils.	Value.
	Dols.
Almond .....	150.54
Castor .....	3,322.01
Copra .....	14,574.20
Cotton-seed .....	625.80
Essential .....	2,264.65
Olive, edible .....	243,882.23
Olive, for manufacturing .....	112,464.86
Poppy .....	153.43
Peanut, edible .....	974.26
Peanut, manufacturing .....	55,910.65
Sesame .....	41,276.71
Various including medicinal .....	1,710.17
Total .....	477,309.51

### XIV.—TANNING; LEATHER; GLUE, Etc.

#### TANNING MATERIALS; PRODUCTION OF —.

*Bull. of the Imperial Institute (Supplement to the Board of Trade J.) 1905, 2, 274—276.*

The following particulars are taken from a leaflet issued by the Biological Agricultural Institute at Amami (German East Africa) relative to certain tanning materials considered suitable for the colony:—*Rhus Species*. One of the most important is *Rhus coriaria* (from which sumach is obtained) which is grown in Sicily, Spain, Portugal, Greece and Cyprus. The plant grows well on sunny slopes of dry, sandy and barren soil; when grown on rich soil, the plant is deficient in tannin. The leaves are dried in the sun, powdered and exported. After about 15 years' growth the shrubs cease to yield leaves rich in tannin. The tannin content of sumach leaves varies from 23 to 27 per cent., occasionally reaching 30 per cent. *Rhus semilata* is indigenous to Japan and China, but grows freely in the Himalayas and in Assam. Its galls contain from 60-70 per cent. of tannin, and are an important source of gallotannic acid. *Rhus vernicifera* and *Rhus succedanea* are indigenous to Japan, and are widely distributed in other sub-tropical and temperate countries. The former yields the valued "Japan lacquer" whilst the latter is cultivated mainly for the sake of its wax (Japan wax). The leaves of both varieties contain small quantities of tannin similar to that obtained from sumach. *Rhus hymenosepalus* yields the material known as "canaigre" or "tanners' dock," and is indigenous to the Southern United States and to Cuba. It has been successfully introduced into Madagascar. The plants require a light, sandy, alluvial soil, with heavy rainfall. The roots of the plant are sliced into thin pieces, dried at



60° C., and extracted with water at 56° C., to produce a canaigre extract; the solution is evaporated *in vacuo* and the residue dried; it contains about 75 per cent. of tannin. The dried roots contain on the average 26 to 38 per cent. of tannin. The yield of dried root is from 10 to 20 tons per acre. *Casulpinia coriaria*: The pods of this tree, which is indigenous to Central America, and is now cultivated in Java, India and Australia constitute the material divi-divi. The tree, which yields a profitable crop until it is about 25 years of age, requires a fairly dry, light soil, and does best at an altitude of 1,500-2,500 feet. The ripe pods are broken up and the husks are dried in the sun, the seeds being rejected. American divi-divi and pods are said to yield 30-50 per cent. of tannin; those from India usually contain about 30 per cent. (See this J., 1904, 794.)—T. F. B.

## XVII.—BREWING, WINES, SPIRITS, Etc.

### ALCOHOL LAW; NEW PERUVIAN —.

Board of Trade J., Jan. 5, 1905.

A Peruvian decree provides for the freeing of denatured alcohol from fiscal duties and municipal taxes in that country from Oct. 27, 1904. The denaturation is to be effected by adding to every 100 litres of alcohol 10 litres of methylene and one gram of Malachite Green or a decigram of Fluorescein. The methylene (according to the decree) should show 90 alcoholometric degrees, and contain a maximum of 40 degrees of methyl alcohol. Those engaged in denaturing alcohol must be registered, and the denaturing has to be performed in special receptacles, and on the estates where alcohol is produced or at the distilleries. In both cases it has to be done in an independent department and in the presence of two employees of the Tax Collecting Co.—apparently a body to which the collection of taxes is "farmed" by the Government. This organisation supplies the denaturing and colouring matters named, for which the registered person using them has to pay cost. He, however, is not called upon to meet the expenses of the officials. He cannot sell quantities of less than 50 litres, and only tradesmen can retail. Not less than a hectolitre can be denatured, and the denaturing of alcohol which contains less than 78 per cent. of absolute alcohol is strictly prohibited under penalty. Also the re-naturing of alcohol is prohibited, and the infraction of this is punishable by forfeiture and fines, the infringer also being liable to an action as a defrauder of the State.

### "CENTRALE FÜR SPIRITUSVERWERTHUNG." 1903-4; REPORT OF THE TECHNICAL SECTION OF THE —.

Z. Spiritusind., 1904, 27, 523.

In spite of the increased price of alcohol, the consumption of denatured spirits in Germany in the year 1903-4 increased to 11 million litres. The sale of spirit-consuming apparatus also showed a marked increase, that of lamps having almost doubled in the last year. The use of alcohol for lighting purposes has made enormous progress. Satisfactory incandescent burners for spirits are now on the market. They consume 20—25 c.c. of spirits per 10 candles per hour, and have to some extent even displaced gas and electricity. The use of spirits for cooking and laundry purposes has shown no perceptible increase. As regards motors, the consumption of alcohol has increased from 2.4 million litres in 1902-3 to 3.6 million in 1903-4; the number of alcohol motors in Germany is about 2000. This increase is mainly due to the fact that spirits for motor purposes were exempt from the general rise in price of 5 pf. per litre. In the year 1904-5, however, an increase of 10 pf. per litre has been imposed on motor spirit, which may restrict further progress. In view of this, the practice of carburetting the alcohol by admixture with benzene may be extended.—J. F. B.

## Patent List.

N.B.—In these lists, A. means "Application for Patent" and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

### I.—PLANT, APPARATUS, AND MACHINERY.

1904.

- [A.] 28,325. Kestner. Evaporating or liquor concentrating apparatus. Dec. 27.
- " 28,396. Mathieson. Evaporators, feed heaters and condensers. Dec. 27.
- " 28,412. Cooper. Machines for mixing solid substances with liquids. Dec. 27.
- " 28,424. Vial. Vaporising apparatus.\* Dec. 27.
- " 28,438. Candy. Filters. Dec. 27.
- " 28,456. Macgregor and Pearson. Presses for expressing liquids. Dec. 27.
- " 28,470. Vial. Concentrating apparatus.\* Dec. 27.
- " 28,539. Decauville. Combined autoclave and hydraulic press. [Fr. Appl., Sept. 10, 1904.]\* Dec. 28.
- " 28,589. Zimmermann (Langheld). Method of oxidation. Dec. 28.
- " 28,684. Robinson. Apparatus for drying sand, minerals, and other substances. Dec. 29.
- " 28,950. Lennox. Evaporators. Dec. 30.
- " 28,951. Lennox. See under XVII.
- " 29,136. Ohlsson. Liners for centrifugal liquid separators. [Appl. in Sweden, Jan. 5, 1904.]\* Dec. 30.
- " 29,178. Kestner and Liversedge. Centrifugal apparatus for the purification of gases, applicable also for the absorption of gas by liquids. Dec. 31.
- " 29,265. Harris. Method of separating fluids. Dec. 31.
- " 29,358. Hencke. Apparatus for mechanically separating solids from liquids. Dec. 31.
- " 29,392. Gill (Tailfer). Discharging vacuum evaporating pans. Dec. 31.
- " 29,402. Lake (Schodde). Apparatus for indicating sudden changes in temperature and maximum temperatures. Dec. 31.
- " 29,464. Goddin. Evaporating, concentrating, desiccating and distilling. Dec. 31.
- " 29,479. Baudry. See under III.
- " 29,512. Renshaw. Filtering apparatus. Dec. 31.
- " 29,543. Hemming. See under XVIII A.
- " 29,573. Lennox. Filters.\* Dec. 31.

1905.

- " 92. Gielis. Furnaces with horizontal retorts.\* Jan. 2.
- " 149. Lomas. See under X.
- " 195. Elias. Means for spraying liquids. Jan. 4.
- " 341. Heys (Goldstein, Patterson, McElroy and Shepherd). Thermostat.\* Jan. 7.

- [C.S.] 4552 (1904). Singleton. Revolving kler. Dec. 31.  
 .. 4589 (1904). Bamberger and Böck. Composition for heating by chemical reaction and means for utilising the same. Jan. 11.  
 .. 9635 (1904). Rider. Apparatus for dissolving, filtering, condensing, evaporating and separating substances. Dec. 31.  
 .. 21,469 (1904). Walker. Drying machines. Dec. 31.  
 .. 24,796 (1904). Gery. *See under IX.*  
 .. 26,270 (1904). Richards. *See under IX.*

## II.—FUEL, GAS, AND LIGHT.

1904.

- [A.] 28,376. Maxim. Self-combustive compound \* Dec. 27.  
 .. 28,508. Neilson. *See under III.*  
 .. 28,707. Wesselsky. Gas generators especially for the exploitation of dust coal.\* Dec. 29.  
 .. 28,765. Maréchal. Purifying or desulphurising lighting gas.\* Dec. 29.  
 .. 28,774. Otto-Hilgenstock Coke Oven Co., Ltd. (Otto and Co.). Production of coke in ovens. Dec. 29.  
 .. 28,811. Koppers. Gas furnaces or coke ovens. Dec. 29.  
 .. 28,900. Fielding. Gas producers. Dec. 30.  
 .. 28,966. Von Kerpely. Gas generators.\* Dec. 30.  
 .. 28,989. Goulton. Manufacture of briquettes or artificial fuel. Dec. 30.  
 .. 29,170. Towns. Gas Producers.\* Dec. 30.  
 .. 29,178. Kestner and Liversedge. *See under I.*  
 .. 29,360. Schwarz. Purification of furnace gases. Dec. 31.  
 .. 29,474. Cutler. Gas purifiers.\* Dec. 31.  
 .. 29,610. Hatton. Regenerative gas furnaces. Dec. 31.

1905.

- .. 161. Vogelsang and Born. Water gas generators.\* Jan. 3.  
 .. 241. Wagner. Apparatus for treating briquettes. Jan. 5.  
 .. 257. British Thomson-Houston Co., Ltd. (General Electric Co.). Electric arc lamp electrodes.\* Jan. 5.  
 .. 347. Middleton. Agglutinants for use in solidifying under pressure fuel dust, ores, peat, or other broken or granulated material. Jan. 7.  
 .. 351. Wagner. Process for the preparation of briquette compounds. Jan. 7.  
 [C.S.] 1826 (1904). Everitt and Redman. Extraction of tar and other impurities from illuminating gas. Dec. 31.  
 .. 2456 (1904). British Thomson-Houston Co., Ltd. (General Electric Co.). Machines for treating filaments for electric lamps. Jan. 11.  
 .. 4708 (1904). Settle and Padfield. Mode of making coke and apparatus to be used therefor. Dec. 31.  
 .. 4944 (1904). Russo. Arc lamps and carbons therefor. Dec. 31.  
 .. 5218 (1904). Badger. Burning of liquid fuel. Jan. 11.

## III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

1904.

- [A.] 28,508. Neilson. Purification of and recovery of tar and other substances from blast furnace, producer, and like gases. Dec. 28.

- [A.] 28,997. Meyer. Process of treating creosote, and product of the same.\* Dec. 30.  
 .. 29,479. Baudry. Method of distilling and separating unequally volatile elements contained in a complex mixture, particularly in a mixture of hydrocarbons such as naphtha, crude petroleum, tar, &c. Dec. 31.  
 .. 29,491. Lyle. Continuous retort for the destructive distillation or revivification of finely divided vegetable substances. Dec. 31.

## IV.—COLOURING MATTERS AND DYESTUFFS.

1904.

- [A.] 28,547. Lichtenstein. *See under VI.*  
 .. 28,593. Johnson (Badische Anilin und Soda Fabrik). Manufacturers of new colouring matters of the anthracene series. Dec. 28.  
 .. 28,596. Lake (Oehler). Manufacture of mordant azo dyes.\* Dec. 28.  
 .. 28,734. Newton (Bayer and Co.). Manufacture of a dyestuff of the anthracene series. Dec. 29.

1905.

- .. 82. Inray (Soc. Chem. Ind. in Basle). Manufacture of azo dyestuffs for wool. Jan. 2.  
 .. 132. Boehm (Weber). Process of manufacturing azo dyes. Jan. 3.  
 [C.S.] 28,506 (1903). Iljinskij, and Wedekind and Co. Manufacture of oxyanthraquinone derivatives. Dec. 31.  
 .. 6225 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of indoxyl and derivatives thereof. Dec. 31.  
 .. 6226 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of indigo white.  
 .. 6839 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matter and lakes therefrom. Jan. 11.  
 .. 6840 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matter from *o*-chlor-*p*-toluidine and  $\beta$ -naphthol and of lakes therefrom. Dec. 31.  
 .. 25,505 (1904). Lake (Oehler). Manufacture of chloronitransol. Dec. 31.

## V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

1904.

- [A.] 28,305. Lendrum. Scouring, milling and dyeing fabrics and analogous materials. Dec. 27.  
 .. 28,454. Bloxam (Verein. Glanzstoff-Fabr. A.-G.). Manufacture of films or threads of cellulose. Dec. 27.  
 .. 28,693. Welding and Calisch. Machine for printing textiles, paper, &c., by means of sprayed colours. Dec. 29.  
 .. 28,712. Tompkins and Crombie. Manufacture of fibres or threads from cellulose solutions. Dec. 29.  
 .. 28,733. Newton (Bayer and Co.). New artificial silks. Dec. 29.  
 .. 28,802. Gazeneuve. Manufacture of artificial silk. Dec. 29.  
 .. 28,835. Prestwich. Production of rainproof fabrics and yarns. Dec. 30.  
 .. 28,951. Lennox. *See under XVII.*



- [A.] 28,954. Bamberg. Manufacturing solid soluble bleach. Dec. 30.
- " 28,987. Goulton. Process of separating the gums and waxes from flax, straw, &c. Dec. 30.
- " 29,130. Adam (Erste Triester Reisschäl Fabrik Act.-Ges.). *See under XIV.*
- " 29,137. Harris. Treatment of rhea grass, wood fibre, and the like. Dec. 30.
- " 29,272. Haddan (Ballencourt). Machines for preparing vegetable fibres. Dec. 31.
- " 29,501. Johnson (Badische Anilin und Soda Fabrik). Dyeing and printing. Dec. 31.
- " 29,514. Adamson. Scouring and milling or fulling woollen goods, &c. Dec. 31.
- " 29,592. Rhodes. Apparatus for preparing, dyeing, ageing, scouring, setting, bleaching, or otherwise treating with liquids fibrous material. Dec. 31.
- " 29,606. Sellars. Solutions for impregnating and weatherproofing vegetable fibres, hair fabrics, porous compounds or materials. Dec. 31.
- " 29,618. Rössler. Apparatus for dyeing textile fibres.\* Dec. 31.
- " 29,633. De Naeyer. Apparatus for dyeing, bleaching, or similarly treating textile materials [Belg. Appl., Jan. 30, 1904].\* Dec. 31.
- " 29,650. Fielding. *See under VI.*

## 1905.

- " 279. Davies and Booth. Fabric singeing and treating apparatus. Jan. 6.
- " 360. Waters. Dyeing machines. Jan. 7.
- [C.S.] 4787 (1904). Détré. Apparatus for the dyeing, mordanting, bleaching, or other treatment of textile material in bobbin or like form. Jan. 11.
- " 4907 (1904). Pope and Hübner. Engraved bowls or rollers for producing a silky finish on textile fabrics or paper. Jan. 11.
- " 6093 (1904). Norton, Hellewell and Hellewell. Means for and method of treating pile fabrics. Jan. 12.
- " 7397 (1904). Johnson (Badische Anilin und Soda Fabrik). *See under VII.*
- " 8409 (1904). Gruschwitz and Herminghaus. Jigger dyeing machines. Jan. 11.
- " 16,351 (1904). Soc. Anon. des Rizeries Françaises. *See under XVIII. A.*
- " 24,482 (1904). Duschek and Witte. Composition for impregnating textile fabrics, bags, &c. Dec. 31.
- " 24,505 (1904). De Naeyer. Dyeing or otherwise treating with liquor of textile materials in rolls, spools, cheeses, or the like. Jan. 11.
- " 25,702 (1904). Watson. *See under IX.*
- " 25,728 (1904). Howorth (Soc. Anon. Coop. per la Stagionatura e l'Assaggio delle Sete ed Affini). Processes for dyeing or charging silks with tin compounds. Dec. 31.
- " 26,084 (1904). Fries. Machines for treating yarn. Jan. 11.

## VI.—COLOURING WOOD, PAPER, LEATHER, ETC.

## 1904.

- [A.] 28,547. Lichtenstein. Compounds applicable as colouring matters or for impregnating wood, &c. Dec. 28.
- " 28,693. Welfing and Calisch. *See under V.*
- " 29,650. Fielding. Printing on dyed or coloured paper. Dec. 31.

## VII.—ACIDS, ALKALIS, AND SALTS.

## 1904.

- [A.] 28,433. De Stuckle. Manufacture of caustic alkalis or analogous hydrates. [Ger. Appl., March 22, 1904.]\* Dec. 27.
- " 28,585. Gonnermann. *See under XXIII.*
- " 28,613. Eyde. Process for producing nitrites. [Appl. in Norway, Jan. 22, 1904.]\* Dec. 28.
- " 28,614. Eyde. Production of pure nitrites from a mixture of nitrates and nitrites. [Appl. in Norway, Jan. 26, 1904.]\* Dec. 28.
- " 28,658. Spence, Llewellyn, and Spence and Sons, Ltd. Manufacture of aluminous compounds. Dec. 29.
- " 28,725. Haddock. Manufacture of alkali metal. Dec. 29.
- " 28,726. Haddock. Manufacture of alkali metal. Dec. 29.
- " 28,946. Hargreaves. Apparatus for the manufacture of salt. Dec. 30.
- " 28,954. Bamberg. *See under V.*
- " 29,283. Bloxam (Administration der Minen von Buchsweiler A.-G.). Manufacture of sodium ferrocyanide. Dec. 31.
- " 29,602. Walker (Ray). Apparatus for evaporating brine. Dec. 31.
- [C.S.] 26,314 (1903). Garroway. Manufacture of basic ferric sulphate. Jan. 11.
- " 28,667 (1903). Mehner. Manufacture of nitrogen compounds from atmospheric and other elementary nitrogen. Dec. 31.
- " 7397 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable dry hydro-sulphites. Dec. 31.

## VIII.—GLASS, POTTERY, AND EARTHENWARE.

## 1904.

- [A.] 28,947. Batt. Method of treating china clay. Dec. 30.
- " 29,278. Courmont. Manufacture of imitation ceramic tiles and the like. Dec. 31.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

## 1904.

- [A.] 28,368. Trapnell and Wood. Manufacture of bricks, tiles and the like. Dec. 27.
- " 28,729. Weed. Treating wood.\* Dec. 29.
- " 28,974. West. Treatment by impregnation of timber, &c. Dec. 30.
- " 28,986. Goulton. Bricks or the like. Dec. 30.
- " 28,990. Goulton. Manufacture of bricks, artificial stone, or the like. Dec. 30.
- " 29,023. Cheffins and Hewitt. Manufacture of cement or plaster. Dec. 30.
- " 29,189. Cave-Brown-Cave. Manufacture of an artificial stone product. Dec. 31.
- " 29,198. Blitz. Manufacture of artificial stone and marble. Dec. 31.
- " 29,414. Swan and Lodge. Apparatus for the manufacture of cement. Dec. 31.
- [C.S.] 26,290 (1903) Barham. Kilns for drying and burning bricks. Dec. 31.
- " 4557 (1904). Twynbam. Utilisation of blast furnace slag and similar materials. Dec. 31.

- [C.S.] 11,523 (1904). Stöfler. Manufacture of lime and sand bricks or blocks. Jan. 11.  
 „ 24,796 (1904). Gery. Tunnel kilns for burning bricks or other articles. Dec. 31.  
 „ 25,702 (1904). Watson. Manufacture of fibrous fireproof sheet. Dec. 31.  
 „ 26,270 (1904). Richards. Hot air driers for drying bricks and other clay products. Jan. 11.

## X.—METALLURGY.

1904.

- [A.] 28,478. Maunder. Smelting and treatment of complex, refractory, and other ores. Dec. 27.  
 „ 28,570. Refays. Manufacture of steel. Dec. 28.  
 „ 28,601. King. *See under XI.*  
 „ 28,759. Hatten. Manufacture of steel. Dec. 29.  
 „ 28,976. Hodgkin and May. Manufacture of iron in blast furnaces and steel in converters. Dec. 30.  
 „ 28,992. Atkinson. Preliminary treatment of refractory ores. Dec. 30.  
 „ 29,022. Reynolds. Metallurgical furnaces. Dec. 30.  
 „ 29,186. Swinburne. Treatment of antimony, arsenic, bismuth and gold ores. Dec. 31.  
 „ 29,270. Dekker. Treatment of metallic compounds of sulphur, arsenic and antimony. Dec. 31.  
 „ 29,299. Sulman and Kirkpatrick-Picard. The dry treatment of ores. Dec. 31.  
 „ 29,300. Sulman and Kirkpatrick-Picard. Treatment of ores containing lead and zinc. Dec. 31.  
 „ 29,316. Kershaw and Cruikshank. Process for the extraction of antimony. Dec. 31.  
 „ 29,374. Sulman, Kirkpatrick-Picard and Ballot. Separation of metalliferous minerals from gangue. Dec. 31.  
 „ 29,622. Horn. Extracting precious metals from water containing them. Dec. 31.

1905.

- „ 149. Lomas. Apparatus for the separation of liquids from solids, more especially intended for use in the treatment of metalliferous ores. Jan. 3.  
 „ 256. British Thomson-Houston Co., Ltd. (General Electric Co.). Magnetic separators. Jan. 5.  
 „ 347. Middleton. *See under II.*  
 [C.S.] 28,491 (1903). Cammell, Laird and Co., Ltd., Fletcher and Hamilton. Manufacture of steel. Dec. 31.  
 „ 3998 (1904). Levis (General Electric Co.). Method of obtaining metals from compounds containing silicon. Dec. 31.  
 „ 24,136 (1904). Angel. Reduction of sulphide ores and recovery of the metals therefrom. Jan. 11.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

1904.

- [A.] 28,434. Billwiler and Schweizerische Nihilith-Fabr. Dr. P. Karrer. Insulating material and process of manufacturing same.\* Dec. 27.  
 „ 28,601. King. Apparatus for electro-deposition of metals.\* Dec. 28.  
 „ 29,057. Meirowsky. Electric insulation. Dec. 30.  
 „ 29,065. Butler. Dry batteries. Dec. 30.  
 „ 29,129. Blackmore. Electromagnetic separators. Dec. 30.

- [A.] 29,138. Day (Empire State Dry Battery Co.). Dry batteries. Dec. 30.

1905.

- „ 250. Lorenz and Crane. Solution for the formation of accumulator plates. Jan. 5.  
 „ 315. Thompson (Pflüger Accumulatoren-Werke). Plates for secondary batteries. Jan. 6.  
 [C.S.] 2152 (1904). Raschen, Clayton, and United Alkali Co., Ltd. Electrolytic cells. Dec. 31.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

1904.

- [A.] 28,442. Arledter. Utilisation of waste products in the manufacture of soaps or soap size. Dec. 27.  
 „ 28,671. Buchanan. Filters for linseed and other oils. Dec. 29.  
 „ 28,939. Hutcheson. *See under XIII. B.*  
 „ 28,987. Goulton. *See under V.*  
 „ 29,081. Holmblad. Candles. Dec. 30.  
 „ 29,463. Lorrain. Method of manufacturing candles. Dec. 31.  
 „ 29,494. De Witt. Candles. Dec. 31.  
 „ 29,542. Strange. Process of retining linseed oil. Dec. 31.  
 „ 29,558. Bradford, Garfield and Grossmann. *See under XVIII. B.*

1905.

- „ 46. Soc. Anon. "Union." *See under XVIII. A.*  
 „ 207. Day and Murch. Candle making machines. Jan. 4.  
 [C.S.] 4415 (1904). Castle. Manufacture of soap, washing compounds, and the like. Dec. 31.  
 „ 6080 (1904). Slater and Slater. Manufacture and subsequent treatment of soap. Dec. 31.

## XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

## (A).—PIGMENTS, PAINTS.

1904.

- [A.] 29,141. Davey. Manufacture of vegetable black.\* Dec. 30.  
 „ 29,245. Ojeda and Quesada. Copying inks.\* Dec. 31.  
 „ 29,335. Moreton and Tregarthen. Paint compositions. Dec. 31.  
 [C.S.] 4447 (1904). Smith and Beswick. Writing fluid. Dec. 31.  
 „ 6839 (1904). Johnson (Badische Anilin und Soda Fabrik). *See under IV.*

## (B).—RESINS, VARNISHES.

1904.

- [A.] 28,939. Hutcheson. Method of clearing and brightening varnishes and vegetable and animal oils. Dec. 30.  
 „ 29,379. Marks (Holtkott). Machines for manufacturing linoleum. Dec. 31.



## (C.)—INDIA-RUBBER.

1901.

- [A.] 28,574. Frost. Vulcanising apparatus. Dec. 28  
 „ 29,311. Frost. Vulcanising apparatus. Dec. 31.

1905.

- „ 330. Thomson (Michie and Gollidge). Method of separating or coagulating india-rubber and appliances therefor. Jan. 7.

## XIV.—TANNING; LEATHER, GLUE, SIZE, ETC.

1904.

- [A.] 29,003. Staynes. Manufacture of leather. Dec. 30.  
 „ 29,130. Adam (Erste Triester Reisschäl Fabrike Act.-Ges.). Manufacture of sizing or finishing media. Dec. 30.

1905.

- „ 363. Lake (Schoellkopf, Hartford and Hanna Co.). Depilatory Composition.\* Jan. 7.

## XVI.—SUGAR, STARCH, GUM, ETC.

1904.

- [A.] 28,987. Goulton. *See under V.*  
 [C.S.] 5574 (1904). Kantorowicz. Manufacture of new products from starch, dextrin or the like. Dec. 31.

## XVII.—BREWING, WINES, SPIRITS, ETC.

1904.

- [A.] 28,619. Schrottky. Manufacture of beer.\* Dec. 28.  
 „ 28,809. Rosalt. Treatment of alcohols. Dec. 29.  
 „ 28,951. Lennox. Evaporators for evaporating the liquid in brewers' wash, sewage, waste or spent dyes, and the like. Dec. 30.  
 [C.S.] 4651 (1904). Allitt. Apparatus for treating brewers' wort for cooling and other purposes. Dec. 31.

## XVIII.—FOODS; SANITATION, WATER PURIFICATION; &amp; DISINFECTANTS.

## (A.)—FOODS.

1904.

- [A.] 28,374. Dubnisson. Process and apparatus for the preservation of natural butter. Dec. 27.  
 „ 28,415. Kunick and Elworthy. Methods of homogenising milk and apparatus therefor. Dec. 27.  
 „ 29,367. Mills (Bévenot and De Neveu). Desiccation and preservation of milk, cream, casein and their derivatives. Dec. 31.  
 „ 29,427. Howorth (Whetham). Apparatus for treating flour for improving the colour thereof. Dec. 31.  
 „ 29,543. Hemming. Method of and apparatus for sterilising and aerating foods, liquids and organic substances and treating other materials with gases. Dec. 31.

1905.

- „ 28. Hatmaker. Eggs and egg-containing substances in dry form and process for obtaining same. Jan. 2.  
 „ 46. Soc. Anon. "Union." Process of improving and refining margarine and the like.\* Jan. 2.

- [C.S.] 16,351 (1904). Soc. Anon. des Rizeries Françaises. Treatment of rice flour with a view to its substitution for various starches used in sizing and finishing. Jan. 11.

## (B.)—SANITATION; WATER PURIFICATION.

1904.

- [A.] 28,403. Lines. Deodorisation of sewage and other gases, and the treatment of sewage and other liquids. Dec. 27.  
 „ 28,646. Spence, and Spence and Sons, Ltd. Treatment and utilisation of sewage. Dec. 29.  
 „ 28,951. Lennox. *See under XVII.*  
 „ 29,315. Candy. Sterilisation and purification of water. Dec. 31.  
 „ 29,558. Bradford, Garfield and Grossmann. Method and apparatus for recovering fatty and oily matter from sewage sludge. Dec. 31.

1905.

- „ 276. Adams. Apparatus for sewage purification. Jan. 6.  
 [C.S.] 16,934 (1904). Lake (Jewell). The purification of water. Dec. 31.

## XIX.—PAPER, PASTEBOARD, &amp;c.

1904.

- [A.] 28,454. Bloxam (Verein. Glanzstoff-Fabr. Act.-Ges.). *See under V.*  
 „ 28,712. Tompkins and Crombie. *See under V.*

1905.

- „ 248. Matas y Rodas. Manufacture of cork compositions.\* Jan. 5.  
 [C.S.] 4907 (1904). Pope and Hübner. *See under V.*  
 „ 4996 (1904). Jackson. Manufacture of paper pulp from printed paper. Dec. 31.  
 „ 5286 (1904). Howorth (Soc. Franç. de la Viscose). Apparatus for treating viscose. Jan. 11.  
 „ 5730 (1904). Howorth (Soc. Franç. de la Viscose). Apparatus for the treatment of viscose. Jan. 11.  
 „ 23,245 (1904). Loria. Method of and apparatus for the continuous manufacture of cardboard. Jan. 11.  
 „ 25,726 (1904). Tailfer. Paper-making machines. Dec. 31.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

1904.

- [A.] 29,330. Howorth (Morana Co., Akt.-Ges.). Process for the production of sulphuretted hydrocarbons. Dec. 31.

1905.

- „ 81. Imray (Soc. Chem. Ind. in Basle). Manufacture of *c-c*-dialkylbarbituric acids. Jan. 2.  
 [C.S.] 16,002 (1904). Kalle und Co. Manufacture of bromine alkylacetamides. Dec. 31.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

1904.

- [A.] 28,544. Cleave. Process of producing and fixing photographic portraits in natural colours. Dec. 28.

- [C.S.] 4941 (1904). Hesekiel. Colour photography. Dec. 31.
- .. 4994 (1904). Imray (Meister, Lucius und Brüning). Manufacture of coloured photographic images or prints and of sensitive surfaces therefor. Dec. 31.
- .. 25,718 (1904). Soc. Anon. des Plaques et Papiers A. Lumière et ses fils. Sensitised plates for a process of colour photography. Jan. 11.
- .. 26,247 (1904). Morgan. Manufacture of sensitive photographic printing papers of the class known as self-toning printing out papers. Jan. 11.

## XXII.—EXPLOSIVES, MATCHES, Etc.

1904.

- [A.] 28,808. Central-stelle f. Wissenschaftlich-Techn. Untersuch., G.m.b.H. Manufacture and use of dinitrolycerine. [Ger. Appl., March 18, 1904.]\* Dec. 29.

- [A.] 29,056. Dittmarr. Explosive or blasting compounds.\* Dec. 30.

- .. 29,459. Brodie, and the British Moss Litter Co., Ltd. Manufacture of explosives. Dec. 31.

1905.

- .. 159. Thorn. Matches.\* Jan. 3.

- [C.S.] 25,797 (1904). Johnson (Soc. Anon. des Poudres et Dynamites). Manufacture of explosives. Dec. 31.

## XXIII.—GENERAL ANALYTICAL CHEMISTRY.

1904.

- [A.] 28,585. Gonnermann. Device for determining the percentage of salt in sea water or other water contained in closed receptacles. Dec. 28.



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Popplewell, J. M., 1 o Leeds; c/o Brotherton and Co., Ltd., Provan Chemical Works, Millerston, Glasgow.  
Propach, C., 1 o E. Kinzie Street; 1096 N. Clark Street, Apartment G., Chicago, Ill., U.S.A.  
Richardson, Walter W., 1 o Cliff Road; Aldingham, Park View Crescent, Roundhay, Leeds.  
Sayers, Jos. J., 1 o Mayville; Nobel Villa, Stevenston Ayrshire.  
Shishikoff, S. A., 1 o Moija; Perm, Russia.  
Smith, H. Procter; all communications to Shotton Lane Shotton, Flintshire.  
Smith, Walter E., 1 o Doyle Ave.; 141, Cypress St., Providence, R.I., U.S.A.  
Thornton, Christopher, 1 o Hillside Avenue; 26, Larel Street, Providence, R.I., U.S.A.  
Thurlow, N., 1 o Lancaster, Pa.; 4, Union Place, Yonkers N.Y., U.S.A.  
Uhlig, E.C.; all communications to Fulton Gas Works Nevins and Degraw Streets, Brooklyn, N.Y., U.S.A.  
Wyatt, Dr. Francis, 1 o S. William Street; 402, West 23rd Street, New York City, U.S.A.  
"Zeitschrift f. das gesammte Brauwesen"; Journal to Herrn R. Oldenbourg, Glückstrasse 8, München Bavaria.  
Zimmele, H. B., 1 o Niagara; c/o Westinghouse Electric Manufacturing Co., East Pittsburgh, Pa., U.S.A.

### CHANGE OF ADDRESS REQUIRED.

Cerasoli, A., 1 o 29, West Kensington Mansions, W.

## Deaths.

Bicknell, G. Arthur, 839, East Madison Ave., Cleveland, Ohio, U.S.A.  
Cuthbertson, Sir J. Neilson, 29, Bath Street, Glasgow, Jan. 26th.  
Dey, Preo Lall, 4, Beadon Street, Calcutta, India.  
Goodhue, F. A., 32, India Street, Boston, Mass., U.S.A., Jan. 31.  
Mackenzie, J. Kenneth, 1120, The Rookery Building, Chicago, Ill., U.S.A.

## Liverpool Section.

### ERRATUM.

#### STUDIES ON THE CLAUS KILN REACTION. PART III.

BY R. FORBES CARPENTER AND S. E. LINDER.

(This J., 1905, 63-71.)

In fig. 2 p. 69, right hand, lower corner, the expression "*Broken Brick* (air:  $H_2S$  :: 3:2:1)" refers to a result 8 per cent. HCN decomposed to free nitrogen at a temperature  $565^\circ C$ . (Expt. No. 20, Table II., p. 66), the  $\odot$  corresponding to which has been omitted in error.

## New York Section.

### ERRATUM.

Meeting held on December 16th, 1904 (this J., 1905, 18). Dr. Russell W. Moore was in the chair on this occasion, and not Mr. Clifford Richardson, as stated.



## Canadian Section.

*Meeting held in the Chemical Department, University of Toronto, on Feb. 26th, 1903.*

DR. HAROLD VAN DER LINDE IN THE CHAIR.

### THE RECOVERY OF TIN SCRAP.

BY JAMES MILLAR NEIL.

The annual average quantity of scrap tin, collected from can factories, &c., in the United States, is from 0,000 to 30,000 tons, and of that amount about 24,000 tons are treated there for the recovery of the tin and iron, the rest being sent to Germany for treatment. The principal recovery works are situated at Chicago, Cleveland and Jersey City.

A few years ago scrap tin was thrown away, but to-day it is pressed into bundles weighing about 250 lb. each, and shipped to the recovery works, and fetches 13-50 dols. per long ton in New York.

Tin plate was formerly made from puddled iron of the very best quality, and contained on an average about 1 per cent. of tin; to-day it is made from sheets of mild steel dipped into a bath of molten tin and passed through rollers, whereby an enormous pressure is applied, until only the very thinnest possible coating of metallic tin remains, rarely reaching 2 per cent.

There is one source of scrap tin which would increase the quantity if it could only be utilised, and it is that of old cans, as nearly all the tin plate is used to make cans for reserved goods. But in practice these old cans are hardly worth special collection, and must usually be retrieved from dust bins and rubbish heaps, and the supply is apt to be uncertain. Next, they have to be completely cleaned before treatment; they are bulky and troublesome to handle; they are inconvenient to strip either electrolytically or by chemical reagents; so that until these difficulties are overcome, the recovery works have to depend upon the cuttings from the new tin plate, which is clean and capable of being packed at a small expense, at a size easy to handle.

The tin recovered has a value of about 25 cents per lb., and the residue of stripped iron has a value depending entirely on its freedom from tin.

Scrap tin packs so closely together that difficulty is experienced in getting every particle of tin into contact with the solvent. The stripped iron, due to its bulky nature, is not a favourite with iron workers, and it can only be used to advantage in an open hearth furnace, and then perfectly free from tin is worth at the present time about 14.00 dols. per ton, f. o. c. at the iron works. Traces of tin render the finished iron brittle and liable to crack during welding.

Prof. Richards, of the Franklin Institute, Philadelphia, devised a process for the separation of tin and iron in tin scrap, which is fully described in the Society's Journal, 1901, 902.

The processes that are having a practical success may be classed under the following heads:—

Purely electrolytic processes, the caustic soda electrolytic process, the stannic chloride process, the Browne-Neil electrolytic process.

Under the purely electrolytic processes, that of P. Nauhardt, Germany, has very good prospects of giving satisfactory results. (Eng. Pat. 21,942 of 1901; this J., 1902, 261 and 864.) This process would be an ideal one if it were not that there has yet to be found a rotating drum which will expose, for a sufficient length of time, every part or side of the scrap-tin under treatment, so that the electric current will have time to strip off the tin. Again, it is very costly to fill and empty such drums carrying scrap tin under treatment; besides, in order to make them strong enough to hold the scrap, they would have such a very small electrolytic surface exposed that the outlay in plant would be excessive.

In all purely electrolytic processes the difficulties lie

in that the current can only strip off the tin on the surface which comes under its action, and in the finding of some practical scheme whereby the surface of the scrap may be changed about so that every part of tin may be stripped.

One of the most important processes is the stannic chloride one invented by P. Bergsøe, of Copenhagen, and which is now worked in Germany. (Eng. Pat. 7026 of 1900; this J., 1901, 368.)

The principal drawback to his process is that while the scrap tin is being treated with stannic chloride, the latter not only attacks the tin, but also dissolves a good part of the iron, thereby causing a heavy loss of chlorine, and every time it is used the efficiency of the stannic chloride solutions becomes reduced by the amount of iron dissolved. Another drawback is the facility with which these stannic compounds form oxides, which cause precipitates in the electrolytic bath.

Caustic soda, while an electric current is being passed through it, dissolves tin from scrap tin, without touching the iron, and this property is utilised in recovery works to-day; but even with the very best skill in working this process there remains a small percentage of metallic tin on the cleaned scrap—about 0.2 per cent. Full details of this process are given by H. Menckie (this J., 1902, 980).

The Browne-Neil electrolytic process (this J., 1902, 1083) utilises the reduction of ferric chloride by tin, with the result of obtaining very pure tin and an iron absolutely free from tin.

The scrap tin bundles are first cut open and tossed about, so as to open up the scrap. This is then thrown into large reed baskets, holding about 200 lb., which are then lowered into concrete vats containing a concentrated solution of ferric chloride, kept at boiling point. This solution attacks the tin at once, completely forming stannous chloride and ferrous chloride. The moment that all the tin is off, the basket of cleaned scrap iron is drawn out, and another basket with fresh scrap tin is lowered in, and so on until the whole of the ferric chloride solution becomes reduced. The cleaned iron is then washed, after which it is dipped into a tank of petroleum to keep it from rusting, and then bundled ready to be shipped to the iron works.

The ferrous stannous chloride solution is now run into a series of electrolytic baths, the outside one being made of concrete, and the inside or inner ones being made of porous clay. In the outer ones a small stream of the ferrous stannous chloride solution is kept running continuously, and into the porous cells is run a solution of ferrous chloride, derived from the last of the series of the concrete baths. The cathode consists of sheets of pure tin, and the anode of graphitised carbon. The whole series of baths are then connected on to the electric current. In its flow the ferrous stannous chloride solution deposits on the cathode large bright crystals of pure metallic tin, while the chlorine liberated at the anode immediately converts the ferrous chloride solution flowing through the porous baths, into ferric chloride, which is pumped back to the dipping tank to be again reduced by fresh scrap tin. So that in the first of the series of plating baths a continuous stream of ferrous stannous chloride solution passes through the outer chamber, which deposits its tin and becomes gradually richer in ferrous chloride until, as it leaves the last of the series, it contains no tin at all. It is this solution of ferrous chloride which is run through the porous baths, and by absorbing the chlorine becomes converted into ferric chloride.

After a day's run, the tin crystals are taken from the baths and thrown on to a filter, where they are allowed to drain, then washed with slightly acidulated water, dried, pressed into plugs and then melted.

The process thus described appears to be continuous and simple, but when worked out on a practical scale presents difficulties. In the first place, in order to secure iron that is absolutely free from tin, some of the iron—about one-half of the amount of tin on the scrap tin—must be allowed to be dissolved by the ferric chloride, chlorine corresponding to which must be put back into the process by the plating out of the amount of iron dissolved. Again, it is impossible to get all the tin dissolved

off the scrap tin by the simple lowering of the basket into the tank of ferric chloride, and to get the result desired it was necessary to give to the basket an upward and downward movement. In this way was obtained a scrap iron free from metallic tin.

The plating baths are run in series of five large concrete tanks, each one containing ten porous boats; in the first three baths a chemically pure tin is obtained, in the fourth a tin contaminated with about 20 per cent. metallic iron, whilst in the last of the series, the flow of ferrous stannous chloride solution is regulated so that enough iron will plate out to give the chlorine necessary to make a concentrated ferric chloride solution coming from the final porous bath. In the plating baths, the tin comes down in bright, sparkling crystals in the first two baths, and gradually gets greyer or darker in each succeeding bath. The amount of tin carried is about 25 grs. per litre, as it comes from the dipping tanks.

The iron and tin crystals obtained in the fourth tank are used to reduce any stannic or ferric chloride that may remain in the liquors coming from the dipping vats, and as the test for running off the dipping vats is simply that of the change of colour from the red of the ferric to the green of the ferrous, this precaution is absolutely necessary in order to obtain pure crystals of tin, and to have full efficiency from the electric current.

Again, one is forced to use either concrete or porcelain in all the apparatus required, as wooden tanks rot away in a very short time, and metals of any kind are out of the question; besides all pumps, &c., have to be of earthenware.

The sample of pig iron made from the clean iron scrap is exceedingly hard, owing to the deficiency of carbon, and hardens half way between cast iron and cast steel.

There is obtained 34 lb of pure metallic tin every 24 hours, at an electrical expense of 2-3 h.p. per hour. The strength of the electric current carried on each series of baths is 25 volts at 500 amperes and the sizes of baths are so calculated as to carry on each  $\frac{1}{2}$  sq. in. a current of 200 amperes.

The amount of tin recovered per ton of scrap treated is 40 lb.

## Scottish Section.

### ERRATA.

#### HIGH-TEMPERATURE MEASUREMENTS (WITH DEMONSTRATION OF PYROMETERS).

BY THOMAS GRAY, PH.D., D.Sc.

(See this J., 1904, 1192-1197.)

Page 1194, col. i., line 26, for "852°" read "443°."

1195 for "Fig. IV." read "Fig. V."

" " "Fig. V." " " "Fig. IV."

1196, col. i., line 17, delete "half."

1196, col. ii., lines 1-2, for "each other. Rotation, &c." read "each other, rotation," &c.

### Obituary.

#### SIR JOHN NEILSON CUTHBERTSON.

FORMERLY CHAIRMAN OF THE GLASGOW AND SCOTTISH SECTION OF THE SOCIETY OF CHEMICAL INDUSTRY.

John Neilson Cuthbertson was born in 1829, and educated at the High School and University of Glasgow; also at the Royal College, Versailles. In the Chemical Trade he held a high position as a chemical and produce broker. He was a member of the University Court, Glasgow, and a Governor of the Glasgow and West of Scotland Technical College.

In 1887, Sir John Cuthbertson was elected the Chairman of the Glasgow and Scottish section of this Society, and in the same year he received the honour of knighthood; also the degree of LL.D. was conferred upon him by the University of Glasgow, in 1895. For twenty-five years he was a member of the Glasgow School Board, and for fifteen of these, he occupied the position of chairman. He was one of the best known public men in Glasgow and the West of Scotland, and especially distinguished himself in works of philanthropy and benevolence.

He died January 26th, at the age of seventy-five.

## Journal and Patent Literature.

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United States.—1s. each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3<sup>e</sup>).



**I.—PLANT, APPARATUS, MACHINERY.****ENGLISH PATENTS.**

*Centrifugal Apparatus for Evaporating, Cooling, Heating, Absorption, Gas-Purifying, and like purposes.* E. Theisen, Munich, Germany. Eng. Pat. 25,458, Nov. 21, 1903.

A centrifugal apparatus, in which a gas and a liquid are made to rotate together by means of a "winged" drum working in a casing, the fluid is guided on the surface of the casing by flanges or channels of suitable inclination in spiral form, arranged on the inner surface of the casing, in this manner a forward movement is given to the liquid in motion by the current of gas. The speed of the liquid can be regulated by altering the inclination of the guiding flanges or channels.—W. H. C.

*Dissolving, Filtering, Condensing, Evaporating, and Separating Substances; Apparatus for —.* C. H. Rider, St. Louis. Eng. Pat., 9635, April 27, 1904.

CLAIM is made for the combination of an acid-tank and a water-tank, connected by suitable pipes and valves to an upper series of tanks and also to a lower series of tanks, the upper series of tanks is connected with the lower series and each tank with the other. A retort (e.g., for making nitric acid) set in a furnace has a pipe leading through the lower series of tanks to a condenser. The upper series of tanks is connected with the pipe from the retort and the latter is also connected with a gas-holder. Any desired mixture of acid and water may be made in the upper series of tanks and allowed to flow on to the material (e.g., ores, &c.) to be treated, contained in the lower series of tanks, which are provided with trunnion false bottoms. The contents of the lower series of tanks are heated by the vapours passing from the retort, any uncondensed gas being collected in the gas-holder.—W. H. C.

*Concentrating Liquids, Apparatus for —, especially adapted for Removing the Albuminous Matter from Serum and the like Liquids.* H. W. Southworth, London. Eng. Pat. 24,870. Nov. 16, 1904.

A SCREW conveyor, mounted in a hollow shaft, is arranged to work in an inclined jacketed tube or shoot, the inclination of which can be varied as desired. The material to be treated is fed in at the upper end, and is cooled by the circulation of a cooling agent through the jacket and hollow shaft. The screw-conveyor carries the deposited solids separated from the liquid by the cooling, to the upper end of the shoot, where they are discharged, whilst the liquid works its way downwards, through slots and perforations in the blades of the conveyor, to the outlet at the lower end. The feed-pipe is provided with a valved overflow-pipe leading to a tank, into which, if the apparatus clogs, the liquid overflows and operates an electric alarm signal. There is also a "gate" which is opened automatically if pressure accumulate in the shoot, and has an electric alarm signal. In order to prevent the clogging of the blades of the conveyor, a portion of the upper surface of the tube is cut away, and in the rectangular slot so formed, a series of V-shaped "wipers," of glycerined raw hide, carried on an endless band, clears the spaces between the blades of the screw-conveyor.

—W. H. C.

*Kiers; Vomiting —.* A. J. Boulton, London. From E. D. Jefferson, Lowell, U.S.A. Eng. Pat. 25,307, Nov. 21, 1904.

SEE U.S. Pat. 775,450 of 1904; this J., 1904, 1022.—T.F.B.

*Earthenware Cocks for Use with Acids, Lyes and the like; Impts. in Protected —.* C. Ruppel. Höchst-on-the-Maine, Germany. Eng. Pat. 25,310. Nov. 21, 1904.

A PROTECTED earthenware cock is made with its body entirely cylindrical and limited in length to just beyond what is necessary for the plug. The earthenware body is surrounded by a metal protective casing, provided with lateral "reinforcements," through which the holes for the bolts, which connect the cock with the piping, pass. Ribs

are formed on the outer side of the casing to prevent any liquid that may escape around the plug from flowing on to the flange joints. In another form of construction the metal casing is cylindrical, with threads formed upon the ends, to receive screwed caps for connection with the piping. When the protective covering is of soft metal, an outer casing of hard metal provided with threaded ends may be used.—W. H. C.

**UNITED STATES PATENTS.**

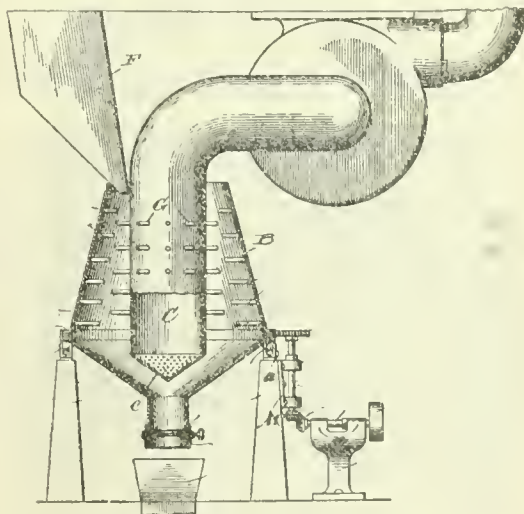
*Separator; Centrifugal Liquid —.* J. H. F. Dicks and C. J. Möllmann, Osnabrück, Germany. U.S. Pat. 778,406, Dec. 27, 1904.

A SERIES of horizontal rings having slotted flanges on their outer edges, is arranged upon the central pipe in the bowl of a separator. Radially disposed blades, provided with notches in their inner edges corresponding with the rings and flanges, are arranged round the rings. The slots in the flanges allow the blades to be readily placed in position or removed.—W. H. C.

*Centrifugal Machine.* J. C. Morrison, Chicago, Ill., Assignor to United States Peat Fuel Co., Illinois. U.S. Pat. 778,458, Dec. 27, 1904.

A FEEDING screw charges wet material from a hopper, intermittently, into the basket of a centrifugal machine having an open top, and discharge doors in the bottom. After a suitable period, the feed is stopped, the discharge doors are automatically opened, and a scraper, working on the central pillar of the machine, is brought into action to assist in the discharge of the dried material. The whole series of operations is arranged to take place automatically and without stopping the rotation of the basket, the feed being stopped while the discharge doors are opened and *vice versa*. Separate channels are provided for the delivery of the liquid and solid products.—W. H. C.

*Rotary Drier.* F. A. Wegner and J. D. Bourdeau, Detroit, Mich. U.S. Pat. 779,106, Jan. 3, 1905.



IN drying and cooling apparatus, claim is made for a receptacle B, which can be rotated round a vertical axis relatively to a stationary conduit C, extending downwards into, and concentric with, the receptacle. The conduit is connected with exhaust mechanism as shown, and has circular perforations, as shown, through the sides, and a perforated cap or partition e, between the material and the exhaust. A series of radial projections, at G, extends inwards from the receptacle, B, and outwards from the conduit, C. There is also a charging shoot F, at the top, and a valve-controlled outlet passage at the bottom of the receptacle, B.—W. H. C.

*Filtering Apparatus for Separating Solids from Liquids.*

K. Kiefer, Cincinnati. U.S. Pat. 779,607, Jan. 10, 1905.

SEE Fr. Pat. 325,255 of 1902; this J., 1903, 690.—T. F. B.

*Roasting Furnace.* F. Klepetko, New York. U.S. Pat. 779,717, Jan. 10, 1905.

THE furnace has a number of superposed hearths, through the centres of which a rotating hollow shaft passes, carrying over each hearth, hollow, radiating arms of special character, each arm communicating by means of an air conduit with a separate chamber in the hollow shaft.—E. S.

*Elevating Acids; Means for —.* S. Hughes, Summerville, S.C., Assignor to E. F. Lowndes, Charleston, S.C. U.S. Pat. 779,853, Jan. 10, 1905.

A PIPE closed at the bottom and made of acid-resisting material, is sunk in a well-casing, and extends upward as high as the supply tank with which it is connected by another pipe. Inside it is placed a delivery-pipe, open at the bottom and communicating at its upper end with a receiving-tank. Compressed air is blown into the lower end of the delivery-pipe, and a valve in the supply-tank controls the flow of liquid.—L. F. G.

*Elevating Liquids; Apparatus for —.* S. Hughes, Somerville, S.C., Assignor to E. F. Lowndes, Charleston, S.C. U.S. Pat. 779,941, Jan. 10, 1905.

A LONG vertical pipe open at the bottom stands in a well-casing, and communicates at its upper end with a receiving-tank. A shorter pipe leads from its lower end up to a supply-tank, and is provided with a short vertical pipe open to the atmosphere. Compressed air from a reservoir is blown into the bottom part of the long pipe, and the emulsion of liquid and air discharged into the receiving-tank. (See also preceding abstract.)—L. F. G.

*Crystallisation; Method of —.* V. Schutze, Riga, Russia. U.S. Pat. 780,148, Jan. 17, 1905.

SEE Fr. Pat. 339,896 of 1904; this J., 1904, 708.—T. F. B.

**II.—FUEL, GAS, LIGHT.***Spirit for Lighting Purposes (Carburised Spirit).* O. Mohr. Z. Spiritusind. 1905, 23, 11.

THE author shows that, contrary to certain statements, carburised spirit can never compete with petroleum so far as light-giving power is concerned. Most carburised spirits (e.g., those containing naphthalene) contain a carbonaceous constituent which is less volatile than the alcohol, with the result that the carburising substance concentrates at the top of the wick causing smoking and clogging. The lighting power of a fuel is determined by the proportion of carbon the flame is capable of maintaining in the incandescent state, and this depends on the temperature of the flame, as does also the degree of incandescence attained. The heat of combustion of alcohol is, however, only one-half that of petroleum, so that even if the difficulty of clogging were surmounted, the alcohol flame could not carry so much carbon as the petroleum flame, without smoking. On the other hand, alcohol is far more suited for burning with incandescent mantles than petroleum.—J. F. B.

*Incandescent Mantle; Theory of the —.* V. B. Lewes. J. Gas Lighting, 1905, 89, 161-163.

THE author discusses the various theories which have been propounded to account for the brilliant incandescence of the Auer mantle and expresses himself in favour of the catalytic theory, formerly supported, but now rejected by Bunte (this J., 1904, 1140). That ceria, as it occurs in a mantle, can act catalytically, is shown by the well-known fact that, under proper conditions, a mantle once raised to incandescence, can be kept luminous in a cold stream of coal-gas and air. The fundamental experiments which caused Bunte to discard the catalytic theory consisted in first determining the temperature at various points on the surface of a

naked Bunsen flame, and then, having placed a mantle over it, determining the temperature at the same points as before. The flame was found to be considerably hotter than the mantle at the corresponding points. In the author's opinion, such a comparison is fallacious as the shape, and therefore the temperature, of the Bunsen flame are altered when a mantle is placed over it, and the proportion of air drawn in at the air-hole is reduced. His experiments lead him to the following conclusions. Thoria, owing to its non-conductivity, low specific heat and low heat-emissivity, can acquire the temperature of the flame, whilst catalytic action on the gaseous mixture raises the thoria a few degrees even above this point. Ceria, when added in quantities up to 1.5 per cent. by weight ("or 0.15 per cent. by volume") tends by its still greater catalytic power to localise the combustion on the surface of the mantle, raising the temperature of the particles of ceria to a far higher temperature than the mantle. The addition of more ceria so increases the heat-emissivity of the mantle, that both mantle and flame are cooled by radiation, and the illuminating power falls correspondingly.—H. B.

*Cadmium Amalgam Lamp of Quartz.* O. Lummer and E. Gehrecke. XI. A., page 139.

## ENGLISH PATENTS.

*Heating by Chemical Reaction; Compositions for —, and Means for Utilising the same.* M. Bamberger and F. Böck, Vienna. Eng. Pat. 4580, Feb. 24, 1904.

SEE Fr. Pat. 343,724 of 1904; this J., 1904, 1021.—T. F. B.

*Coke; Improved Mode of Making —, and Apparatus to be used therefor.* T. Settle and W. A. Padfield, Exeter. Eng. Pat. 4708, Feb. 26, 1904.

THE variable density of coke, produced in the ordinary way, is said to be due to charging the coal in bulk. It is proposed to get over this difficulty by charging it in small regulated quantities and at short intervals, thus gradually building up, in the coke-oven, incandescent piles of coke with sloping sides and an outer layer of fresh uncoked coal. The apparatus consists of a conical charging hopper, through which a vertical rod passes, and extends through the vertical passage leading to the oven. Two conical plungers are mounted on this rod at an adjustable distance apart. By imparting a reciprocating vertical motion to the rod, the coal is measured and discharged into the oven.—W. H. C.

*Carbon Dioxide [from Furnace Gases, &c.]; Manufacture of —.* J. C. Stead. Eng. Pat. 18,710, Aug. 30, 1904. VII., page 132.*Tar and other Impurities; Extraction of — from Illuminating Gas.* W. Everitt, Ilkley, and T. Redman, Bolton, Yorks. Eng. Pat. 1826, Jan. 25, 1904.

SEE U.S. Pat. 768,792 of 1904; this J., 1904, 930.—T. F. B.

*Electrodes; Arc Lamp —.* H. C. Levis, London. From The General Electric Co., Schenectady, U.S.A. Eng. Pat. 4134, Feb. 18, 1904.

THE claims cover arc lamp electrodes consisting of tubes of iron or other metal filled with particles of iron, and closed at one end.—T. F. B.

## UNITED STATES PATENTS.

*Fuel; Artificial — and Process of Making same.* G. W. Herbein, San Francisco, Cal. U.S. Pat. 778,781, Dec. 27, 1904.

THE fuel is composed of a mixture of "alkaline-peat charcoal" and a partially saponified mixture of petroleum, resin and an alkali. The resin is dissolved in petroleum, an alkali added, and the mixture heated to partial saponification. The peat is rendered alkaline with an alkali and burnt to charcoal. The latter is then mixed with the partially saponified petroleum and resin, and a drier added.—W. H. C.



*Oil as Fuel; Means for the Utilization of Crude* — J. O. Alwood, Richmond, Va. U.S. Pat. 779,985, Jan. 10, 1905.

THE claim is for a combination comprising a steam superheater coil concentric with a vapour-generator coil, means for supplying oil and steam to these, and a heater common to both coils. The vapour-generator coil is connected to an independent mixing-chamber supplying the heater with gas, and the steam superheater-coil is connected to a radiator.—L. F. G.

*Smoking; Process of* — A. Custodis, Düsseldorf, Germany. U.S. Pat. 778,846, Jan. 3, 1905.

SEE Addition of Jan. 7, 1903, to Fr. Pat. 305,879 of 1900; this J., 1903, 944.—T. F. B.

*Gas; Process of Making* — V. G. Apple, Dayton, Ohio. U.S. Pat. 777,829, Dec. 20, 1904.

THIS is a continuous process for the manufacture of coal-gas and enriched water-gas. A constantly-renewed body of carbonaceous material is subjected to dry distillation, while moving through a heated area, and the incandescent coke obtained is quenched in water, the steam generated thereby is mixed with the gas obtained by the distillation, and the mixture is passed through the incandescent coke at a point between the area of distillation and that of cooling the coke.—W. C. H.

*Gas-Producer*. S. T. Wellman, C. H. Wellman, and J. W. Seaver, Assignors to the Wellman-Seaver Engineering Co., Cleveland, Ohio. U.S. Pat. 778,614, Dec. 27, 1904.

THE producer comprises a rotating body provided with double-chambered outer water-jacket, and having inwardly projecting hollow stirring arms communicating with one of the chambers of the water-jacket, and circulating pipes projecting into the hollow arms, communicating with the other water-chamber, and means for supplying water to one of the chambers, and conveying it from the other. A sealed air-chamber surrounds the lower portion of the body of the producer, and communicates with the inwardly projecting tuyère-boxes carried by the body. The body has upper and lower flanges and sealing troughs, and means are provided for the supply of air, under pressure, to the chamber between the upper and lower sealing troughs.—W. C. H.

*Gas; Apparatus for Manufacturing* — P. Eyermann, Beloit, Wis., Assignor to J. R. Wenminger, Westmont, Pa. U.S. Pat. 779,776, Jan. 10, 1905.

A GAS-PRODUCER is connected by a pipe at its upper part to a gasholder, and by a pipe at its lower part to a second gasholder, the air blast being supplied through a central pipe at the bottom. While the air blast is in operation, the gas produced is led off at the top to the first gasholder; the air blast is then stopped, and the gas is forced back through the incandescent fuel into the second gasholder, for the purpose of fixing the tarry vapours and moisture, and converting the carbon dioxide into carbon monoxide. Two producers may be connected to the same two gasholders, so that the gas generated in the one may be forced down through the incandescent fuel in the other. The connecting pipes are provided with suitable valves for effecting the reversals.—H. B.

*Illuminating Gas; Apparatus for Generating* — F. J. Foveaux, Alameda, Cal. U.S. Pat. 779,842, Jan. 10, 1905.

A WATER-GAS generator is connected to a tower, the upper portion of which is filled with checker work, and forms a steam-superheater; the middle portion, which constitutes the carburetting chamber, is provided with inlets for superheated steam, oil, and water-gas; and the lower portion, forming the initial fixer, is filled with checker work and connected at the foot to a supplementary fixer. The latter has an inlet pipe for oil fuel and an outlet pipe for finished gas, at its upper end, and is connected at its lower end to the initial fixer.—H. B.

*Gas-Producer*. J. A. Herrick, Philadelphia, Pa. U.S. Pat. 779,935, Jan. 10, 1905.

A GAS-PRODUCER is claimed, having a blast-pipe extending across its base, this pipe having one end connected with a blower, and the other end provided with a test-valve. The hopper of the gas-producer has parallel pipes extending into and through it, and these pipes are provided with blast-ports, which discharge within the hopper.—L. F. G.

*Gas-Producer*. W. J. Crossley and T. Rigby, Manchester. U.S. Pat. 780,090, Jan. 17, 1905.

SEE Fr. Pat. 341,970 of 1904; this J., 1904, 897.—T. F. B.

#### FRENCH PATENTS.

*Agglomerate [Briquettes] of the "Charbon de Paris" Type; New —, and Process of Manufacturing it*. F. A. Cardot. Fr. Pat. 339,173, Nov. 19, 1903.

POWDERED charcoal, chalk, and dextrin are intimately mixed together in suitable proportions, and steamed. The mass is then moulded into briquettes and dried. A suitable composition is stated as being: 10 parts of chalk, 0.5 part of dextrin, and 89.5 parts of charcoal.—L. F. G.

*Gas-Producer [Suction]*. P. Lamare. Fr. Pat. 346,142, Sept. 9, 1904.

THE fuel in the producer rests on a solid hearth of refractory material, which can be oscillated by means of an external handle, for the purpose of loosening the fuel. A boiler, for supplying the steam required by the producer, is placed in the path of the hot gases between the producer and the scrubber. The latter is built up of superposed, interchangeable, short cylindrical sections provided with horizontal plates having devices for breaking up the current of gas as it ascends through the water flowing down over the plates. At the top of the scrubber the washed gas enters a chamber fitted with a spiral partition, which acts as a centrifugal purifier. The apparatus is characterised by detail modifications in the construction of the fuel hopper, the boiler feed, sight-holes, starting pump, &c. The outer limb of the syphon pipe, which admits the water to the scrubber, is of large diameter, to prevent air bubbles being dragged in, thus diluting the gas.—H. B.

*Gas-Purifier [Vertical]*. Soc. Anon. des Ateliers de Montreuil. Fr. Pat. 346,140, Sept. 8, 1904.

THE purifier, which is adapted for purifying coal-gas, is arranged vertically instead of horizontally, each section consisting essentially of a gas-tight vertical chamber divided longitudinally into three compartments by means of two vertical partitions constructed of louvres. The middle compartment is filled with the purifying material, the louvres serving to keep the material in position whilst permitting the free passage of the gas from one of the outer compartments, through the purifying material, into the other outer compartment. The spent purifying material is discharged when necessary by withdrawing a plug at the bottom of the chamber. Horizontal baffle plates in the outer compartments cause the gas on entering to be distributed over the whole surface of the screen of purifying material. The sections are grouped together in any desired manner. Charging takes place from a staging above the vessels.—H. B.

*Filament; An Indestructible — for Heating and Lighting Purposes*. G. Michand and E. Delasson. Fr. Pat. 346,307, Sept. 17, 1904.

FINELY powdered magnesia, silica, lime, or alumina is fed through the central tube of an oxy-hydrogen blow-pipe on to a support made of alumina carried on the top of a screwed shaft. The material melts, and by gradually screwing back the support, a filament is produced. The uniform distribution of the material is ensured by an electric tapping arrangement.—L. F. G.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

*Petroleum: Commercial* — M. Weger. Chem. Ind., 1905, 28, 24—29.

A NUMBER of commercial burning oils of American, Russian, Roumanian, Galician and German origin, were examined for their physical properties and composition, and the results are expressed in a number of tables together with a diagram of curves, indicating the percentages of constituents of various boiling points.

The specific gravity, ranging from 0.7905 to 0.8255, depends in part on the boiling point, and also on the chemical composition of the oil, i.e., the ratio between the paraffins, naphthenes and olefine group (with which are included the benzene and partially hydrated cyclic bodies), high sp. gr. and low boiling point indicating a large proportion of olefines, and also an inferior oil.

The flashing point, with the exception of two admittedly under-test oils, was equal to the German standard (21° C.), and in most cases to the Austrian standard (28° C.).

To determine the boiling points, the continuous system of distillation (Frank apparatus), employed in testing benzene, was preferred to the Engler intermittent method, being quicker, equally accurate and enabling the results to be expressed graphically, thus facilitating comparison. The copper still is preferably lowered half way into the

heating furnace, to facilitate distillation of the higher fractions; and the temperature at which the first drop is discharged from the condenser, is regarded as the initial boiling point. The volume of distillate is read off at intervals of 10°, and distillation is carried up to the point at which 90 per cent. (vol.) distils over. The results are expressed in the diagram, and in conjunction with the sp. gr., as shown in the following table, furnish pretty clear idea of the properties of the oils.

Number of Oil in Diagram.	Oil.	Limits of b.p.	Sp. Gr. at 15° C.
(1)	Urania (American) .....	155°–298° C	0.7905
(2)	Nobel (Russian) .....	143°–289° C	0.8100
(3)	Meteor (Russian) .....	141°–247° C	0.8090
(4)	Aurora (Roumanian) .....	138°–239° C	0.8100
(5)	Lipinki "salon" oil (Galicia) .....	130°–336° C	0.8255
(6)	Gorlice "export" oil (do.) ..	135°–310° C	0.8155
(7)	German oil from Wietze ...	135°–270° C	0.8050
(8)	Danubia (Roumanian) .....	135°–284° C	0.8102
(9)	Gorlice "salon" oil (Gal.) ..	134°–316° C	0.8200
(10)	Lipinki "export" oil (do.) ..	133°–323° C	0.8165
(11)	Edelweiss (Roumanian) ....	130°–298° C	0.8003
(12)	Standard white (American) ..	125°–332° C	0.8015
(13)	Gorlice "under-test" oil (Gal.) ..	105°–316° C	0.7925
(14)	Lipinki "inflammable" oil (do.) ..	82°–343° C	0.8120

From the curves of the two Galician "under-test" oil it appears that whilst that from Gorlice is rich in light spirit ("benzene"), and therefore dangerous, the Lipinki "inflammable" oil is merely a mixture of light fraction ("benzene") and "solar" oil, without any true burning oil fractions.

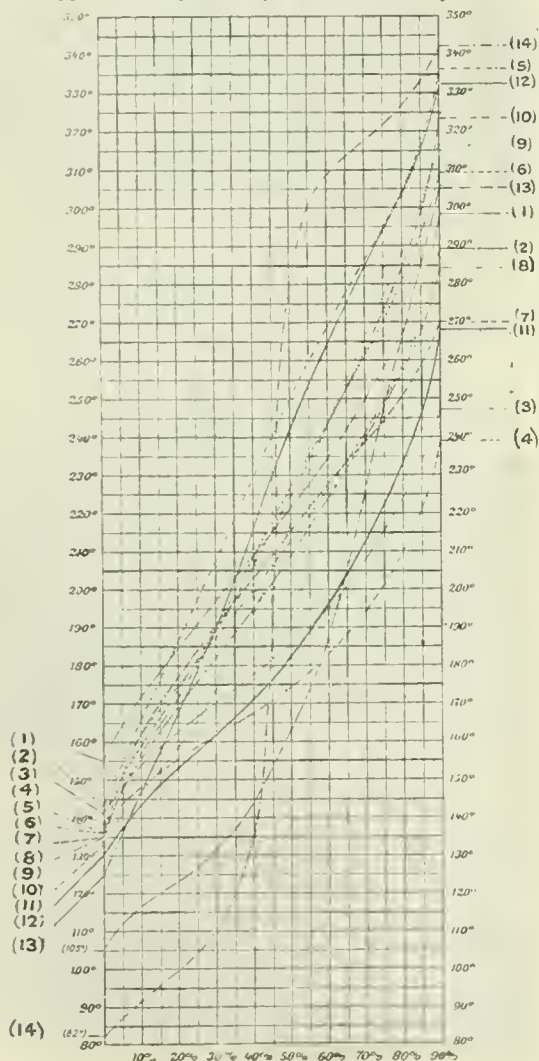
The variation of the coefficient of refraction is approximately parallel with that of the sp. gr. of the oils.

The method adopted for determining the percentage of the olefines was that of Kraemer and Böttcher, viz., by agitating 25 c.c. of oil with an equal volume of pure sulphuric acid for 15 minutes in a globular flask fused to a burette, filling up the flask with acid at the end of 30 minutes, and reading off the volume of paraffins and naphthenes displaced into the burette. The smallest percentage is found in American and Russian oils, the largest in those from Galicia and Roumania. The proportion in fractions of equal boiling point can be estimated from the sp. gr. of the paraffins plus naphthenes.

Tests of the illuminating power with a 12" Schuster and Baer burner showed that in point of consumption of oil per candle hour, the American oils are surpassed by several Russian, Galician and German oils, the figures being Meteor (Russian), Lipinki "export" oil, and Gorlice "export" oil, 3.0 grms. per Hefner candle hour; German Nobel and Gorlice "salon" oil, 3.1 grms.; Urania (American), Aurora (Roumanian) and Edelweiss (Roumanian), 3.2 grms.; Danubia (Roumanian) and Lipinki "salon" oil, 3.3 grms.; Standard white oil, 3.4 grms. With regard to the colour of the flame, however, different results were obtained and in this respect the proportion of members of the olefine group seems to have a direct influence in reddening the light, as is shown by the following figures, the white flame coming first:—Urania (olefine content 10.7 per cent.) Standard White (14.6 per cent.), Meteor (10.4 per cent.), German oil (16.2 per cent.), Nobel oil (12.2 per cent.), Galician oils (22.24 per cent.), Aurora (24.0 per cent.), Edelweiss (21 per cent.), Danubia (22.0 per cent.). The naphthenes also have a certain influence in the same direction. Moreover, on eliminating the olefines from the red-burning oils by washing with a large amount of sulphuric acid, the residual oil gave a white flame. Owing to the large proportion of heavy hydrocarbons in the Lipinki "salon" oil and Standard white oil, a considerable decrease in illuminating power was observed towards the close of the tests.—C. S.

*Hexanes: Iso* — in Roumanian Petroleum. P. Poniac and N. Costachescu. Annal. Scient. de l'Univ. de Jassy, 1904, 3, 95–102. Chem. Centr., 1905, 1, 217.

THE fractions of Roumanian petroleum boiling between 59.5° and 64.5° C. consist of 2-methyl- and 3-methylpentane. The former has the sp. gr. 0.6765 at 0°/0° C.





3-Methylpentane when heated with nitric acid of sp. gr. 1.4 in a sealed tube at 60° C. is converted into 3-nitro-3-methylpentane, together with a small quantity of a linitro-compound, and can in this way be separated from 2-methylpentane. (See also this J., 1903, 20.)—A. S.

*Phenol; Determination of* — S. J. Lloyd. XXIII, page 155.

#### UNITED STATES PATENTS.

*Retort [Wood Distillation].* J. C. Mallonee, Charlotte, N. Carolina, Assignor to J. J. Mallonee, Crichton, Ala. U.S. Pat. 774,261, Nov. 8, 1904.

Two cylindrical horizontal retorts are arranged side by side, and each covered with a smoke cap (arch), standing in a furnace built underneath. The furnace is divided into two parts by a central brick wall extending transversely from end to end, and extending into the smoke caps. Flues are arranged longitudinally along the sides of the retorts for conveying the hot furnace gases. In the destructive distillation of the wood, the gases escape by a pipe at the top of each retort, whilst the tar settles down and is discharged through an outlet at the lower part of the retort.—L. F. G.

*Bituminous Material, Crude; Distillation and Treatment of* — H. W. Ash, Cambridge, Mass., Assignor to Warren Bros. Co., Boston, Mass. U.S. Pat. 779,197, Jan. 3, 1905.

CRUDE bituminous material is heated in a still to about 300° F., and at the same time subjected to a blast of hot air carrying finely-divided matter such as lampblack, in order to force this into the distillate, the mixture being cooled suddenly by a cold blast.—A. G. L.

*Bituminous Material; Method of Distilling Crude* — H. W. Ash, Cambridge, Mass., Assignor to Warren Bros., Co., Boston, Mass. U.S. Pat. 779,198, Jan. 3, 1905.

THE bituminous material within a still is subjected to the action of a heated blast on the outside of it; at the same time the products of combustion which have passed the outside of the still are introduced under pressure into the interior. The hot blast may be charged with finely divided solid matter, such as lampblack.—A. G. L.

#### FRENCH PATENTS.

*Hydrocarbons; Process for Producing —, and for Eliminating the Sulphur from Hydrocarbons and Petroleum containing it.* H. S. Blackmore. Fr. Pat. 346,275, Sept. 15, 1904.

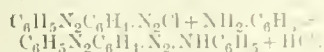
PETROLEUM or other hydrocarbon containing sulphur is purified by passing it, in a state of vapour, over a mass of heated metallic or alkaline-earth carbide, which treatment results in the formation of metallic or alkaline-earth sulphide and a hydrocarbon or mixture of hydrocarbons; e.g., by starting with dimethyl sulphide, a mixture of ethylene and acetylene is produced. This treatment is also applicable to removing sulphur compounds from coal gas. In place of using a carbide, acetylene may be used; or the hydrocarbon vapour mixed with steam, may be passed over the heated carbide. After the treatment, the hydrocarbon is preferably agitated with an "oxide or metallic base" to further purify it, and then it is distilled with steam.—T. F. B.

### IV.—COLOURING MATTERS AND DYESTUFFS.

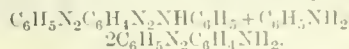
*Diazobenzene and Aniline; Limit of Combination of* — L. Vignon. Comptes rend., 1905, 140, 91—93.

THE author endeavoured to combine one mol. proportion of diazobenzene chloride with one of aminoazobenzene in presence of one of potassium carbonate, under various conditions, but without success. By the action of the chloride of diazotised aminoazobenzene on aniline

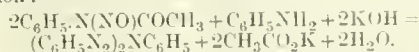
in presence of potassium carbonate in aqueous solution at 0° C., diazoaminoazobenzene was formed, according to the equation:—



The yellow product may be crystallised from alcohol. By the action of a mixture of aniline and aniline hydrochloride it is converted, after 24 hours' action at 10° C., into aminoazobenzene, according to the equation:—



The author remarks that Nietzki and Diesterweg obtained a very small amount of a more complex product from this reaction in the form of the acetyl compound  $\text{C}_6\text{H}_5\text{N}_2\text{C}_6\text{H}_4\text{N}_2\text{C}_6\text{H}_4\text{NHCOC}_6\text{H}_5$ . Attempts to obtain aniline bisdiazobenzene ( $\text{C}_6\text{H}_5\text{N}_2$ )<sub>2</sub>NC<sub>6</sub>H<sub>5</sub> by the action of one mol. of diazobenzene chloride on diazoaminoazobenzene and by the action of two mols. of diazobenzene chloride on aniline, failed. This substance is formed, however, by the action of two mols of nitrosoacetanilide on one mol. of aniline in presence of caustic alkali, according to the equation:—



This substance forms yellowish-orange needles, is unstable, and detonates on warming. On heating for 24 hours at 40° C. with aniline and aniline hydrochloride it is transformed into aminoazobenzene, which seems to represent the stable limit of the azo compounds derived from diazobenzene and aniline.—E. F.

*Methylene Blue; Determination of* — E. Kuecht. XXIII., page 154.

*Archil, Cudbear and other Lichen Colours; Note on the Detection of* — L. M. Tolman. XXIII., page 154.

#### ENGLISH PATENTS.

*Oxyanthraquinone Derivatives [Anthracene Dyestuffs]; Manufacture of* — M. Iljinskij, Krefeld, Germany, and R. Wedekind and Co., Uerdingen, Germany. Eng. Pat. 28,506, Dec. 28, 1903.

THE non-dyeing β- and β,α-hydroxyanthraquinones are converted into chloro-derivatives by treatment with hypochlorites in alkaline solution. In strongly alkaline solution the monochloro-derivatives are mainly obtained, but when alkali carbonates are used, di- and trichloro-derivatives are obtained with ease. The products are valuable raw materials for the production of dyestuffs, which give brighter and faster shades than those obtained in an analogous manner from the non-chlorinated compounds.—E. F.

*Anthraquinone Derivatives [Anthracene Dyestuffs]; Manufacture of* — H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4377, Feb. 22, 1904.

SEE Fr. Pat. 340,517 of 1904; this J., 1904, 820.—T. F. B.

*Indoxyl, its Homologues and their Derivatives; Manufacture of* — O. Imray, London. From The Basle Chemical Works, Basle, Switzerland. Eng. Pat. 5303, March 3, 1904.

SEE U.S. Pat. 761,440 of 1904; this J., 1904, 712.—T. F. B.

*Indoxyl and Derivatives of Indoxyl; Manufacture of* — J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 6225, March 14, 1904.

SEE U.S. Pat. 772,775 of 1904; this J., 1904, 1084.—T. F. B.

*Indigo White; Manufacture of* — J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 6226, March 14, 1904.

INDOXYL and indoxyllic acid are oxidised by indigo to indigo white, the indigo being simultaneously reduced to the same substance. The speed of the reaction is increased

by the addition of an oxygen carrier, such as a salt of iron or an alkali sulphite. It is not necessary to isolate the indoxyl or indoxylie acid, as the alkaline melt obtained during their manufacture may be employed directly in aqueous solution. It is also unnecessary to use indigo which has been prepared beforehand, as the indoxyl or indoxylie acid may be partially oxidised by air or any other oxidising agent to indigo, and this indigo then allowed to react with the remaining indoxyl or indoxylie acid. The alkaline indigo white solution, which results by any of these methods, may be filtered from any unchanged indigo, and the indigo white can then be precipitated by acids or by carbon dioxide.—E. F.

*Azo Colouring Matter [Dyestuff] and Lakes therefrom: Manufacture of* — J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 6839, March 21, 1904.

SEE U.S. Pat. 765,079 of 1904; this J., 1904, 819.—T. F. B.

*Azo Colouring Matter from Ortho-chlor-para-toluidine and Beta-naphthol; Manufacture of* —, and of Lakes therefrom. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 6840, March 21, 1904.

SEE U.S. Pat. 765,080 of 1904; this J., 1904, 819.—T. F. B.

*Alizarine [Anthracene Dyestuff]; Manufacture of* — J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 7398, March 28, 1904.

SEE Fr. Pat. 344,680 of 1904; this J., 1904, 1210.—T. F. B.

*Chloronitroanisol; Manufacture of* — K. Oehler, Offenbach-on-Maine, Germany. Eng. Pat. 25,505, Nov. 23, 1904.

*o*-NITROANISOL is treated with chlorine in presence of an organic acid, such as formic acid. 4-Chloro-2-nitroanisol is formed; the reaction is a very smooth one, and the presence of a chlorine carrier such as ferric chloride is unnecessary. For example, 153 parts of *o*-nitroanisol and 23 parts of 98 per cent. formic acid are mixed and chlorine introduced. The temperature rises to 60–65° C., and is finally raised to 80° C. When the increase of weight amounts to 35.5 parts the whole is poured into water, by which means the chloronitroanisol is precipitated.—E. F.

#### UNITED STATES PATENT.

*Disazo Dye [Azo Dyestuff]; Black* —, and Process of Making same. K. Schirmacher, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 778,610, Dec. 27, 1904.

TETRAZOPHENOLSULPHONIC acid, produced according to Eng. Pat. 18,283 of 1903 (see this J., 1904, 818), is combined with  $\beta$ -naphthol. The resulting dyestuff is soluble in hot water to a bluish-violet solution, and dyes wool directly a red-brown shade, becoming black on subsequent chroming.—T. F. B.

*Anthraquinone Dye [Anthracene Dyestuff] and Process of Making same.* H. Wetz, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 779,825, Jan. 10, 1905.

SEE Eng. Pat. 20,153 of 1903; this J., 1904, 319.—T. F. B.

*Sulphur Dye [Sulphide Dyestuff]; Ficht* —, and Process of Making same. A. Lüttringhaus, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 779,800, Jan. 10, 1905.

SEE Eng. Pat. 24,930 of 1903; this J., 1904, 1143.—T. F. B.

#### FRENCH PATENTS.

*Anthracene Series; Manufacture of Colouring Matters of the* — [Anthracene Dyestuffs]. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 339,192, Nov. 27, 1903.

SEE Eng. Pat. 26,182 of 1903; this J., 1904, 1143.—T. F. B.

*Indoxyl, its Homologues and their Derivatives; Process for Manufacturing* —. Fabr. Bâloise de Prod. Chim. Fr. Pat. 346,153, Sept. 9, 1904.

SEE U.S. Pat. 776,884 of 1904; this J., 1905, 23.—T. F. B.

*Anthracene Series; Manufacture of Dyestuffs of the* — [Anthracene Dyestuffs]. Farbenfabr. vorm. F. Bayer and Co. Fr. Pat. 346,398, Sept. 21, 1904.

HYDRO-AZINES of the anthracene series, and their derivatives, obtained according to Fr. Pats. 309,503, 332,261 and 343,608 (this J., 1902, 42; 1903, 1192; 1904, 1026) or by other methods, are converted into new dyestuffs of greater solubility and giving greener shades when dyed from a reducing vat, by treatment with formaldehyde in an acid medium, for instance, in strong sulphuric acid at temperatures varying from 20° to 100° C. Thus, 10 kilos. of the hydro-azine dyestuff obtained from 1-amino-2-bromoanthraquinone, dissolved in strong sulphuric acid and treated with 10 kilos. of 40 per cent. formaldehyde solution, yield a dyestuff which dyes cotton from a hydro-sulphite vat in pure, fast, greenish-blue shades.—E. F.

*Antiseptic; Fluorescent* —. E. Turpin. Fr. Pat. 346,363, Sept. 20, 1904. XVIII. C., page 148.

### V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

*Silk; Artificial* —. Bull. of the Imperial Inst. (Suppl. to the Board of Trade J.), 1905, 2, 266–269.

THE physical properties of the artificial silks produced by the various processes at present in use are very similar, but are inferior to those of natural silks, their elasticity and tenacity, especially when wetted, being considerably lower on the whole. Appended are the results of some tests of breaking stresses, given in kilos. per sq. mm. :—

	Breaking Stresses.	
	Dry.	Wet.
<b>NATURAL SILKS—</b>		
Chinese .....	53.2	46.7
French, raw .....	50.4	40.9
French, boiled off .....	25.5	13.6
<b>ARTIFICIAL SILKS—</b>		
De Chardonnet's "collodion," undyed .....	14.7	1.7
Lehner's "collodion," undyed .....	17.1	4.3
"Viscose" (early samples) .....	11.4	3.5
"Viscose" (latest samples) .....	21.5	—

Samples of cotton yarn gave results of 11.5 and 18.6 kilos. respectively.—T. F. B.

*"Noir Réduit"; Preparation of* —. E. Lauber. Z. Farben- u. Textil-Ind., 1905, 4, 40.

72 KILOS. of logwood extract Ia. (53° T.) are stirred with 12 litres of acetic acid (10° T.) until the solution is quite homogeneous. 5400 grms. of potassium bichromate, finely powdered, are made into a paste with 1.2 litres of boiling water. 18 litres of acetic acid (10° T.) added, and the whole brought slowly to the boil with constant stirring. When all is dissolved, it is poured, half a litre at a time, into the logwood solution with vigorous stirring, in order to prevent the oxidised hæmatein which separates out from forming large lumps. After stirring about 1 hour longer, a mixture of 18 litres of sodium bisulphite solution (57° T.) with 8 litres of water, is added 2 litres at a time, with vigorous stirring, the stirrer is then taken out and the vessel well covered. From hour to hour it is inspected to see whether crusts have formed on the surface. If this is so, they are passed with a strong brush through a coarse hair sieve and then replaced in the vessel. From time to time a drop of the mixture is examined on a glass plate; if it is bright olive coloured to transmitted light, the product is good. It is ready for immediate use after passing through a fine sieve.—A. B. S.



*Formic Acid; Use of* —, in *Dyeing and Printing*.  
S. Kapf. *Färber-Zeit.*, 1904, 15, 357—361.

*Wool Dyeing.*—Formic acid may be used in all cases where, on account of irregular absorption of a dyestuff from a bath containing sulphuric acid, acetic acid or ammonium acetate has been hitherto adopted as a more suitable assistant to the dyeing. It is said to cause a larger proportion of dyestuff to be taken up by the wool; to enable the after-rinsing to be accomplished readily and effectually; and, unlike acetic acid, to leave the dyed material free from objectionable smell. Again, in applying dyestuffs to wool mordanted with chrome, the addition of formic acid to the dyebath is said to cause an increased proportion of dyestuff to become combined with the mordant and more intense dyeings to result.

*Dyeing Woolen Tissues with Woven Silk Effects.*—These are frequently so dyed that the silk remains undyed, or is dyed differently from the wool. The following dyestuffs, possessing as they do greater affinity for wool than for silk, are serviceable for producing such effects:—Alizarin Sapphirol (Bayer), Naphthol Green B (Cassella), Azo Fuchsin G (Bayer) (the red dyeings from this may be converted by after-chroming into black), Fast Yellow S (Cassella). From a sulphuric acid bath, these dye both fibres, but the silk less deeply than the wool. When acetic acid, or, in some cases, oxalic acid is used, more satisfactory results are obtained, especially if the tissues, after dyeing, are treated with bran or ammonium acetate, to clear the silk, but much dyestuff is left in the bath. By the substitution for these acids of formic acid, the dyebaths are caused to become completely exhausted, the silk being more deeply coloured than it is with acetic acid, but less so than with sulphuric acid. The use of formic acid is to be recommended when the silk is afterwards to be dyed in a different colour from that in which the wool has first been dyed.

*Mordanting Wool with Chrome.*—This is the most important application of formic acid in dyeing. With  $1\frac{1}{2}$  per cent. (of the weight of the wool) of potassium bichromate and  $1\frac{1}{2}$  per cent. of formic acid (85 per cent.), the chromic acid is not only liberated, but completely reduced, and the resulting chromic oxide is wholly fixed upon the wool, after  $1\frac{1}{2}$  hours' boiling, a stronger mordanting being effected than that produced with 3 per cent. of potassium bichromate and 2½ per cent. of tartar. It is stated that so perfectly is the chromium absorbed that in the case of loose wool, the bath may be afterwards employed as a dyebath, the wool so mordanted and dyed, spinning very regularly and easily. The deepest shades ordinarily required upon woollen materials are obtained upon a mordant produced from about 2 per cent. of potassium bichromate and 2 per cent. of formic acid solution (85 per cent.), a little more of the latter being taken, when necessary, in order to counteract the influence of the dissolved salts, when "hard" water is used in mordanting. The dyeings obtained on the wool mordanted in this manner are very fast to milling and to rubbing.

Formic acid may also be advantageously applied along with chromic acid or potassium bichromate to complete the after-chroming of dyed tissues. As the whole of the chromium is thus caused to be absorbed, the bath may be preserved for use again in dyeing. Chromium formate is not suitable for the purpose.

*Cotton Dyeing.*—The acid may be used to give a seroopy silk-like feel to mercerised cotton tissues, for which purpose acetic acid is valueless, sulphuric acid dangerous, and citric and tartaric acids too expensive.

*Silk Dyeing and Finishing.*—Formic acid is very suitable for use in dyeing and brightening silk tissues.

*Calico Printing.*—With printing mixtures containing Methylene Blue, Auramine and Magenta, formic acid is found to give paler and brighter shades than acetic acid. In resisting Aniline Black, sodium formate is capable of replacing double its weight of sodium acetate.

*Waterproofing Tissues.*—Aluminium formate because of the ease with which it decomposes is especially suitable for this purpose. The tissues are passed through a solution of the salt and dried; they may be afterwards treated with a boiling soap bath to increase their impermeability.

*Antiseptic Properties.*—A sample of stained patte containing 5 per cent. of the acid, remained fresh and sound long after a second sample made without the acid had become watery and decomposed. [See A. G. Green and A. B. Steven, this J., 1904, 111.]—E. B.

*Fastness to Perspiration; Tests for* —, P. Heermann.  
*Färber-Zeit.*, 1905, 16, 21—22.

A CRITICISM of an article by Davidis (this J., 1905, 85). The author shows that Davidis' method often indicates results which are not in accord with practical experience.  
—A. B. S.

*Colouring Matters in Dyed Cotton Fabrics; Quantitative Determination of Some* —, E. Knecht. XXIII., page 154.

#### ENGLISH PATENTS.

*Revolving Kier [for Treatment of Textile Fibres, &c.]* —, J. Singleton, Manchester. Eng. Pat. 4552, Feb. 24, 1904.

AN "oblong hollow cylinder" is supported axially by a hollow perforated shaft mounted in suitable bearings. The cylinder is divided lengthwise into four or more equal compartments, by means of perforated partitions; these compartments are also provided with perforated false ends. Each compartment is fitted with a door for filling with the material and with a valve for letting out the liquid. The whole cylinder is mounted so as to revolve slowly in a cistern, and liquid is forced through the perforations of the central shaft by means of a suitable pump. This passes through the material and out through the outlet valves.—A. B. S.

*Dyeing Machines; Jigger* —, C. Gruschwitz, Olfersdorf, and C. Herminghaus, Hilden, Germany. Eng. Pat. 8409, April 12, 1904.

SEE Fr. Pat. 342,345 of 1904; this J., 1904, 934.—T. F. B.

*Dyeing or otherwise Treating with Liquor, Materials in Rolls, Spools, Cheeses, or the Like.* T. de Naeyer, Alost, Belgium. Eng. Pat. 24,505, Nov. 12, 1904. Under Internat. Conv., Nov. 26, 1903.

SEE Fr. Pat. 344,752 of 1904; this J., 1904, 1212.—T. F. B.

*Dyeing or Charging Silk with Tin Compounds.* F. W. Howarth, London. From Soc. Anon. Coop. per la Stagionatura e l'Assaggio delle sete ed' Affini, Milan. Eng. Pat. 25,728, Nov. 25, 1904.

To prevent the tendering of loaded silk, it is treated during the operations of charging, clearing or dyeing, with a solution of 0.5—3 per cent. of sulphocyanic (thiocyanic) acid or one of its salts.—A. B. S.

*Textile Fibres, Bags, Boxes, &c.; Composition for Impregnating [Water and Oil-Proofing]* —, F. Dnschek and L. Witte, Bucharest. Eng. Pat. 24,482, Nov. 11, 1904.

10 KILOS. of argillaceous earth are mixed with 2 kilos. of red lead and 3 kilos. of glycerin. The mixture is thoroughly ground up, and a 40—50 per cent. gelatin solution containing 50 kilos. of gelatin is added hot, together with 10 grms. of salicylic acid, 0.5 kilo. of soda-alum, and 2 kilos. of common salt. The whole mass is then boiled, cooled down to 36° C., and 0.2 kilo. of ammonium chromate added. The material is applied at once to the bag or other object, and after drying, treated with a solution of tannin and chrome alum to make the gelatin insoluble. The coatings formed are stated to be quite impermeable to liquids and perfectly flexible, and remain intact even if the receptacle itself be damaged.—A. B. S.

#### UNITED STATES PATENTS.

*Silk-like Thread; Manufacture of* —, R. Müller, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 779,175, Jan. 3, 1905.

SILK-LIKE threads are manufactured by forcing alkaline

solutions of "cellulose-cuprammonium" through capillary tubes, into caustic alkaline solutions, washing the "wound-up threads" thus formed successively with acids and water, and subsequently drying.—T. F. B.

*Fabrics; Apparatus for Treating — with Fluids.* J. Gebauer, Charlottenburg, Germany. U.S. Pat. 779,076, Jan. 3, 1905.

SEE Eng. Pat. 21,949 of 1903; this J., 1904, 932.—T. F. B.

*Dyeing; Process of —.* H. Mann, Munich, Germany. U.S. Pat. 779,228, Jan. 3, 1905.

SEE Fr. Pat. 326,010 of 1902; this J., 1903, 739.—T. F. B.

*Dyeing Machine.* J. A. Willard, Assignor to Vacuum Dyeing Machine Co., Chattanooga, Tenn. U.S. Pat. 780,398, Jan. 17, 1905.

Is the centre of the dye-vat which is cylindrical in form, is an overflow pipe of large diameter, extending nearly to the top of the vat. A perforated plate to support the goods to be dyed, and a perforated compression plate are provided in the vat, with suitable arrangements for removing and replacing these plates. Within the overflow pipe is situated a pipe with perforated end, connected with a pump, which removes the overflowing liquor, and pumps it again through a supply pipe which feeds a number of pipes which enter the dye-vat beneath the supporting plate, thus maintaining a circulation of the liquor.—T. F. B.

*Dyeing; Apparatus for —.* J. A. Willard, Chattanooga, Tenn. U.S. Pat. 780,399, Jan. 17, 1905.

THE dye-vat is cylindrical in form, and is composed of a number of shallow flanged sections jointed together, so that the capacity of the vat can be increased or diminished as desired. In the base of the vat, and extending below it, is a casing containing a centrifugal pump; two or more pipes for circulating liquid are connected on the one hand with the casing, and on the other hand with the top of the dye-vat. Steam pipes are provided for heating the contents of the vat and also the liquor supply pipes. Perforated supporting and compression plates are provided in the vat, with suitable mechanism for operating them.—T. F. B.

*Dyeing, &c.; Vat for —.* J. A. Willard, Assignor to Vacuum Dyeing Machine Co., Chattanooga, Tenn. U.S. Pat. 780,402, Jan. 17, 1905.

THE overflow openings of the dye-vat, which are situated close to the top of the vat, are connected with small receptacles, which are provided with filters and outlet pipes connected with a pump, and also with a number of vertical rods, which carry "locking dogs" to keep the perforated compression plate in position in the vat. The lower face of the compression plate and the upper face of the fibre-supporting plate are coated with some metal which is not affected by alkaline liquors. Other claims relate to a special form of strengthened compression plate, and to devices for holding it in position in the vat.—T. F. B.

*Fabric; Figured —.* J. Morton, Carlisle. U.S. Pat. 779,300, Jan. 3, 1905.

SEE Eng. Pat. 18,897 of 1903; this J., 1904, 932.—T. F. B.

*Waterproofing and Process of Making same.* H. Paschke, New York. U.S. Pat. 780,379, Jan. 17, 1905.

Two sheets of fabric are coated with a waterproofing composition consisting of bitumen or asphalt and "the gummy products of the refinement of petroleum," and the treated faces are united by means of a solution of the same waterproofing compound in a suitable solvent.—T. F. B.

*Wool-wash Waters; Apparatus for Treating [Separating Fat from] —.* G. E. Behrens and G. Taylor. U.S. Pat. 780,475, Jan. 17, 1905. XII., page 141.

## FRENCH PATENTS.

*Benzene used for Dry Cleaning Fabrics; Process and Apparatus for Recovering the —.* E. Delhotel. First Addition, dated Sept. 6, 1904, to Fr. Pat. 344,848, July 16, 1904.

THE addition relates to certain improvements in the apparatus described in the principal patent (this J., 1904, 1213), with the object of accelerating the operation. For example, two drying chambers are employed, and are connected together and with the air and vacuum pipes by means of valved pipes, one of the chambers being in use while the other is being emptied or re-filled. Devices are also described for suspending the goods which have been cleaned, in such a way as to obtain more rapid and even removal of the benzene.—T. F. B.

*Dyeing Yarns; Process for —, enabling them to be Treated by the Processes and in the Apparatus used in Dyeing Fabrics.* Soc. L. Destrée, A. Wiescher et Cie. Fr. Pat. 346,256, Aug. 2, 1904.

SEE Eng. Pat. 17,240 of 1904; this J., 1904, 1087.—T. F. B.

*Discharging [Dyed Textiles] by means of Hydrosulphites; Process of —.* Badische Anilin und Soda Fabrik. Second Addition, dated Sept. 17, 1904, to Fr. Pat. 297,370, Feb. 19, 1900. Under Internat. Conv., June 27, 1904.

INSTEAD of adding a concentrated solution of caustic alkali to the discharge mixture, as described in the First Addition (see this J., 1905, 87), saturated solutions of certain salts may be used. Thus, a fabric printed with a mixture of dyestuff, sodium hydrosulphite and sodium chloride can be dried for several hours at 100° C. without the hydrosulphite losing its discharging properties.—T. F. B.

*Finishing Material; Preparation of a — [from Molasses, &c.].* M. Kowalski. Fr. Pat. 346,355, Sept. 19, 1904.

MOLASSES or similar by-product from the manufacture of sugar is run into water at 50°–60° C., and the mixture is immediately submitted to the action of sulphuric acid in an acid-resistant vessel until it gives a strongly acid reaction; at the same time the mixture is kept well stirred and a metallic powder, such as zinc, aluminium or tin, is added. The mixture is heated to 50°–70° C. If the liquid has a clear yellow colour, more metallic powder is added, and the mixture is treated with sulphuric anhydride or chlorine until the acidity attains a certain point. The liquid is passed through a filter press and thickened by evaporation. The filtrate is finally neutralised by means of carbonates. It forms a clear yellow syrup very suitable for finishes.—A. B. S.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

*Dyeing of Leather, &c.; New Processes for the —.* Sedlacek. Färber-Zeit., 1905, 16, 17–20.

THE sulphide dyestuffs can be applied to leather by the addition of glucose or tannin to the dye-bath, which prevents the injurious action of the sodium sulphide on the leather. The dyeings can be treated afterwards with bichromate or other metallic salts. The glucose may be replaced by formaldehyde. Very fast yellow and brown shades can be obtained by soaking the tanned leather several hours in a solution of a titanium salt. Titanium salts can also be used as mordants for the various dye-woods. Very fast shades are obtained by tanning with dye-wood extracts mixed with other tannin materials, and then treating with titanium salts. For hair dyeing, water or alcoholic solutions of many substances such as *p*-phenylene-diamine, *p*-aminophenol and *p*-diaminodiphenylamine are used. On exposure to the air or by the action of oxidising agents such as hydrogen peroxide, these substances give brown oxidation products of various shades according to the choice and strength of the solutions.—A. B. S.



## VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

*Chamber Process; Theory of the* — G. Lunge. Z. angew. Chem. 1905, 18, 60—71. (See this J., 1904, 440, 924, 1178, 1213.)

ASCHIG denies that the nitrous character of the chamber acid is due to nitrosylsulphuric acid, and holds that the chamber acid merely contains dissolved nitrogen trioxide. Solutions of nitrous acid in water or weak sulphuric acid are, however, exceedingly unstable, whilst the nitrous compounds contained in the chamber acid are very stable. Aschig also refers to the small amount of nitrogen trioxide in chamber acid (0.03 per cent. of  $N_2O_3$ , equiv. to say 1 per cent. of nitrosylsulphuric acid), but the author points out that 0.1 per cent. of nitrosylsulphuric acid would mean 600 kilos. in a set of chambers producing 2000 tons of chamber acid, even if there were none in the chamber cloud. The author found that the chamber acid and the "drop-acid" from the Uetikon Works, at Zürich, contained respectively 0.085 and 0.24 per cent. of nitrosylsulphuric acid. Raschig's statement that when nitric oxide and excess of air are shaken with water, nitrous acid, as well as nitric acid, is produced, never more than half the nitrogen being converted into nitric acid, has no bearing on the chamber process, where practically no nitric acid is formed at all; but, as a matter of fact, the author and others (this J., 1905, 88) have shown that the enormous excess of water present in Raschig's experiments alters the reaction fundamentally, and that under other conditions, practically the whole of the nitric oxide present is converted into nitric acid.—J. T. D.

*Alkali Oxides; Affinity of* — for Different Anhydrides. D. G. Gerassimoff. Z. anorg. Chem., 1904, 42, 329—340.

WITH a view to determine the conditions of equilibrium between alkali oxides on the one hand, and volatile and non-volatile anhydrides on the other hand, the author examined: (1) The action of sulphur trioxide on fused alkali tungstates and vanadates; and (2) the action of carbon dioxide on alkali tungstates, vanadates, niobates, tantalates, titanates and aluminates. (1) In most of the experiments equilibrium was attained from two different starting points, viz., by passing air containing a definite proportion of sulphur trioxide over the fused alkali tungstate or vanadate; and by fusing a mixture of

tungstic or vanadic anhydride and sodium sulphate. The sulphur trioxide was prepared by passing a current of air through a heated U-tube containing pumice, which had been impregnated with fused pyrosulphuric acid. (2) In the experiments with carbon dioxide, mixtures of alkali carbonate with the non-volatile anhydride were fused, with or without the passing of a current of carbon dioxide. The results of the experiments, in conjunction with those previously obtained by D. P. Smith (Z. anorg. Chem., 1903, 37, 332) and N. M. von Wittorf (this J., 1904, 488), show that the affinity of an alkali oxide for carbon dioxide or sulphur trioxide increases with its molecular weight in all systems in equilibrium in which the following pairs of anhydrides participate:—Carbon dioxide with silicic, titanitic, tungstic or vanadic anhydride, and sulphur trioxide with tungstic or vanadic anhydride. Vanadic anhydride expels a greater proportion of sulphur trioxide from alkali sulphates than tungstic anhydride. The molecules of carbon dioxide expelled by 1 molecule of the different non-volatile anhydrides from 2 molecules of sodium carbonate at 880° C., under a partial pressure of carbon dioxide of 0.07 atmosphere are given in the following table:—

$V_2O_5$	$Nb_2O_5$	$SiO_2$	$WO_3$	$Al_2O_3^*$	$TiO_2$	$Ta_2O_5^*$
2.000	1.891	1.310	1.047	1.019	0.779	0.727

\*In these cases the anhydride was only partially dissolved in the melt. —A. S.

*Ammonia; Formation of* — from Nitrogen and Hydrogen. F. Haber and G. van Oordt. Z. anorg. Chem., 1905, 43, 111—115.

A CURRENT of pure ammonia was led over finely-divided iron kept at a temperature near 1000° C., the decomposition products were freed from the undecomposed ammonia by means of standardised acid, then led over a further quantity of heated finely-divided iron, and the amount of ammonia re-formed determined. The iron was prepared from iron oxalate in a current of ammonia, and was supported on asbestos in the heating tube. Some experiments were also made with finely-divided nickel supported on silicic acid (prepared by impregnating silicic acid with nickel nitrate and igniting in a current of hydrogen), but this metal proved a less effective catalyst than iron. The results obtained (see table) show that equilibrium is attained from both sides:—

Contact Metal.	Residual Gas (at 0° C and 760 mm.) consisting of $\frac{1}{2}N_2$ + $\frac{1}{2}H_2$ .	Parts of Ammonia decomposed per 1000.	Parts of Ammonia formed instead of 1000.	Temperature in ° C.
	litres.			
1 Iron	14.509		← 0.98 →	1057 ± 23*
2 "	17.948		← 0.46 →	1037 ± 17
3 "	15.706	0.20	0.26	1024 ± 19† (± 10)
4 "	16.530	0.21	0.14	1010 ± 10 (about + 15)
5 "	13.786	0.23	0.16	1009 ± 6 (about — 4)
6 "	16.863	0.15	0.14	1016 ± 4 (about + 9)
7 "	11.380	0.20	0.21	1013 ± 17 (≈ 0)
8 Nickel	12.173	0.25	0.11	1024 ± 18
9 "	12.359	0.485	0.272	1020 ± 4

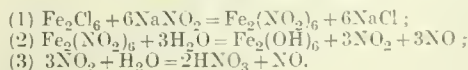
\*Lower temperature at the beginning of the experiment.

†In experiments 1, 2, 8 and 9, the two tubes containing the catalyst were arranged in the same heating tube, but in experiments 3, 4, 5, 6 and 7, two heating tubes were used; the figures in brackets give the variation of the temperature of the second tube from that of the first.

(See also this J., 1904, 915.)—A. S.

*Nitric Oxide together with Nitrogen Peroxide; New Method for the Preparation of* — J. Matusebek. Chem.-Zeit., 1905, 29, 31.

THE author states that in the preparation of nitric oxide, a more regular evolution of gas is obtained by acting upon an alkali nitrite with an aqueous solution of an iron salt, than by the usual method of treating copper turnings with nitric acid. For example, sodium nitrite is treated with an aqueous solution of ferric chloride. A mixture of nitric oxide and nitrogen peroxide is evolved, but on passing through water the nitrogen peroxide is decomposed into nitric acid and nitric oxide. The reactions taking place are represented by the following equations:—



—A. S.

*Ferrous Oxide in Presence of Ferric Oxide; Detection of* — L. Blum. XXIII., page 153.

*Tin in the Stannous State; Detection of* — L. Blum. XXIII., page 153.

*Zinc Oxide intended for the Quantitative Determination of Manganese; Testing with Potassium Permanganate* — L. L. de Koninck. XXIII., page 152.

## ENGLISH PATENTS.

*Alcohol or Marine Distilling Apparatus.* C. Tuckfield and W. G. de Forges Garland. Eng. Pat. 2747, Feb. 4, 1904. XVII., page 147.

*Nitrogen Compounds [Cyanides, Ammonia, &c.]; Manufacture of — from Atmospheric and other Elementary Nitrogen.* H. Mehner, Steglitz, Germany. Eng. Pat. 28,667, Dec. 30, 1903.

SEE U.S. Pat. 754,474 of 1904; this J., 1904, 370.—T. F. B.

*Hydrosulphites; Manufacture of Stable, Dry —.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 7397, March 28, 1904.

SEE Fr. Pat. 341,718 of 1904; this J., 1904, 900.—T. F. B.

*Carbon Dioxide [from Furnace Gases, &c.]; Manufacture of —.* J. C. Stead, London. Eng. Pat. 18,710, Aug. 30, 1904.

THE washed and cooled furnace- or other gases containing carbon dioxide are passed through a series of vertical cylinders ("bicarbonators") charged up to near their tops with a solution of an alkali carbonate. The gases enter each cylinder below a perforated false-bottom, and leave at the top; the exhausted gases finally escape through a pipe which condenses and returns to the cylinder any vapour carried off. The cylinders are connected in pairs by syphon tubes, adapted to automatically circulate the lye in the reverse direction to the flow of gases. The first "bicarbonator" of the series communicates with a "boiling off" vessel at a lower level, into which the bicarbonated lye passes by gravity through pipes provided at their bends with suitable back-pressure valves; and when the absorbed carbon dioxide is expelled from the liquor in the boiler, the decarbonated lye is driven up by steam pressure into the last "bicarbonator" of the series, the original charge having been siphoned off during the charging of the "boiling off" vessel.—E. S.

*Pyrites; Apparatus for Treating — for the Recovery of Sulphur Fumes.* W. R. Simons, Charleston, U.S.A. Eng. Pat. 24,885, Nov. 16, 1904.

SEE U.S. Pat. 778,149 of 1904; this J., 1905, 90.—T. F. B.

*Sodium Silicate; Means for Obtaining a Dissolution of —.* J. B. Watson, Shorne, Kent. Eng. Pat. 25,394, Nov. 22, 1904.

A ROTATING drum, mounted on hollow trunnions, is charged with sodium silicate through a manhole, and, during rotation, steam is admitted through one of the trunnions, into a space kept free within the drum by a perforated partition. A pipe through the other trunnion serves as an outlet for the liquefied silicate. There are insets serving to overturn the silicate as the drum is rotated.—E. S.

*Earthenware Cocks for Use with Acids, Lyes and the like; Impts. in Protected —.* C. Ruppel. Eng. Pat. 25,310, Nov. 21, 1904. I., page 123.

## UNITED STATES PATENTS.

*Hydrochloric Acid; Process of Making —.* W. T. Gibbs, Assignor to the Electric Reduction Co., both of Buckingham, Canada. U.S. Pat. 779,998, Jan. 10, 1905.

AN excess of hydrogen is brought into contact with chlorine, one or both of the gases being previously heated to a temperature above that at which combination begins. Means for collecting and absorbing the hydrochloric acid produced are provided.—E. S.

*Barium Oxide from Barium Carbonate; Process of Producing —.* G. Elgy, Assignor to Gebr. Siemens und Co., Charlottenburg, Germany. U.S. Pat. 779,210, Jan. 3, 1905.

SEE Fr. Pat. 341,200 of 1904; this J., 1904, 823.—T. F. B.

*Lead Silicofluoride; Process of Making —.* W. Mills, London, Assignor to A. O. Granger, Cartersville, Ga. U.S. Pat. 779,091, Jan. 3, 1905.

GALENA, or a mixture of galena and cerusite, or other substance containing lead, is heated with hydrofluosilicic acid of about 1-80 sp. gr., air being blown through during the reaction. Water is then added to the resulting lead silicofluoride.—E. S.

*Lead Silicofluoride; Process of Making —.* W. Mills, London, Assignor to A. O. Granger, Cartersville, Ga. U.S. Pat. 779,092, Jan. 3, 1905.

PURE lead silicofluoride is obtained by heating an oxygen-carrying lead compound, or a corresponding hydrated compound, with an excess of hydrofluosilicic acid, with stirring. More of the lead compound is then continuously added until the acid is neutralised, and the solution is filtered.—E. S.

*Sodium Acetate; Process of Making —.* I. P. Lihme, Assignor to the Grasselli Chemical Co., both of Cleveland, Ohio. U.S. Pat. 779,290, Jan. 3, 1905.

A SLIGHT excess of sodium sulphate crystals is added to a heated solution of calcium acetate; sufficient barium carbonate is then added to react with the dissolved sulphates and "to adhere to the organic matter," and the solution is concentrated while currents of air are injected to oxidise the organic impurities. The cleared solution of sodium acetate is then crystallised.—E. S.

*Chromate of Soda; Method of Treating Alkaline Solutions of —.* W. T. Gibbs, Buckingham, Canada, Assignor to the National Electrolytic Co., N. Y. U.S. Pat. 779,705, Jan. 10, 1905.

THE alkaline solution of sodium chromate is neutralised, and the neutral solution is electrolysed, thus producing an anode solution of sodium bichromate and a cathode solution of sodium chromate and caustic soda. The weak cathode solution is concentrated to such a strength that sodium bicarbonate is insoluble in the liquor, and the free alkali is then removed from the cathode solution as sodium bicarbonate. The treated cathode solution is mixed with a fresh portion of the neutral solution of sodium chromate, and the mixture electrolysed, thus again producing sodium bichromate, the process being continued in this way with successive cathode solutions and successive portions of the alkaline solution.—B. N.

## FRENCH PATENT.

*Calcareous Minerals; Process for Enriching —.* E. Leduc and C. Griffiths. First Addition, dated June 9, 1904, to Fr. Pat. 339,162, Nov. 12, 1903.

SEE Eng. Pat. 12,797 of 1904; this J., 1904, 826.—T. F. B.

## VIII.—GLASS, POTTERY, AND ENAMELS.

*Clay; Influence of Magnesia on —.* L. E. Barringer. Trans. Amer. Ceramic Soc., 1904, 6, 86-90.

THE author, while agreeing with Maekler (this J., 1902, 914) and Hottinger (this J., 1903, 1046; 1904, 901) that magnesia is a desirable substitute for lime in porcelain bodies containing a number of active fluxes, and fired at a low heat, gives the results of some experiments showing that as the number and character of the fluxes change in the direction of porcelain bodies requiring a high firing heat, the influence of magnesia diminishes considerably. Under suitable conditions, a feldspathic porcelain body can be thoroughly vitrified, giving a non-absorbent, hard, dense product with moderate shrinkage, burning into thin-walled pieces that retain their shape well. The introduction of magnesia into a "body" of this character not only fails to give any improvement, but increases shrinkage, lowers the density, "shortens" the mixture,



and imparts to the ware a tendency to "stick" during the firing.—A. S.

*Clays; Investigation of the E. G. Acheson Process of Toughening* —. Le Roy H. Minton. Trans. Amer. Ceramic Soc., 1904, 6, 231—259. (See U.S. Pat. 722,791 and Eng. Pat. 3630 of 1903; this J., 1903, 496 and 697.)

In the author's experiments a liquor prepared by extracting oat-straw with distilled water was used. The results obtained are given in tables and curve-diagrams. From a financial standpoint the method is restricted to the higher grades of the ceramic industry, i.e., to those classes in which the cost of the raw material is very small as compared with the value of the final product. A great improvement in strength and hardness is produced by the treatment when the clays are worked by the plastic method, but the effect is very small when the "slip" method is employed, as is customary in nearly all white-ware plants. (See also this J., 1903, 1195; 1904, 661.)

—A. S.

*Faience v. Majolica*. S. G. Burt. Trans. Amer. Ceramic Soc., 1904, 6, 109—113.

THE author draws attention to the need of a distinct and definite terminology. He suggests the following definitions for faience and majolica:—*Faience*: Pottery in which the coloured clay body is covered with a clear glaze. *Majolica*: Pottery in which the coloured clay body is concealed by an opaque enamel.—A. S.

*Crystalline Glazes; Notes on the Production of* —. R. T. Stull. Trans. Amer. Ceramic Soc., 1904, 6, 186—193.

CRYSTALLINE glazes may be divided into two classes. The first class comprises the Aventurine glazes, and is produced by a mixture in which there is an excess of one or more metallic oxides; or by applying these oxides to the body or bisque before dipping it in the glaze. The second class consists of the true matt glazes, or those in which the whole mass is crystalline. Experiments made to determine the effects of different ceramic materials, showed that the strongest tendencies to crystallisation are imparted to glazes by those elements of low atomic weight, the oxides of which go to make up the RO bases, such as sodium, potassium, magnesium, calcium, manganese, ferrous iron, zinc, &c. Elements of high atomic weight, such as barium, lead, &c., when used in sufficient quantities, appear to retard crystallisation. Of the elements the oxides of which form the acid portion of a glaze, those of higher atomic weight, such as silicon, titanium, phosphorus, &c., are the best for inducing crystallisation, whilst those of lower atomic weight, such as boron, act adversely. In some cases, the introduction of an oxide of the  $R_2O_3$  type materially assists crystallisation. The author, in preparing crystalline glazes, takes as a working basis a natural crystalline silicate or titanosilicate, and prepares experimental mixtures in which the effects of various modifications of the original mixture are shown. The best results are obtained by applying the glaze over a hard, vitrified body which has been fired at a temperature two or three cones higher than that at which the glaze matures. For colouring purposes, in most cases, 0.03 per cent. of a colouring oxide may be added without any prejudicial effect, but an addition of more than 0.05 per cent. interferes with the crystallisation. (See also this J., 1904, 606.)—A. S.

*Silica Content of Glazes; Table for quickly Obtaining the —, where the Total Oxygen-Ratio and the Alumina are given*. R. C. Purdy. Trans. Amer. Ceramic Soc., 1904, 6, 260—268.

By the aid of the table, which fills six pages, there can be found for any given equivalent of alumina, the corresponding equivalent of silica for any desired oxygen-ratio; and also, the oxygen-ratio of any combination of  $RO, Al_2O_3$  and  $SiO_2$ .—A. S.

#### ENGLISH PATENTS.

*Glass; Crucibles Suitable for the Manufacture of* —. F. Lang. London. Eng. Pat. 25,414, Nov. 22, 1904. Under Internat. Conv., May 19, 1904.

SEE Fr. Pat. 343,309 of 1904; this J., 1904, 1090.—T. F. B.

*Clay for the Casting of Clay-Ware; Preparation of* —. E. Weber, Schwepnitz, Saxony. Eng. Pat. 4391, Feb. 22, 1904.

SEE Fr. Pat. 340,664 of 1904; this J., 1904, 824.—T. F. B.

#### UNITED STATES PATENTS.

*Opal Glass; Process of Making Translucent* —. J. Kempner, Berlin. U.S. Pat. 777,734, Dec. 20, 1904.

THE translucent opal is made from a frit composed of 100 parts of felspar (poor in lime) and sodium silicofluoride, 160 to 180 parts of silicic acid (sand) and  $37\frac{1}{2}$  to 50 parts of "soda."—W. C. H.

*Glass-Pot Furnace*. W. T. Nicholls, Wellsburg, W. Va. U.S. Pat. 779,235, Jan. 3, 1905.

A REGENERATIVE glass-pot furnace is provided with a central eye, and means for continuously feeding a fuel mixture upward through the eye, as well as a series of outer downtake-flues for the products of combustion leading through the bench, curved flues to which the downtake-flues lead, single-surface regenerators, and reversible connections between the curved flues and the regenerators.—A. G. L.

#### FRENCH PATENT.

*Glass; Process of Rolling — without Stretching*. L. A. Garchey. Fr. Pat. 339,205, Dec. 3, 1903.

THE glass is poured on to a movable table of cast-iron or other metal, on which are placed lateral ridges of the same height as the thickness of the plate to be made. The table is then moved below a rotating cylinder, which evenly distributes the glass over it. The table is then moved below a second rotating cylinder provided with cutting discs at intervals, which cut the glass longitudinally; if desired, enamel may then be poured on to the surface of the glass. The process may be modified by using a fixed table and travelling cylinders.—A. G. L.

### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

*Refractory Ceramic Products; Determination of Melting-Points of* —. W. C. Heraeus. Z. angew. Chem., 1905, 18, 49—53.

THE author's furnace consists of a tube of pure iridium 200 mm. long, 40 mm. diameter, and 0.2 mm. thick, strengthened at the ends by platinum rings, and furnished with appropriate connections to a source of current which can yield up to 1200 ampères at 5 volts. The tube is enclosed in an outer tube of fused magnesia, which again is surrounded by an outer fireclay cylinder of 160 mm. diameter, the space between being packed with fragments of fused magnesia. The furnace is mounted so as to be movable in any direction. Temperatures were measured by a thermo-element of iridium and iridium-ruthenium (10 per cent. of the latter metal), which was calibrated up to 1600° C. by comparison with a standard element of platinum and platinum-rhodium, and at 1780° by melting platinum; extrapolation then gave temperatures up to 2000° C. The objects to be fused were placed on an iridium plate in the centre of the tube, the ends of which were closed by perforated fireclay stoppers, through one of which passed the thermo-element, whilst through the other the process could be observed by means of a telescope about 1 metre distant. In this way the temperatures both of incipient softening and of complete fusion could be determined. Preliminary experiments showed that with pure clays having a definite melting-point, neither the rate of heating nor the size of the trial piece affected the result; and the fused mass—which

had always a porcelain-like fracture on breaking after cooling—gave the same melting-point when remelted. The melting point of a number of clays, etc.; and of Seger cones, as determined by the above method, are given. An important series of measurements was made by placing the furnace vertically, and allowing the end (1 mm. square) of a weighted iridium rod to rest on the trial piece. By means of a lever and scale attached to the upper end of this rod, the rate at which it sank into the mass at different temperatures, and hence the rate at which the mass softened with rise of temperature, could be determined. Great differences were found in this respect among clays, some softening slightly far below their melting-points, and then showing little change till close to melting, whilst others became steadily softer from the temperature of incipient softening up to complete fusion. The following Table gives an indication of some of the results obtained:—

Substance.	1.	2.	3.	Differences	
	Melting pt.	Incipient softening.	Speed of sinking of rod 1 mm. per min.	3-2	1-3
	° C.	° C.	° C.	° C.	° C.
Rakonitzclay-slate	1760	1475	1710	230	50
Grünstadt No. 6	1725	1400	1570	170	150
Saarau Kaolin	1750	1320	1700	380	50
Kährlich clay	1670	1450	1510	60	160
Grünstadt palatine	1725	1420	1670	250	55
Grünstadt Qu. 7	1740	1450	1590	140	130
Grünstadt A. Qu.	1670	1410	1500	90	170

—J. T. D.

*Firebrick; Peculiar Action of Soluble Salts on —*  
H. Seger and E. Cramer. *Tonind-Zeit.* 1904. **28**, 1707—1708.

In a works where broken firebricks are ground and mixed in small proportions with fireclay, the unburnt bricks were found covered with an incrustation similar to that occasionally occurring on bricks. On being burnt, however, the bricks proved to have sustained little damage, though other bricks, made from unmixed fireclay and fired in the same kiln, were extensively corroded with bubbles and froth-like markings on the surfaces exposed to the fire-gases. Suspicion being cast on the broken firebrick, a sample was extracted with water, and the solution was found to contain soluble matter corresponding to the following calculated percentages:—Potassium sulphate, 0.04; sodium sulphate, 25.56; sodium chloride, 2.07; magnesium sulphate, 0.67; calcium sulphate, 1.45;

*Sand-Lime Bricks.* H. Gerlings. *J. Chem., Metall. and Mining Soc., S. Africa.* 1904. **5**, 124—127.

GLASENAPP has shown that very much more silica is attacked in a given time in the case of sand-lime bricks made with steam under high pressure than when steam at atmospheric pressure is used. Thus, using coarse sand and a pressure of 147 lb., 7.58 per cent. of soluble silica was obtained after 8 hours' hardening, whilst with fine sand and ordinary pressure, only 3.06 per cent. was obtained in the same time. The fineness of the sand also plays an important part. The formula  $\text{CaH}_2(\text{SiO}_3)_2$  requires only 3 per cent. of lime, but in practice from 4 to 7 or even 10 per cent. is used. When pure kaolin is substituted for the quartz, the silica is not so readily attacked, but ordinary impure clays give better results, especially if the clayey substance is washed out first.—A. G. I.

*Black Speckle for use on a Red Face Brick; Note on a —*  
L. E. Barringer. *Trans. Amer. Ceramic Soc.*, 1904, **6**, 198—202.

IN an attempt to prepare a "red mottled" brick, i.e., a black speckle on a red body, corresponding to the buff mottled brick obtained by adding coarse pyrolusite (manganese dioxide) to No. 2 fireclays, it was found that at the temperature (cone No. 1) at which the red clay burned to a hard dense body, there was no fluxing effect on the pyrolusite. Satisfactory results were obtained, however, by using a manganese frit of the composition: 0.747  $\text{MnO}_2$ , 0.253  $\text{Na}_2\text{O}$ , 0.509  $\text{SiO}_2$ , prepared by fusing together commercial ground pyrolusite, soda ash and flint. The best results were obtained by grinding the frit to 120-mesh, making it into a thick "slip," flecking the faces of the bricks with the "slip" by means of a brush, and burning the mottled bricks in the usual way.

—A. S.

*Drying; Contribution to the Technology of — [Brick-Driers]* R. H. Minton. *Trans. Amer. Ceramic Soc.*, 1904, **6**, 269—286.

THE author gives details of a calculation made to show what can be done in the utilisation in brick-driers of the waste-heat from cooling kilns. The calculation is divided into the following sections:—(1) Heat consumption; (a) evaporation of water; (b) heat carried out by clay in the bricks; (c) heat carried out by the iron brick-cars; (d) radiation from exterior of drier. (2) Volume of hot air required. (3) Heat-loss, i.e., heat carried away by air. (4) Available heat.—A. S.

*Clays; Note on the Tensile Strength of Raw —* H. Ries. *Trans. Amer. Ceramic Soc.*, 1904, **6**, 79—82.

WITH a view to determining whether the tensile strength of air-dried clays is influenced by interlocking of the grains, the author examined five samples of clay of varying strengths. The results are shown in the following table:—

Constituents of Clay.	Percentages.				
	1.	2.	3.	4.	5.
Clay substance, 0.005—0.0001 mm. diam. ....	87.96	30.645	22.00	44.00	59.00
Fine silt, 0.005—0.01 mm. diam. ....	6.95	14.21	5.66	7.11	11.00
Silt and fine sand, 0.01—0.25 mm. diam. ....	3.00	5.585	26.55	24.35	14.70
Medium sand, 0.25—0.5 mm. diam. ....	1.00	6.400	11.45	7.80	3.50
Sand, 0.5—1 mm. diam. ....	—	42.95	33.44	16.35	11.40
Totals .....	98.91	99.79	99.10	99.61	99.60
Average tensile strength, lb. per sq. in. ....	20	105	289	297	453

sulphates of aluminium, manganese and iron, 0.25; and silica, 0.04 per cent.; total 30.08 per cent. of soluble matter. On heating the evaporation residue to the temperature of Seger cone 3, it was found that 8 per cent. of it volatilised within a few minutes, so that the injury was evidently produced by the volatilisation of sodium sulphate in the kiln. The broken firebrick had apparently been used in some chemical works, and there become impregnated with the sodium salt.—C. S.

They indicate that an excessive amount of clay particles weakens the strength of the clay in the same manner as a large amount of "sand." Those clays will give the best results, which contain a mixture of grains of several sizes, with the clay substance preponderating. In accordance with this theory of interlocking grains, it was found possible to prepare from two different clays a mixture having a tensile strength higher than that of either of the clays alone. The author considers that it



incorrect to use the tensile strength as a measure of the plasticity of clays.—A. S.

*Hydraulic Lime: Production and Application of Bagged* — E. Pasquay. *Tonind. Zeit.*, 1904, 28, 1688–1689.

In burning this lime, preference should be given to right kilns, the product possessing superior hydraulic properties to that burned in "ring" kilns. The quicklime is slaked with 12–14 per cent. (volume) of water soon as drawn from the kiln, and is piled in heaps about 8 feet high for a fortnight. If the slaking period is reduced, the quality can be improved by storing for 4 weeks in silos. If ground and "bagged" without kilning, the expansion in damp weather will burst the bags, and the mortar made from such lime will not harden properly. After screening, the lumps are ground and mixed with the screened powder, and, indeed, these lumps greatly improve the hydraulic and binding properties of the lime. They contain, on the average, about 10 per cent. of aluminium silicate and 50 per cent. of lime. The ground lime should be again stored in silos or dry storehouses for some time before bagging. In use, the bagged lime is mixed dry with the sand, and then worked up with the necessary amount of water. Mixing is best performed a little time before the mortar is needed, the plasticity of the mortar being thereby improved. This lime is superior to that slaked in pits, inasmuch as it hardens sooner, taking only 30–36 hours to set, and there is no trouble arising from the presence of unslaked lumps. The mortar has double the tensile strength of that from unslaked lime, the preparation takes less time, and the operation of producing a uniform mortar is readily superceded. Though the first cost is somewhat higher, the author's experiments prove that the ultimate cost of the mortar is about 5 per cent. cheaper, whilst the tensile strength of the mortar from 1 part of lime and 2 of sand is about 5.06 kilos. per sq. cm., as compared with 2.20 kilos. in the case of pit-slaked lime; and with 3 parts of sand to 1 of lime the relative strengths are 3 kilos. and 0.6 kilos respectively per sq. cm.—C. S.

*Blast-Furnace Slag: Granulated* — H. Seger and E. Cramer. *Tonind.-Zeit.*, 1904, 28, 1687.

In contrast to the general assumption among makers of "iron" Portland cement, that the blast-furnace slag is of constant composition, two samples, one white, the other yellowish, recently examined by the authors, gave the following results, the figures in brackets relating to the yellow slag:—Insoluble matter, 3.95 per cent. (1.25 per cent.); containing silica, 3.45 per cent. (0.3 per cent.); and  $R_2O_3$ , 0.45 per cent. (0.32 per cent.). The soluble matter consisted of silica, 29.87 per cent. (35.12 per cent.); alumina, 12.72 per cent. (10.29 per cent.); iron oxide, 0.82 per cent. (0.76 per cent.); lime, 46.88 per cent. (47.25 per cent.); magnesia, 2.85 per cent. (2.83 per cent.); sulphur trioxide, trace (0.12 per cent.); sulphur, 0.4 per cent. (2.49 per cent.); loss on calcination, 1.89 per cent. (1.23 per cent.). The chief differences are in the proportions of soluble silica and of alumina, both samples being characterised by a relatively high content of sulphide sulphur.—C. S.

*Portland Cement: Influence of Ground Ores on the Crushing Strength of* — H. Seger and E. Cramer. *Tonind.-Zeit.*, 1904, 28, 1662–1663.

From the results of the tests made by the authors it would seem that the practice of adding iron filings or ground ores to cement paving to diminish wear caused by traffic, is less advantageous than the use of an equal amount of ground sand. The crushing strength of a mixture of 1 part of Portland cement and 3 parts of sand was found to be average 315.7 kilos. per sq. cm. Replacing 0.25 part of the sand by ground ore raised the figures to 394.5 kilos. per sq. cm. by substituting ground sand for the ore, the strength was increased to 487.0 kilos. per sq. cm. Similarly, in abrasion tests after storing in water for a month, the ground sand mixture gave the best results, the loss in

weight being only 13 grms., as compared with 16 grms. in the ore mixture and 18 grms. with pit-slag.—C. S.

*Cement: Notes on* — A. V. Bleining. *Trans. Amer. Ceramic Soc.*, 1904, 6, 150–166.

*Limits of Free Silica and Calcium Oxide allowable in Portland Cements manufactured by the Dry Grinding Process.* Experiments were made with cement mixtures consisting of varying proportions of kaolin, potters' flint and whiting, together with so much red Clinton iron ore that the cements in all cases contained about 3 per cent. of ferric oxide. It was found that the ratios of combined to free silica and of silica to alumina are of great importance. The best results are obtained when the ratio of combined to free silica is 1:2.56, and of silica to alumina 3:1. The most satisfactory ratio of lime to silica depends largely upon the fineness of grinding, but, in general, the best results are obtained with dry-ground mixtures having a silica to alumina ratio of 3:1, when the formula  $(2.8CaO.SiO_2)(2CaO.Al_2O_3)$  is adhered to. These results were confirmed by tests made with a silicious clay and a hard limestone occurring in Ohio (see following table):

Formula.	Tensile Strength 1:3; 28 days.	Boiling Test.
	lb. per sq. in.	
(2.9 CaO, SiO <sub>2</sub> ) (2 CaO, Al <sub>2</sub> O <sub>3</sub> )	290	Good.
(2.8 CaO, SiO <sub>2</sub> ) (2 CaO, Al <sub>2</sub> O <sub>3</sub> )	360	Good.
(2.7 CaO, SiO <sub>2</sub> ) (2 CaO, Al <sub>2</sub> O <sub>3</sub> )	190	Good, but off glass.

*Effect of Calcium Hydroxide on Natural Cements.*—The author examined the effect of adding 5 per cent. of dry slaked lime to four different specimens of ground natural cement, prepared by burning the natural cement rock till practically all carbon dioxide was expelled. It was found that the addition caused an increase in the tensile strength of the cement of from 44.4 to 170 per cent. Experiments with natural cement mortars, to which varying amounts of lime paste were added, gave the following results:—

Composition of Mixture.	Tensile Strength after 26 weeks; 1:2	Gain in Tensile Strength
	lb. per sq. in.	Per cent.
Natural cement	292	
96% cement + 4% lime	335	14.7
92% cement + 8% lime	325	11.4
90% cement + 10% lime	325	11.4
85% cement + 15% lime	322	10.4
80% cement + 20% lime	357	22.3
75% cement + 25% lime	304	4.1

It appears, therefore, that the addition of dried calcium hydroxide during the grinding of the natural cement gives the best results. (See also this J., 1903, 1048.)—A. S.

*Concrete: Impermeability of* — to Water. Feret. *Tonind.-Zeit.*, 1904, 28, 1578; *Chem.-Zeit.*, 1905, 29, Rep. 8.

The author finds that the permeability of concrete to water varies inversely with the proportion of cement in the mixture, and the fineness of the cement particles present. Furthermore, the permeability is reduced to a minimum when the coarse and fine particles are in equal quantity, with a moderate proportion of medium particles; it is also rapidly lowered when salt or fresh water is allowed to circulate freely in the concrete. In some cases it was ascertained that the water penetrating the mass, dissolves out lime, which is reprecipitated near the surface and thus closes up the pores; and on this basis, experiments were successfully made in rendering concrete impermeable by treatment with slaked lime. Sodium silicate, soap and alum are also recommended, but the best method is to plaster the concrete with rich cement mortar.—C. S.

## ENGLISH PATENTS.

*Fireproof Coatings.* F. A. Eymer and Eymer Ges. m.b.H., Frankfurt-on-Maine, Germany. Eng. Pat. 1400, Jan. 19, 1904.

SEE Fr. Pat. 339,641 of 1904; this J., 1904, 715.—T. F. B.

*Fire-proof, Acid-proof and Electrically Insulating Material; Improved* ——. U. A. Marga, Dieghem, Belgium. Eng. Pat. 25,128, Nov. 18, 1904.

THE material, called "Refragor," is made by mixing ten parts of previously ignited asbestos with 1 part of litharge or lead dioxide, manganese dioxide or other oxides, and 3 parts of linseed or other oil. A paste is produced which can be moulded: this is allowed to cool, and after it has become harder through the continued oxidation of the oil, a solvent such as alcohol or ether, or a mixture of the two, is added in sufficient quantity to make the material moist enough to be worked. The mixture is then forced by pressure or rolling into a metallic cloth. The oxidation of the oil is quickened by adding cellulose to the mixture and then submitting the objects manufactured to a high temperature. To make them more acid-proof they are dipped into dilute sulphuric acid; or else the linseed oil may be heated to about "250°" and the necessary quantity of oxidising material added.—A. G. L.

*Fireproof Sheet [Asbestos, &c.]; Manufacture of Fibrous* ——. J. B. Watson, Shorne. Eng. Pat. 25,702, Nov. 25, 1904.

THE fibre-cement, asbestos, or other pulp is supplied to a service-box, in which it is kept from settling, and which discharges it by means of a channel and apron in regulated width and depth on to a wire sheet travelling over a wire cloth drum or drums serving to drain the water from the pulp, which is squeezed between the wire drum and a felt-covered couch roll or rolls. The film formed, is picked up by the felt and passed on to a collecting drum; it is then wound around this drum and compressed together with the preceding layers between the drum and a roll supporting the drum so as to consolidate the successive film layers into a film sheet until the desired thickness of sheet is attained, after which the sheet produced is severed and unrolled from the drum. Adhesion between the successive layers wound on the drum may be caused by placing cementitious matter between the layers. Wire cloth may also be fed on to the drum together with the fibrous layers, and incorporated with them.

The machinery for carrying out the above operations is also claimed.—A. G. L.

*Refractory Material; Products of Silica as a* ——. L. Williams and H. Tomkins, Stockton-on-Tees. Eng. Pat. 4433, Feb. 23, 1904.

As a binding material for silicious bricks, blocks, ganister and the like for metallurgical purposes, in place of lime, the inventors propose some compound of magnesium; either raw magnesite (magnesium carbonate), which may be mixed with water to form a "milk," or calcined magnesite, which, with water, forms magnesium hydroxide. It is said that the binding power is equal to that of lime, 3 per cent. of raw or calcined magnesite being capable of binding 97 per cent. of silicious material containing the highest known percentage of silica, and the magnesite having much less tendency than lime to flux the silica at high temperatures, risk of fusion is thus decreased.—W. C. H.

*Kilns for Burning Bricks, Tiles and other Clay Goods, and Lime and Cement; also for Burning Sanitary Ware and for Salt Glazing.* F. J. R. Lee, Cardiff. Eng. Pat. 27,834, Dec. 19, 1904.

EACH kiln of a series is connected with one or more double flues, having openings between each of the two sections, as well as shafts or connections between each of these sections and the interior of each kiln. By means of flues with controlling dampers, &c., the heat given off in any kiln may be conducted to any other, not

necessarily adjacent to it, and utilised for the drying of "green" goods.—A. G. L.

*Blast Furnace Slag; Utilisation of — and Similar Materials.* T. Twynam, Leeds. Eng. Pat. 4557, Feb. 24, 1904.

FINELY-GROUND slag is moistened with water and the pressed or moulded into bricks, &c. These, together with the moulds, are then stacked in a chamber kept at about 100° C., and subjected at this temperature to the action of gases containing carbon dioxide, such as exhaust gas from gas engines, until thoroughly hardened, 24 hours being usually sufficient. Solid lumps or chippings may also be mixed with the powder before moulding. It is convenient to employ a tunnel-shaped chamber, through which trucks laden with the bricks, &c., travel slowly.—A. G. L.

## UNITED STATES PATENTS.

*Wood; Process of Fireproofing* ——. G. Blenio, New York. U.S. Pat. 779,761, Jan. 10, 1905.

THE wood is first steamed, and then, after being dried, soaked in a hot solution of ammonium phosphate and starch.—A. S.

*Clay; Process of Treating* ——. D. B. Williams, Connelville Pa., Assignor to J. R. Stauffer, Scottsdale Pa. U.S. Pat. 779,195, Jan. 3, 1905.

CLAY is moulded and dried, and then embedded in amorphous coke within a closed chamber. The whole is then surrounded by fuel-coke, which is fired, so as to bring the confined amorphous coke to an incandescent condition in which it is maintained until the clay has hardened.—A. G. L.

*Clay Product and Process therefor.* D. B. Williams, Assignor to J. R. Stauffer, Scottsdale, Pa. U.S. Pat. 779,196, Jan. 3, 1905.

AN abrasive product is made by mixing untreated clay material with previously hardened, crushed abrasive material, or with "carbo clay," moulding and drying the mixture and then subjecting the dry form to the action of the gas from an incandescent body of carbon, well sealed from extraneous sources of oxygen. (See preceding patent).—A. G. L.

*Rotary Cement-Kiln.* G. H. Sharp, Jonesville, Mich. U.S. Pat. 778,611, Dec. 27, 1904.

THE kiln consists of an outer casing, provided with inwardly-projecting shelving, the end of which is turned up at right angles, and means for rotating the casing. Concentric cylinders are arranged within, and secured to the outer casing, and are provided with inwardly and outwardly projecting shelving, and with retaining rings at their ends. A feed-pipe with perforations extends into the ends of the cylinders and the casing, to supply material separately to each.—W. C. H.

## FRENCH PATENT.

*Cement-Kiln; Rotary — Heated by Water-Gas.* E. Gobbe. Fr. Pat. 346,383, Sept. 20, 1904.

THE rotary kiln is furnished with a gas-generator placed so as to receive the burnt clinker, to which carbon in regulated quantity is added from a hopper placed above the generator; this carbon is gassed by a suitable mixture of air and steam blown into the generator, the heat of the burnt clinker being utilised for this operation. The ash-pit of the generator is placed below the entry holes for the air, and extends straight downwards so as to enable the generator to be worked without closing the ash-pit, thus rendering it possible to withdraw the cement continuously from the latter. The air blown into the generator is pre-heated by passing between the double walls of the kiln proper, and the air needed for the actual combustion, which is introduced at intervals along the kiln, is heated in the same manner. Partitions provided with openings are placed inside the kiln to assist in retaining the heat and to prevent too rapid passage of the gases through the kiln.—A. G. L.



## X.—METALLURGY.

*Gold Milling; Use of Electro-plated Copper Plates in the Battery in* — F. W. Cindell. *J. Chem., Metall. and Mining Soc. of S. Africa*, 1904, 5, 92—95.

The author approves the use of a copper plate within the mortar, mercury being fed in at intervals, and of several rows of electro-silver-plated copper plates outside, two ounces of silver per sq. ft. being recommended. At the Homestake Mine in June, 1902, of the total amalgam obtained, 35 per cent. was caught in the mortar box, 40 per cent. on the first row of plates, 13 per cent. on the second row, 7 per cent. on the third row, and 6 per cent. on the fourth row; the gold obtained from the amalgam from the mortar box was 820 fine, that from the first row 810, second row 556, third row 550, fourth row 495. In the 200-stamp mill there are in all 160 plates, the total amalgamated surface of which is 8640 sq. ft. The ore treated contained roughly 6 per cent. of pyrites, and 55 per cent. of silica, the remainder being hornblende and argillaceous schist or slate. The ore is very finely crushed, so that 78 per cent. passes a 10,000 mesh screen.

In the discussion, which followed the reading of the paper, most of the speakers agreed with the author that fine crushing and large amalgamating areas were to be recommended, especially now that the effective cyaniding of slimes was possible, also that it was advantageous to use shaking plates. One speaker thought that when the mill water was acid, amalgamated copper plates were better than electro-silvered plates.—J. H. C.

*Gold Bullion; Notes on* — A. C. Claudet. *Inst. of Mining and Metall., Bull. No. 4*, Jan. 12, 1905.

VITH reference to the author's previous note (this J., 1904, 1149), details of the cost of "toughening" gold bullion in England are given as follows:—

Coarse bullion treated .....	2830 oz. troy.
Saltpetre used, 33lb. at 2d. per lb. ....	66d.
Gas coke used, 112 lb. at 3d. per ton ..	22d.
One man, 8 hours at 1s. per hour .....	96d.
One crucible (Creusot de Paris, No. 21) ..	24d.

Total cost on 2830 oz. of coarse bullion = 208d. = 17s. 4d.

	Gold.	Silver.
Before treatment .....	581 ..	116 per 1000
After .....	756 ..	136 .. "

Thus if colonial costs were double those obtaining in England, the cost of toughening would be about  $\frac{1}{4}$ d. per oz. of fine gold. The slags are re-melted when 10,000 ozs. have been accumulated; any gold present is in the form of pellets, and there is no real loss throughout the process. —A. S.

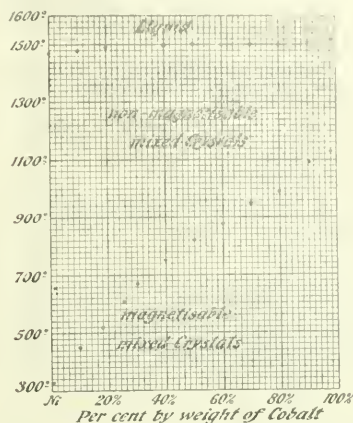
*Chromium; New Method of Preparing Metallic* — C. Goldschmidt. *Chem.-Zeit.*, 1905, 29, 56.

METALLIC chromium can be separated from solutions of its salts by contact with metallic zinc or its alloys. Thus if a solution of chromium nitrate be allowed to stand in the cold in a zinc vessel, chromium is deposited partly in the amorphous and partly in the crystalline form, in the course of a day. The chromium hydroxide simultaneously deposited can be removed by treatment with alkali in excess. The best results are obtained with crystalline chromium nitrate, other chromium salts not being so suitable for the purpose.—C. A. M.

*Cobalt and Nickel; Alloys of* — W. Guertler and G. Tammann. *Z. anorg. Chem.*, 1904, 42, 353—361.

The authors determined the melting-point curves of cobalt-nickel alloys, and also the temperatures at which such alloys are transformed from the magnetisable into the non-magnetisable condition. The results are shown in the curve diagram (see figure). In this diagram the melting-point curve separates the field corresponding to the molten metal from that corresponding to the non-magnetisable crystals, and the transformation-curve divides the field of the non-magnetisable from that of the magnetisable crystals. At all temperatures between the melting-point

of pure nickel, 1484° C., and that of cobalt, 1528° C., the fused alloy is in equilibrium with mixed crystals of approximately the same composition. At temperatures on the



transformation, curve the magnetisable mixed crystals are in equilibrium with the non-magnetisable crystals.

—A. S.

*Zinc-Antimony Alloys.* K. Mönkemeyer. *Z. anorg. Chem.*, 1905, 43, 182—196.

THE author determined the melting-point curve of zinc-antimony alloys, and also the time occupied from the beginning to the end of the eutectic crystallisations and polymorphous transformations. The melting-point curve has two maxima, C and E (see table), and three eutectic points, B, D and F. The composition of the alloys corresponding to these points is given in the following table:—

[Composition in Parts per cent. by weight.		Constituents.	Melting Point.
			° C.
A	100% Zn	Zn	419
B	97.5% Zn + 2.5% Sb	Zn + Zn <sub>3</sub> Sb <sub>2</sub>	411
C	44.96% Zn + 55.04% Sb	Zn <sub>3</sub> Sb <sub>2</sub>	561
D	37.5% Zn + 62.5% Sb	Zn <sub>3</sub> Sb <sub>2</sub> + ZnSb	539
E	35.48% Zn + 64.52% Sb	ZnSb	544
F	21% Zn + 79% Sb	ZnSb + Sb	607
G	100% Sb	Sb	631

The micro-structure of the alloys was in agreement with the existence of the two compounds Zn<sub>3</sub>Sb<sub>2</sub> and ZnSb.

—A. S.

*Metals; Microscopic Examination of* — J. H. B. Jenkins and D. G. Kiddick. *Analyst*, 1905, 30, 2—13.

THE paper deals mainly with the preparation, mounting and microscopic examination of sections of mild steel. It is accompanied by 10 plates, containing 41 micro-photographs.—A. S.

*Gold Assaying; Note on the Influence of Fine-crushing on the Assay Value.* A. Whitby. *XXIII*, page 153.

*Manganese Sulphide; Determination of* — in *Manganese Ores containing Barium*. L. Blum. *XXIII*, page 153.

## FRENCH PATENTS.

*Steel; Manufacture of* — C. Cammell and Co., Ltd., J. E. Fletcher and W. B. Hamilton, Sheffield. *Eug. Pat.* 25,491, Dec. 28, 1903.

THE iron is melted in an open-hearth furnace, partly by the waste heat from a connected converter, and partly by

the combustion of gas led into the furnace together with air, which may be heated by regenerative chambers through which the final waste gases are passed on their way to the chimney. The open-hearth furnace, as shown, is mounted for tilting, so that its charge, when molten, may be run into the converter, the position of which can also be adjust d.—E. S.

*Steel; Toughening and Hardening* — T. H. Gannon, Rochdale, and W. H. Phillips, Oldham. Eng. Pat. 28,736, Dec. 31, 1903.

STEEL, heated to from 921° F. to 1200° F., is plunged into a bath consisting of a solution of about 9 parts of nickel-ammonium sulphate (or other suitable nickel salt) in 100 parts of boiling water.—E. S.

*Cupolas or Kilns, applicable for Treating Materials used in the Production of Basic Linings for Converters and Furnaces, and for like purposes.* J. W. Mackenzie, London. From H. Fas, Paris. Eng. Pat. 28,602, Dec. 29, 1903.

THE apparatus described is designed to secure continuous or practically continuous working. A hearth-plate forms the bottom of the kiln. The cupola or kiln is supported by means of brackets on its exterior, which rest upon girders, and a clear opening is left all round between the hearth-plate and the wall of the cupola for the required height. The lower part of the cupola, in the case of a blast being used, and also the hearth-plate, are enclosed within a chamber which excludes the outer air. A hoe-shaped pusher-bar is caused to travel hoe-wise, and continuously but slowly, to-and-fro along the plate, pushing the material off the plate first on one side and then on the other, and allowing the material above to descend. The material pushed off, falls on an inclined plate and thence on a continuous conveyor, by which it is conveyed to a hopper forming part of the enclosed chamber, or, in the case of a kiln into which a blast is not blown, into any convenient place. The bottom of the hopper is fitted with a door which is opened from time to time to discharge a large quantity of material in an extremely short time, during which the blast may be shut off without substantially affecting the working of the kiln, although it will probably be found unnecessary to shut off the blast during this short time. The air may be forced into the chamber and pass from thence through openings immediately above the hearth instead of through tuyères.—A. G. L.

*Blast Furnace Slag and similar Materials; Utilisation of* — T. Twynam. Eng. Pat. 4557, Feb. 24, 1904. IX., page 136.

*Air; Appliances for Extracting Moisture from —, and Feeding such Air to Blast or other Furnaces or Converters, or for other Purposes.* J. Gayley, New York. Eng. Pat. 13,892, June 20, 1904.

SEE Fr. Pat. 314,399 of 1901; this J., 1901, 1095.—T. F. B.

#### UNITED STATES PATENTS.

*Tool-Steel; Manufacture of* — J. A. Matthews, Syracuse, N.Y., Assignor to Crucible Steel Co. of America, N.J. U.S. Pat. 779,171, Jan. 3, 1905.

THE claim is for high-speed steel containing less than 1 per cent. of carbon, more than 6 per cent. of molybdenum, and from 0.10 to 1 per cent. of vanadium.—J. H. C.

*Smelting Ore; Method of* — J. Gayley, New York. U.S. Pat. 779,037, Jan. 3, 1905.

THE blast employed is thoroughly dried, whereby the amount of fuel required is materially lessened.—J. H. C.

*Smelting Furnace.* A. E. Manchester, Newburgh, N.Y. U.S. Pat. 779,953, Jan. 10, 1905.

THE furnace is attached to a forehearth by an interposed cut-off valve, comprising two longitudinal members, having an open portion and a closed portion, and means being provided for securing the open portion or the closed portion of each member to its respective furnace or forehearth, as well as for securing the two together.—E. S.

*Furnace [for Roasting Ores]; Rotary* — H. C. Davey, San José, Cal. U.S. Pat. 779,119, Jan. 3, 1905.

THE furnace consists of a series of inclined revolving cylinders each having a conical receiving end forming substantially a close joint with the masonry in which it turns; an enlarged head rigid with the discharge end of the revolving cylinder and provided with an outwardly extending annular flange; a stationary head abutting on the head of the cylinder and having an annular channelled interior at one end to receive the said flange and a delivery shoot; a furnace near to the stationary head which delivers the products of combustion thereinto and into the cylinder; an open receiver in communication with the delivery shoot of the stationary head and with the conical inlet of the succeeding cylinder, all in combination as described. Thrust-bearings, consisting of annular bevelled rings on the cylinder and corresponding bevelled pinions journaled at right angles with the cylinder axis, are provided to maintain the joint between the conical inlet and the masonry.—J. H. C.

*Ore Briquettes; Furnace for Burning* — G. Gröndal, Djursholm, Sweden. U.S. Pat. 780,337, Jan. 17, 1905.

SEE Eng. Pat. 23,764 of 1903; this J., 1904, 118.—T. F. B.

*Metallic Compounds; Recovering — from Solutions.* S. W. Vaughn, Lorain, Ohio, and J. W. Cabot, Johnstown, Pa. U.S. Pat. 779,058, Jan. 3, 1905.

THE metals are treated with a solution of an "iron cyanide of an alkali," whereby they are precipitated as "iron cyanides," which by subsequent treatment with caustic alkali are converted into oxyhydrates, alkali iron cyanides being at the same time reformed for subsequent use. Any excess of precipitant left in the original solution is separated by means of a soluble zinc salt.—J. H. C.

*Metal Values [Copper]; Recovering — from Slag and Mine-Waters.* R. Baggeley, Pittsburg, Pa. U.S. Pat. 779,252, Jan. 3, 1905.

WATERS containing copper are made to drop through successive vessels containing iron or comminuted smelter slag.—J. H. C.

*Metals [Iron and Zinc]; Obtaining — from their Ores.* S. Peacock, Chicago, Ill. U.S. Pat. 779,310, Jan. 3, 1905.

ORES containing iron and zinc are pulverised and then roasted at such a temperature as will reduce the iron but not the zinc. The mass is cooled in a reducing atmosphere, the iron separated out, and the zinc is subsequently reduced in the usual manner.—J. H. C.

*Zinc or other Sulphides; Apparatus for Recovering — from their Ores.* J. H. Gillies, Melbourne. U.S. Pat. 780,281, Jan. 17, 1905.

SEE Eng. Pat. 20,159 of 1904; this J., 1904, 1150.—T. F. B.

*Mineral Wool; Manufacture of* — T. B. Parkison, Muncie, Ind. U.S. Pat. 779,307, Jan. 3, 1905.

THE molten slag is projected through smoke and steam.—J. H. C.

#### FRENCH PATENT.

*Metals; Apparatus for Determining the Temperature of Heated and Fused* — Soc. Schneider et Cie. Fr. Pat. 339,206, Dec. 4, 1903.

THE method is based on the fact that metals when heated acquire different tints at definite temperatures. It consists in comparing the tint of the heated or fused metal with that of one of a series of coloured transparent discs (e.g., water-shaped coloured pieces of glass). The apparatus, in one of its forms, is a telescopic tube having at one end an incandescent lamp, and at the other end an eye-piece for observation, whilst midway between the ends provision is made for the insertion of a frame (circular, or a long strip) carrying at regular distances the series of coloured discs, adjustments being provided whereby any one of the discs may be brought into the field.—E. S.



## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A).—ELECTRO-CHEMISTRY.

*Alternating Current; Electrolysis with* ——. C. Rossi. *L'Ind. Chimica*, 1904, 6, 333—335. *Chem. Centr.*, 1905, 1, 61.

THE reactions which take place when potassium chlorate solutions rendered faintly acid with sulphuric acid are electrolysed between copper electrodes with alternating current, are very complicated. The copper electrodes become coated with cuprous chloride; the solution contains chlorine and copper. Bluish-green basic copper chlorate,  $\text{Cu}(\text{ClO}_3)_2 \cdot 3\text{Cu}(\text{OH})_2$ , separates from the solution at the electrodes and on the bottom of the containing vessel. With direct current, cuprous chloride is formed at the anode, together with some basic chlorate and chloride, whilst a mixture of cupric hydroxide, copper, cupric oxide and cupric chloride separates from the electrolyte; the solution contains no copper, but only potassium chlorate and chloride. The copper goes into solution in the form of cuprous ions, reduces the chlorate, and is precipitated by the potassium hydroxide formed at the cathode. Similar results are produced with iron electrodes.—A. S.

*Cadmium Amalgam Lamp of Quartz*. O. Lummer and E. Gebrecke. *Z. Instrumentenkunde*, 1904, 24, 298. *Chem. News*, 1905, 91, 27—28.

THE vacuum arc lamp filled with cadmium amalgam described by Gumlich in 1897 (*Z. Instrumentenkunde*, 1897, 17, 161) was, for many purposes, superior to the mercury lamp, but it was never a real success on account of its short life. By using fused quartz, the authors have succeeded, however, in constructing a cadmium amalgam lamp capable of continued use. The lamp is of the form (compare this J., 1904, 246), and is filled with an amalgam containing 14 grms. of cadmium per 100 grms. of mercury. After being used for some time, it showed signs of deterioration, but when re-exhausted, and then again started, it acted as well as at first.—A. S.

*Antimony and Tin: Electrolytic Determination and Separation of* — from Solutions of their Sulpho-salts, together with a Study of the Determination of Antimony by the Trisulphide Method. A. Fischer. XXIII., page 153.

### ENGLISH PATENTS.

*Zinc Blende and other Substances containing Zinc; Treating* ——. W. Simm and H. Simm, Prescott, Lancs., R. Storey, Llandudno, and J. S. Sellers, Liverpool. Eng. Pat. 4058, Feb. 18, 1904.

THE ore is heated in an electric furnace of the type described in the next abstract, into which air is subsequently admitted. The zinc oxide produced is condensed and the sulphur dioxide or other gases utilised.—R. S. H.

*Electric Furnaces*. W. Simm and H. Simm, Prescott, Lancs., R. Storey, Llandudno, and J. S. Sellers, Liverpool. Eng. Pat. 4059, Feb. 18, 1904.

AN electric resistance furnace is constructed with three or more cross-bars of carbon, connected alternately in parallel. The spaces between the bars are filled with a mixture of ground silica and carbon which serves as the resistance.—R. S. H.

*Galvanic Cell [Electrodes for]* ——. R. Ziegenberg, Berlin. Eng. Pat. 19,266, Sept. 6, 1904.

SEE Fr. Pat. 346,104 of 1904; this J., 1905, 95.—T. F. B.

*Fire-proof, Acid-proof and Electrically Insulating Material; Improved* ——. U. A. Marga. Eng. Pat. 25,128, Nov. 18, 1904. IX., page 136.

### UNITED STATES PATENTS.

*Battery; Galvanic* ——. C. J. Reed, Philadelphia, Pa., Assignor to Security Investment Co., Pennsylvania. U.S. Pat. 778,893, Jan. 3, 1905.

THE invention comprises a receptacle containing a solution of one or more ferrous salts, such as the sulphate, with an iron electrode in the solution, and a solution of one or more ferric salts, such as the sulphate, with an electro-negative carbon electrode in the solution. The two liquids are separated by a partition having "a high degree of porosity for preventing rapid mixing of the two solutions."—B. N.

*Spongy Lead for Secondary Battery Electrodes; Process of Making* ——. C. J. Reed, Philadelphia, Pa., Assignor to Security Investment Co., Pennsylvania. U.S. Pat. 778,894, Jan. 3, 1905.

ONE or more compounds of lead, such as the oxides, are mixed with finely-divided zinc or zinc dust in chemically equivalent proportions, and the mixture is subjected to the action of a liquid, such as zinc chloride, so as to form metallic lead and a soluble zinc salt, which is then washed out. The mixture, before treatment, may be applied as a coating to a lead plate, or as a filling in openings in a lead plate or frame, and may be previously mixed with an inert soluble granular material, which is washed out with the zinc salt.—B. N.

*Storage-Battery Plates; Protective Covering for* ——. A. Meygret, Paris. U.S. Pat. 779,553, Jan. 10, 1905.

THE battery-plate consists of a retaining base, or metal body, with active material applied to it. The plate is dipped into a solution of soluble material so as to form a soluble film on the exterior face of the active material, and the plate and film are then dipped into a solution furnishing a protective coating, so that the soluble film is interposed between the active material and the covering.—B. N.

*Electrode*. E. F. Price, Assignor to Union Carbide Co., Niagara Falls. U.S. Pat., 779,733, Jan. 10, 1905.

THE electrode consists of calcium carbide and a carbon binder containing coked bituminous coal and a liquid hydrocarbon.—B. N.

*Electrolysis [Apparatus for]* ——. G. Rambaldini, Miniera di Boccheggiano, Italy. U.S. Pat. 779,735, Jan. 10, 1905.

SEE Eng. Pat. 2376 of 1902; this J., 1903, 216.—T. F. B.

*Electrolytic Apparatus and Process [Alkali Manufacture]*. C. P. Townsend, Washington. U.S. Pat. 779,383 and 779,384, Jan. 3, 1905.

SEE Fr. Pat. 345,871 of 1904; this J., 1905, 33.—T. F. B.

*Chromate of Soda; Method of Treating Alkaline Solutions of* ——. W. T. Gibbs, Assignor to the National Electrolytic Co., N.J. U.S. Pat. 779,705, Jan. 10, 1905. VII., page 132.

### FRENCH PATENT.

*Electrodes for Accumulators*. E. W. Jungner. Fr. Pat. 346,380, Sept. 20, 1904. Under Internat. Conv., Oct. 7, 1903.

SEE Eng. Pat. 21,402 of 1904; this J., 1905, 94.—T. F. B.

### (B).—ELECTRO-METALLURGY.

*Iron and Steel Manufacture; Electric Processes for* ——. Electrochem. Ind. Harbord and Haanel, 1904. 479—486.

AN abstract of portions of the Report of the Canadian Commission appointed to investigate electric processes in use in Europe for iron and steel manufacture. Mr. Harbord was appointed Chemist to the Commission, and his conclusions are:—1. Steel equal to the best

Sheffield crucible steel can be produced at considerably less cost by the Kjellin, Heroult, or Keller process. 2. Electric furnaces can only produce commercially high-class steels for special purposes, and cannot compete with the Siemens or Bessemer processes for producing structural steel. 3. In the electric smelting furnaces, the reactions involved in the reduction of iron and its combination with silicon, sulphur, phosphorus and manganese, are similar to those in the blast-furnace. Any grade of white or grey iron can be produced by altering the burden and regulating the temperature, and these changes can be effected much more rapidly than in the blast-furnace. 4. Grey pig iron suitable for the acid Bessemer or Siemens process, can be produced in the electric furnace. 5. Pig iron low in silicon and sulphur, for the basic Bessemer or Siemens process, can be produced if the ore mixture contain oxide of manganese, and a basic slag is maintained by suitable additions of lime. 6. Pig iron can be produced at a cost to compete with the blast-furnace only where electric energy is cheap and fuel dear. With electric energy at £2 per E.H.P. year, and coke at 28s. per ton, the cost of production either way is about the same. 7. Where blast-furnaces are established, electric smelting cannot compete, but where ample water-power is available and coke not readily obtainable, it may be commercially successful.

Haanel augurs a hopeful future for electric smelting, when it has been developed, on a basis of further practical experiment in specially and adequately designed furnaces. In many places electric energy will be available at much lower cost than 40s. per E.H.P. year, and if it be combined with the use of peat-coke or briquetted charcoal made from mill refuse, the cost of these may be reduced to half of that taken as a basis in the report. The temperature attainable in the electric furnace being so high and so easily regulated, the process may probably be applied with advantage to the smelting of other ores besides those of iron, especially those which have hitherto proved refractory.—J. T. D.

*Iron: New Method for the Preparation of Electrolytic* — S. Maximowitsch. Z. Elektrochem., 1905, 11, 52—53.

ELECTRO-DEPOSITED iron is usually very hard, but exceedingly brittle, which property is ascribed to the occluded hydrogen. The author finds that using an electrolyte containing ferrous bicarbonate in which the concentration of hydrogen ions is very low, a much softer and more satisfactory deposit can be obtained. The bath is prepared by adding sodium bicarbonate, at intervals, to the solution of ferrous and magnesium sulphates. The iron only attains its best condition after the bath has been in use for several weeks.—R. S. H.

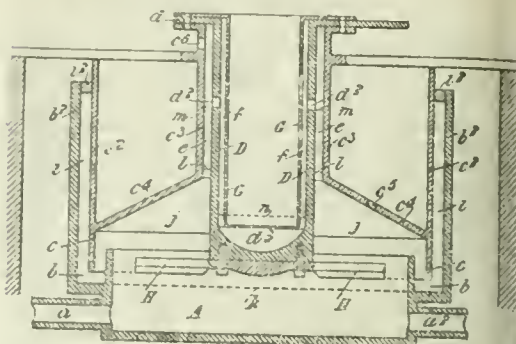
*Tantalum: its Preparation and Properties.* W. von Bolton. Z. Elektrochem., 1905, 11, 45—51.

VANADIUM, niobium and tantalum have been prepared by passing an electric current through rods of some coloured oxide of these metals (in the last two cases the tetroxide) when supported in a vacuum, which is maintained in order to pump off the oxygen set free at a high temperature. By this method, coherent rods of the metal are obtained. Tantalum is also prepared in larger masses by the method of Berzelius and Rose (action of alkali metals on the alkali-tantalum fluorides), and subsequent fusion of the metal powders thus obtained with the electric arc. The melting point of the metal lies between 2250° and 2300° C.; it is very ductile, and can be drawn to wire of 0.03 mm. diam., but possesses the remarkable property of becoming extremely hard after hammering. So hard is the metal, that it is practically impossible to bore it even with a diamond point, and it is hoped to employ it for machine tools. In chemical properties tantalum approaches the noble metals. It is intended to make use of tantalum in the form of wire for the filaments of incandescent electric lamps. Such lamps only absorb about 1.5 watts per candle, as against the 3.5 watts of the carbon filament; 0.5 cm. of the 0.05 mm. wire are required for a 110-volt lamp. The efficient life of these lamps is 400—600 hours.

—R. S. H.

# ENGLISH PATENTS.

*Cells [for Production of Metallic Sodium]: Electrolytic* — J. Raschen, G. C. Clayton and the United Alkali Co., Ltd., Liverpool. Eng. Pat. 215 Jan. 28, 1904.



THE sodium-lead alloy, acting as the anode, enters at the denuded lead leaving at a2, k showing the level of the alloy in the circular iron well A. The iron cover of the cell consists of outer and inner circular walls c2 and c3, a connecting conical crown c4, and a lip c dipping into the recess b surrounding the cell A. A thermometer may be introduced at c5. The molten caustic soda forming the electrolyte is contained within the closed annular space and fills the recess b and the space j to the level l. The hollow cathode D, preferably of nickel, is bolted to nickel radiating pole-pieces H, which dip into the electrolyte. An annular diaphragm G, of iron or nickel is suspended from the top of the cathode, so that the wall c3, the cathode D, and the diaphragm form two annular spaces e and which are closed hermetically at the top. Any gas formed in the cell is conveyed away through a pipe attached to c6. Sodium collects in e to the level m, and overflows through the openings d2 into f, and deposits at the bottom d3 of the hollow cathode. Air is thus prevented from coming into contact with the metal while the latter is in contact with the electrolyte, and the metal may be removed without admitting air to the cell.—B. N.

*Metals: Methods of Obtaining* —, from Compounds containing Silicon [e.g., Aluminium from Clay]. H. Lewis, London. From the General Electric Co. Schenectady, N.Y. Eng. Pat. 3998, Feb. 17, 1904.

CLAY and similar substances, containing aluminium (or similar metals) associated with silicon and other impurities are heated, together with carbon, in an electric furnace such as is used in producing carborundum. The product consisting of a mixture of the carbides of silicon and aluminium, is treated with a reagent, such as caustic soda solution, whereby the aluminium carbide (and if alumina present) dissolve, with production of sodium aluminate and of methane gas, whilst the silicon carbide remains undissolved. If, however, the mixture of clay and carbon is heated to the temperature of the calcium carbide furnace, at which temperature silicon volatilises as well as iron and other impurities, then the carbides of aluminium, calcium, &c., are formed, of which only the former is soluble in an alkaline solution. From the solution of alkali aluminate, aluminium hydroxide, and from that the metal, may be obtained.—E. S.

*Nickel Ores: Process for Melting* — in an Electric Furnace and an Improved Crucible therefor. Société Electro-Metallurgique Française, Froges, France. Eng. Pat. 23,380, Oct. 29, 1904. Under Internat. Conv. Oct. 30, 1903.

SEE FR. Pat. 336,376 of 1903; this J., 1904, 378.—T. F. B.

# UNITED STATES PATENTS.

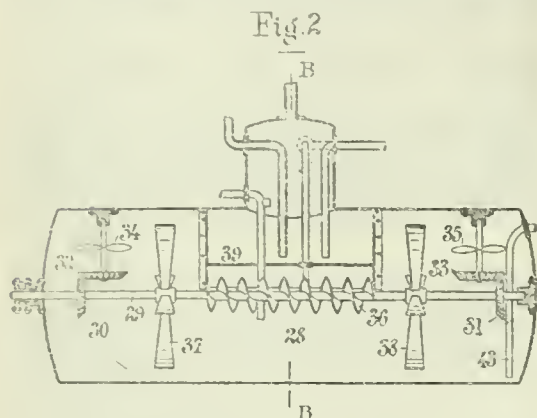
*Furnace; Electric* — [for Treating Iron Ore]. D. R. S. Galbraith, Assignor to W. Stewart, Auckland, New Zealand. U.S. Pat. 779,844, Jan. 10, 1905.

SEE FR. Pat. 336,726 and 336,727 of 1903; this J., 1904, 378.—T. F. B.





with about 10 per cent. of sodium silicate) leaves the reservoir tank by the pipe 4, and is pumped by means of the pump 5, through the pipe 6 into the measuring cylinder 7, whence the excess above the predetermined level falls back into the reservoir through the pipe 9 controlled by a float. The measured quantity of lye passes through the coil 3 contained in the tank of water 2, and falls through the pipe 15 into one of the twin chambers 17, where the temperature is brought to about 80° C. by means of a steam coil at the bottom. At the same time the fatty matter coming from the tank through the pipe 10 is pumped by means of the pump 11 into the reservoir chamber 12 (which has a double bottom), the excess being returned to the general tank through the pipe 13. A steam tube 14 passes through the pipe 10, with the object of keeping the fat liquid whatever the external temperature may be. The regulated amount of fat passes through the pipe 19 (the cock of which is opened and closed by an endless chain) into the second of the twin chambers 18, where it is heated to about 45° C. by means of a steam coil. The supply of steam to the twin chambers is regulated by the cocks 24 and 25. As soon as the required temperatures are obtained, the cock 27 is opened, and the lye falls into the saponifying chamber 28. This contains a horizontal shaft on which revolve paddles 37 and 38 (Fig. 2) and an Archimedeian screw 36, whilst horizontal motion is



imparted to the helical stirrers, 34 and 35, by means of the wheels 32 and 33. The chamber is also fitted with a perforated partition, 39, supported by iron ends rivetted to the interior of the chamber. When the whole of the lye has entered the saponifying chamber, the cock 41 is opened and the fat admitted, the pressure driving it through the perforations of the partition 39, so that it falls into the lye in a finely divided state and is thoroughly mixed by means of the paddles, &c. Steam is not admitted to the autoclave until the whole of the fat has been introduced, this being indicated on the pressure gauge 42. The saponified mass is transferred through the pipe 43 to the vessel 45, a certain proportion of sodium carbonate (5 to 20 per cent.) being simultaneously added, and after thorough admixture, is discharged through the outlet controlled by the handle 46. It is stated that the entire operation can be carried out within 15 minutes.—C. A. M.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

#### (A).—PIGMENTS, PAINTS.

##### ENGLISH PATENTS.

*Zinc Blende and other Substances Containing Zinc; Treating* — W. Simm, H. Simm, R. Storey, and J. S. Sellers. Eng. Pat. 4058, Feb. 18, 1904. XI A., page 139.

*Sulphide of Zinc; Process for the Manufacture of* — E. Marlier, Brussels. Eng. Pat. 4295, Feb. 20, 1904. SEE Fr. Pat. 338,059 of 1903; this J., 1904, 545.—T. F. B.

*Paint; Antifouling and Preservative — for Ships' Bottoms and other Submerged Structures.* G. G. Schobert, Birmingham. Eng. Pat. 24,989, Nov. 17, 1904.

A PAINT for protecting materials against corrosion and against growths of animal or vegetable matter, consist of calcium arsenite ground to a paste with linseed oil and incorporated with resin, asphalt, and zinc oxide or other pigment.—T. F. B.

##### UNITED STATES PATENTS.

*Lamplack; Process of Making —, from Acetylene.* J. M. Morehead, Chicago. Assignor to Union Carbide Co., Niagara Falls, N.Y. U.S. Pat. 779,728, Jan. 10, 1905.

A GASEOUS mixture of acetylene and oxygen or air, the proportion of air being above 1 per cent., and preferably about 4.5 per cent., is made, then compressed and passed into a vacuum explosion vessel. The mixture is exploded, the minimum pressure required to effect dissociation being used, namely, about 60 lb. per square inch. The resulting carbon is removed from the explosion vessel by an air-blast.—B. N.

*Paint, and Process of Producing same.* W. A. Hall, Bellows Falls, Vt. Assignor to Casein Co. of America, New Jersey. U.S. Pat. 780,001, Jan. 10, 1905.

A LIQUID paint or enamelling composition is prepared by adding 10 parts of asbestos to 90 parts of sodium silicate, agitating the mixture to reduce the asbestos to a finely-divided condition, and finally incorporating with the mass, 200 parts of an earthy or mineral base, such as talc or whiting, 15 parts of a vegetable oil, and 100 parts of water.—A. S.

*Paint; Oil* — M. Hérisson Paris. U.S. Pat. 780,340, Jan. 17, 1905.

SEE Fr. Pat. 342,550 of 1904; this J., 1904, 989.—T. F. B.

##### FRENCH PATENT.

*Paint; New Base for —, and the Method of Manufacturing it.* L. B. Germain. Fr. Pat. 339,180, Nov. 21, 1903.

THIS new base for use in paint manufacture is prepared by mixing together in suitable proportions zinc sulphide (20 to 25 parts by weight), zinc oxide (15 to 20) and barium silicate (40 to 55). The barium silicate may be replaced by silicates of aluminium, magnesium, zinc or lead.—M. C. L.

#### (B).—RESINS, VARNISHES.

*Sealing-Wax and Copal Resin; Preparation of* — C. Goldschmidt. Chem.-Zeit., 1905, 29, 33.

THE author recommends the use of formaldehyde-resins for the preparation of sealing-wax. For a blue wax, the resin obtained by heating a mixture of formaldehyde, hydrochloric acid and methyldiphenylamine for two hours, and oxidising the reaction-product, is most suitable. The formaldehyde-resins are cheap, non-poisonous, and stable, and appear to be very suitable for the preparation of a substitute for copal resin.—A. S.

*Boiled Linseed Oils; Rules for Testing* —, issued by the Russian Ministry of Marine. XXIII., page 155.

##### FRENCH PATENT.

*Varnish Containing Wood Extract.* M. Flandrak. Fr. Pat. 346,164, Sept. 10, 1904.

A WOOD or bark extract, in the crude state, or partially freed from tannin, is dissolved in alcohol, ether, or other solvent, and applied as a varnish to wood. This varnish



covered with a coating of a lac varnish to give a brilliant lish.—T. F. B.

#### (C.)—INDIA-RUBBER, &c.

*rubber of Landolphia petersiana from the East Africa Protectorate.* Bull. of the Imperial Inst. (Suppl. to the Board of Trade J.), 1905, 2, 221—222.

SAMPLE of rubber from the East Africa Protectorate, stated to have been prepared from *Landolphia petersiana*, is very porous, and contained a considerable quantity of acid liquor; it was soft and rather spongy, but was satisfactory as regards elasticity and tenacity. On analysis it was found to contain moisture, 17.8 per cent.; outchoue, 67.7 per cent.; resin, 11.1 per cent.; dirt, 1 per cent.; and ash (included in dirt), 1.2 per cent. The percentage of caoutchouc (82.5 per cent. on the dry sample) is satisfactory, but the resin content is high, compared with that of *Landolphia Kirkii* obtained from the same district. The rubber is valued at about 3s. per lb. in London, but a carefully prepared sample would probably be worth considerably more.—T. F. B.

#### FRENCH PATENT.

*rubber; Process for Manufacturing a Substitute for* ——. H. Tichsen. Fr. Pat. 346,369, Sept. 20, 1904.

Eng. Pat. 17,579 of 1904; this J., 1904, 1154.—T. F. B.

#### XIV.—TANNING, LEATHER, GLUE, SIZE.

*Galotannic Acid; Decomposition of* ——. Utz. Chem.-Zeit., 1905, 29, 31—32.

SOLUTION of 5 grms. of tannin in 100 c.c. of water was treated with 8 c.c. of a 25 per cent. solution of hydrochloric acid and boiled under a reflux condenser. It was found that after one hour, enough sugar had been produced to give the Bandouin reaction (rose coloration on heating with hydrochloric acid and sesame oil). After long continued boiling, the liquid was repeatedly extracted with chloroform. In the chloroform solution, levulinic acid and furfural were detected.—A. S.

*Mangrove Bark in Queensland; Utilisation of* ——. Bull. of the Imperial Inst. (Suppl. to the Board of Trade J.), 1905, 2, 276—278.

THE subjoined table gives the results of comparative analyses made on samples of the mangrove bark of Queensland and wattle bark imported from other parts of Australia, the latter being the principal tanning agent at present employed in Queensland:—

	Wattle bark from—			
	Mangrove	Tasmania	New Zealand	South Australia
Moisture	9.35	10.34	9.53	9.46
Total ash	4.78	2.67	2.47	3.33
Soluble ash	1.70	0.96	0.84	1.64
Insoluble matter, &c.	0.75	1.40	0.61	1.80
Total extractive matters	47.90	40.48	39.80	42.40
Tannin	37.50	29.60	27.65	31.25
Non-tannin extractive matter	6.70	9.92	11.96	10.51

Concessions have recently been granted to strip the bark from the trees of the extensive forests of Queensland, and it is probable that, in addition to supplying its own needs, the Colony will be in a position to compete with many of the principal sources from which mangrove is at present exported.—T. F. B.

#### UNITED STATES PATENT.

*Tanning Apparatus.* E. G. Steinke, Cincinnati, Ohio. Assignor to the Louisiana Leather Manufacturing Co. U.S. Pat. 780,450, Jan. 17, 1905.

THE apparatus consists of an outer drum containing the

tanning liquor, within which is arranged an inner open-work drum composed of longitudinal slats secured to the ends of the outer drum, these slats having pins projecting inward. The ends of the inner drum are formed of slats extending to the sides of the outer drum at some distance from the ends of the latter. At each end of the apparatus, between the ends of the two drums, reticulated material is arranged to form a chamber into which tannin extracts may be introduced.—A. S.

#### FRENCH PATENT.

*Tanning; Substances for* ——. E. E. M. Payne. Fr. Pat. 346,405, Sept. 21, 1904. Under Internat. Conv., Oct. 14, 1903.

CLAIM is made for a tanning extract containing humus, obtained by the decomposition of vegetable matters. Peat, which is a suitable raw material, is first extracted with a solution of caustic soda or potash or of an alkali carbonate, and the solution obtained is afterwards acidified. A solid extract may be obtained by adding acid until precipitation occurs, and dissolving the precipitate in a solution of a neutral salt, e.g., sodium acetate, when required for use. Other sources of raw materials are waste liquors obtained in the manufacture of paper from wood, and in washing flax thread.—M. C. L.

#### XV.—MANURES, Etc.

*Calcium Cyanamide as a Fertiliser; Employment of* ——. R. Perotti. Staz. speriment. agrar. ital., 1904, 37, 787—805. Chem. Centr., 1905, 1, 117.

THE author points out that under certain conditions, calcium cyanamide has an injurious influence on the germination of seeds, alters the constitution of the plant tissues, and interferes with the growth of bacteria. To avoid these defects, it should be applied to the soil some time before the seed is sown, and the loss in value caused thereby must be allowed for in reckoning the value of the fertiliser. (See this J., 1903, 809; 1904, 1037.)—A. S.

#### XVI.—SUGAR, STARCH, GUM, Etc.

*Cane Sugar in Official Roots.* M. Harlay. J. Pharm. Chim., 1905, 21, 49—55.

THE roots were extracted with boiling 95 per cent. alcohol containing a little chalk, the alcoholic extract was evaporated on the water-bath, the residue taken up with water containing thymol, and a portion of the solution, examined with the polarimeter and with Fehling's solution, invertase was added to the other portion, which was left for five days at the temperature of the laboratory, and then examined as before. Cane sugar was also isolated and crystallised, after separation as barium succinate, from the liquors obtained from *Levisticum officinale* Koch, and *Eryngium campestre* L. The results are given in a table. In four cases the optical rotation after inversion did not agree with the deviation calculated from the empiric-reducing power, probably owing to the presence of other sugars in addition to cane sugar. The presence of cane sugar in the roots is general, and in those of the *Umbelliferae* the quantity is considerable. The amount of reducing sugar is small, except where vegetative functions are resumed or in the case of old or dried organs.—L. J. DE W.

[*Sugar*] Juice; Filtration of ——. H. C. Prinsen-Geerligs. Mededeelingen van het proefstation voor suikerriet in West-Java, "Kagok" te Pekalongan, 75, 10—15. Chem. Centr., 1905, 1, 192.

FOR filtering the clear juice obtained by defecation and settling, the author recommends the use of sieves of fine bronze-wire gauze, instead of sand filters.—A. S.

*Galactose; Birotation of* ——. G. Heikel. XXIV., page 156.

*Sugar Cane Molasses; Industrial Fermentation of Sulphited* ——. G. Meunier. XVII., page 145.

## ENGLISH PATENTS.

*Sugar; Treatment or Preparation of* —. E. Shaw. London. Eng. Pat. 28,293, Dec. 24, 1903.

CLAIMS are made, in the production of "arated" or "basket" sugar, for the preparation and use of a solution of the sugar, and the addition to it of a definite proportion of invert sugar with the object of producing sugar containing predetermined proportions of sugar, invert sugar and water, irrespective of the amount of alkaline ash contained in the sugar under treatment: for the rapid boiling of the mixture by forcing it through an externally steam-heated pipe, and for the subsequent rapid formation of very minute crystals.—T. H. P.

*Sugar; Treatment or Preparation of* —. E. Shaw. London. Eng. Pat. 28,297, Dec. 24, 1903.

THE process is the same as that described in the preceding abstract, but is applied to a solution of raw sugar juice instead of to a solution of sugar.—T. H. P.

*Starch, Dextrin or the like; Manufacture of New Products from* —. J. Kantorowicz, Breslau. Eng. Pat. 5574, March 7, 1904.

THIS process, which relates to the manufacture of a new modified form of starch, having the valuable property of swelling up with cold water to a viscous liquid like starch paste, consists in treating any convenient kind of starch, soluble starch, dextrin, or the like, in the presence of water, with caustic alkalis and liquids with which starch does not swell up, such as alcohols, acetone, mixtures of alcohol and ether, or the like, and separating the new products after neutralisation.—T. H. P.

## UNITED STATES PATENTS.

*Sugar Juice; Process of Purifying* —. H. Breyer, Kogel, Assignor to A. J. von Wehrstedt, Castle Puchberg, Austria-Hungary. U.S. Pat. 779,261, Jan. 3, 1905.

SEE Fr. Pat. 345,463 of 1904; this J., 1904, 1229.—T.F.B.

*Sugar-bearing Materials; Treatment of* —. C. Steffen, Vienna. U.S. Pat. 779,816, Jan. 10, 1905.

SEE Eng. Pat. 5439 of 1903; this J., 1903, 811.—T.F.B.

*Adhesives; Process of Producing* —. H. K. Brooks, Bellows Falls, Vt., Assignor to Casein Co. of America, New Jersey. U.S. Pat. 779,583, Jan. 10, 1905.

A PECULA is heated with a solution containing ammonium persulphate and sulphuric acid, with agitation, and the product is rendered neutral or slightly alkaline by addition of borax.—A. S.

## FRENCH PATENTS.

*Liquids [Sugar Juices, &c.]; Evaporation, Concentration, Distillation and Drying of* —. A. Montupet and L. Jannin. Fr. Pat. 339,177, Nov. 21, 1903.

IN an ordinary closed boiling pan, heated by steam coils or tubes, the vapour evolved from the surface of the boiling liquid is withdrawn from the top of the pan by means of an injector working with exhaust or high pressure steam. The mixed vapours are then forced through a pipe into the steam chamber of the boiling pan. In this manner the recuperative principle of the multiple effect system is utilised in a single pan; boiling may be effected under atmospheric or reduced pressure.—J. F. B.

*Sweetening Agent; New* —. A. H. Tissot. First Addition, dated Sept. 9, 1904, to Fr. Pat. 335,379, Sept. 14, 1903. (See this J., 1904, 197.)

THE "eduleorant porchère" is mixed with gum arabic, tartaric acid and sodium bicarbonate, or with the salts of various mineral waters.—J. F. B.

*Levulose from Artichoke Roots; Preparation of Industrial* —. J. B. Gaillhat. Fr. Pat. 346,469, Sept. 24, 1904.

ARTICHOKE roots are pulped or sliced, and then treated systematically with boiling water, acidified by 0.2 per cent. of hydrochloric or sulphuric acid. The liquid so

obtained is very rich in sugar, which consists of 95 per cent. of levulose and only 5 per cent. of dextrose.—J.F.B.

*Finishing Material; Preparation of* — [from Molasses &c.]. M. Kowalski. Fr. Pat. 346,355, Sept. 19, 1904. V., page 130.

## XVII.—BREWING, WINES, SPIRITS, Etc.

*Malts for Different Beers; Requisites of* —. W. O'Connor. J. Inst. Brewing, 1904, 10, 530—531.

*Moisture*.—The usual limit of 3 per cent. is a fair one, but the circumstances should be taken into account. Malt may absorb as much as 1 per cent. of moisture during railway transit for 24 hours, and may thus exceed the limit in spite of excellent conditions of storage. The proportion of moisture is mainly of importance as an indication of the conditions of storage and the alteration of the albuminoids which may follow on damp storage.

*Tenderness* is a measure of the modification of the endosperm and the accessibility of the starch to the action of the diastase. It is an indication of slow and careful growth, complete withering and skilful kilning.

*Time of saccharification* is also an indication of the care with which the malt has been prepared; the proportion of ready formed sugars is not a reliable guide.

*Appearance of skin*.—This is a very deceptive indication of quality, but it may be taken that a bright skin showing the "bloom" of the barley indicates a "forced" malt, since a slow germination destroys the brightness and bloom of the skin.

The considerations affecting the selection of malt for special beers are tint and diastatic power. As regards the latter the most desirable limits appear to be 22—27 (Lintner's scale) for mild ales and stout, and 30—33 (Lintner) for pale ales.—J. F. B.

*Water Hardening [for Brewing]*. A. W. Rogers. J. Inst. Brewing, 1904, 10, 528—529.

THE typical standard water for pale ales may be taken to have the following composition:—Calcium sulphate 60; magnesium sulphate, 10; calcium and magnesium carbonates, 20; sodium chloride, 4; total mineral salts 94, expressed in grains per gallon. If magnesium sulphate be already present in too large a quantity, its proportion can be reduced by adding calcium chloride. When magnesium salts are present in excess the resulting beers are liable to "fret". For mild ales, gypsum and kainite may be added to the brewing water. The salts should be added to the sparging water as well as to the mashing liquor; they should not be added to the grist-case. Waters which contain an excessive quantity of nitrates are improved by boiling with sulphurous acid before use.—J. F. B.

*Starch; Diastatic Coagulation of* —. J. Wolff and A. Fernbach. Comptes rend., 1905, 140, [2] 95—97.

FURTHER experiments confirm the previous statements by the authors that, when the diastatic coagulation of starch has been once started, it proceeds even when the diastases have been destroyed by heating (this J., 1904, 449). They also come to the conclusion that the state of liquefaction of the starch, which is favourable to the diastatic formation of amylocellulose, is equally favourable to coagulation. The difference in the quantity of amylocellulose formed, on the one hand in the absence of diastase, and, on the other hand, in its presence, becomes the greater according to the degree to which the starch has been heated.

—W. P. S.

*Sorbose Bacterium; Biochemical Study of the* —. G. Bertrand. Bull. Assoc. Chim. Sucr. et Dist., 1904, 22, 478—480.

SORBOSE does not exist as such in mountain ash berries, but is produced by the oxidation of the sorbitol by the sorbose bacterium. The same bacterium has been utilised for the preparation of several other ketoses from the corresponding polyvalent alcohols; it always attacks one of the secondary alcoholic groups, converting it into a ketone. The following ketoses have thus been pre-



ured:—Dihydroxyacetone, "erythralose," "arabinose," sorbose, levulose, perseose and volenose. Since the ketoses are converted by sodium amalgam into mixtures of two stereoisomeric polyvalent alcohols, one of which is different from the parent alcohol, it is possible to combine the action of the bacterium with that of sodium amalgam and to pass from one alcohol to another, e.g., from sorbitol to *d*-iditol, from *l*-erythritol to *d*-erythritol and from annitol to sorbitol. By a similar combination of actions, an aldose sugar can be converted into a ketose and one ketose into another; e.g., dextrose into sorbose, or xylose into sorbose. The bacterium only oxidises the polyvalent alcohols of a certain stereochemical type, and leaves those of other types unchanged; thus sorbitol can be separated from iditol (compare also sorbieritol, this J., 1904, 1155 and 1905, 37). The bacterium oxidises ketoses by converting them quantitatively into the corresponding monobasic acids; ketoses are gradually oxidised without the production of any characteristic products. When an aldose has been oxidised into the monobasic acid, a subsequent oxidation takes place if a secondary alcoholic group capable of being attacked be present, and a ketonic acid is thus produced, e.g., dextrose converted into oxallic acid. —J. F. B.

*Wine Yeasts; Selection of* ——. H. W. Watson. J. Inst. Brewing, 1904, 10, 536–538.

Pitching yeast should be pale in colour, since a dark colour indicates deposits of resins and caramel on the walls of the flasks. It should be firm in consistency and show no signs of decomposition; the sedimentary yeast should be caseous in character and not too readily disseminated in beer. A good healthy yeast, the cells are fairly uniform in size, plump, with well defined outlines, and round or slightly oval in shape. Many wild yeasts assume the same shape as culture yeast, and the only reliable test is the spore formation. The protoplasm should be transparent and homogeneous; if it is at all granular, weakness and degeneration are indicated, also accompanied by thick cell-walls and very large vacuoles. Dead cells should be rare; they are stained by the addition of a little Methylene Blue to the preparation. Even good yeast is seldom free from bacteria. If only 3 or 4 bacteria be observed in a complete passage along a diameter of the cover-glass, the sample is sufficiently pure. The sporulation test for wild yeasts should be performed periodically; no spores are formed in 10 days at 10°–11° C., so trouble need be anticipated from wild yeasts. The sample for this purpose should be taken towards the close of primary fermentation, at which stage wild yeasts are most numerous. —J. F. B.

*Top-Fermentation Beer Worts [German]; Boiling* ——. *Under Pressure*. A. Gribat. Woch. f. Brau. 1905, 22, 18.

THE writer has adopted the method of boiling worts for top fermentation in a closed copper under pressure, as is the rule in England in the case of porter worts. Working with the two-mash decoction process and boiling the main wort and after-runnings separately, he first boiled the main wort for half an hour with the copper open and then with the copper closed at a pressure of 14.5 lb. per sq. in., releasing the pressure half an hour before the conclusion of the boiling. In subsequent work he mixed some of the first of the sparging liquors with the main wort in order to fill the copper, and after boiling without pressure until the wort showed a "break," he boiled for 1 hour under a pressure of 20 lb. per sq. in., corresponding to a temperature of 05° C. The results have proved in every way satisfactory, the worts have an extremely good "break," fermentation proceeds quietly with an extraordinarily solid "curly head," and is completed in 4 days. The beer is racked direct from the fermentation tuns to the transport casks and has a pleasant, aromatic flavour, not quite so sweet as formerly. The writer strongly recommends this method of boiling, and would even extend it to bottom fermentation beers, especially those of the Munich type; the increase in the "body-flavour" brought about by boiling the wort under pressure should enable the brewer to brew a wort of lower gravity without loss of quality. —J. F. B.

*Fermentation; Relative Production of Alcohol and Carbon Dioxide during* ——. L. Linde and P. Maron. Comptes rend., 1904, 139, 1223–1225.

THE authors have determined the quantities of alcohol and carbon dioxide produced at different stages during fermentation. Equal volumes of the same tri-fold must were sown with equal quantities of the same yeast, the products of fermentation being collected. Determinations of the latter, made when fermentation had proceeded for different periods, showed that in the first stage the quantity of alcohol produced was distinctly greater than that of the carbon dioxide; whereas, later, the quantities of the two products were practically identical. The temperature of fermentation and the acidity of the must had no sensible influence on the general results. This preponderance of alcohol production over that of carbon dioxide is probably connected with the reproduction of the yeast, since the formation of new cells is practically confined to the first stage of fermentation. —J. F. B.

*Attenuation for Different Beers; Requisites of* ——. W. O'Connor. J. Inst. Brewing, 1904, 10, 539–541.

IN making his calculations the author refers in all cases to beers of an original gravity of 55°, as that is one at which pale, mild and black beers are frequently brewed. Assuming that only the free maltose is attacked during primary fermentation, the subtraction of 11 from the actual gravity at the end of primary fermentation will show the gravity due to malto-dextrins, upon which the case-condition of the beer depends.

In absence of added sugars ["priming"], the desideratum for pale ales is a "condition" which shall develop slowly during protracted storage, without sacrificing fullness of flavour. For this purpose a wort, rich in high-type malto-dextrins, should be produced, which will attenuate during primary fermentation down to an apparent gravity of 16°–19°, leaving malto-dextrins equivalent to 12.5°–15° for secondary fermentation. For mild ale, the malto-dextrins should be equivalent to 14° and should be of low type, easily attacked by secondary fermentation yeasts, yielding rapid conditioning and clarification. For stouts, malto-dextrins equivalent to 15° are the rule, and these should be of a type as low as or lower than that of the malto-dextrins in mild ale worts. —J. F. B.

*Sugar Cane Molasses; Industrial Fermentation of Sulphited* ——. G. Meunier. Bull. Assoc. Chim. Sucr. et Dist., 1904, 22, 484–486.

WHEN an antiseptic substance, such as sulphite, is present in the wash, its influence can be overcome by increasing the quantity of pitching yeast; in other words, the quantity of antiseptic fixed by a single cell is a function of the number of cells and the weight of antiseptic per litre. The author has determined the number of cells which must be sown in the first pan of a continuous propagating apparatus [Jacquemin's system] in order to arrive at a constant output in a minimum of time, that is, to make it produce equal quantities of yeast cells of a given activity for each fermentation. It was found that for the fermentation of sulphited cane molasses the first propagating pan (200 litres) must be pitched with 3.5–4 kilos of pressed brewery yeast with 70 per cent. of moisture. It is not necessary that the yeast should be acclimatised towards sulphites in the propagating vessels, but the wash in the first pans should be highly acidified (6 grms. of sulphuric acid per litre), the proportion of acid being gradually reduced in subsequent vessels down to 2.5 grms. per litre in the main fermentation tuns. The wash in the propagating pans should be sterilised by heat, and should be mixed with nutrient salts, but the main wash need not be sterilised. Under these conditions 60.5–61 litres of alcohol were obtained per 100 kilos. of reducing substances (calculated as saccharose). The initial concentration of the washes was 110–115 grms. of reducing sugars per litre, 8–10 grms. remaining unfermented. The yeast crop was 15–16 kilos. of pressed yeast per 100 kilos. of molasses, which is about the same as the crop obtained from 100 kilos. of grain. Traces of sulphides were present in the phlegms, but

were easily removed by chlorine water; an abundant evolution of sulphuretted hydrogen was observed in the fermentation on this.—J. F. B.

*Alcohol. Denaturing of —. Report of Sectional Commission to the French Finance Minister.* L. Lindet. Bull. Assoc. Chim. Sac. et Dist. 1904, 22, 459–474.

The denaturing agent at present employed in France consists of 10 litres of wood spirit and 0.5 litre of heavy petroleum benzine (naphtha) per hectolitre, costing nearly 9 francs. The Commission has examined a large number of proposed denaturing agents, but the only substances which could be entertained are:—(1) Petroleum benzene (b. pt. 100–160° C.) mixed with toluene: this benzene has the advantage that it can be detected by Halphen's reaction in all fractions when alcohol containing it is submitted to distillation, a guarantee which the heavy Excise benzene (b. pt. 156–250° C.) does not possess. (2) Pyridine, 0.5 per cent., as employed in Germany. (3) Acetone-oils from wool-scouring. (4) Formalin.

*Behaviour of Various Denaturants Towards Fraudulent Treatment.*—The commonest fraud consists in blending a certain proportion of denatured alcohol with pure alcohol and disguising the flavour by aromatic bodies. The addition of formalin in denaturing, to the extent of 0.5 per cent., will still be detected with certainty when the denatured spirit is blended with 15 times its volume of pure alcohol. If the denatured spirit contains 2.5 per cent. of wood-spirit, the presence of methyl alcohol can only be detected so long as the blending does not exceed the proportion of 1:8. In order to obtain a higher guarantee against blending, it is desirable that benzene and pyridine or acetone oils should be present. A rarer form of fraud consists in agitating the spirit with benzene or carbon tetrachloride and brine and re-distilling the aqueous portion in a rectifying apparatus. This process yields 60 per cent. of potable alcohol, but requires considerable plant. By this means the whole of the benzene, pyridine and acetone oils are eliminated, but traces of formalin can always be detected in the re-natured alcohol, whilst the whole of the methyl alcohol remains. If the re-natured spirit be used for blending purposes, the sole guarantee would rest with the methyl alcohol, which would escape detection at dilutions greater than 1 to 8.

*Proposed New Formula for a Denaturing Agent.*—The Commission recommends the following mixture:—2.5 per cent. of wood spirit, the methyl alcohol of which serves as an indicator in cases of re-distillation and to a certain limit in those of blending: 0.5 per cent. of formalin (33 per cent. of formaldehyde), mainly as a very delicate indicator in cases of blending and (in the form of traces) in those of re-distillation without subsequent blending: 0.5 per cent. of heavy Excise benzene, together with 0.25 per cent. of pyridine, the flavour of which is very nauseous even at extremely high dilutions, the object of these being to compel the blender (without re-distillation) to employ smaller proportions of denatured spirit in his mixtures. It is calculated that the above mixture would lower the cost of denaturing by 5 francs per hectolitre, and would extend the use of denatured spirits by reducing the price to the small consumer by 5 centimes per litre.—J. F. B.

*Malt, Wort and Beer; Determination of the Ash of —, and the Proportion of Sulphuric Acid in the Ash.* W. Windisch. XXIII., page 155.

*Spirits for Lighting Purposes [Carburised Spirit].* O. Mohr. II., page 124.

*Formaldehyde; Detection of— in Spirit Denatured with Formalin.* L. Lindet. XXIII., page 154.

#### ENGLISH PATENTS.

*Malting Apparatus [Pneumatic Drum].* O. Krueger, Berlin. Eng. Pat. 4249, Feb. 20, 1904.

THE processes of germination, drying and kilning are performed in the same drum by dividing the interior of the latter into sections by partitions, either radial or parallel to the axis, each of which sections is again divided into two

unequal chambers, communicating with each other by sliding valves, so that as the malt shrinks on drying, it automatically collects in the larger of the two chambers during the rotation of the drum. The air-pipes inside the drum are so arranged that they form the centres of cooling-zones, and their dimensions are not greater than would correspond to the cooling capacity of the cooled and damped air introduced. In front of the air-pipes are arranged separate pipes which can be used either for heating or cooling, whereby the air is re-warmed or re-cooled after traversing a short distance.—J. F. B.

*Breeding, Distilling and like Processes; Apparatus for —.* R. H. Leaker, Bristol. Eng. Pat. 4560, Feb. 24, 1904.

THE apparatus consists of two vessels with a pair of fluted crushing rolls interposed between them. Whole malt is charged into the first vessel, which has been previously filled with water at 120°–140° F. The malt is washed by agitating with a "rouser"; the water and refuse are drawn off, and a supply of fresh water, at a temperature of 150–160° F., is run in. The malt is saccharified in this vessel, the temperature being maintained by means of a heating coil. After conversion, the mash is passed through the crushing rolls and discharged into the second vessel. It is allowed to remain there for a short time, after which the clear wort is drained off through a perforated bottom. The second vessel is fitted with agitating rakes and a sparger.—J. F. B.

*Brewers' Wort; Apparatus for Treating —, for Cooling and other Purposes.* J. B. Allott, Nottingham. Eng. Pat. 4651, Feb. 25, 1904.

THIS specification describes apparatus for subjecting brewers' wort to a pressure below that of the atmosphere, access of which to the wort is meanwhile prevented; the froth formed being dissipated so as to release the enveloped steam from the liquid of the froth. The wort may be passed through a series of vacuum pans, the pressures in which are different, and which are so connected that wort is run direct into the pan in which the highest pressure obtains, thence into the next pan for further treatment, and so on. Gradual cooling is effected by causing the same cooling liquid to pass successively through the condensers of the several pans from the last to the first. Claims are also made for cooling wort under reduced pressure, with exclusion of air, and subsequently aerating it by subjecting it to the action of a refrigerator located in a chamber to which air is introduced through a filter so as to render it germless.—T. H. P.

*Alcoholic Liquids; Fermentation and Clarification of —.* A. van de Kerckhove, Brussels, and A. A. J. Lebbe, Ypres, Belgium. Eng. Pat. 24,994, Nov. 17, 1904.

THE liquids are "fined," and the yeast nutrition is increased, by adding to the wort or must, before fermentation, a certain proportion of "alimentary gelatin," prepared by boiling fresh animal tissues, drying the product and reducing it to powder, this powder being subjected to the action of ozonised air. In the case of beer, the powdered gelatin is preferably added to the wort in the cooler when the temperature is about 90° C. In the case of grape must, the gelatin should first be dissolved and the solution should be added shortly before fermentation.—J. F. B.

*Brewers' Grains, other Grain, Seed and the like; Kilns and Machinery for Drying —.* S. Dymond, Bristol. Eng. Pat. 5263, March 3, 1904.

IN kilns for drying brewers' grains, &c., where the material is made to take a serpentine course on a series of perforated travelling carriers running round chain pulleys driven by toothed gearing, the following improvements are claimed:—(1) An endless travelling feed conveyor for delivering the grain or other material to be dried, on to the uppermost of the series of carriers, the said conveyor receiving its charge from a magazine fitted with a sliding door, controlling an aperture in the magazine through which the conveyor extends, to discharge on to an inclined plane directing the material on to the carrier. (2) The provision, as part of the construction of the kiln,



of girders extending lengthwise parallel with the carriers. (3) The use of angle-irons to bridge over the spaces between the side edges of the carriers and the walls of the kiln. (4) The construction of the stoves or drying chambers with double walls, with an intervening space, and having the apertures for the escape of heat interspaced in the respective walls.—T. H. P.

*Must for the Manufacture of Spirits of Wine, the Feeding of Cattle, and the Manufacture of Dextrose; Method of Preparing* — W. H. Wheatley, London. From International Spiritus-Ind. Ges. m.b.H., Berlin. Eng. Pat. 41,413, May 13, 1904.

SEE FR. Pat. 343,745 of 1904; this J., 1904, 1039.—T. F. B.

*Alcohol or Marine Distilling Apparatus.* C. Tuckfield and W. G. de Forçés Garland, East Molesey. Eng. Pat. 2747, Feb. 4, 1904.

CLAIMS are made for (1) a distilling apparatus having means for heating the liquid treated near its surface, with a heat exchanger below; (2) a distilling apparatus with a closed tank (for recovering the solids) connected by a valve to its lower end; (3) a distilling apparatus with a suspended heat exchanger; (4) the combination of the above claims with pressure valves.—T. H. P.

#### FRENCH PATENTS.

*Beer; Process for Preparing* — L. Nathan. Fr. Pat. 346,295, Sept. 16, 1904. Under Internat. Conv., Oct. 7, 1903.

SEE Eng. Pat. 20,534 of 1904; this J., 1905, 100.—T. F. B.

*Spirits; Apparatus for Measuring and Sampling during Distillation.* L. Rušić. Fr. Pat. 346,116, Sept. 24, 1904.

AN apparatus is fixed to the discharge-end of the condenser, consisting of a collecting chamber communicating with a large measuring cylinder, in which a small tube is situated. An external gauge glass is fitted to the cylinder, and when the latter is full, it is emptied in such a manner that the bulk of the spirit is discharged into a cask, whilst, at the same time, the contents of the small tube are collected in a sampling vessel, the diameter of the small tube bearing a fixed relation to that of the large measuring cylinder. During the operation of discharging, the spirit from the still collects in the upper chamber, the outlet from which is closed automatically.—J. F. B.

#### UNITED STATES PATENT.

*Drier [Brewer's Grains].* C. H. Caspar, Newark, N.J. U.S. Pat. 779,264, Jan. 3, 1905.

SEE Eng. Pat. 23,066 of 1904; this J., 1905, 100.—T. F. B.

## XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

### (A).—FOODS.

*Gluten in Wheat Flour; Determination of* — E. Fleurent. XXIII., page 155.

*Archil, Cudbear and other Lichen Colours; Note on the Detection of* — [in Foods]. L. M. Tolman. XXIII., page 154.

#### ENGLISH PATENTS.

*Rice Flour; Treatment of* —, with a view to its Substitution for various Starches used in Sizing and Finishing. Soc. Anon. des Rizeries Françaises, Havre, France. Eng. Pat. 16,351, July 23, 1904. Under Internat. Conv., Aug. 1, 1903.

SEE FR. Pat. 334,369 of 1903; this J., 1904, 59.—T. F. B.

*Concentrating Liquids; Apparatus for* —; especially adapted for removing Albuminous Matter from Serum and the like Liquids. H. W. Southworth. Eng. Pat. 24,870, Nov. 16, 1904. I., page 123.

*Food and other Perishable Substances; Preservation of* —, J. Breckwoldt, Blaikeness, Germany. Eng. Pat. 25,514, Nov. 23, 1904.

THE food is placed in a suitable receptacle from which the air is withdrawn. Hydrogen is then introduced, and the receptacle hermetically closed. W. P. S.

#### UNITED STATES PATENTS.

*Centrifugal Cream-Separator.* G. T. Rennerfelt, Brooklyn, N.Y. U.S. Pat. 779,099, Jan. 3, 1905.

IN the drum of the separator are placed a number of superposed radially corrugated division plates, arranged in the liquid space across the radial lines of the drum. Each plate has the shape of a truncated cone, the inner and outer edges of which are curved upwards. The corrugations form channels between the plates. Apertures are provided at the middle of the plates by downwardly converged edges. A baffle plate is placed at the top of the division plates. Oppositely flowing currents of liquid are thus established between the plates, and each current is directed upwards from the opposite edges to the plates.—W. P. S.

*Centrifugal Liquid [Milk] Separator* —, A. L. Christenson, Stockholm. U.S. Pat. 779,990, Jan. 10, 1905.

THE centrifugal separator-bowl contains a liner consisting of a number of conical plates superposed on each other, and a flanged central inlet-pipe for conducting the full milk through the wall of cream obtained during separating. —L. F. G.

*Sterilising Organic Substances; Method of* —, C. C. L. G. Budde, Copenhagen. U.S. Pat. 779,637, Jan. 10, 1905.

SEE FR. Pat. 321,639 of 1902; this J., 1903, 158.—T. F. B.

#### FRENCH PATENTS.

*Milk; Treatment of* — for the Extraction of various Useful Products [Milk-Sugar] therefrom. S. R. Kennedy. Fr. Pat. 346,374, Sept. 20, 1904.

SEE U.S. Pat. 772,517 of 1904; this J., 1904, 1105.—T. F. B.

*Cream; Process and Apparatus for Separating the Fatty Portion of* — and for Making therefrom a Food Product Substituting Fresh Cream. C. M. Taylor. Fr. Pat. 346,401, Sept. 21, 1904.

SEE Eng. Pat. 20,292 of 1904; this J., 1905, 101.—T. F. B.

*Water, Beverages and Foods; Sterilisation of* —, A. Krause. Fr. Pat. 346,377, Sept. 20, 1904.

PEROXIDES of the alkalis or of calcium and magnesium are added to the article to be preserved, the peroxide being subsequently decomposed by means of carbon dioxide, bicarbonates, weak organic acids or acid phosphates. The substances may be heated to a temperature of 40° to 50° C. before adding the peroxide. Sugar, salt, aromatic substances and sodium bicarbonate may also be added. (See also Eng. Pat. 12,113, 1904; this J., 1904, 1108.)—W. P. S.

### (B).—SANITATION; WATER PURIFICATION.

*Carbon Monoxide in Confined Atmospheres; Determination of* —, A. Lévy and A. Péroul. XXIII., page 154.

*Bacillus Coli Communis; Neutral-Red Reaction for* —, E. W. Moore and C. Revis. XXIII., page 154.

#### ENGLISH PATENT.

*Water; Purification of* —, H. H. Lake, London. From W. M. Jewell, Chicago. Eng. Pat. 16,934, Aug. 2, 1904.

SEE U.S. Pat. 765,146 of 1904; this J., 1904, 833.—T. F. B.

## C.) DISINFECTANTS.

## FRENCH PATENTS.

*Gas [Sulphur Dioxide] for Disinfecting or Extinguishing Purposes: Apparatus for the Production of —.* E. Delhotel. Fr. Pat. 346,379, Sept. 20, 1904.

SULPHUR is burned on the hearth of a jacketed iron generator, a current of cold air being passed through the jacket, and cold water or air circulated in a vessel arranged within the generator above the hearth. The air to support combustion of the sulphur is drawn from a vessel in which a desiccating agent is distributed on oppositely inclined surfaces. The sulphur dioxide formed is led through purifying columns containing vegetable charcoal, copper turnings, or vegetable fibres, and one of them may contain iron turnings. The gas, thus mechanically and chemically purified, is then brought into contact with a volatile antiseptic liquid (such as formaldehyde), and it may also be mingled with the gas evolved from liquid sulphur dioxide stored in a separate apparatus. An apparatus is described at once aspirative and propulsive by which the gas is drawn and propelled through a cooling arrangement, and may be subsequently injected into the places where disinfection, or the extinction of fire, is required.—E. S.

*Antiseptic: A Fluorescent —.* E. Turpin. Fr. Pat. 346,363, Sept. 20, 1904.

THE substance claimed is resorcinol-phthalein (fluorescein). It may be mixed with perfumes, dentrifices and hygienic products to render them antiseptic, and, if desired, rendered alkaline to enhance its fluorescent properties.—W. P. S.

## XIX.—PAPER, PASTEBOARD, Etc.

*Wood-Pulp; Poplar —.* Wochenbl. f. Papierfab., 1904, 35, 3941—3942.

POPULAR is the only paper-making wood which occurs to any great extent in Italy. The mechanical pulp is not very valuable, it works very "free," and is largely contaminated with splinters owing to the softness of the wood. Large quantities of poplar wood cellulose are, however, manufactured both in Italy and America by the sulphite process. Poplar wood cellulose gives a short-fibred, soft pulp, which does not bleach so white as the best pine cellulose. It is not so suitable as straw pulp for writing paper, being deficient in "rattle." But its special properties make it a good substitute for esparto and cotton, especially in the best sorts of printing papers. A thick, uncalendered sheet takes a very clean impression without much pressure. Poplar pulp carries a large proportion of clay, and in the calendered state answers very well for common writing paper. In combination with 20 or 30 per cent. of cotton, bleached poplar pulp has been used successfully for high-class writing papers, but alone it is too hard and very transparent. For cheap chromo and copper-plate papers it is an excellent material.—J. F. B.

*Nitrocellulose; Hygroscopicity of —.* W. Will. Mitt. Centralst. f. Wiss.-Tech. Unters., Berlin, 1904, No. 4, 1—33. (See Orme Masson, this J., 1904, 1143.)

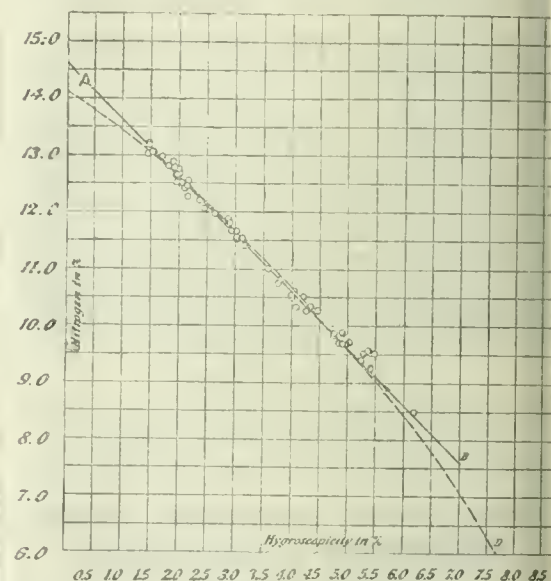
THE author has made an exhaustive study of the influence of the combined nitro groups upon the hygroscopic properties of cellulose. In order to obtain comparative results it was necessary to select two limits representing the two extremes of humidity at which constant equilibria were established. In view of the instability of nitrocellulose at higher temperatures, the author defines his standard of hygroscopicity as the difference between the weights of the materials when dried in an ordinary oven at 40° C. to a constant weight, on the one hand, and when exposed to an atmosphere fully saturated with moisture at a temperature of 25° C. for 24 hours, on the other hand.

*Hygroscopicity of various Celluloses and other Carbohydrates.*—Raw cottons of different origin, cotton waste and hemp all had the same hygroscopic value of 7—8 per cent.; purified cotton rag-pulp and wood

cellulose showed 6.4—7 per cent. of hygroscopic moisture; jute with 10.8 per cent. and the starches with 10.6—11.1 per cent. were considerably more hygroscopic than the celluloses. Mechanical treatment (pulping) or extraction of the waxes by ether increased the hygroscopicity of the raw cottons to nearly 10 per cent., which may be regarded as approximately the true value for pure cellulose. Treatment with dilute acids and alkalis, on the other hand, decreased the affinity of the cellulose for water, as did also the previous superheating of the cotton above 100° C.

*Hygroscopicity of Nitrocelluloses.*—The determination of the hygroscopicity of 63 samples of nitrocellulose, prepared from a large variety of different cottons and containing proportions of nitrogen ranging from 13.21 to 8.20 per cent., showed that the sum of the percentage of nitrogen and the hygroscopic moisture was constant in all cases, with a value of about 14.6. This constant remained unchanged by various mechanical, physical and chemical treatments, e.g., pulping, solution or gelatinisation, treatment with dilute acids or alkalis, partial elimination of the nitrogen, complete denitration followed by re-nitration. The hygroscopic moisture was found to have no connection with the degree of solubility of the nitrocellulose in ether-alcohol, but depends solely on the percentage of nitrogen. Unstable nitrocelluloses show abnormally high values which, however, are reduced to the normal when the products are rendered stable by long boiling with water.

The accompanying diagram shows the experimental results obtained in the above determinations. The straight line A B illustrates the equation  $H = 14.6 - N$



which, however, is only correct within certain limits, which comprise most of the nitrates of industrial importance. Extrapolation values are better expressed by the equation  $H = 33.43 - 23.65N$  which takes account of the variation in molecular weights of the different nitrates, and in which the sum of the hygroscopicity and the nitrogen varies with the proportion of nitrogen; this equation is illustrated by the curved dotted line C D.

*Influence of Variations from the Standard Hygroscopicity.*—(a) By further drying over sulphuric acid, after drying at 40° C. under ordinary conditions, all the nitrocelluloses lost a further quantity of water; the sum of the hygroscopic moisture and percentage of nitrogen was then no longer a constant, but varied with the proportion of nitrogen to a greater extent. The second equation above was thus changed to  $H = 40.58 - 28.7N$

(b) By varying the temperature at which the products



were exposed to a moist saturated atmosphere from 5° C. to 15° C. and 5° C., while adhering to the ordinary method of drying at 40° C., the hygroscopic moisture was considerably increased, the increase being greater from 25° to 15° C. than from 15° to 5° C. In these cases the sums of the hygroscopic moisture and nitrogen are constants within the practical limits, the equations being  $H = 20 - 1.3N$  for 15° C. and  $H = 21.6 - 1.4N$  for 5° C.

(c) When the moist equilibrium was established in air of various degrees of humidity, short of saturation, an exposure of 24 hours was necessary before complete interchange was effected. It was found that the ratio between the relative humidity of the air and the hygroscopicity was only constant up to about 80 per cent. of saturation. Between 80 per cent. and complete saturation, the affinity of the nitrocellulose for moisture increased in a far greater measure than the humidity of the air. No constant relation between the percentage of nitrogen and the hygroscopicity of the nitrocellulose could be traced in or below the saturation point.—J. F. B.

#### ENGLISH PATENTS.

*Paper Stock or Pulp; Process and Apparatus for the Manufacture of*—H. C. Pfeiffer, Goritzheim, Saxony. Eng. Pat. 27,587, Dec. 16, 1903.

SEE Fr. Pat. 338,330 of 1903; this J., 1904, 620.—T. F. B.

*Pulp from Printed Paper; Manufacture of*—H. Jackson, London. Eng. Pat. 4996, Feb. 29, 1904.

WASTE printed paper is pulped in the presence of water with a substance which has a solvent action on the printers' ink, but is immiscible with water. A substance is then added which will cause the immiscible substance to dissolve in the water, the pulp is washed, and the solvent is recovered. For instance, 1 ton of paper is pulped with 5 cwt. of oleic acid or a suitable mixture of liquid fatty acids; subsequently 36–90 lb. of strong ammonia solution are added and the oleic acid is regenerated from the washings.—J. F. B.

*Paper Making Machines.* L. Tailfer, Paris. Eng. Pat. 25,726, Nov. 25, 1904. Under Internat. Conv., Dec. 21, 1903.

SEE Fr. Pat. 337,911 of 1903; this J., 1904, 558.—T. F. B.

*Cardboard; Method and Apparatus for Continuous Manufacture of*—H. D. Loria, Jura, France. Eng. Pat. 23,245, Oct. 28, 1904.

ROLLS of completely formed paper in the moist condition, i.e., containing 35–50 per cent. of water, in which state they will not bind together by simple pressure, are unrolled in superposed layers upon a travelling band. Between each web an adhesive material, preferably in the form of dry powder, e.g., flour, is distributed uniformly on the moist surface of the paper. When a sufficient number of layers have thus been superposed, the whole compound web is pressed together and finished in the usual way.—J. F. B.

*Viscose; Apparatus for Treating [Removing Air and Carbon Bisulphide from]*—F. W. Howorth, London. From La Soc. Franç. de la Viscose, Paris. Eng. Pat. 5286, March 3, 1904.

SEE Fr. Pat. 340,690 of 1904; this J., 1904, 834.—T. F. B.

*Viscose; Apparatus for the Treatment [Firing] of*—F. W. Howorth, London. From La Soc. Franç. de la Viscose, Paris. Eng. Pat. 5730, March 8, 1904.

SEE Fr. Pat. 340,812 of 1904; this J., 1904, 821.—T. F. B.

*Alkaloid; Process for the Production of Non-Inflammable*—G. E. Woodward, London. Eng. Pat. 9277, April 22, 1904. Under Internat. Conv., April 6, 1904.

SEE Fr. Pat. 344,048 of 1904; this J., 1904, 1111.—T. F. B.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Hyoscyamus Muticus from India.* Bull. of the Imperial Inst. (Suppl. to the Board of Trade J.), 1905, 2, 222–224.

OF two specimens of *Hyoscyamus muticus* from India, one obtained from the Punjab was found to contain 0.36 per cent. of hyoscyamine in the dry stems, and 0.38 per cent. in the dry leaves; the second, from Larkana, contained 0.28 per cent. of hyoscyamine; in neither case was any other alkaloid detected. These low alkaloid contents would indicate that the Indian plant could not compete with the richer Egyptian variety as a commercial source of hyoscyamine, and hence of atropine.—T. F. B.

*Datura Stramonium from India; Seeds of*—Bull. of the Imperial Inst. (Suppl. to the Board of Trade J.), 1905, 2, 224–225.

A SAMPLE of the seeds of *Datura stramonium*, obtained from Bushahr, India, was found to contain 0.26 per cent. of hyoscyamine, as compared with 0.35 per cent. found in Egyptian and European specimens. As in the case of *Hyoscyamus muticus* (see preceding abstract), there is no other alkaloid present in any of these specimens.—T. F. B.

*Harmine and Harmaline.* O. Fischer and C. Buck. Ber., 1905, 38, 329–335. (See also this J., 1897, 1036.)

WHEN harmic acid is heated it loses two carboxyl groups and is converted into apoharmine; when the acid is heated under pressure at 200° C. with concentrated hydrochloric acid it loses only one carboxyl, yielding apoharmine-monocarboxylic acid in the form of the hydrochloride. This substance has both acid and basic characters, it is decomposed at a temperature of about 330° C. with formation of apoharmine. Apoharmine-monocarboxylic acid yields both methyl and nitro derivatives.

*Nitroapoharmine* contains the nitro group in combination with a carbon atom: when reduced by tin and hydrochloric acid it is converted into amino-apoharmine; it also yields a methyl derivative when treated with methyl iodide.

*Dihydroapoharmine* forms a well characterised picrate, melting at 198° C, which salt is of great assistance in the preparation of the pure base. Harmine, when carefully warmed with acetic anhydride and sulphuric acid, yields no acyl derivative, but is converted into *harmine-sulphonic acid*, in which the sulphonic group is attached to a nitrogen atom, which is additional evidence of the secondary nature of the base.—J. F. B.

*Isophysostigmine.* Ogiu. Apoth.-Zeit., 1904, 19, 891. Pharm. J. 1905, 74, 76.

THE author has examined isophysostigmine, which was found by Merck accompanying physostigmine in Calabar beans. The two bases have the same chemical composition. Physostigmine is soluble in ether, and gives no precipitate when a 1 per cent. aqueous solution of its sulphate is treated with platinum chloride. Isophysostigmine, on the other hand, is insoluble in ether, and forms a crystalline chloroplatinate when a 0.5–1 per cent. solution of its sulphate is treated with platinum chloride. Isophysostigmine sulphate melts at 202° C., physostigmine sulphate at 140°–142° C. The physiological action of the two bases is similar in character, but 0.75 mgrm. of isophysostigmine produces the same effect as 1 mgrm. of physostigmine.—A. S.

*Siberian Fir (Pichta; Abies Sibirica); Crystalline Products of the Essential Oil of*—P. Golubev. J. russ. phys.-chem. Ges., 1904, 36, 1096–1108. Chem. Centr., 1905, I, 95. (See this J., 1903, 879.)

THE essential oil of *Abies sibirica* contains two crystalline compounds, viz., *l*-bornyl acetate (43.96 per cent.) and *l*-camphene (about 10 per cent.). The *l*-bornyl acetate

was isolated in the form of rhombic crystals melting at 29° C. and boiling at 223°–224° C. at 758 mm. As regards rotation, in alcoholic solution  $[\alpha]_D^{20} = -45.47$  (t 20° C.) with c 15.5, and  $-44.02$  (t 16° C.) with c 19.6. The *l*-borneol obtained from it melted at 204° C. and boiled at 210° C. at 779 mm.; in alcoholic solution  $[\alpha]_D^{20} = -36.14$  (t 20° C.) with c 15.22 and  $-37.77$  (t 15°–16° C.) with c 15.40. *l*-Borneol, when oxidised with nitric acid of sp. gr. 1.4, or by a mixture of chromic and glacial acetic acids, is converted into *l*-camphor,  $C_{10}H_{16}O$ , m. pt. 188°–189° C., b. pt. at 757 mm., 204° C.;  $[\alpha]_D^{20} = -41.11$  in alcoholic solution with c = 9.97 and t = 20° C. This *l*-camphor closely resembles ordinary camphor. The *l*-camphene,  $C_{10}H_{16}$ , from essential oil of *Abies sibirica*, solidifies at 38°–39° C., melts at 40°–41° C., boils at 159°–160° C., and  $[\alpha]_D^{20} = -85$  with c 1.76 and t 18° C. (See also this J. 1904, 336 and 1042.)—A. S.

*Peppermint Oil; Java* —. P. Vander Wieden. Pharm. Weekbl., 1904, 41, 1081–1084. Chem. Centr., 1905, 1, 95.

THE essential oil of Java peppermint (*Mentha javanica*) has a pleasant odour different from that of ordinary peppermint, a faint bitter taste, and a bright green colour. It has the sp. gr. 0.9214 at 15° C.,  $d_4^{15} = +4.41$  (100 mm. tube), and is soluble in 1.5 vols. of 70 per cent. alcohol. The oil contains a considerable quantity of pulegone, but little or no menthol and menthone.—A. S.

*Cajuput Oil; Green Colour of* —. H. C. Prinsen-Geerligs. Chem.-Weekbl., 1904, 1, 931–934. Chem. Centr., 1905, 1, 95.

THE characteristic green colour of cajuput oil is stated to be due to the presence of copper, kept in solution by the butyric and valeric acids and esters of the same contained in the oil. If specimens of cajuput oil freed from acids and esters, be mixed with water and with ethyl formate, acetate, propionate, butyrate, valerate, lactate, citrate, cinnamate, and oxalate respectively, together with a few drops of the corresponding acid, and the whole allowed to act on copper turnings, only those samples of oil containing butyrate and valerate are coloured; in all other cases the dissolved copper is found in the aqueous layer. Valerian oil, when left in contact with copper turnings, also acquires a green colour, and is not decolorised by agitation with water.—A. S.

*Mercuric Chloride; Volatility of* — in Aqueous Solution. A. Minozzi. XXIII., page 154.

*Phenol; Determination of* —. S. J. Lloyd. XXIII., page 155.

*Saccharin; Detection of* —. G. v. Mahler. XXIII., page 154.

*Cane Sugar in Official Roots.* M. Harlag. XVI., page 143.

#### ENGLISH PATENTS.

*Formates; Manufacture of* —. J. Y. Johnson, London. From Rud. Koepf and Co., Oestrich-in-the-Rheingau, Germany. Eng. Pat. 7875, April 5, 1904.

SEE Fr. Pat. 342,168 of 1904; this J., 1904, 911.—T. F. B.

*Bromine Alkyl Acetamides [Bromodialkylacetamide]; Manufacture of* —. Kalle und Co., Biebrich-on-Rhine, Germany. Eng. Pat. 16,602, July 27, 1904. Under Internat. Conv., Dec. 9, 1903.

SEE Fr. Pat. 345,231 of 1904; this J. 1904, 1238.—T. F. B.

*Acetylene Tetrachloride; Process for Producing* —. P. Askenasy and M. Mugdan, Nuremberg, Germany. Eng. Pat. 18,602, Aug. 27, 1901.

ACETYLENE and chlorine are successively passed into cooled antimony pentachloride; the first product is  $SbCl_5 \cdot C_2H_2$ , which readily and smoothly absorbs 4 atoms of chlorine, acetylene tetrachloride (tetrachloro-ethane) being formed. The reaction may be made a continuous

one, since even when the antimony pentachloride is considerably diluted by acetylene tetrachloride, the reaction still takes place sufficiently rapidly. The acetylene and chlorine may be introduced simultaneously into the antimony pentachloride, which should then be contained in two separate, but communicating vessels. The acetylene tetrachloride is isolated from the reaction product either by fractional distillation or by decomposing the antimony pentachloride with water or hydrochloric acid. Acetylene tetrachloride is an excellent solvent for oils, fats, resins, &c.—T. F. B.

#### UNITED STATES PATENTS.

*Sesquiterpene Alcohol [Perfume]; Process of Making* —. M. Kerschbaum, Assignor to Chem. Fabr. zu Holmünden Ges. m. b. H., Holmünden, Germany. U. S. Pat. 775,978, Nov. 29, 1904.

A SESQUITERPENE alcohol, of the formula " $C_{15}H_{26}O$ ," obtained from essential oils of cassia or of ambrette seed and also from certain other essential oils, by treatment with anhydrides of organic acids, e.g., phthalic anhydride. The oil is first treated with dilute alkali and fractionated, the fraction distilling between 150° and 200° C. (and 20 mm. pressure), being treated with the anhydride; the mixture is distilled, the crude ester is decomposed with alkali, and the product distilled with steam. The distillate is then fractionated under reduced pressure, the portion boiling between 155° and 165° C. (10 mm. pressure) constituting the pure alcohol. It is a colourless or soluble in organic solvents; of b. pt. 160° C. (10 mm.,  $n_D^{20}$  corrected): sp. gr. = 0.885 at 18° C., and  $n_D^{20} = 1.488$ . On oxidation with chromic acid it is converted into a aldehyde, the semicarbazone of which melts at 133°–135° C. The new alcohol is said to have a pleasant floral odour, and is suitable for the preparation of perfume (Compare Fr. Pat. 326,658 of 1902; this J., 1903, 819).—T. F. B.

*Chloral-Acetone-Chloroform and Process of Making same* —. C. F. Schaerges, Assignor to the Firm of F. Hoffmann, Laroche, Basle, Switzerland. U. S. Pat. 778,27 Dec. 27, 1904.

CHLORAL-ACETONE-CHLOROFORM is produced by heating molecular proportions of chloral and "acetone-chloroform," and re-crystallising the resulting mass from suitable solvent. It is a solid of m. pt. 65° C., and capable of sublimation without decomposition; possesses a faint odour and taste resembling camphor, sparingly soluble in cold water, and easily soluble in dilute alcohol; it is decomposed by sulphuric acid into chloral and acetone-chloroform, and reduces hot potassium permanganate solution. Its composition is given as  $C_6H_8O_3Cl$ .—T. F. B.

*Acetylsalicylphenetidine; Process of Making* —. S. I. Summers, Philadelphia. U. S. Pat. 778,556, Dec. 27, 1904.

ACETYSALICYL-*p*-PHENETIDINE is produced by the action of "an acetylsalicylic acid compound" on *p*-phenetidine in presence of xylene; the mixture is heated until solution is complete, and the crude product which separates on cooling is purified. (See also U. S. Pats. 706,355 and 706,356 of 1902; this J., 1902, 1154.)—T. F. B.

*$\alpha$ - $\beta$ -Methylionone and Process of Making same* —. R. Schmidt, Holmünden, Germany. U. S. Pat. 779,187 Jan. 3, 1905.

METHYLIONONE is heated with a solution of bisulphite and the oil which is insoluble is purified. The  $\alpha$ - $\beta$ -methylionone thus obtained, is a fragrant liquid, suitable for use in perfumery and for flavouring food products; it has a b. pt. of 135°–140° C. (20 mm.); sp. gr. 0.931, and refractive index 1.5003 at 20° C. Its semicarbazone melts at 202° C., and its bromophenylhydrazine at 124°–125° C.—T. F. B.

*Bornyl Esters and Process of Making Camphor, &c.* B. R. Seifert, Radebeul, and C. Philipp, Dresden, Assignors



to Chem. Fabr. von Heyden. Act.-Ges., Radebeul, Germany. U.S. Pat. 779,377, Jan. 3, 1905.

E. Eng. Pat. 26,785 of 1903; this J., 1904, 204.—T. F. B.

*oxidising Methyl Groups in Aromatic Hydrocarbons: Process of* —. M. Bazlen and H. Labhardt, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 780,404, Jan. 17, 1905.

E. Eng. Pat. 17,982 of 1903; this J., 1904, 910.—T. F. B.

*alkylbarbituric Acid; Process of Making* —. K. Stephan and P. Hunsalz, Assignors to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 780,421, Jan. 17, 1905.

ALKYLBARBITURIC acids are produced by oxidising the corresponding dialkylmalonylguanidines in acid solution. The process of preparing diethylbarbituric acid is specially aimed.—T. F. B.

#### FRENCH PATENTS.

*alcohols and their Derivatives; Production of new Industrial Compounds* —. and *General Method for Preparing Primary Alcohols*. L. Bonveault and G. Blanc. First Addition, dated Nov. 18, 1903, to Fr. Pat. 338,895, June 27, 1903. (See this J., 1904, 798.)

DIMETHYLOCTANOL and 3,7-dimethyloctene-4-ol are prepared by reducing dimethyl-3,7-octenoic ester and methyl-3,7-octadiene-2,4-oic ester respectively with lithium and absolute alcohol. These esters are prepared by condensing the corresponding methylheptanone or thylheptenone with iodoacetic ester, and dehydrating the resulting compound. This method can be extended to the preparation of other analogous alcohols. 5,9-methyl-4,8-decadienol is produced by the reduction of myrideneacetic ester, whilst a homologous alcohol, containing two more carbon atoms, results from reducing the condensation product of citral and acetoacetic ester. Instead of preparing alcohols, as in the original patent, by reducing the esters of the corresponding acids, they may be prepared by reducing (with sodium and absolute alcohol) the corresponding acid amides,  $R.CO.NR'_2$ , where  $R'$  represents hydrogen or an alkyl radical. The necessity for using perfectly dry amides and absolutely anhydrous alcohol is emphasized.—T. F. B.

*rimidine; Process for Producing Cyano-derivatives of* —. Maison E. Merck. Fr. Pat. 346,188, Sept. 3, 1904. Under Internat. Conv., Sept. 15, 1903.

condensing dicyanodiamide with acetoacetic ester, malonic esters, or cyanoacetic esters, or their substitution derivatives, in presence of alkaline condensing agents, cyanamino-6-hydroxypyrimidine derivatives are obtained. For example, 2-cyanamino-4-methyl-6-hydroxypyrimidine is obtained from acetoacetic ester by condensation with dicyanodiamide in presence of sodium hydroxide.—T. F. B.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*aminophenol Soda as a Developer*. E. Valenta. Phot. Korr.; through Brit. J. Phot., 1905, 52, 28.

REBEL'S statement that the addition of three molecules of caustic soda to a solution of diaminophenoldihydrochloride (i.e., sufficient to produce the sodium salt of diaminophenol) gives a rapid developer, producing negatives quite free from fog, is declared to be erroneous, since such a solution is found to fog the plate immediately. The best result was obtained by the addition of two mols. of caustic soda, i.e., sufficient to liberate the free base, by further addition at once rendering the developer useless on account of the fog produced. Owing, however, to the rapidity with which such a developer oxidises, it is found best, for practical purposes, to use a developer in which only one of the hydrochloric acid groups was neutralised, the composition being diaminophenol, 5 grms.; sodium sulphite (crystals) 10 grms.; caustic soda solution

(1 per cent.) 100 c.c.; water 900 c.c. Such a developer remains clear, works rapidly, and gives softer results than the ordinary amidol developer.—T. F. B.

*Thiocarbamide Toning Bath; The* —. Kessler. Brit. J. Phot., 1905, 52, 28.

PRINTS toned by means of a solution of gold chloride and thiourca are found to be quite as permanent as those toned by any other gold or other toning bath. The solution recommended is made by adding a 2 per cent. solution of thiourca to 25 c.c. of a 1 per cent. gold chloride solution, until the precipitate first formed is redissolved (14 to 15 c.c. are necessary). 0.5 grm. of citric acid is then added, and the solution made up to 1 litre. Toning takes place very rapidly, and the prints should be well washed before immersion in the bath. Brownish-red to blue-violet tones are obtainable according to the duration of treatment.—T. F. B.

*Silver Image Toned with various Metals; Composition of the* —. A. and L. Lumière and A. Seyewetz. Brit. J. Phot., 1905, 52, 68–69.

THE coloured silver images, obtained by toning negatives with uranium, iron and copper salts, were examined. The toning baths all contained potassium ferriyanide, the other constituents being uranium nitrate, ferric citrate and cupric chloride respectively. The images were all found to contain small quantities of potassium, due to incomplete decomposition of the ferriyanide. Rejecting this potassium content, the images appeared to consist of substances of complex composition, and not closely related to one another. Thus, the uranium-toned image appeared to have a composition intermediate between those represented by the formulæ  $Fe.Ag_2UO_2(CN)_6$  and  $[FeAgUO_2(CN)_6]:UO_2$ ; similarly the iron-toned image appeared to lie between  $Ag_2Fe_2''Fe_2'''(CN)_{12}$  and  $Fe_3''Fe_2'''(CN)_{12}$ , and the copper image between  $[Fe.Cu.Ag(CN)_6]_2=Cu$  and  $FeCu_2(CN)_6$ .—T. F. B.

#### ENGLISH PATENTS.

*Colour Photography*. A. Hezekiel, Berlin. Eng. Pat. 4941, Feb. 29, 1904.

THIS invention relates to the production of photographs in natural colours from an ordinary negative, by printing upon a specially prepared paper or transfer tissue. This latter is prepared by coating a suitable support with successive layers of sensitised gelatin, coloured with different pigments, the order in which these layers are placed depending upon the actinic intensity of the light reflected by the different colours in the object photographed. For example, in landscape photography, the sky provides the predominating high lights, so the blue film is placed uppermost in a very thin layer; the light yellow parts come next in intensity, so the yellow layer is placed under the blue one, and is of somewhat greater density than the latter. In order to avoid confusion of colours, a layer of gelatin of a colour complementary to the blue is interposed between the latter and the yellow layer. For general landscape work, the following order of films is found to be best:—Blue, pink or crimson, yellow, red, green and black, the black layer being adjacent to the support. After printing, the paper is transferred to a second support, and developed in warm water, after which it may be transferred to a "permanent support." As a general rule, it is stated that each layer should be so thick as to prevent the layer beneath it from showing through it in single transfer work, and so powerful (as regards colour) as to prevent the layer below from being visible through it in double transfer work.

—T. F. B.

*Photographic Images or Prints; Manufacture of Coloured* —, and of *Sensitive Surfaces therefor*. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine, Germany. Eng. Pat. 4994, Feb. 29, 1904.

It is found that the leuco-compounds of organic dyestuffs, when mixed with a substance containing a nitro- or nitroso-group that can be easily eliminated, are oxidised to the corresponding dyestuff on exposure to light. This

is applied to the preparation of paper, &c., for use in preparing coloured photographic prints. For example, 0.4 grm. of "leucoaniline" is dissolved in 20 grms. of alcohol, and 20 grms. of ether, 50 grms. of 4 per cent. collodion are added, and the mixture applied to paper, and allowed to dry. The image is "fixed" by dissolving out the unoxidised leuco-compound by means of an aromatic hydrocarbon, chloroform, monochloro-acetic acid, &c. The sensitiveness of such papers is considerably increased by the addition of some oxygen carrier, such as platinum chloride, turpentine oil, or quinoline. By this process, leucoaniline yields a red image, hexamethyl-leucoaniline a blue-violet image, the leuco bases of the Malachite Green series green to blue images, and those of Flavaniline, Uranine, &c., yellow images. Suitable compounds for mixing with the leuco-dyestuff are nitro-carbohydrates, such as nitrocellulose or nitroglucose, and nitrosamines, such as phenylmethyl- or diphenylnitrosamine. —T. F. B.

*Colour Photography. Sensitised Plates for a Process of —.* Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses Fils, Lyon-Monplaisir, France. Eng. Pat. 25,718, Nov. 25, 1904. Under Internat. Conv., Jan. 13, 1904.

This specification constitutes an addendum to Eng. Pat. 22,988 of 1904 (see this J., 1905, 104). The coloured particles for preparing the plates may consist of a mixture of red, yellow, and blue particles (with orange, green and violet as well, if desired), or a mixture of these with any other coloured particles may be employed. Two layers of such particles are not absolutely necessary; the desired result may be obtained by coating the plate with a layer having at no point of its surface any superimposed particles. The coating may also be formed of particles of different sizes: the larger particles may be applied first, and the smaller ones dusted on subsequently in such a manner as to fill up the interstices between the larger particles; these smaller particles may be of similar colours to the larger ones, or they may be of any other colour, even black. —T. F. B.

*Photographic Printing Papers of the Class known as Self-toning Printing Out Papers; Manufacture of —.* E. C. Morgan, Richmond. Eng. Pat. 26,247, Dec. 2, 1904.

If, instead of using gelatin or collodion for preparing the emulsion for "self-toning" printing out papers, a mixture of arrowroot and agar-agar be employed, the gold salt is found to be more easily reduced on immersion in the "hypo" solution. The emulsion may be prepared as follows:—6 drms. of sugar, 5 drms. of citric acid, 64 grs. of ammonium chloride and 4 drms. of Rochelle salt are dissolved in 24 oz. of water containing 1.5 oz. of arrowroot or other starch. The following solutions are then added:—9 drms. 36 grs. of silver nitrate in 8 oz. of water; 11 grs. of gold chloride in 6 oz. of water; 2 drms. of agar-agar in 18 oz. of water. The paper is coated with this emulsion, and subsequently treated in the usual manner. —T. F. B.

#### UNITED STATES PATENTS.

*Transfer Paper; [Photographic] Carbon —.* C. L. A. Brasseur, New York. U.S. Pat. 778,947, Jan. 3, 1905.

A PHOTOGRAPHIC carbon transfer paper or tissue is made by interposing between a pliable support and a film of coloured soluble gelatin, a film of some easily soluble substance to facilitate transfer. —T. F. B.

*Silver [Photographic] Emulsions; Process of Producing —.* J. Gaedicke, Berlin. U.S. Pat. 779,777, Jan. 10, 1905.

SEE Eng. Pat. 18,183 of 1904; this J., 1904, 1044. —T. F. B.

*Reproducing Pictures by Means of Catalysis.* W. Ostwald and O. Gros, Leipzig, Germany. U.S. Pat. 779,797, Jan. 10, 1905.

SEE Fr. Pat. 327,379 of 1902; this J., 1903, 962. —T. F. B.

#### FRENCH PATENT.

*Photographic Plate with several Sensitive Coatings.* J. Smith. Fr. Pat. 346,244, Sept. 15, 1904. Under Internat. Conv., Sept. 17, 1903.

SEE Eng. Pat. 19,940 of 1904; this J., 1904, 1112. —T. F.

### XXII.—EXPLOSIVES, MATCHES, Etc.

*Nitrocellulose; Hygroscopicity of —.* W. Will. XII page 148.

#### ENGLISH PATENT.

*Explosives; Manufacture of —.* J. Y. Johnson. London. From Soc. Anon. des Poudres et Dynamit Paris. Eng. Pat. 25,797, Nov. 26, 1904.

SOLID nitro derivatives of toluene when dissolved nitroglycerin are stated to lower its freezing point, —20° C. without altering its sensitiveness and stability. mixture of solid dinitrotoluene (80 per cent.) and trinitro toluene (20 per cent.), constitutes after fusion a liquid mixture which answers the same purpose as each of the solid constituents, and claim is made for this liquid mixture in explosives containing nitroglycerin. (See a Fr. Pat. 333,502; this J. 1903, 1367.) —G. W. McD.

#### UNITED STATES PATENTS.

*Nitrated Starch; Process of Making —.* F. B. Holm Woodbury, N.J., Assignor to The Eastern Dynamite Co., Wilmington, Del. U.S. Pat. 779,421, Jan. 10, 1905.

A STABLE nitrated starch is produced by nitrating starch separating the nitro compound from the acids, and boiling it in the presence of an insoluble substance (calcium carbonate) capable of neutralising acid. —G. W. McD.

*Nitrated Starch; Process of Making —.* F. B. Holm Woodbury, N.J., Assignor to The Eastern Dynamite Co., Wilmington, Del. U.S. Pat. 779,422, Jan. 10, 1905.

NITROSTARCH is rendered stable by dissolving it in a mixture of alcohol and a solvent having a lower evaporating point than alcohol (acetone), evaporating off the acetone and separating the nitrated starch from the alcohol. —G. W. McD.

*Explosive.* C. E. Bichel, Hamburg, Germany. U.S. Pat. 779,760, Jan. 10, 1905.

SEE Fr. Pat. 325,507 of 1902; this J., 1903, 710. —T. F.

*Match Composition.* H. Staier, Brooklyn, N.Y. U.S. Pat. 779,674, Jan. 10, 1905.

THE composition consists of scarlet phosphorus (20 parts) powdered sulphur (6 parts), potassium chlorate (90 parts), powdered glass (42 parts), plaster of Paris (8 parts), zinc oxide (8 parts), whiting (4 parts), and glue (32 parts). —G. W. McD.

### XXIII.—ANALYTICAL CHEMISTRY.

#### INORGANIC—QUALITATIVE.

*Manganese; Testing with Potassium Permanganate, Zinc Oxide used for the Quantitative Determination of —.* L. L. de Koninck. Rev. Univ. des Mines, 1904. Chem. Zeit., 1905, 29, Rep. 5.

TWO to three grms. of the zinc oxide are carefully triturated with 20—30 c.c. of water containing 0.5—1.0 grm. pure iron alum in solution. The mixture is then dissolved by agitation in a sufficient quantity of 6N-sulphuric acid, added by degrees, excess being avoided. A single drop of permanganate solution should suffice to color the liquid a decided pink; but if the oxide contains metallic zinc or zinc sulphide, the reduction of the iron thereby to the ferrous state will lead to decolorisation of the permanganate. —C. S.



rium and Strontium; Detection of Small Quantities of —. L. Blum. Z. anal. Chem., 1905, 44, 9—10.

The presence of small quantities of barium and strontium may easily be overlooked in qualitative analysis, owing to their being precipitated as sulphates by the ammonium phosphate almost invariably present in yellow ammonium sulphide used for the precipitation of the iron group. It is, therefore, of especial importance to use freshly prepared ammonium sulphide, and also to examine for barium and strontium the residue left after the sulphide precipitate has been dissolved.—T. F. B.

ferrous Oxide in Presence of Ferric Oxide; Detection of —. L. Blum. Z. anal. Chem., 1905, 44, 10—11.

TEMPTS to apply the well-known ferrous sulphate and phosphoric acid test for nitric acid to the detection of ferrous salts, failed, owing to the mixing of the nitric and sulphuric acids. It was found, however, that the detection could be easily carried out by adding to the solution to be tested an equal volume of concentrated sulphuric acid, and introducing a large crystal of potassium nitrate into the mixture. The presence of ferrous salt is manifested by the appearance of a red-brown coloration of the solution near the crystal. When considerable quantities of a chloride are present, it is well to boil the solution and then cool it previous to adding the potassium nitrate.—T. F. B.

in the Stannous State; Detection of —. J. L. Blum. Z. anal. Chem., 1905, 44, 11—12.

THE method described in the preceding abstract for detecting ferrous compounds may be applied indirectly to the detection of stannous compounds. A small quantity of ferric chloride solution is added to the solution to be tested, and the mixture tested for ferrous compounds by the method described above. A coloration would indicate the presence of a stannous compound, which had reduced the ferric chloride to the ferrous state.—T. F. B.

### INORGANIC QUANTITATIVE.

Palladium-Hydrogen; Use of — as a Reducing Agent in Quantitative Analysis. A. C. Chapman. Analyst, 1904, 39, 346—357.

THE applicability of palladium-hydrogen as a reducing agent for the quantitative analysis of various inorganic salts was examined. The palladium-hydrogen was prepared by soldering pieces of palladium foil, 2 in. square, and weighing 8 grms., to stout palladium wire, and charging the metal with hydrogen electrolytically in a solution of sulphuric acid. Solutions of ferric salts, containing about 0.1 gm. of iron, acidified with sulphuric acid, were completely reduced to the ferrous condition by boiling with the palladium-hydrogen for about 20 minutes; the presence of aluminium salts and of phosphates in no way interferes with the accuracy of the process. Acidified solutions of chromates were completely reduced to the corresponding chromic salts in a similar manner. Dilute, acidified solutions of cupric salts were similarly completely reduced to cuprous salts by palladium-hydrogen, the copper being determined by precipitation as thiocyanate, and then weighed as such, or as sulphide. When "uncharged," palladium is boiled in acid solutions of ferric or cupric salts, reduction to the ferrous or cuprous salts occurs, with evolution of palladium chloride. Alkaline solutions of ferric ferriyanide (about 0.2 gm.) were completely reduced to ferrocyanide by boiling with palladium-hydrogen for about 20 minutes. Excess of alkali is to be avoided, and the treatment should not be unduly prolonged. Ceric salts in acid solution were also completely reduced to cerous salts. Only very dilute solutions of potassium permanganate could be reduced by this method. The reduction of potassium chlorate by palladium hydrogen was always imperfect, the results varying between 47 and 94 per cent. of theory. Perchlorates, bromates, iodates, mercuric and stannic salts, and arsenic acid were only very slightly reduced, and

only 10 per cent. of the nitrogen of potassium nitrate was converted into ammonia by palladium-hydrogen. In the case of vanadium and molybdenum salts, the reduction is of an indefinite character, proceeding past the formation of vanadium tetroxide and molybdenum dioxide respectively, but not ceasing sharply at a point corresponding to the formation of a lower oxide.—T. F. B.

Manganese as Sulphide; Determination of — in Manganese Ores containing Barium. L. Blum. Z. anal. Chem., 1905, 44, 7—9.

IN the precipitation of manganese sulphide by means of yellow ammonium sulphide, some barium sulphate is precipitated by the sulphate existing as impurity in the ammonium sulphide solution, if the manganese ore contains barium, as is the case with most Brazilian, Spanish and Indian ores. It is proposed, therefore, to add a small quantity of dilute sulphuric acid to the manganese solution before precipitating the iron and alumina as basic acetates. Emphasis is also laid on the desirability for using freshly prepared ammonium sulphide for the precipitation of the manganese.—T. F. B.

Gold Assaying; Note on the Influence of Fine Crushing on the Assay Value. A. Whitby. J. Chem., Metall. and Mining Soc. of S. Africa, 1904, 5, 95.

THE author brings evidence to show that very finely crushed material gives higher results on assay by fusion than does the same material when less finely crushed. He recommends the 100 linear mesh as a sort of standard. In the discussion, some speakers thought that adequate fluxing and the addition to the fused mass of a mixture of litharge and charcoal (reduced lead)—termed "washing" the slag—was of more importance than fine grinding of sample.—J. H. C.

Antimony and Tin; Electrolytic Determination and Separation of — from Solutions of their Sulpho-salts, together with a Study of the Determination of Antimony by the Trisulphide Method. A. Fischer. Z. anorg. Chem., 1904, 42, 363—417.

ELECTROLYTIC methods for the determination of antimony and tin from solutions of their sulpho-salts have the disadvantage that polysulphides are formed which exert a solvent action on the deposited metal. In order to avoid the complicated process recommended by Ost and Klapproth (this J., 1900, 911; 1901, 1028) to overcome this difficulty, the author has tried the addition of reducing agents to the electrolyte, and has found that satisfactory results can be obtained by addition of sodium sulphite or hydrosulphite (hyposulphite) or especially potassium cyanide in the determination of antimony in sodium sulphide solution, and of sodium sulphite in the determination of tin in ammonium sulphide solution. It is preferable to use platinum-iridium instead of platinum anodes. In the determination of tin, a uniform separation can only be effected if the platinum cathode be coated with tin; this is best done by depositing on the platinum, first a thin coating of copper from a hot oxalic acid solution, and then a coating of tin from an ammonium binoxalate solution rendered acid with oxalic acid. The separation of antimony and tin can be effected from sodium sulphide solution saturated at 20° C. if potassium cyanide be added to the electrolyte, which must also contain 2—4 grms. of free sodium hydroxide. The temperature should not exceed 30° C. and the E.M.F. must not be greater than 1.4 volts. Trivalent antimony may be separated from tin without the addition of potassium cyanide. In this case, the electrolyte is a solution of sodium sulphide saturated at 50° C., and the E.M.F. should not exceed 0.9 volt. The cause of the higher results obtained in the determination of antimony by the electrolytic method than by the gravimetric trisulphide method, is that the composition of the antimony trisulphide does not correspond exactly to the formula  $Sb_2S_3$ . A specimen of the trisulphide prepared with great care by the author contained 27.98 per cent. of sulphur instead of 28.58; and 72.03 per cent. of antimony instead of 71.42.—A. S.

*Carbon Monoxide in Confined Atmospheres; Determination of —.* A. Levy and A. Pecoul. *Comptes rend.* 1905, 140, 98–99.

THE authors employ a method based upon the reduction of anhydrous iodic acid by carbon monoxide. The liberated iodine is received in about 4 c.c. of pure chloroform, and, by comparing the depth of colour of the pink solution obtained with that yielded by known amounts of iodine, the quantity of carbon monoxide in a given volume of air may be ascertained. The presence of 1,200,000 of carbon monoxide can be determined by this method, the volume of air required being 4 litres. A small quantity of water may be placed on the surface of the chloroform to prevent evaporation of the latter.—W. P. S.

*Mercuric Chloride; Volatility of —, in Aqueous Solution.* A. Minozzi. *Boll. Chim. Farm.*, 1904, 43, 745–747. *Chem. Centr.*, 1905, 1, 70–71.

THE author found that on distilling 300 c.c. of a 0.1–1 per cent. solution of mercuric chloride with steam, so that one-half distilled over in 40–45 minutes, the distillate contained from 0.00025 to 0.0022 gram. of mercuric chloride. The quantity of mercuric salt carried over increases with the concentration of the solution, and the error introduced into analysis under these conditions may amount to 0.2 per cent. Similar results were obtained with mercuric chloride solutions in presence of hydrochloric acid (3.5 grms. in 300 c.c.), and of phosphoric acid (5 c.c. of sp. gr. 1.25) and sodium chloride (5 grms.), but in presence of phosphoric acid alone, the volatility of the mercuric chloride appeared not to appreciably increase with the concentration of the solution.—A. S.

#### ORGANIC—QUALITATIVE.

*Formaldehyde; Detection of —, in Spirit Denatured with Formalin.* L. Lindet. *Bull. Assoc. Chim. Sucrier Dist.*, 1904, 22, 475–477.

THE proposed decrease of the proportion of wood-spirit in French denatured alcohol (see page 146) has necessitated the introduction of formalin as a delicate indicator for the detection of fraud. The most certain method for the detection of formaldehyde is that of Trillat (condensation with dimethylaniline at the temperature of the water-bath, extraction of the base with ether and oxidation by lead peroxide). As a rapid preliminary test, the author prefers, however, the following modification of Eury's test (*Ann. de Chim. analyt.* 1904, 254):—10 c.c. of the spirit are placed in a test glass and a pinch of dry casein is introduced. A few drops of a dilute solution of ferric chloride are added, then 10 c.c. of syrupy phosphoric acid and, finally, 10–15 c.c. of sulphuric acid. If formaldehyde be present a violet coloration appears at once, whilst in absence of formaldehyde, the coloration is brown. This test is capable of detecting 1 part of formaldehyde in 300,000 of spirit. Acetaldehyde gives no coloration, but if the proportion be large, the mixture turns black; such samples should be diluted. Certain higher aldehydes, such as butyric and valeric aldehydes, appear to yield the violet coloration, but these are never present in the "head products" of distillation, which alone are used for denaturing.—J. F. B.

*Archil, Cudbear and other Lichen Colours; Note on the Detection of —.* L. M. Tolman. *J. Amer. Chem. Soc.*, 1905, 27, 25–26.

COLOURING matters from lichens such as archil and cudbear are frequently used for colouring medicines and foods where coal-tar dyestuffs are prohibited. For distinguishing between these two classes of dyestuffs, the ammoniacal solution of the material under examination is extracted with amyl alcohol, in which the natural colouring matters of fruits and wines are insoluble. The amyl alcohol extract is evaporated, and the residue tested by dissolving in water and reducing with tin and hydrochloric acid. Lichen colouring matters are decolorised, but are reproduced by oxidation with ferric chloride, and can in this way be distinguished from Magenta and azo dyestuffs.

—A. S.

*Bacillus Coli Communis; Neutral Red Reaction for —.* E. W. Moore and C. Revis. *J. of Pathol. and Bact.* 1904, 10, 97–104.

IS working with the Neutral Red reaction for *Bac. coli communis*, with broth containing glucose, according to the directions of Savage (*J. of Hyg.*, 1901, 1, 437), the authors failed to obtain satisfactory results, even with undoubted cultures of the *Bac. coli*. By using broth without the addition of glucose, good results were obtained, and it was found that whilst the reaction only takes place in the broth contain "respirable material" of some kind, broth which is free from such material is not rendered suitable by addition of glucose. Addition of lactose, was, however, found to give satisfactory results in all the types of media used, viz., neutral and alkaline broth prepared from meat and from commercial meat extracts. The use of lactose also affords a means of distinguishing between *Bac. coli communis* and *Bac. enteritidis* (Gaertner) since in broth containing no "respirable material" other than lactose, Gaertner's bacillus would not give the Neutral Red reaction.—A. S.

*Saccharin; Detection of —.* E. v. Mahler. *Chem. Zeit.*, 1905, 29, 32.

FOR the detection of saccharin, especially in presence of salicylic acid, the author recommends warming the substance under examination with metallic sodium and potassium, and testing the reaction-product for the presence of sulphide by means of sodium nitroprusside.—A. S.

#### ORGANIC—QUANTITATIVE.

*Dyestuffs; Quantitative Determination of some —.* *Dyed Cotton Fabrics.* E. Knecht. *J. Soc. Dye and Colourists*, 1905, 21, 3–6.

DIRECT cotton (azo) dyestuffs can be accurately determined on the fibre by direct titration with titanous chloride (compare this *J.*, 1903, 825). Active chlorine removed from the fabric by boiling for about 5 minutes with hydrochloric acid (1:3), carbon dioxide passed into the solution, the titanous chloride solution added and heat applied until the colour has disappeared when the contents are cooled, and the excess titanous chloride determined by titration with ferric alum solution, using potassium thiocyanate as indicator. The passage of the current of carbon dioxide is continued throughout the operation. Accurate results were obtained by this method with Benzopurpurin 4B, Chrysophenin Brilliant Yellow and Erika B, and it was found applicable to the determination of Methylene Blue the only basic dyestuff tried. In determining the amounts of dyestuff on cotton dyed in mixed shades, the remarkable selective action of titanous chloride was observed; thus, in greens obtained from Diamine St Blue and Chrysophenin, Chrysamine or Stilbene Yellow C, respectively, the yellow was always destroyed first leaving the pure blue on the fibre.—T. F. B.

*Methylene Blue; Determination of —.* E. Knecht. *J. Soc. Dyers and Colourists*, 1905, 21, 9.

ONE gram of Methylene Blue is dissolved in 250 c.c. of water, and 50 c.c. of this solution are warmed with a few drops of hydrochloric acid; a current of carbon dioxide is then passed through the solution and a standard solution of titanous chloride run in until the colour has just disappeared; the end point of the reaction is found to be quite sharp. On the assumption that 1 mol. of the dyestuff requires 2 atoms of hydrogen for reduction a sample of pure Methylene Blue was found by this method to contain 95–96 per cent. of dyestuff and 4.0 per cent. of water. The method described by Pell and Garuti (this *J.*, 1904, 1047) is considered inadequate for general use, since the differentiation between samples of nearly equal strength would necessitate exceedingly delicate manipulation and observation.—T. F. B.

*Beeswax; Analysis of —.* G. Buchner. *Chem.-Zeit.* 1905, 29, 32.

THE following method is recommended as giving



highest (and concordant) results in the determination of the saponification value of beeswax. For the determination of the acid value, the wax (5 grms.) is boiled for an hour over wire gauze with 3 c.c. of  $N/2$  alcoholic potassium hydroxide solution in a flask connected with a Soxhlet's extractor and Vigreux's condenser. The continual concentration of the liquid in the flask leads to more complete saponification, and the maximum values are obtained after 1 hour with beeswax, whether pure or containing ceresin. If saponification be carried out in a flask with a long tube to act as condenser, maximum values are also obtained with beeswax after 1 hour, but samples containing ceresin require the boiling to be continued for several hours. The author confirms the value of Werder's proposal of amyl alcohol as the saponifying medium in the case of waxes of high melting point, e.g., carnauba and montan wax.

It is pointed out that abnormal values in beeswax may sometimes be due to alterations in its constituents. For instance, a beeswax of known purity gave the following values: acid value, 23.3; saponification value, 95.7; and ratio number 3.0. Here the ratio number is normal, but the acid value appears to have been raised at the expense of the ester value. In the bleaching of beeswax, this change can be plainly observed.

			Acid Value.	Saponification Value.	"Ratio" Number.
Beeswax before bleaching	..	..	20.0	95.1	3.7
.. after ..	..	..	25.1	95.1	2.8

**Ghedda Wax.**—In the author's opinion, this Indian wax affords another example that such changes may occur naturally in beeswax. Thus, a sample gave the following results: acid value, 5.33; and saponification value, 95.68. Calculating from the normal ester value of beeswax (75) and adding the difference between this and the "ester value" found, to the acid value, gives results agreeing with the normal values for ordinary wax. The composition of a specimen of Ghedda wax calculated from the analytical values, the amount of melissyl alcohol (determined by Buisson's method of fusion with potassium hydroxide) and determination of hydrocarbons, was found to be as follows: stearic acid, 5.13; palmitic acid, 37.87; melissyl alcohol, 10.09; and hydrocarbons, 8.65 per cent.—C. A. M.

**Rules for Testing Boiled Linseed** —, issued by the Russian Minister of Marine. Chem.-Zeit., 1905, 29, 56.

A COMMISSION appointed by the Russian Minister of Marine has reported that the following tests are to be applied to all boiled linseed oil delivered to that Department:—

**1. APPEARANCE:** (a) *Colour:* This may be light to dark brown. (b) *Transparency:* Complete transparency desired, but certain oils that are transparent at first, may become slightly turbid from the separation of traces of lead or manganese soaps, without depreciation of their value. **II. PRACTICAL TESTS:** (a) The varnish is read in a thin layer on glass and kept at 16°–19° C. A dark varnish should not be sticky after, at most, 12 hours, and a light varnish after 20 hours. The film should be completely and be brilliant and elastic. (b) The durability is determined by drying the film for 24 hours in an oven at 100° C. There should be no cracks and the film should yield shavings when scraped with a knife.

There should be but little darkening in shade when the white or chemically pure white lead are rubbed with the varnish. (d) Twenty-five parts of the varnish are mixed with 20 parts of zinc white and the mixture spread over a smooth slab of wood. The paint ought to dry within 8 to 9 hours. (e) The presence of fish oil is recognised by the unpleasant odour, which is more

perceptible when the oil is rubbed between the hands or warmed. **III. CHEMICAL TESTS:** (a) The specific gravity at 15° C. must not be less than 0.941. (b) Mineral, rosin or turpentine oils are detected by saponifying the oil by boiling it under a reflux condenser with alcoholic potassium hydroxide, and diluting the soap with 2 to 3 parts of water. Pure boiled linseed oil furnishes a completely transparent solution. Resinous substances can also be identified by means of the polarimeter. In doubtful cases, the varnish is distilled with steam and the distillate examined for hydrocarbons. (c) Small amounts of colophony are admissible, but the acid value of the oil must not exceed 8. This value is determined by dissolving 10 grms. of the sample in 50 c.c. of warm neutralised alcohol and titrating the solution with  $N/10$  alcoholic potassium hydroxide solution, with phenolphthalein as indicator. (d) The amount of ash must not exceed 0.75 per cent.—C. A. M.

**Malt, Wort and Beer; Determination of the Ash of —, and the Proportion of Sulphuric Acid in the Ash.** W. Windisch. Woch. f. Brau., 1905, 22, 17–18.

ACCORDING to the standard German method for the determination of the sulphuric acid in the ash of brewery products, the ash is prepared for this purpose by incinerating the material in presence of a base, such as baryta or sodium carbonate. The author shows the great necessity for this precaution, since certain beer ashes which contained 16–18 per cent. of sulphuric anhydride when prepared in presence of sodium carbonate, contained only 1.76–3.25 per cent. when prepared by incineration without a base. Consequently the published analyses of ashes of such materials, which have been prepared in the latter way, are not correct, so far as the sulphuric acid is concerned. The difference is attributed partly to the volatilisation of organic sulphur, but mainly to the reduction of the sulphates to sulphides. It is shown that the primary phosphates of the ash decompose the sulphides produced, with the evolution of sulphuretted hydrogen. For this reason also, it is desirable that the determination of the ash itself should be made with the addition of a basic substance.—J. F. B.

**Gluten in Wheat Flour; Determination of —.** E. Fleurent. Comptes rend., 1905, 140, 99–101.

A WEIGHED quantity of the flour is made into a dough with a little water. The cake of dough is kneaded with water containing 0.1 gm. of chalk per litre, the water also containing sufficient carbon dioxide to hold the chalk in solution. The temperature of the water should be 16° C. Eleven minutes are required for the kneading and 2 minutes for a final washing, or 13 minutes in all. The gluten is then dried at 100°–105° C. and weighed. The use of distilled water slightly diminishes the yield of gluten, as does also the substitution of calcium sulphate or chloride for the calcium bicarbonate. The presence of sodium chloride in the wash-water decreases the yield in a similar manner. Old, acid flour must be previously treated with sodium bicarbonate in order to obtain the correct quantity of gluten.—W. P. S.

**Phenol; Determination of —.** S. J. Lloyd. J. Amer. Chem. Soc., 1905, 27, 16–24.

OF the different workers who have devised methods for the determination of phenol based upon the reaction:  $C_6H_5OH + 3Br_2 = C_6H_2Br_3OH + 3HBr$ , Beckurts (this J., 1886, 546) recognised that some tribromophenol bromide,  $C_6H_2Br_3OBr$ , was formed, but assumed that it was quantitatively converted into tribromophenol by potassium iodide. The author finds, however, that the conversion of the tribromophenol bromide into tribromophenol by potassium iodide is not complete. The formation of tribromophenol bromide can be prevented by working in strongly acid solution, and the following method is recommended:—The solution containing the phenol is treated in a stoppered flask with a volume of hydrochloric acid (sp. gr. 1.2) equal to about one-third or one-fourth of the combined volumes of the phenol solution and the hypobromite solution that will probably be required. A standardised solution of potassium hypobromite (9 c.c. of bromine dissolved in 2 litres of a solution containing

28 grms. of potassium hydroxide) is then added until the solution becomes permanently yellow, followed by a further quantity (10–20 per cent. of the amount previously added) of the same solution, and an excess of potassium iodide solution (17 grms. per 100 c.c.). The solution is diluted, 10 c.c. of chloroform added, and the free iodine determined by titration with a  $N/50$  solution of thiosulphate. It is stated that in this way the phenol can be determined to within 1 or 2 parts per 1000.—A. S.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Galactose: Biorotation of —.* G. Heikel. *Annalen*, 1904, 338, 71–104.

THE most probable explanation yet given of the biorotation of a sugar is that, in solutions of different rotatory powers, the sugar exists in two different stereo-isomeric "lactonic" forms, which readily pass one into the other, possibly with intermediate formation of the aldehydic modification (see Löwy, this J., 1903, 828). The hydrate theory of biorotation has been disposed of by Behrend and Roth (this J., 1904, 388), whose results were confirmed by E. F. Armstrong (this J., 1904, 388), and by Jungius and Lobry de Bruyn (Konink. Akad. wetensch. Amsterdam, 1904, 864). By acetylating galactose in pyridine solution under different conditions, the author demonstrates the existence of three isomeric pentacetylgalactoses, and also the close connection between these compounds and the modifications of galactose having different rotatory powers.—T. H. P.

## Prizes.

*Cements: Investigations on Hydraulic —.*

THE Prussian Minister of public works, jointly with the Prussian ministers of war, agriculture, and trade and industry, the imperial secretary of the navy, and the German society of Portland cement manufacturers, issued a call for a prize competition of essays on the chemical processes which take place during the hardening of hydraulic cements. Prizes to the amount of 15,000 marks are offered, and the prospectus specifies that contributions must be submitted in the German language, each signed with a pseudonym, and the name of the author inclosed in a sealed envelope marked with the same pseudonym, which latter will be opened only in case the paper bearing such pseudonym receives a prize. Thus prepared, all papers for competition are to be addressed to the "Ministry of Public Works, No. 80, Wilhelm-Strasse, Berlin," where they will be received until 3 p.m. December 31, 1905.

The papers will be submitted to a jury composed as follows: Prof. van 't Hoff, Berlin; Prof. Scheibbe, Wilmersdorf; Dr. Michaelis, Berlin; E. Cramer, editor of the *Thonindustrie Zeitung*, Berlin; Prof. W. Fresenius, Wiesbaden; Director F. Schott, Heidelberg; Dr. H. Passow, Hamburg, and officials of the royal testing station near Berlin.

The scope of the investigation is indicated by the following translation of the schedule which defines the questions to be solved:

Demonstration of the properties and of the hardening process of calcareous hydraulic cements, synthetically, analytically, microscopically, mineralogically (hardening in air, fresh water, and sea water).

(a) To prove whether silicic acid, alumina, and oxide of iron combine with lime as crystalloids in stable proportions, or as colloids in varying proportions.

(b) To prove whether double combinations result between silicic acid, alumina, and oxide of iron with lime, and in what manner these substances are engaged in the hardening process.

(c) Consideration of the swelling phenomenon which accompanies the hydraulic hardening.

(d) Consideration of the influence of the temperature and length of time of the burning process on the different kinds of hydraulic cements.

(e) Properties of puzzolana and its hardening with lime beginning with silicic acid as the most active and prevailing puzzolana, alumina, oxide of iron, and manganese independently and in combination with silicic acid, either natural or artificial puzzolana.

The competitors may choose for the purpose of investigation any or all of the foregoing questions.

## New Books

**TECHNO-CHEMICAL ANALYSIS.** By Dr. G. LUN. Authorised Translation by ALFRED I. COHN. 1<sup>st</sup> Edition. John Wiley and Sons, New York. Chapman and Hall, Ltd., London. Price 4s. 6d.

SMALL 8vo volume, with table of contents, bibliography, 128 pages of subject matter with 16 illustrations, and alphabetical index of subjects. The subjects treat may be brought under the following classes:—I. Scope, techno-chemical analysis. II. General operations preceding Analysis. III. Technical Gas-Analysis. IV. Volumetry. V. Fuels and Heating. VI. Water. ORGANIC CHEMICAL MANUFACTURES. I. Sulphurous and Sulphuric Acids. II. Nitric Acid. III. Sulphates. Hydrochloric Acid. V. Soda. VI. Carbonated L. VII. Chlorine Industry. VIII. Potassium Salts. Clay and Cement Industry. X. Artificial Manures. Gas and Ammonia Manufacture. APPENDUM I. Calcium Carbide. II. Coal-tar Industry. III. Mineral Oils. Oils and Fats; Soaps; Glycerin and Sugar. V. Alcohol Manufacture (Brandy, &c.). VI. Vinegar, Wine; Beer Brewing; Tanning Materials; Dyeing.

**DER PYROGENE ZERFALL DES KAUTSCHUKS.** Aeltere u. Neuere Studien über die Produkte der trocknen Destillation des Kautschuks. Von Dr. RICHARD DITMAR. Steinkopff und Springer, Dresden—A. Germany. Price M.1.

PAMPHLET of 38 pages, containing at the end detailed literature on the subject, and also on closely associated subjects (Isoprene and Dipentene).

**BULLETIN OF THE BUREAU OF STANDARDS.** Department of Commerce and Labor; U.S. America. Vol. I., No. 8. W. S. STRATTON, Director. Issued November 1, 1904. Government Printing Office, Washington, U.S. America. 1904.

LARGE 8vo volume containing 124 pages of subject matter with illustrations. The subjects treated of in this volume are as follows:—I. Recombination of the United States Prototype Meter. II. Study of the Silver Voltameter. III. So-called International Electrical Units. IV. Speed of Mixed Gases. V. Secondary Spectra and the Conditions under which they may be Produced. VI. Some Non-Rectifying effects in Conducting Gases. VII. Filament resembling Quartz in their Elastic Properties. VI. The Temperature of the Arc.

**JAHRBUCH DER ELEKTROCHEMIE UND ANGEWANDTE PHYSIKALISCHE CHEMIE.** Begründet und bis 1904 herausgegeben von Prof. Dr. W. NERNST und Prof. W. BORSCHERS. Berichte über die Fortschritte des Jahres 1903. Unter Mitwirkung der Herren Dr. Askanius; Prof. Dr. K. Elbs; Dr. F. Harms; J. He. Dr. H. Ley; Dr. J. Meyer; Dr. M. Mugden; Dr. O. Sackur. Herausgegeben von Dr. H. Danneberg. X. Jahrgang. Wilhelm Knapp's Verlag, Halle a. S. 1905. Price M.26.

LARGE 8vo volume, containing 837 pages of subject matter with 137 illustrations, 9 pages devoted to New Books, the year 1903, a list of Journals consulted in compiling the work, and alphabetical Indexes of subjects and names of authors, &c., to page 930. The work is divided into two sections, and is arranged as follows:



SCIENTIFIC SECTION. (i) General. (ii) Educational. (iii) Apparatus and Methods. (iv) Systematising the Chemical Substances. (v) Doctrine of Phases and Equilibrium. (vi) Laws of Mass Action, Hydrolysis, &c. (vii) Conductivity, &c. (viii) Chemical and Electrical Equilibrium. (ix) Polarisation and Electrolysis, &c. II. APPLIED ELECTROCHEMISTRY. (i) Current-production. (ii) Inorganic Electrochemical Processes and Products. (iii) Carbides. (iv) Metals. (v) Organic Compounds. (vi) Electrolysis of Alkali Chlorides and Bleaching Processes. (vii) Electrical Furnaces. (viii) Galvanology and Allied Branches. (ix) Apparatus for the Electrochemical Technology.

VISUAL OF CHEMICAL ANALYSIS AS APPLIED TO THE ASSAY OF FUELS, ORES, METALS, ALLOYS, SALTS, AND OTHER MINERAL PRODUCTS. By EUGENE PROST, D.Sc. Translated from the original by J. Cruickshank Smith, F.R.S., &c. MacLaren and Sons, 37 and 38, Shoe Lane, London, E.C. D. van Nostrand Company, 23, Murray St. 27, Warren Streets, New York, U.S.A. 1904. Price 12s. 6d. nett., 13s. post free; 14s. to Colonies and abroad.

Large 8vo volume, containing prefaces, and 296 pages of subject matter with 44 illustrations. The subject matter is divided into three parts:—I. FUELS, WATERS, ORES, AND OTHER MINERAL INDUSTRIAL PRODUCTS. II. METALS, including Iron and Steel; Copper; Zinc; Lead; Antimony; Tin; Nickel; and Antimony. III. ALLOYS.

## Trade Report.

### I.—GENERAL.

#### CHEMICAL AND MINERAL TRADES IN AMERICA.

*C. Schnatterbeck. Eng. and Mining J., Jan. 5, 1905.*

Assumption in most lines in 1904 was unsatisfactory, prices low, impairing profits. Imported products from Great Britain and the Continent are feeling the expansion of domestic production; thus, imports of chlorate of soda have fallen off about 82 per cent.; caustic soda, 28 per cent.; bleaching powder 22 per cent.; and ash, 14 per cent. "Sal soda," however, showed an increase of 31 per cent. in imports as a result of the heavy consumption. Cement receipts have been 62 per cent. more than 1903, and domestic exports have increased 10 per cent. Imports of salt are 9 per cent. larger than 1903, while domestic exports show nearly three times as much increase. Raw materials, notably nitrate of soda, continued high in price.

Interesting developments during the year were the liquidation of an additional \$6,000,000 in 8 per cent. preferred stock to liquidate the loan made by the Virginia Chemical Company; payment of 6 per cent. dividend on the preferred shares of the American Agricultural Chemical Company; suspension of dividends by the General Chemical Company, because of a depression in business and serious loss by fire and flood; initial dividends of 5 per cent. on the \$25,000,000 preferred stock of the E. I. Du Pont de Nemours Company, and 2.5 per cent. on the \$9,000,000 common stock of the International Powder and Chemical Company, which has a substantial Government contract and is controlled by the Federal trust; increase in capitalisation of the Pennsylvania Salt Manufacturing Company from \$3,000,000 to \$5,000,000, yielding 12 per cent. in dividends annually; release of additional salt lands at Delray, Michigan, by the Solvay Process Company; erection of new by-product ovens by the Semet-Solvay Company, one of the largest producers of gas-liquor sulphate of ammonia in the United States.

In heavy chemicals the feature has been bleaching powder, which, since the signing of the triangular agreement among the manufacturers in Great Britain, the Continent and America, has advanced, selling at \$1.20 to \$1.25 per 100 lb. for prime brands on contract delivery. No shipments from Great Britain to the United States

have fallen off about one-third in favour of the Continental makers. Total imports were approximately \$8,587,628 lb., as against 113,285,240 lb. in 1903; showing a decrease of 24,697,612 pounds. Soda compounds have been steady, advancing for 1905 delivery. Caustic soda, of which imports were about 2,179,803 lb. or 790,983 lb. less than 1903, sold at \$1.90 to \$1.95 per 100 lb. for foreign, f. o. b. New York, while domestic high test brought \$1.75 to \$1.85 at works. Alkali, imported to the extent of 18,907,015 lb., as against 21,859,365 lb. in 1903, moved at 85 to 92.5c. per 100 lb. for foreign at New York, and 72.5 to 77.5 for domestic at works. Sal soda imports were 4,511,228 lb., against 3,454,005 lb. in 1903, while selling prices were 67.5c. per 100 lb. for foreign at New York, and 60c. for ordinary domestic at works. Chlorate of potash, of which the imports fell to 85,638 lb.—the smallest quantity on record—suffered a decline in price to 7c. to 8.75c. per lb. for foreign at New York, and 6.5 to 8.75c. for domestic.

Owing to competition, cyanide sold at 17 to 20c. per lb. at New York. Small exports were made, principally to Mexico and Canada, at rather low prices compared to domestic deliveries. With an increased demand from the Transvaal gold mines, the European situation has improved materially.

Copper sulphate exports have increased, amounting to 25,650,000 lb., initiating an advance in price from \$4.90 to \$5.40 per 100 lb. for domestic deliveries, and from \$3.77 to \$4.81 for export. Small quantities of British makes have been imported, paying a duty of 0.5 per lb., and selling at about domestic prices.

Acids were firm in price, because of the strength in raw materials. Oxalic acid, imported to the amount of about 5,500,000 lb. per annum, sold at \$5 to \$5.50 per 100 lb. at New York—a price that affords little profit. Nitric acid, manufactured on a large scale in the United States, has been marketed at \$4.50 to \$5 per 100 lb. for 36° in carboys, f. o. b. New York; \$4.75 to \$5.25 for 28°; \$5 to \$5.50 for 40°, and \$5.375 to \$5.75 for 42°, the higher price ruling at the close of the year for 1905 shipments. Hydrochloric acid ruled steady at \$1.50 per 100 lb. for 18°; \$1.60 for 20°, and \$1.75 for 22°, f. o. b. New York.

Copperas shows an increased consumption in the purification of water, preparation of pigments, &c. Being controlled by an understanding among makers, the price has been unchanged from 47.5c. per 100 lb. in bulk, and 52c. in barrels, f. o. b. New York.

Alum was in good demand, and contracts for 1905 have been booked at unchanged prices, namely, \$1.75 to \$1.80 per 100 lb. for lump, \$1.80 to \$1.85 for ground, and 90c. for paper stock. Tin crystals were advanced from 18c. to 22c. per lb., in barrels, suggesting that competition among makers has been quieted.

The barytes trade has seen keen competition, partly the result of expansion in the domestic production, oversupply of the poorer grades, and a scarcity of prime white. American crude No. 1, sold at \$9.75 per short ton; No. 2 at \$8, and No. 3 at \$7; snow-white at \$15 to \$16; while foreign gray brought \$13.50; snow-white \$17.25 to \$18.75.

Asbestos for fire-proofing purposes has been in active demand this year, and besides meeting the domestic consumption, the United States has made exports to Europe at remunerative prices. As the crude mineral is largely under contract to a few manufacturers, market prices have ruled steady.

Asphalt, of which the United States consumes annually about one-third of the world's supply, shows a decrease of over 25 per cent. as a result chiefly of competition with other paving materials. Imports were approximately 123,500 tons, mostly from Trinidad, as trade with Venezuela has been interrupted by the litigation between the Castro Government and the American Company operating the Sere deposits.

### III.—TAR PRODUCTS, PETROLEUM, Etc.

PITCH; ARCHANGEL —: U.S. CUSTOMS DECISION.

Nov. 22, 1904.

Merchandise invoiced as Archangel pitch, but which

on analysis was shown not to be a wood tar pitch but a preparation from the residues of the distillation of fatty acid compounds, was held to be dutiable at 20 per cent. *ad valorem*, under section 6, as a "manufactured article unenumerated." As the importer presented no evidence to support his claim for free entry as a "wood pitch or tar," under paragraph 678, it was overruled.—R. W. M.

### V.—TEXTILES, YARNS, AND FIBRES.

ALIZARIN ASSISTANT: U.S. CUSTOMS DECISION.

Nov. 15, 1904.

Merchandise invoiced as lubricating oil, but consisting of a sulfonated saponification of resin and other oils and containing no castor oil, was decided to be dutiable at 30 per cent. *ad valorem*, under paragraph 32 of the present tariff, as "alizarin assistant not otherwise provided for"—R. W. M.

### VII.—ACIDS, ALKALIS, AND SALTS.

SULPHUR AND PYRITES IN THE UNITED STATES.

C. C. Schnatterbeck. *Eng. and Mining J.*, Jan. 5, 1905.

The development of the Louisiana sulphur industry has resulted in a reduction in the imports of brimstone, alarming the Sicilian combination, which, by exporting about one-third of its output to America at an advance of 3 dols. to 7 dols. per ton, has in eight years, increased its profits 221 per cent. Sulphur recovered from pyrites, produced largely in Virginia, and imported from Spain and Canada, duty free, is used chiefly in the manufacture of sulphuric acid, while the brimstone from domestic mines and imported from Sicily and Japan, also free of duty, is consumed by paper mills. The consumption of sulphur as pyrites and brimstone in this country in the last two years is estimated as below, in long tons:

	1903.	1904.
Sulphur, domestic .....	34,396	191,250
Net imports .....	186,237	129,454
	220,633	320,704
Pyrites, sulphur, domestic ....	87,730	79,976
Net imports .....	200,215	196,048
	287,945	276,024
Total consumption .....	508,578	596,728

Apparently brimstone furnished 53.8 per cent. of the total consumption, and pyrites 46.2 per cent., which compares well with 1896—the first year of the Sicilian combination—when the ratio of consumption was 50.7 per cent. for brimstone, and 49.3 per cent. for pyrites sulphur.

Small lots of Louisiana sulphur have been exported to Europe, and sold at comparatively higher prices than domestic deliveries. It is said that, owing to the low cost of production and purity of this sulphur, it can be sold in Italy at the Sicilian's cost of mining and preparing for market. Approximately 106,294 tons of Sicilian brimstone have been exported to the United States in 1904, as against 155,996 tons in 1903, and 168,919 tons in 1902. Some Japanese sulphur arrived at San Francisco for gunpowder and acid factories, notwithstanding the war with Russia.

The industry in Sicily has suffered from heavy rains during the fusion season, from intermittent labour troubles, and a smaller demand from America and Great Britain, though exports to vine countries, notably France and Italy, have increased. Fearing the growth of the American industry, the Chambers of Commerce at Girgenti and Caltanissetta have asked a government investigation, while the local press in Italy proposes to raise a fund of 10,000 dols. by public subscription, as a premium to the inventor of new uses for brimstone. Meantime the Anglo-Sicilian Company, controlling about 80 per cent. of the sulphur stocks at seaports, amounting to over 365,000 tons

—nearly a year's export—is promising the mine-owners more money if they will renew the agreement which expires in June, 1906, for another 10 years.

Trade in pyrites has been rather unfavourable as a result of keen competition and low prices in the face of a decreased consumption. New deposits are being opened in Alabama. Calculated on the sulphur content, and allowing for expense of burning, consumers of pyrites are paying from 25 to 50 per cent. less than is charged for brimstone.

Sulphuric acid, the manufacture of which in the United States is controlled by a few concerns who are on friendly terms, has held firm 50° in bulk, selling at 13.50 dols. to 14.50 dols. per ton; 60° at 18 dols. to 20 dols., and at 21 dols. to 23 dols., f. o. b. New York. Acid in carboys is worth from 3 dols. to 6 dols. per ton more. Manufacturing costs have been reduced by improvements, and much attention is now being given to contact processes, while one American patent has been issued for an electrolytic method.

BROMINE IN THE UNITED STATES.

*Eng. and Mining J.*, Jan. 5, 1905.

A record production for the United States was reported in 1904, amounting to 897,100 lb., which includes the bromine contained in bromides, all of which was made in Michigan. As compared with the 597,000 lb. output in 1903, this shows an increase of over 50 per cent. In order of their importance, the producing States are Michigan, Ohio, Pennsylvania and West Virginia.

The market for bromine and bromides has been good during the past year, and at times the urgent demand advanced prices. Prices at New York were 48 cents per lb. for bromine in bulk, and 30 cents for potassium bromide.

FLUORSPAR IN THE UNITED STATES.

*Eng. and Mining J.*, Jan. 5, 1905.

A notable expansion in the consumption of fluorspar in the United States is taking place, from which higher prices have resulted. Foundries find it advantageous to use more fluorspar for thinning their slag, thereby strengthening and purifying their castings, especially when much scrap is used. It is also used in making open-hearth steel, with excellent results. A further advance in price is expected during the ensuing year, as a result of the increased demand from cupolas. At present, Kentucky gravel fluorspar, unwashed, containing about 15 per cent. silica and 73 per cent. calcium fluoride is quoted at 3.50 dols. per ton, f. o. b. at shipping point, carrying 80 per cent. fluoride, at 4 dols.; 90 per cent. at 5 dols.; 95 per cent., at 6.50 dols.; 98 per cent., at 7.70 dols. per ton. Ground mineral, 99 per cent. fluoride, is worth 12 dols. per ton, and the pure mineral for acid making 15 dols. Imported fluorspar is quoted at New York at 8—10 dols. per ton for lump, and 11.50—13.50 dols. or ground.

NITRATE OF SODA IN THE UNITED STATES.

*Eng. and Mining J.*, Jan. 5, 1905.

The American consumption in 1904, principally in the blasting powder and fertiliser manufacturing industries, was the largest on record—275,000 long tons—notwithstanding the high prices of 45.26 dols. to 53.20 dols. per ton. The European deliveries, mostly to sugar-growing countries, were approximately 1,105,000 tons, being less than 1903 by reason of business depression in the distributing markets. About 28,000 tons were consumed by the powder factories of the nitrate companies in Chile, and by agriculturists in neighbouring countries.

PHOSPHATE INDUSTRY OF THE UNITED STATES.

*Eng. and Mining J.*, Jan. 5, 1905.

In 1904 the production of phosphates in the United States, principally in Florida, Tennessee and South Carolina, amounted to approximately 1,782,503 long tons.



valued at 5,703,582 dols. This is an increase compared with 1903 of 212,275 tons in quantity, and 709,670 dols. in value. Exports in 1904, chiefly to Germany, France, Italy and Great Britain, totalled about 880,000 tons, as against 785,259 tons in 1903, showing an increase of 94,741 tons, or 12 per cent. The ocean freight was 2 61 dols. to 72 dols., equivalent to from one-third to one-half of the i. f. prices paid for the phosphates, which were 9.84 dols. to 12.09 dols. for Florida high-grade rock; 6.39 dols. to 40 dols. for land pebble; 9.54 dols. to 11.40 dols. for Tennessee rock; 5.61 dols. to 6.88 dols. for South Carolina rock. In competition with the American phosphates are exports of 775,000 tons from Africa, paying an ocean freight of 1.44 dols. to 2.22 dols., and selling in Europe at dols. to 7.60 dols. for Algerian, and 5 75 dols. to 6 60 dols. for Tunis rock. There were also sent to Europe in 1904 some 125,000 tons of high-grade phosphate from Christmas and Ocean islands, paying a freight of about 6.48 dols., and marketed at 11.75 dols. to 14.45 dols. per ton, delivered. In all, Europe imported from the countries named a total of 1,780,000 tons, valued at approximately 3,375,683 dols., of which 5,105,650 dols. or over 50 per cent. represented cost of freight.

III.—GLASS, POTTERY, AND EARTHENWARE.

CARBORUNDUM; U.S. CUSTOMS DECISION.

Nov. 14, 1904.

Silicon carbide or carborundum was assessed for duty 1 cent. per pound as "manufactured emery," under paragraph 419 of the present tariff. In the absence of testimony as to the character and uses of the article, the aim that it was dutiable at 20 per cent. *ad valorem* under section 6, as a "manufactured article unenumerated," was overruled, and the assessment of duty affirmed.

—R. W. M.

X.—METALLURGY.

TIN PRODUCTION IN 1904.

Eng. and Mining J., Jan. 12, 1905.

The production of tin in 1904 is estimated as follows, in long tons of 2240 lb. :—

	1904.	1903.
	Tons.	Tons.
Straits	58,657	55,365
Banka and Billiton	14,638	18,720
Australia	5,082	4,377
Malaya	9,200	9,790
England	4,282	4,300
Germany and Austria	100	100
Miscellaneous	125	100
Total	92,084	92,752

The decrease in 1904 was thus 0.7 per cent., notwithstanding the considerable increase in the Straits output, and the smaller, though proportionately large, gain in Australia. This was more than offset by the reduction in the Banka and Billiton sales and output, while the Sinckep mines produced no tin during the year.

Outside of this tin, which is included in the table above, there is a production in China which is not given, because it is entirely impossible to ascertain its actual amount. Estimates vary from 10,000 to 20,000 tons yearly, but the latter figure is probably too high. Nearly all this tin, whatever its amount may be, is consumed in China itself, though occasionally some parcels of Yunnan tin appear on the London market. Allowing for this production, it appears that the world's supply of the metal is a little over 100,000 tons yearly.

The German official returns show a production of about 5000 tons of tin yearly in that country, but this is almost entirely from foreign ores. There are also some 250 tons of pig tin produced yearly in Germany from tin scrap, and a small quantity is made in the same way in the United States. This, however, is not new metal.

The Metallgesellschaft, of Frankfort, gives the consumption of tin during 1904 approximately as follows:—

	Tons.
United States	38,500
Great Britain	15,838
Germany	14,832
France, Italy, Spain, Russia	17,920
Eastern Europe and South America	4,905
Eastern Asia	3,000
Total consumption	94,755

Thus the consumption, as reported in 1904, exceeded the output by 2681 tons. This apparent excess of consumption is equal approximately to the increase in public stocks, which was 2973 tons. These public stocks include the quantities known to be in store in Great Britain, Holland and the United States, together with the tin known to be afloat, or in transit to those points from producing countries.

COPPER, LEAD, ZINC, TIN, NICKEL AND ALUMINIUM; PRODUCTION AND MARKET POSITION OF —, DURING THE LAST TEN YEARS.

F. Krull. *Zeits. angew. Chem.*, 1905, 18, 84—92.

Statistics relating to the production and consumption of the metals enumerated above, during the past decade, are given in a series of tables, curves and diagrams, which are based upon the official publications of the various countries concerned and of large business houses.

**Copper.**—The world's production increased from 330,000 tons (1 ton=1009 kilos) in 1894 to 550,000 tons in 1903; the consumption, from 325,000 tons to 572,000 tons in the same period; whilst the average London price for the year rose from 39.7*l.* per ton in 1894 to 72.5*l.* in 1899 and 1900, falling to 51.75*l.* in 1902 and rising to 57.25*l.* in 1903. North America produced more copper than all other countries put together, the output rising from 162,355 tons in 1899, to 303,427 tons in 1903; the Montana mines were the chief contributors. Spain and Portugal together produced 55,042 tons in 1899, the output falling to 50,535 tons in 1903, the Rio Tinto mines being the main sources.

**Lead.**—The world's production increased from 622,000 tons in 1894 to 880,000 tons in 1903; the consumption, from 630,000 tons to 879,000 tons in the same period; whilst the average London price for the year, after rising steadily from 9.35*l.* per ton in 1894 to 16.4*l.* in 1900, fell to 11.05*l.* in 1902 and 11.55*l.* in 1903. The output from the United States rose from 129,300 tons in 1900 to 262,200 tons in 1903; that from Spain fell from 180,500 tons in 1898 to 163,400 tons in 1903. The consumption in the United States rose from 173,413 tons in 1894 to 284,466 tons in 1903; in England, from 161,847 tons to 232,317 tons; and in Germany, from 100,678 tons to 167,516 tons, in the same period; whilst that in France receded from 86,160 tons to 80,003 tons.

**Zinc.**—The world's production increased from 381,000 tons in 1894 to 571,000 tons in 1903; the consumption, from 384,000 tons to 578,000 tons in the same period; whilst the average London price for the year fluctuated between 10.35*l.* (in 1898) and 24.5*l.* (in 1900) per ton, the price in 1903 being 20.65*l.* Germany and America were the principal producers, and also the principal consumers.

**Tin.**—The world's output, 74,800 tons in 1894 fell to 70,400 tons in 1898, and thereafter rose steadily to 91,000 in 1903. The consumption rose somewhat irregularly from 62,100 tons in 1894 to 86,200 tons in 1903; whilst the average London price for the year fluctuated between 58.4*l.* (in 1896) and 131.5*l.* (in 1900), the price in 1903 being 125.3*l.* per ton. North America, Germany and Great Britain were the principal consumers.

**Nickel.**—The world's production rose from 1829 tons in 1889 to 9850 tons in 1903, about one-half being obtained from New Caledonia minerals and the balance mainly from the United States and Canada. The price has varied as follows:—1889, 4.5 marks per kilo; 1901, 2.9—3.2 marks; 1902, 2.9—3.5 marks; 1903, 3—3.75 marks.

**Aluminium.**—The production of aluminium rose from 4034 tons in 1898 to 7810 tons in 1900, and has since only slowly increased to 8252 tons in 1903, the limit to its uses

having apparently been reached. North America, Germany and France were the principal producers. The bauxite required in its manufacture is obtained chiefly from the south coast of France. The price of aluminium, which in 1886 was about 100 marks per ton, fell to 2-25 marks in 1900, and is now about 2-5 marks per ton. H. B.

#### MINERAL AND METAL PRODUCTION OF THE UNITED STATES DURING 1904.

*Eng. and Mining J., Jan. 5, 1905.*

The subjoined table gives the estimated mineral and metal production of the United States during 1904, the figures for 1903 being added for comparison:—

		1903.		1904.			
Customary Measure.	Quantity.	Value.		Value.			
		Total.	Per Unit.	Total.	Per Unit.		
Non-metallic:							
Arsenic, white	Sh. tons.	611	\$35,028	\$57.33	498	\$29,504	\$59.25
Barytes	do.	50,397	152,150	3.02	22,502	74,736	3.32
Bauxite	L. tons.	48,087	171,306	3.56	48,966	189,325	3.87
Bromine	Lb.	597,000	170,140	.29	897,100	313,985	.35
Carbonadum	Lb.	4,760,000	476,000	.10	7,000,000	700,000	.10
Cement, natural hydraulic	Bbl. (a)	7,030,271	3,675,520	.52	5,000,000	2,500,000	.50
Cement, portland	Bbl. (b)	22,342,973	27,713,319	1.21	22,000,000	20,900,000	.95
Coal, anthracite	Sh. tons.	75,288,206	158,100,232	2.10	69,749,962	149,090,870	2.15
Coal, bituminous (c)	do.	277,076,986	327,075,530	1.18	273,774,822	316,763,701	1.16
Coke	do.	25,262,360	66,459,623	2.63	23,500,000	56,400,000	2.40
Cobalt oxide	Lb.	120,000	228,000	1.90	100,000	215,000	2.15
Copper sulphate (d)	Lb.	43,124,464	1,811,227	.04	63,309,394	2,849,484	.05
Copperas (e)	Sh. tons.	20,240	121,440	6.00	12,404	868,315	70.00
Crushed steel	do.	378	52,850	139.82	395	55,300	140.00
Fluorspar	do.	42,523	213,617	5.05	26,140	153,081	5.85
Garnet	do.	4,413	146,955	33.30	3,363	99,463	29.58
Graphite, artificial	Lb.	2,620,000	178,670	.07	3,195,251	221,686	.07
Graphite, crystalline	Lb.	4,525,700	164,247	.04	4,594,282	173,120	.04
Iron ore	L. tons.	32,471,550	55,201,635	1.70	29,366,634	36,708,318	1.25
Lead, white	Sh. tons.	112,700	12,218,624	108.50	113,079	11,807,900	100.00
Lead, red	do.	12,300	1,385,900	112.63	13,800	1,759,500	127.50
Lead, orange mineral	do.	1,000	168,000	168.00	800	124,000	155.00
Limestone and dolomite flux	L. tons.	12,029,719	5,423,732	.45	8,788,000	3,515,200	.40
Litharge	Sh. tons.	12,400	1,326,800	107.00	14,200	1,597,500	112.50
Phosphate rock	L. tons.	1,570,228	4,993,912	3.18	1,782,503	5,703,582	3.20
Pyrites	do.	199,387	787,759	3.95	181,763	647,276	3.56
Sulphur	do.	29,310	789,728	20.09	191,250	8,139,600	42.56
Zinc-lead	Sh. tons.	4,500	253,125	56.25	6,781	398,384	58.75
Zinc oxide	do.	54,034	5,005,394	92.63	58,808	5,513,855	93.76
Zinc ore, exported	do.	39,418	987,000	25.04	31,392	882,516	28.11
Total non-metallic	..	..	\$675,496,873	..	..	\$620,295,184	..
Metallic:							
Aluminium	Lb.	7,500,000	\$2,325,700	\$0.31	4,633,036	\$301,147	\$0.07
Antimony (e)	Lb.	6,174,000	389,579	.06	(f) 10,891	22,871	2.10
Bismuth	Lb.	Nil.	..	..	748,540,800	84,551,300	2.10
Copper	Lb.	689,045,796	19,726,660	.13	748,540,800	84,551,300	2.10
Gold	Troy ounce.	3,560,000	73,591,700	20.67	4,090,532	84,551,300	20.67
Iron, pig	L. tons.	18,009,252	288,148,032	16.00	16,563,938	219,474,679	13.25
Lead	Sh. tons.	276,694	23,447,050	84.74	313,553	27,021,997	86.18
Nickel	Lb.	114,200	45,900	.40	100,000	47,000	.47
Platinum	Troy ounce.	110	2,080	18.91	120	2,340	19.50
Quicksilver	Flasks (i)	37,866	1,564,734	41.32	43,499	1,783,459	41.00
Silver	Troy ounce.	54,200,000	29,322,000	.54	53,603,000	30,672,173	.57
Zinc	Sh. tons.	158,502	17,118,216	108.00	170,849	18,038,593	102.00
Total metallic	..	..	\$526,681,651	..	..	\$477,504,224	..

(a) Barrel of 300 lb. (b) Barrel of 380 lb. (c) Includes cannell. (d) Includes a small amount made from metallic copper. (e) Existing only as a constituent (20% of hard lead. (f) Bismuth contents of ore mined, but not smelted in the United States. (g) Average value of Lake copper at New York, less 0.25 c. per pound. (h) Average price at New York of Lake and electrolytic copper. (i) Flask of 75 lb. (j) Includes only that marketed as copperas.

#### PLATINUM IN THE UNITED STATES.

*Eng. and Mining J., Jan. 5, 1905.*

The production of platinum did not show an increase in 1904, although the demand for it continues very strong. As in previous years, fully nine-tenths of the production of this valuable metal were supplied by Russia, chiefly from placer workings in the Ural region. In 1903 the reported output in Russia was 204,892 troy oz. Some increase was made in that year, chiefly due to the introduction of dredges in the valley of the river Iss, where the most productive placers are found. In 1904 the production was curtailed on account of the war with Japan and the drafting of many of the Ural workers into the army.

Outside of Russia, the principal part of the supply comes from placer workings in Columbia, in South America. A small quantity is obtained in British Columbia, and other small amounts in Wyoming, Oregon and California. The California metal is obtained at the San Francisco Mint, in parting and refining gold, which comes from certain localities in that State. Some platinum and palladium also recovered at the Orford Copper Company's works, at Constable Hook, N.J., in refining nickel matte from the Sudbury district in Ontario. The quantity of the domestic supply, however, is not sufficient to affect the market seriously, and the principal part of the metal used in America is imported from Russia. Most of it arrives in crude form, and is refined at the works in Newark, N.J.

and in New York. For the 11 months ending November 30, these imports are reported at 6,596 lb., which compares with 7,607 lb. in 1903, and 6,467 lb. in 1902.

Prices of platinum in the United States were very strong throughout the year, as supplies were not abundant, and the consumption in the electrical and chemical industries is generally increasing. The quotation for ingot metal New York advanced from 18.50 dols. per oz. to 19.50 do at the close of the year.

#### MERCURY PRODUCTION OF THE UNITED STATES.

*Eng. and Mining J., Jan. 5, 1905.*

The production of quicksilver in the United States



the month of December, 1904, estimated, was as follows, in flasks of 76.5 lb. each:—

	1903.	1904.
Quicksilver .....	32,094	37,295
Flasks .....	5,029	5,336
Total .....	37,123	43,631

Production was reported from the Black Butte district in Oregon. Almost the entire increase came from mines in Brewster County, in Texas, where development still continues encouraging, and where several new discoveries have been made.

The California producers last year decided to reduce the standard content of a flask of quicksilver from 76.5 to 75 lb. There has been a general compliance with the new standard. Texas producers, however, still report their output in flasks of 76.5 lb.

Exports of quicksilver for the eleven months ending November 30 were 1,280,298 lb. in 1903, and 1,479,298 lb. in 1904; an increase of 199,000 lb., or 15.5 per cent.

#### BISMUTH IN THE UNITED STATES.

Eng. and Mining J., Jan. 5, 1905.

In 1904 the United States re-entered the list of producers, producing 61 short tons of bismuth ore, as compared with 37.5 tons in 1902, and 318.6 tons in 1901. The total output, analysing from 7.5 to 15 per cent. metallic bismuth, with some gold and silver, came from Leadville, Colorado, and from a new mine near Banning, California. A new discovery has been made 40 miles west of Tonopah, Nevada, where the ore occurs as bismuthinite and as chloride of bismuth, assaying 4.48 to 4.83 per cent. bismuth, 7 to 80 oz. silver, with a trace of gold. A small production is reported annually in Saxony, Germany, Australia and other countries. The war in the East stimulated demand for bismuth subnitrate and similar compounds for medicinal and surgical purposes. The United States imports annually about 200,000 lb. of metal, and a small quantity of bismuth salts in pharmaceutical compounds.

#### CUBA; MINING INDUSTRY OF —.

U.S. Cons. Rep. No. 2149, Jan. 5, 1905.

The output of the five Cuban asphalt mines in operation during 1904 was about 13,500 tons, valued at \$4,580. The three copper mines produced an output valued at \$907. Iron mines, of which twelve were worked, produced 729,336 tons, value \$29,380. The production of the three manganese mines amounted to 32,625 tons, valued at \$32,600. One naphtha mine was worked, and produced 60 tons during last year. The total mineral production was valued at \$89,200.

#### TIN DROSS: U.S. CUSTOMS DECISION.

Nov. 14, 1904.

Tin ashes were held to be free of duty, under paragraph 3 of the present tariff. The assessment of duty at 1 per cent. *ad valorem*, as "waste," under paragraph 463, was overruled.—R. W. M.

#### XIII. A.—PIGMENTS, PAINTS, Etc.

PAINT; DRY COPPER —: U.S. CUSTOMS DECISION.

Nov. 9, 1904.

It was decided that metallic copper in the form of powder, to some extent oxidised, and designed for use in the manufacture of copper paint, was dutiable at 1 per cent. *ad valorem*, as a "crude pigment," under paragraph 53 of the present tariff. The assessment of duty at 45 per cent. *ad valorem*, as a "manufacture of metal," under paragraph 193, was overruled.—R. W. M.

#### XIII. B.—RESINS, VARNISHES, Etc.

BALATA INDUSTRY OF BRITISH GUIANA.

Board of Trade J., Jan. 19, 1905.

The report for 1903-4 on British Guiana, prepared by the Assistant Government Secretary, states that in 1902-3 the balata industry was particularly successful, and in 1903-4 the amount of the gum obtained, 539,498 lbs., was only 1,302 lbs. less. There has been a certain amount of prospecting for other varieties of rubber, and on one or two estates on the sea coast experimental planting has been done. In the new Crown Lands Regulations, which came into force in October last, opportunity was taken to provide more stringent and effective measures for the protection of the balata-producing forests.

#### RESINATE OF MANGANESE: U.S. CUSTOMS DECISION.

Nov. 22, 1904.

Resinate of manganese, consisting of resin soap, caustic soda and manganese sulphate, was held to be dutiable at 25 per cent. *ad valorem*, as a "chemical compound." The claim of the importer that it was dutiable at 1 cent per pound and 10 per cent. *ad valorem*, as a "gum advanced in value" was overruled.—R. W. M.

#### GUM SANDARAC IMITATION: U.S. CUSTOMS DECISION.

Nov. 18, 1904.

Merchandise invoiced as gum sandarac imitation was assessed for duty at 25 per cent. *ad valorem*, as a "chemical compound," under paragraph 3 of the present tariff. Analysis showed it to be a preparation of resin acids and not sandarac. The claims of the importers that it was dutiable at 1 cent per pound and 10 per cent. *ad valorem*, as a "gum advanced in value," under paragraph 20, or at 20 per cent. *ad valorem*, under section 6, as a "manufactured article unenumerated," were accordingly overruled.—R. W. M.

#### XIV.—TANNING; LEATHER; GLUE, Etc.

LENTISCU: U.S. CUSTOMS DECISION.

The United States Circuit Court decided that the powdered leaves of *pistacia lentiscus* are free of duty as a "crude article used in dyeing or tanning," under paragraph 482 of the present tariff. This decision reverses the Board of General Appraisers, who had held the article to be dutiable at 1 cent per lb. and 10 per cent. *ad valorem* as a "drug, advanced in value," under paragraph 20, the Court holding that it was not a drug.—R. W. M.

BONE SIZE: U.S. CUSTOMS DECISION.

Nov. 9, 1904.

Following a decision of the United States Circuit Court, the Board of General Appraisers held that bone size is dutiable at 20 per cent. *ad valorem* under Section 6 of the present tariff, as a "manufactured article unenumerated."—R. W. M.

#### XVIII. C.—DISINFECTANTS.

SHEEP DIP: U.S. CUSTOMS DECISION.

Nov. 22, 1904.

Following a decision of the United States Circuit Court, the Board of General Appraisers held that an alkaline preparation of mineral oil and coal tar distillates containing pyridine bases and resin compounds, is dutiable at 25 per cent. *ad valorem* under paragraph 3 as a "chemical compound." Since the above compound can be used for other purposes than as a sheep dip, the claim for free entry under paragraph 657 was overruled.—R. W. M.

#### XX.—FINE CHEMICALS, Etc.

ETHYL CHLORIDE: U.S. CUSTOMS DECISION.

Nov. 22, 1904.

Ethyl chloride was held to be dutiable at 1 dol. per lb.

under paragraph 21 of the present tariff; the claim of the importer that it was dutiable at 25 per cent. *ad valorem* under paragraph 3 as a "chemical compound" was overruled.—R. W. M.

CISICINE AND GINGERINE: U.S. CUSTOMS DECISION.  
Nov. 25, 1904.

The above-named articles were assessed for duty at 40 cents per lb and 45 per cent. *ad valorem* as "alcoholic compounds," under paragraph 2 of the present tariff act. The Board of General Appraisers held, however, that they were properly dutiable at 55 cents per lb, or at not less than 25 per cent. *ad valorem*, as "medicinal preparations containing alcohol and in the preparation of which alcohol was used" under paragraph 67.—R. W. M.

SULPHURIC ETHER AND COLLODION FOR THE MANUFACTURE OF PHOTOGRAPHIC PAPER: FREE ADMISSION OF — INTO THE NETHERLANDS.

*Board of Trade J.*, Jan. 19, 1905.

The Dutch "Staatscourant" for the 7th January, contains the text of a Royal Decree exempting from import duty, subject to certain conditions, sulphuric ether and collodion for use in the manufacture of photographic paper.

## Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journal, in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

### I.—PLANT, APPARATUS, AND MACHINERY.

- [A.] 552. Compton. Continuous firing kiln. Jan. 11.
- .. 595. Rowlands and Rowlands. Method of and apparatus for obtaining gaseous or vaporous pressure. Jan. 12.
- .. 673. Adams. Kilns. Jan. 13.
- .. 690. Dawes. *See under X.*
- .. 805. Gayley. Method of extracting moisture from air for use in the arts.\* Jan. 16.
- .. 988. Murphy. *See under XVII.*
- .. 1017. Larsen. *See under XI.*
- .. 1033. Lees and Jackson. Filtering funnels. Jan. 19.
- .. 1129. Euman. Apparatus for conveying and filtering liquids from one vessel to another. Jan. 20.
- .. 1211. Haslam. Apparatus for drying and cooling air, especially suitable for treating air for use in blast furnaces, &c. Jan. 21.
- .. 1287. Hesketh. *See under II.*
- .. 1304. Ter Meer. Centrifugal machines. [Ger. Appl., Feb. 16, 1904.]\* Jan. 23.
- .. 1606. Spooner (Aktiebolaget Separator). Centrifugal separators.\* Jan. 26.
- .. 1646. Lennox. Spraying devices for evaporating liquids and for other purposes. Jan. 27.
- .. 1673. Wella. Filtering apparatus. Jan. 27.
- .. 1697. Wynne. *See under X.*

- [A.] 1731. Phipps. Centrifugal separating apparatus. Jan. 28.
- .. 1747. Werner. Condensers. Jan. 28.
- [C.S.] 22,479 (1903). Alexander and Shiels. Apparatus for heating, cooling, condensing, evaporating, & Jan. 25.
- .. 1584 (1904). Hieronimus. Cooling and condensing apparatus. Jan. 25.
- .. 2808 (1904). Howard. Filters. Feb. 1.
- .. 5688 (1904). Johnson (Badische Anilin und Soda Fabrik). *See under XI.*
- .. 6133 (1904). Kane. Heating apparatus. Jan. 1.
- .. 6548 (1904). Brooke. Furnaces. Jan. 25.
- .. 7139 (1904). Austin and Scott and Co., Ltd. Cooling and cooling apparatus. Feb. 1.
- .. 16,885 (1904). Dierks and Möllmann. Centrifugal liquid separators. Jan. 18.
- .. 18,382 (1904). Féry and Cie. pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. Pyrometers. Jan. 25.
- .. 27,180 (1904). Chamberland. Filters for water and other fluids. Jan. 25.
- .. 27,392 (1904). Ransford (Michelin et Cie.). Apparatus for compressing gases. Jan. 25.

### II.—FUEL, GAS, AND LIGHT.

- [A.] 563. Smyth. Plant for manufacturing acetylene gas. Jan. 11.
- .. 753. Webster and Webster. Purifiers for coal gas and method of operating same. Jan. 14.
- .. 823. Bayer. *See under XXIII.*
- .. 916. May. Process of making fuel from garbage. Jan. 17.
- .. 924. The Chalk Power Gas Synd., Ltd., and Lew. Manufacture of producer gas. Jan. 17.
- .. 964. Dowson. Gas generators. Jan. 17.
- .. 1232. Cleveland. Incandescence mantles for gas oil burners. Jan. 21.
- .. 1260. Pearson. Apparatus for mixing gas. Jan. 23.
- .. 1287. Hesketh. Apparatus for recovering volatile liquid from air and gas by refrigeration. Jan. 23.
- .. 1288. Drees. Gas purifying apparatus.\* Jan. 23.
- .. 1306. Daniels, and Daniels, Ltd. Gas producer plant and apparatus connected therewith. Jan. 23.
- .. 1307. Daniels, and Daniels, Ltd. Gas producer. Jan. 23.
- .. 1329. Beck. Method of treating fuel for power production. Jan. 24.
- .. 1361. Williams. Gas, coke, and steam producer. Jan. 24.
- .. 1421. Lewes.\* Manufacture of carbons suitable for use in electric arc lamps. Jan. 24.
- .. 1422. Lewes. Manufacture of heat radiating bodies suitable for use in gas fires or the like. Jan. 24.
- .. 1434. Bubb. Water gas generators.\* Jan. 24.
- .. 1507. Lake (Cie. Gen. d'Electricité). Electrodes for arc lamps.\* Jan. 25.
- .. 1587. Mareconnet. Process of and apparatus for producing gas from pulverulent fuel. [F. Appl., Feb. 1, 1904.]\* Jan. 26.
- .. 1656. Tcherniac. *See under VII.*
- .. 1679. Armstrong. Manufacture of coke and gas and apparatus therefor. Jan. 27.
- .. 1696. Whitfield. Suction gas producer plant. Jan. 28.
- [C.S.] 599 (1904). McKnight. Regenerating gas burners and heaters. Jan. 18.
- .. 1628 (1904). Zohrab. Mode and apparatus for producing dry peat and peat charcoal. Jan. 18.



- [S.] 2001 (1904). Duttonhofer. Manufacture of illuminating gas. Feb. 1.  
 2268 (1904). Macgregor and Pearson. Apparatus for the manufacture of peat fuel. Jan. 25.  
 3089 (1904). Armstrong, Whitworth and Co., Ltd., Orde and Sodeau. Use of liquid fuel and the construction of apparatus for burning the same. Jan. 25.  
 4506 (1904). Leinss. *See under VII.*  
 5535 (1904). Smith and Grant. Gas producers. Jan. 18.  
 5825 (1904). Prentice. Apparatus for producing gas. Jan. 18.  
 6719 (1904). Talbot and Mond. Gas producers. Jan. 25.  
 6999 (1904). Forster. Gas producers and like apparatus. Feb. 1.  
 14,213 (1904). Simpkin and Ballantine. Manufacture of briquettes for fuel and other purposes. Jan. 18.  
 14,355 (1904). Gersabeck. Process and apparatus for generating air-gas. Jan. 25.  
 24,336 (1904). Carpenter and Davis. Artificial composition fuel and process of producing same. Jan. 18.  
 26,920 (1904). Lindsay. Arc light electrodes and methods of making same. Jan. 18.  
 27,276 (1904). Dury and Piette. Coke furnaces. Feb. 1.  
 27,466 (1904). Lüttke, Arndt and Löwengard. *See under XXI.*  
 27,713 (1904). Thompson (Deuts. Gasglühlicht Act.-Ges.). Process for the formation of incandescence bodies for electric incandescence lamps. Jan. 25.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [.] 580. Bowing. Destructive distillation of coal and other substances and apparatus therefor. Jan. 11.  
 „ 1202. Birkbeck (Barboni). Non-inflammable benzine and the manufacture thereof. Jan. 21.  
 [S.] 26,192 (1904). Di Salasco and Rovere. *See under XII.*  
 „ 27,506 (1904). Vesely and Votcek. Process for obtaining pure anthracene from crude anthracene. Jan. 25.

### —COLOURING MATTERS AND DYESTUFFS.

- [A.] 406. Imray (Meister, Lucius und Brüning). *See under V.*  
 „ 644. Junius and Vidal. Manufacture of black sulphur dyes. Jan. 12.  
 „ 755. Heys (Pollak). Manufacture of monoazo colouring matter.\* Jan. 14.  
 „ 847. Newton (Bayer and Co.). Manufacture of new tetrazo dyestuffs. Jan. 16.  
 „ 853. Johnson (Badische Anilin und Soda Fabrik). Manufacture of a new compound and colouring matters therefrom. Jan. 16.  
 „ 1062. Newton (Bayer and Co.). Manufacture of oxyanthraquinones. Jan. 19.  
 „ 1368. Shillito (Aniline Colour and Extract Works, formerly J. R. Geigy). Production of blue-black colouring matters. Jan. 24.  
 „ 1499. Newton (Bayer and Co.). Manufacture of quinazarin. Jan. 25.  
 „ 1509. Newlands. *See under XVI.*

- [A.] 1675. Newton (Bayer and Co.). Manufacture of new azo dyestuffs and of new intermediate products for use therein. Jan. 27.  
 [C.S.] 6217 (1904). Abel (Act.-Ges. f. Anilinfabr.). *See under XIII. A.*  
 „ 6741 (1904). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of the nitro derivatives of certain aromatic bases. Jan. 25.  
 „ 7040 (1904). Cosway and the United Alkali Co., Ltd. Manufacture of blue sulphur colouring matters or dyes. Feb. 1.  
 „ 7041 (1904). Cosway and the United Alkali Co., Ltd. Manufacture of blue-black to black sulphur colouring matters or dyes. Feb. 1.  
 „ 7042 (1904). Cosway and the United Alkali Co., Ltd. Manufacture of green sulphur colouring matters or dyes. Feb. 1.  
 „ 7692 (1904). Newton (Bayer and Co.). Manufacture of anthracene dyestuffs, suitable for dyeing and printing. Jan. 25.

### V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 406. Imray (Meister, Lucius und Brüning). Manufacture of blue dyestuffs by oxidation on the fibre. Jan. 9.  
 „ 504. Keith and Wardle. Machine for drying warps or other material. Jan. 10.  
 „ 909. Pearse. Machines for treating fibres. Jan. 17.  
 „ 1120. Moore and Moore. Mechanism for use in the washing and drying of fibrous substances, fabrics, &c. Jan. 20.  
 „ 1156. Kunz. Dyeing machines.\* Jan. 20.  
 „ 1283. Bloxam (Verein. Glanzstoff-Fabr.). *See under XIX.*  
 „ 1284. Bloxam (Verein. Glanzstoff-Fabr.). *See under XIX.*  
 „ 1367. Shillito (Aniline Colour and Extract Works, formerly J. R. Geigy). Production of light fast violet to blue shades on wool. Jan. 24.  
 „ 1198. Bartelt. Machinery for washing fabrics. Jan. 25.  
 „ 1501. Linkmeyer and Pollak. Manufacture of artificial silk and the like.\* Jan. 25.  
 „ 1506. Linkmeyer and Pollak. Preparation of artificial silk and the like.\* Jan. 25.  
 „ 1547. Wood. Continuous open fabric steaming apparatus. Jan. 26.  
 „ 1686. Vittencet. Manufacture of artificial silk and silk goods. [Fr. Appl., Dec. 3, 1904.]\* Jan. 27.  
 „ 1745. Bloxam (Verein. Glanzstoff-Fabr.). *See under XIX.*  
 [C.S.] 6383 (1904). Mather, Hübner and Pope. Mercerising and apparatus therefor. Jan. 25.  
 „ 6456 (1904). Brandwood. Tube for use in dyeing, bleaching, and the like operations. Jan. 25.  
 „ 6568 (1904). Lindsay. Process or dressing for rendering woollen fabrics, flannelette, wadding, muslin, canvas and the like unflammable. Jan. 18.  
 „ 6848 (1904). Imray (Meister, Lucius und Brüning). Printing with indanthrene and flavanthrene. Jan. 18.  
 „ 8851 (1904). Graham and Cope. Means for and method of bleaching animal fibres. Jan. 18.  
 „ 13,895 (1904). Kemp (Morley). Apparatus for dyeing raw cotton, loose wool or silk, rags, mungo, yarns, slubbing and the like. Jan. 18.  
 „ 25,165 (1904). Calico Printers' Assoc., Ltd., and Warr. Mordanting vegetable fibres for dyeing or printing. Jan. 25.

## VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

- [C.S.] 6849 (1904). Murray (Meister, Lucius und Brüning). Manufacture of many coloured, marbled, or unequally mixed paper and apparatus therefor. Feb. 1.

## VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 961. Dekker. *See under X.*  
 „ 962. Haddan (Dekker). *See under X.*  
 „ 1139. Kaiser. Process for producing ammonia. Jan. 20.  
 „ 1363. Holdsworth. *See under X.*  
 „ 1656. Tcherniac. Production of sulphocyanides from crude coal gas. Jan. 27.  
 [C.S.] 4506 (1904). Leinss. Preparation of calcium carbide. Feb. 1.  
 „ 5603 (1904). Lennard. Apparatus for the manufacture of carbonate of ammonia. Jan. 18.  
 „ 6216 (1904). Murray (Meister, Lucius und Brüning). Manufacture of stable hydrosulphite compounds. Jan. 18.  
 „ 6898 (1904). Bollé (Chem. Fabr. Grünau, Landshoff und Meyer Act.-Ges.). Manufacture of neutral sulphate and of sulphurous acid from bisulphate. Jan. 25.  
 „ 7056 (1904). Ashcroft. *See under XI.*  
 „ 21,387 (1904). Jaubert. Preparation of substances containing easily liberated oxygen. Jan. 18.  
 „ 22,004 (1904). Johnson (Deuts. Gold- und Silber-Scheide Anstalt). Manufacture of sodium perborate. Jan. 25.  
 „ 26,278 (1904). Mackenzie. Concentration of sulphuric acid and apparatus therefor. Jan. 25.

## VIII.—GLASS, POTTERY, AND EARTHENWARE.

- [C.S.] 8602 (1904). Fleming. Manufacture of pottery ware. Jan. 25.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 577. Eissrich. Fire and acid proof material and process of manufacturing same. Jan. 11.  
 „ 652. Smith, Eywell and Spurr. Composition for paving, roofing, waterproofing and other purposes. Jan. 12.  
 „ 769. Boulton (Gasse). Manufacture of artificial stone. Jan. 14.  
 „ 1127. Sandmann. Process of making firebricks. Jan. 20.  
 „ 1142. Hannay. Treatment of timber for various purposes. Jan. 20.  
 „ 1200. Scammell and Muskett. Insulating and waterproofing compositions. Jan. 21.  
 „ 1457. Armstrong. Process in the manufacture of Keen's or other cements having a gypsum base.\* Jan. 25.  
 „ 1514. Hannay. Treatment of timber. Jan. 25.  
 [C.S.] 1339 (1904). Reid. Kilns for use in firing bricks and other earthenware goods. Jan. 25.  
 „ 1776 (1904). Butterfield. Making of macadamised roads and the like and solutions to be employed therein. Jan. 25.  
 „ 5711 (1904). Bittel, Bittel and Nitz. Magnesia cement composition and process of making same, applicable for making artificial stone and the like. Jan. 18.  
 „ 6600 (1904). Cleminson Electric Light Attachment, Ltd., and King. Cement for use in electric lamps and for other purposes. Jan. 25.  
 „ 27,857 (1904). Gerster, Freund, Freund and Imre. Manufacture of bricks from magnesite. Feb. 1.

## X.—METALLURGY.

- [A.] 411. Gayley. Method of smelting ore. [U.S. A.] Oct. 25, 1904.\* Jan. 9.  
 „ 605. Bennett, Rodda and Rule. Method of separating bodies capable of being magnetised from others with which they are associated. Jan. 12.  
 „ 690. Dawes. Separating gold or other metallic substances from fluids holding same in suspension. Jan. 13.  
 „ 775. Delporte. Manufacture of steel.\* Jan. 13.  
 „ 792. Buttenshaw. Manufacture of bronze. Jan. 13.  
 „ 961. Dekker. Method and apparatus for treatment of metallic compounds of sulphur, arsenic and antimony. [Fr. Appl., Aug. 1904.]\* Jan. 17.  
 „ 962. Haddan (Dekker). Process and apparatus for the treatment of sulphurous, antimonious and arsenious minerals.\* Jan. 17.  
 „ 969. Harrison. Cupolas for melting blast furnace slag. Jan. 18.  
 „ 1169. Simm and Sellers. Magnetic separation. Jan. 21.  
 „ 1211. Haslam. *See under I.*  
 „ 1308. Jenkins. Magnetic ore separators. Jan. 21.  
 „ 1356. Stanbridge. Method of hardening arm plates, projectiles, and other articles. Jan. 21.  
 „ 1363. Holdsworth. Manufacture of market zinc products from zinc ore. Jan. 24.  
 „ 1599. Goldschmidt. Method of and apparatus for treating tinned sheet iron for facilitating removal of the tin.  
 „ 1697. Wynne. Machine for the concentration of ores or other substances of different specific gravities. Jan. 28.  
 [C.S.] 1556 (1904). Malzac. Process for treating silicated ores (simple or complex) of nickel. Jan. 18.  
 „ 4793 (1904). Wolf. Separation of metals from their ores. Feb. 1.  
 „ 5041 (1904). Moore and Heskett. Apparatus for treating ferruginous ore for the manufacture of iron and steel therefrom. Feb. 1.  
 „ 7658 (1904). Kunicke. Precipitating boxes for gold or other metal bearing solutions. Jan. 25.  
 „ 19,142 (1904). Swyny and Plucknett. Process for the extraction of normally buoyant mineral particles from slimes, tailings and like metalliferous materials. Jan. 25.  
 „ 23,906 (1904). Schwarz. Process for extracting metalliferous particles from ore and apparatus therefor. Feb. 1.  
 „ 24,175 (1904). De Dion and Bouton. Manufacture of nickel steel. Jan. 18.  
 „ 24,585 (1904). Blenkinsop. Treatment of copper ore. Feb. 1.  
 „ 25,948 (1904). Soc. Electro-Métallurgique Française. Manufacture of steel. Feb. 1.  
 „ 27,073 (1904). Wedge. Furnaces for roasting and smelting and analogous uses. Jan. 18.  
 „ 27,865 (1904). Blackmore. Process of reducing aluminium and other metals. Feb. 1.  
 „ 27,894 (1904). Vandevelde. Manufacture of steel. Feb. 1.  
 XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.  
 [A.] 521. Meosnier and Mounier. Secondary battery. Jan. 10.  
 „ 778. Bloxam (Polzeniusz and Goldschmidt). Manufacture of accumulator plates. Jan. 14.



- A.] 839. Boulton (Smith). Electric storage battery negative pole plates.\* Jan. 16.  
 „ 1015. Galanti and Barrett. Electric accumulators. Jan. 18.  
 „ 1017. Larsen. Apparatus for the electrolytic treatment of gases. Jan. 18.  
 „ 1200. Scammell and Musket. *See under IX.*  
 „ 1360. Cramp. Apparatus for producing electric arcs, sparks, or flames for bleaching or sterilising purposes. Jan. 24.  
 „ 1406. Roselle. Manufacture of plates for secondary electric batteries. Jan. 24.  
 „ 1407. Roselle. Process of and apparatus for the manufacture of plates for secondary electric batteries. Jan. 24.  
 S.] 5688 (1904). Johnson (Badische Anilin und Soda Fabrik). Apparatus for producing reactions in gases by means of electricity. Jan. 18.  
 „ 6402 (1904). British Thomson-Houston Co., Ltd. (General Electric Co.). Electric insulating compositions. Jan. 25.  
 „ 6600 (1904). Cleminson Electric Lamp Attachment, Ltd., and King. *See under IX.*  
 „ 6792 (1904). Leitner. Method of preliminary treatment for electric accumulators plates. Feb. 1.  
 „ 7056 (1904). Ashcroft. Production of metals of the alkali group by electrolysis. Jan. 18.  
 „ 7061 (1904). Leeds Cooper Works, Ltd., and Jobling. Electro-depositing apparatus. Feb. 1.  
 „ 25,095<sup>1</sup> (1904). Jungner. Electric accumulators. Jan. 18.  
 „ 26,949 (1904). Mills (Edison). Continuous apparatus for nickel plating. Jan. 18.

#### II.—FATTY OILS, FATS, WAXES, AND SOAP.

- A.] 1010. Silcock, Silcock and Stevenson. Extracting oil from seeds and the like. Jan. 19.  
 „ 1292. Roussy de Sales. Process of manufacturing soap. [Fr. Appl. March 24, 1904.]\* Jan. 23.  
 „ 1572. Hemptinne. Process for converting oleic acid into stearic acid and like compounds. [Appl. in Belgium, March 19, 1904.]\* Jan. 26.  
 „ 1655. Bloom. Process of preparing oil for edible and other purposes and preparations embodying such and for the products of such processes.\* Jan. 27.  
 S.] 10,350 (1904). Klopfer. Process for producing soap. Feb. 1.  
 „ 26,192 (1904). Di Salasco and Rovere. Process for reducing the density of mineral and vegetable oils. Feb. 1.

#### III.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

##### (A.)—PIGMENTS, PAINTS.

- S.] 6217 (1904). Abel (Act. - Ges. f. Anilinfabr.). Manufacture of colour lakes from sulphur dyestuffs. Jan. 18.

##### (C.)—INDIA-RUBBER.

- S.] 27,722 (1904). Ephraim. *See under XVI.*  
 „ 28,051 (1904). Marx. Production of caoutchouc. Jan. 26.

#### IV.—TANNING; LEATHER, GLUE, SIZE, ETC.

- [A.] 1150. Bernstein. *See under XVIII. A.*  
 „ 1158. Nicholas. Preparation for softening and preparing leather for the manufacture of gloves. Jan. 20.

- [A.] 1236. Kunick. Process for making casein and albumen more soluble. Jan. 23.  
 „ 1371. Greenwood. Manufacture of agglutinant material. Jan. 24.  
 [C.S.] 22,156 (1903). Payne. Preparation and use of tanning extracts. Jan. 25.  
 „ 1177 (1904). Schneider. Manufacture of glue and gelatine. Jan. 25.

#### XV.—MANURES, ETC.

- [C.S.] 6101 (1904). Crene, Taylor and Williams. Manufacture of fertilisers. Jan. 18.  
 „ 13,664 (1904). Hammerschlag. Manufacture of artificial manure or fertilisers. Jan. 18.

#### XVI.—SUGAR, STARCH, GUM, ETC.

- [A.] 1509. Newlands. Preparation of a colouring matter for and its application in the manufacture of sugar. Jan. 25.  
 „ 1629. Macfarlane. Centrifugal machines for sugar. Jan. 27.  
 [C.S.] 4112 (1901). Shaw. Treatment or preparation of sugar and apparatus for use therein. Jan. 25.  
 „ 27,722 (1904). Ephraim. Process and apparatus for separating and recovering gum from rubber plants. Jan. 25.

#### XVII.—BREWING, WINES, SPIRITS, ETC.

- [A.] 659. Hunt. Manufacture of malt whiskey and of malt extract. Jan. 12.  
 „ 988. Murphy. Process of filtering beer, vinegar, &c. Jan. 18.  
 „ 1214. Hunt. Maturing new whiskey and grain spirit. Jan. 21.  
 „ 1355. Dunbar. Method and means of blending whiskey and the like. Jan. 24.  
 [C.S.] 26,554 (1904). Caspar and Fitzgerald. Mashing and converting process. Jan. 18.  
 „ 26,751 (1904). Hart. Method of and apparatus for use in the fining of beer and other like liquors. Jan. 18.

#### XVIII.—FOODS, SANITATION, WATER PURIFICATION, & DISINFECTANTS.

##### (A.)—FOODS.

- [A.] 825. Köhler. Nutritive preparations.\* Jan. 16.  
 „ 1150. Bernstein. Manufacture of a substance having the properties of egg albumen. Jan. 20.  
 „ 1236. Kunick. *See under XIV.*  
 „ 1312. Blogg. Manufacture of culinary essences.\* Jan. 23.  
 „ 1609. Appleby and Banks. Treatment of food-stuffs, more especially cereals and their products. Jan. 26.  
 „ 1649. Cook. Method for the production of humanised milk, and generally for rendering the milk of animals more digestible. Jan. 27.  
 [C.S.] 3531 (1904). Hatmaker. Dry milk and milk-like products. Jan. 18.  
 „ 22,927 (1904). Preisz. Method of sterilising food-stuffs and the like. Jan. 25.  
 „ 23,100 (1904). Döllner. Production of desiccated milk and milk preparations. Feb. 1.  
 „ 25,624 (1904). Székely and Kovács. Process for making an easily digestible milk preparation free from germs. Jan. 18.  
 „ 27,266 (1904). Aufsberg. Process for preparing food products containing iron. Jan. 25.

## (B.)—SANITATION: WATER PURIFICATION.

- [A.] 916. May. *See under* II.  
 „ 1143. Taylor. Contact beds and percolating filters, more especially for use in bacterial sewage purification works.\* Jan. 20.

## (C.)—DISINFECTANTS.

- [A.] 1530. Cooke. Mercury compounds to be used for medical disinfecting and antiseptic purposes. Jan. 26.

## XIX.—PAPER, PASTEBOARD, Etc.

- [A.] 443. Carr, Carr and Carr. The surfacing of water-proof papers. Jan. 10.  
 „ 505. Varannes and Vains. Manufacture of paper pulp. Jan. 10.  
 „ 1283. Bloxam (Verein. Glanzstoff-Fabr. A. G. Elberfeld). Manufacture of threads, films, or other forms of cellulose. Jan. 23.  
 „ 1284. Bloxam (Verein. Glanzstoff-Fabr. A. G. Elberfeld). Manufacture of threads, films, or other forms of cellulose. Jan. 23.  
 „ 1727. Bertram and Milne. Apparatus for the treatment of fibrous material to be used for the manufacture of paper. Jan. 28.  
 „ 1745. Bloxam (Verein. Glanzstoff-Fabr. A. G. Elberfeld). Manufacture of films, threads, or other forms of cellulose. Jan. 28.  
 [C.S.] 26,953 (1903). Booth. Manufacture of printing surfaces and a composition therefor. Jan. 18.  
 „ 9962 (1904). Abel (Act.-Ges. f. Anilinfabr.) Manufacture of coherent and opaque films, sheets, or masses of pyroxylin, collodion cotton, celluloid, or the like. Feb. 1.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 1465. Dakin. Manufacture of a group of chemical substances related to adrenalin, and of allied bodies and intermediate products. Jan. 25.  
 „ 1503. Lake (California Products Co.). Process for producing cream of tartar.\* Jan. 25.  
 [C.S.] 5549 (1904). Richardson. Manufacture of camphors. Jan. 18.  
 „ 6652 (1904). Zimmermann (Chem. Fabr. anfangen vorm. E. Schering). Manufacture of camphor from isoborneol. Jan. 25.  
 „ 23,578 (1904). Knoevenagel. Manufacture of odoriferous compounds or perfumes. Jan. 18.

- [C.S.] 28,035 (1904). Johnson (Boehringer und Soehne). Manufacture of camphor from isoborneol. Feb. 1.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 559. Ponton and Horne. Production of color effects on photographic paper. Jan. 11.  
 „ 1290. Gillard and Molyneux. The coating or preparation of media for photographic purposes. Jan. 23.  
 [C.S.] 1008 (1904). Drac. Method and apparatus for production of coloured photographs. Jan. 23.  
 „ 9962 (1904). Abel (Act.-Ges. f. Anilinfabr.). *under* XIX.  
 „ 27,267 (1904). Krebs. Powders or compositions for use in artificial lighting for photographic purposes. Jan. 25.  
 „ 27,268 (1904). Krebs. Powders or compositions for use in artificial lighting for photographic purposes. Jan. 25.  
 „ 27,465 (1904). Lüttke Arndt and Löwenberg. Flash powder for producing artificial light for photographic and other purposes. Jan. 25.  
 „ 27,466 (1904). Lüttke, Arndt and Löwenberg. Flash light cartridges for producing artificial light for photographic and other purposes. Feb. 1.

## XXII.—EXPLOSIVES, MATCHES, Etc.

- [A.] 601. Russell. Explosives for blasting and other purposes. Jan. 12.  
 „ 837. Jacob. Matches [U.S. Appl., Jan. 28, 1904]. Jan. 16.  
 „ 1415. Hesketh and Willcox. Manufacture of explosives. Jan. 24.  
 „ 1416. Hesketh and Willcox. Manufacture of nitroglycerine, nitrocellulose, and like explosives. Jan. 24.  
 [C.S.] 23,973 (1904). Mitchell. Explosives. Feb. 1.  
 „ 27,162 (1904). Allison (Muller-Jacobs). Explosive compounds and method of manufacturing the same. Feb. 1.  
 „ 27,166 (1904). Lheure. Manufacture of explosives. Feb. 1.  
 „ 29,056 (1904). Dittmar. Explosive or blasting compounds. Feb. 1.

## XXIII.—GENERAL ANALYTICAL CHEMISTRY.

- [A.] 823. Bayer. Apparatus for analysing gases. Jan. 16.



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Session 1904-5—Friday, March 3rd—Dr. J. Grossmann, "Improved Method of Indigo Testing"; Dr. Otto Oberländer, "Theory of Colouring Matters"; Mr. George H. Hurst, "Exhibition of Viscometers."

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## Official Notices.

### COMMUNICATIONS.

Authors of communications read before the Society, or of its Local Sections, are requested to take notice that Rule 43 of the Bye-laws the Society has the right of property of publication for three months of all such papers. Payment of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be acted for the Journal, in which case no reprints can be furnished to the author.

### ANNUAL GENERAL MEETING, 1905.

The Annual General Meeting will be held in London early next, and the proceedings will commence on Friday, July 10th. Full particulars will appear later.

### THE BRITISH SCIENCE GUILD.

The British Science Guild, which was founded some years ago by Sir Norman Lockyer, with the object of bringing home to the people of this country the necessity of applying scientific methods to all branches of human activity, has now published a first list of its members, which includes Professor Attfeld, Dr. James Bell, Sir William Brunnner, Professor Chureh, Sir William Crookes, Professor E. Dovers, Dr. Gore, Dr. Griffiths, Professor Professor Liversidge, Professor Meldola, Mr. Müller, Neville, Professor Odling, Mr. Pedler, Professor Pope, V. Ramsay, Mr. Shenstone, Professor Wertheimer, Whitham, and Professor Sydney Young. One of the principal aims of the Guild is the promotion of the extension of the application of scientific principles to industrial and general purposes—an object closely connected with that of the Society of Chemical Industry. Education, not only of the classes interested, but of the opinion in general, on this subject, is very desirable, though its progress may be slow, perhaps no surer way can be devised than that of enlisting in a single organisation all those whose sympathies are in favour of the application of exact methods in every department of science. The annual subscription to the Guild is 2s. 6d., with entrance fee of 2s. 6d., payable to Lady Lockyer, Penywern Road, S.W. Life member's subscription 2s. Information may be obtained from the Honorary Secretary, Mr. C. Cuthbertson, 9, York Terrace, N.W.

### List of Members Elected.

February 23rd, 1905.

Ayeyard, J. R., Royal Technical Institute, Salford, Lecturer.  
Miss M. M., Tulane University Library, New Orleans, La., U.S.A., Librarian.  
Bregard, A. P., c/o Emil Calman & Co., Long Island City, N.Y., U.S.A., Varnish Chemist.  
Ben. Henry, St. Louis Chemical Co., St. Louis, Mich., U.S.A., Secretary.  
Auer, A. G., 534, Canal Street, New York City, U.S.A., Agent for Kalle & Co.  
Blz, Hugo, 175, High Street, C. on M., Manchester, Chemist.  
Cler, Prof. Edwin E., Longmeadow, R.I., U.S.A., Professor of Chemistry.  
Clen, George H., Canton Junction, Mass., U.S.A., Manufacturer of Enamels and Dressings for Leather.

Carter, Robert A., c/o Roessler & Hasslacher Chem. Co., 100, William Street, New York City, U.S.A., Chemist.  
Cormack, William, c/o Messrs. G. Nelson, Dale & Co., Ltd., Emscote Mills, Warwick, Chemist.  
Cotton, W. H., The Schlüsselburg Calico Printing Co., Schlüsselburg, nr. St. Petersburg, Russia, Chemist.  
Crosley, W., Hall Mines Smelting Co., Ltd., Nelson, B.C., Canada, Chemist.  
Davidson, Thomas A., c/o Jos. Watson & Sons, Ltd., and 20, Cromer Terrace, Leeds, Chemist (Glycerin Distillery).  
Dickinson, Cyril, "Abbotsford," Hollycroft Avenue, Hampstead, N.W., Analytical Chemist.  
Eagen, N.B., Toronto, Canada, Barrister.  
Fiebigger, Peter, 530, Canal Street, New York City, U.S.A., Colour Chemist.  
Gallinagh, James P., Electricity Works, Limerick, Ireland, Borough Electrical Engineer.  
Geisenheimer, Albert, P.O. Box 994, New York City, U.S.A., Dyestuff Merchant.  
Gilbertson, I. H., 5, Broad Street, Rhodes, nr. Middleton, Lancs., Calico Printer.  
Grip, August E., 194, Lee Avenue, Brooklyn, N.Y., U.S.A., Chemical Engineer.  
Harcourt, Prof. R., Ontario Agricultural College, Guelph, Ont., Canada, Professor of Chemistry.  
Hawley, Fred. G., La Cananea, Box 10, Sonora, Mexico, Assayer and Chemist.  
Henning, Albert, 92, Harrow Road, Leytonstone, N.E., Chemical Manufacturer.  
Hoppenstedt, A. W., 138, Joralemon Street, Brooklyn, N.Y., U.S.A., Chemist.  
Kirkland, John, S., Corrance Road, Brixton, S.W., Technical Instructor.  
Knapp, Sewell A., Tonopah, Nevada, U.S.A., Mine Manager.  
McDowell, Stewart H., 1246, South 51st Street, Philadelphia, Pa., U.S.A.  
Marland, Percy, c/o Brotherton & Co., Ltd., Ammonia Works, Wakefield, Works Chemist.  
Marlatt, W. T., Oakville, Ont., Canada, Leather Manufacturer.  
Merck, George, Merck & Co., University Place, New York City, U.S.A., Manufacturing Chemist.  
Merzbacher, Aaron, Laboratory of Reading Iron Co., Reading, Pa., U.S.A., Chemist.  
Moorwood, F. Colin, c/o Flockton Tompkin & Co., Ltd., Newhall Steel Works, Sheffield, Steel Manufacturer.  
Mrazsek, F. M., 29, Mincing Lane, London, E.C., Consulting Chemist.  
Needham, Edwd. R., 48, Paton Street, Glasgow, Manufacturing Chemist.  
Peet, W. J., Stock Yards Station, Kansas City, Kas., U.S.A., Superintendent.  
Pirie, F. D., Stonewood Works, Bucksburn, Aberdeen-shire, Paper Manufacturer.  
Pittock, C. K., Baithney Estate, Saklaspur, Hassan, India, Coffee Grower and Chemist.  
Queiroz, Dr. L. M. Pinto de, Rue Direita 10 B., Sao Paulo, Brazil, Manufacturing and Wholesale Chemist.  
Safford, E. Brigham, Albuquerque, New Mexico, U.S.A., Chemist.  
Schmidt, Herman B., 2523, Essex Place, W.W.H., Cincinnati, Ohio, U.S.A., Manufacturing Chemist.  
Simpson, Edward H., 52, Park Street, Jersey City, N.J., U.S.A., Chemist.  
Smith, Arthur, Towend Chemical Works, Bramley, Leeds, Chemical Manufacturer.  
Smith, C. E., Herolds' Institute, Drummond Road, Bermondsey, S.E., Tanner.

Stahl, P. G., 10, Rue des Canonniers, Lille (Nord), France, Chemical Manufacturer.

Stamp, Edward, Florence House, Dewsnap Lane, Dukinfield, Sewage Works Manager.

Turnbull, John, 66, Jarvis Street, Toronto, Canada, Manufacturer of Food Products.

Walt, Dr. Ida, 73, West 83rd Street, New York City, U.S.A., Chemist.

Wyer, Malcolm G., State University, Iowa City, Iowa, U.S.A., Librarian.

## Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

Andrews, Wm. H.; all communications to 79, Tonawanda Street, Buffalo, N.Y., U.S.A.

Beveridge, Jas.; all communications to c/o Miramichi Pulp and Paper Co., Ltd., Chatham, N.B., Canada.

Black, W. Geoffrey; Journals (temp.) to "Malvern," Bradford Street, Bocking, near Braintree, Essex.

Boothby, Chas., 1/o Putney; 70, Bedford Court Mansions, Bedford Square, W.C.

Brooks, H. Kibbe, 1/o Bellows Falls; Swanton, Vermont, U.S.A.

Carey, Eustace; all communications to The United Alkali Co., Ltd., 30, James Street, Liverpool.

Crayen, Dr. Gustav, 1/o 446; 354, West 23rd Street, New York City, U.S.A.

Criper, Wm. R., c/o D. Weldie and Co., Konnagar, near Calcutta, India (correction).

Cronquist, G. W., 1/o Bendorf; Hyllinge, Bjuf, Sweden, Fire Brick Works Manager.

Crush, E. H., 1/o Westcombe Park Road; 225, Westcombe Hill, Blackheath, S.E.

Duff, W. S., 1/o South Woodford; Sebert Villa, Bushwood, Leytonstone, Essex.

Enright, Bernard, 1/o South Bethlehem; Fordwick, Augusta Co., Va., U.S.A., Chemist (Virginia Portland Cement Co.).

Escher, Paul, 1/o 733; 735, West 64th Street, Chicago, Ill., U.S.A.

Fallon, J. H. M., 1/o Croydon; Boulhaf le Dye, Ligne de Tebessa, Algeria.

Fraser, Jas. D., 1/o Waltham Abbey; 8, Percy Street, Ibrox, Glasgow.

Gilchrist, P. C., 1/o Pau; retain Journals.

Gooding, E. Claude, 1/o Washford; 1, Beech Villas, Yelverton, R.S.O., Devon.

Harvey, Chas.; communications to 17, Alloa Road, Goodmayes, Hford, Essex.

Hemingway, H., 1/o Briton Ferry; Marsh Gate Lane, Stratford, E.

Hurd, Geo. E.; Journals to 241, Hampden Court, Chicago, Ill., U.S.A.

Kessler, R., jun., 1/o Sutton-Peck Chemical Co.; c/o Nordmont Chemical Co., Nordmont, Pa., U.S.A.

Kingdon, Holman, 1/o 27; 25, Grappenhall Road, Stockton Heath, Warrington.

Lake, G., jun., 1/o Primrose Lane; Lee Monnt, Glossop, Derbyshire.

Lefebvre, G., 1/o Rue de Bondy; Cie. du Phospho-Gu, 27, Rue la Rochefoucauld, Paris.

Moeckel, H. Alf., 1/o St. Louis; Bockwa, Post Cainsd, Saxony.

O'Neill, Chas., 1/o Manchester; (Journals) c/o The Bury Dyewood and Chemical Co., Ltd., Bury; and (communications) 230, Walmersley Road, Bury, Lancashire.

Ormerod, Ernest; all communications to Pestal Strasse 24<sup>n</sup>, Zurich V., Switzerland.

Pease, F. N., 1/o Altoona; 345, East 33rd Street, New York City, U.S.A.

Pickard, Glenn H., 1/o Cleveland; Susquehanna Iron Works, Williamsport, Pa., U.S.A.

Royle, C. L., 1/o London; c/o Parry and Co., Madras, India.

Schweickert, Karl, 1/o Oliver Street; 45, Hazelm Avenue, Rahway, N.J., U.S.A.

Scott, Walter, 1/o Levenshulme; 696, Stockport Road, Longsight, Manchester.

Sen, N. Nath, 1/o 18; 19, Lower Chitpur Road, Calcutta.

Smythe, Dr. John S.; all communications to Rantall Lane Lane, Wavertree, Liverpool.

Stephen, Alf. E., 1/o Sydney; Lachlan Gold Fields, New South Wales.

Taylor, J. Scott, 1/o Rathbone Place; North London Colour Works, Kentish Town, N.W.

Torrey, Chas. A., jr., 1/o Brookline; 51, Wachusett Street, Worcester, Mass., U.S.A.

Van Marken, J. C.; Journals (temp.) to Repelen bei Meppen, Germany.

Watson, C. E.; Journals to 28, Highfield Road, Stretford, Lancashire.

Webb, Wm. J., 1/o Ash Street; 26, Livingston Avenue, Yonkers, N.Y., U.S.A.

Whipple, G. C., 1/o Brooklyn; St. Paul Building, Broadway, New York City, U.S.A.

Wilkinson, Prof. Jas. A., 1/o Box 3572; Transvaal Technical Institute, P.O. Box 1176, Johannesburg.

Wilson, C. H.; Journals to c/o Sheffield Smelting Co., 1, Royds Mills Street, Sheffield.

Wood, Frank S., 1/o Suffolk Street; Chin Chu, Heath Street, Newland, Hull.

## CHANGE OF STYLE.

Drummond, Hon. G. A., to Drummond, Hon. Sir George K.C.M.G.

## Deaths.

Kenrick, Prof. Edgar B., Assiniboine Avenue, Winnipeg, Canada.

Warren, T. T. P. Bruce, 88, Earlam Grove, Forest Gate, Essex. Feb. 10.



# Manchester Section.

Meeting held at Manchester, on Friday, January 13th, 1905.

MR. J. CARTER BELL IN THE CHAIR.

## MOISTURE TESTS OF WOOD PULP.

### PART II.\*

BY J. H. LESTER, M.Sc., F.I.C.

During the summer of 1903 the writer was asked to examine a Norwegian pulp mill, with the object of examining and improving the methods of testing there adopted in estimating the moisture in bales of wood pulp; the owners of the mill being anxious to explain, if possible, the differences in result as between their own tests and the tests made upon the same bales by the buyers of the pulp in Lancashire.

A week was spent at the pulp mill in making a number of comparative tests intended to demonstrate the correct means whereby freshly packed moist pulp may be tested for moisture. A quantity of pulp was then selected, sampled, weighed, packed, shipped to the Lancashire paper mill, reweighed and retested so as to afford a means of comparison between an ordinary pulp mill test and a paper mill test, made upon the same bales after shipping and storage.

FIRST SERIES OF TESTS.—The method of sampling bales of pulp adopted by the pulp mill previous to my visit was that of picking out two strips from each sheet

method alone can be correct when the outside edges of a sheet are either much drier or much wetter than the centre, but that the method adopted in sampling becomes of less importance as the sheets approach uniformity, and, of course, a sheet that is of uniform moisture throughout may be sampled correctly without any attempt to observe rules of any kind. The above series gives practical proof of the correctness of the theory as applied to a somewhat abnormal sheet. The next series refers to normal sheets.

SECOND SERIES OF TESTS.—These tests were intended to show the difference in result actually to be found in practice according to the method of cutting samples, the first series having reference to a special case.

Procedure.—(A2) 18 or 20 sheets were selected from various parts of several truck loads of sheets awaiting final packing; the samples were selected representing four or five bales. The "mill method" of sampling was adopted, as in C, Fig. 1.

(B2) Wedge-shaped samples were cut as in B, Fig. 1, and dried.

The results are given in Table II.

Conclusions.—That a difference of 1.2 per cent. on the absolutely dry figure, or 2.6 per cent. on the "50 per cent. air-dry pulp" figure may be considered likely to result according to the method of sampling freshly packed pulp.

THIRD SERIES OF TESTS.—The object of the tests was to confirm the previous series. As in the last series, except that the wedge samples were alternately cut transversely and diagonally from the sheets. This method of cutting is theoretically preferable to that adopted in the previous series.

The results are given in Table III.

Conclusions.—That a difference of 1.3 per cent. on the absolutely dry figure, or 3 per cent. on the "50 per cent. air-dry figure" may be considered likely to result between the two methods of sampling as applied to freshly packed moist pulp. The agreement between the second and third series is sufficiently close.

FOURTH SERIES OF TESTS.—These tests were made to show the actual difference in percentage of moisture between the outside edges and the middle of the sheets.

A representative sheet was selected from the press, and the outer edge was cut away to a distance of 1 in. to 1½ in. to form the "edge" sample. An "intermediate" sample was next cut to a width of 2 in. or 3 in. all round the sheet, and the remainder of the sheet was taken as the "middle" sample.

The results are set forth in Table IV.

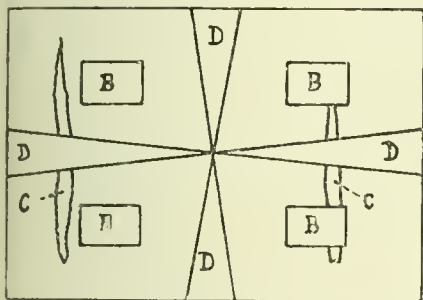
Conclusions.—(1) That the difference in moisture existing between the outer edges and the middle of a sheet of freshly packed pulp is quite enough to account for the difference in results, which follows from different methods of sampling.

(2) Since the whole sheet contained 50.7 per cent. of moisture and the intermediate portion contained 52.6 per cent., it would appear unlikely that any one or more circumscribed areas in the sheet can be found where a representative sample may be drawn. If such positions do exist, they must be less than 2 in. from the edge of such sheets as those experimented upon.

FIFTH SERIES OF TESTS.—These tests were commenced at the pulp mill with the object of showing whether similar results would follow a second sampling and testing after shipment to England and storage. It may be urged that since the bales could not possibly lose anything but moisture in transit, that the same dry contents should be found at whatever time in the life of the bale it chanced to be tested. This is quite true, but it has frequently been alleged that a fair test of a bale could not be made if that bale happened to have been exposed for an undue length of time to wetting or drying influences, and the alleged impossibility of obtaining a really representative sample has been quoted as an explanation of the differing results obtained by pulp maker and paper maker. There is no doubt whatever that their results do frequently disagree.

Procedure in Norway.—Five bales of pulp were made up to a weight of 448 lb. each, after sampling in five places by the cutting out of "wedges." It should be noted that all the samples in this case were cut to the same base length and not according to the method necessary in this

Fig. 1.



at the point of a knife, as shown at C in Fig. 1. It was with the object of demonstrating the inaccuracy of this method and the substantial accuracy of the wedge method, that this series was undertaken.

Procedure.—(A) A doubled sheet of pressed pulp, measuring 24 in. by 18 in. in each fold, was selected from the pressed pulp lying ready for packing, and one-half of it (A) was dried. The sheet chosen for the tests was distinctly wetter at its extreme edges than most of the other sheets; the object of this choice was to accentuate any differences due to methods of sampling.

(3) The fold of pulp adjoining A was sampled according to the method shown at B Fig. 1.

(4) Small pieces of pulp were chipped out of position A Fig. 1 from the same sheet that B was taken.

(5) Samples were cut by the wedge method from the middle of the four sides to the centre of the sheet; B, C, D, being all cut from the same sheet.

The results of the above tests are given in Table I.

Conclusions.—(1) That so far as freshly packed moist pulp is concerned, the wedge method of sampling gives a correct result, because it is practically identical with the result of drying the whole sheet.

(2) That the "mill method," as well as another very similar method sometimes adopted in this country, does not show the amount of moisture that is contained in the whole sheet of freshly packed pulp.

(3) It follows from the theoretical considerations set forth by the writer in 1902 (this J., *loc. cit.*) that the wedge

\* Part I. of this paper appeared in this J., 1902, 380.

country for bales that have been shipped or stored. The variation in length of the base of the samples is only of consequence where we are endeavouring to obtain some representation of the outermost sheets of a bale without unduly increasing the size of the bulk sample. A second lot of 5 bales were similarly selected and sampled, and with the first lot were made up in the ordinary manner with canvas and wire, distinctively marked, and shipped to the Lancashire paper mill for further test.

The result of the remaining tests are given in Table V.

*Procedure in Lancashire.*—Lot A. (See Table V.) The bales were found to have arrived at the paper mill in good condition owing to the special care taken of them in transit to avoid exposure to rain, sea water or undue drying influence. Exactly one month from the time of packing in Norway, the bales were weighed and tested with the results given in Table V., Lot A.

Lot B. These bales were allowed to lie for nearly six months from the time of packing, in the paper mill warehouse. The place of storage was a large upper room mostly filled with similar bales of the same brand of moist pulp so that the conditions of drying would be as nearly as possible the same as in the ordinary routine of a paper mill. Instructions were given to have the bales turned over on to a fresh end or side every week to prevent uneven drying and this is believed to have been done. At the end of the six months, the bales were weighed and tested with the results shown in Table V., Lot B.

*Conclusions.*—(1) That bales of pulp which have lost weight to a considerable extent by drying may still be reliably tested, as regards their dry contents, by the wedge method. We may infer that bales which have been externally wetted during transit may be similarly tested with reasonable accuracy since the wetting probably affects the bale with the same progressive action from the outside to the centre of the bale, though reversed in point of dryness and moisture.

(2) The variation in weight of the separate bales of a consignment, commonly noticed when they are received in this country, is not of necessity due to some having been carried as deck cargo or some having been stored against the boilers, but that differences of at least 2 per cent. in weight are certain to arise between separate bales owing either to different conditions of their exposure to air or to actual variation in moisture at the time of packing and consequent difference in rate of drying.

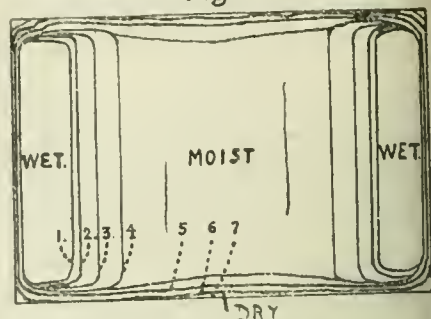
(3) That 50 per cent. pulp should not dry to a greater extent than 2 per cent. in one month nor more than 6 per cent. in six months under ordinary conditions.

(4) That so far as the middle sheets taken from bales of moist pulp are concerned, the centre of the sheets is distinctly drier than the outside edges even after storage for six months. I may here remark that the last-mentioned result was quite unexpected and shows that the drying of a bale of wool pulp is by no means the simple affair that might have been supposed. It needs no proof to convince ourselves that the final drying stage will be that in which the bale is uniformly dry throughout its bulk with the exception of a damp spot at the centre, but the intermediate stages are greatly complicated by the fact that the bale appears to resist drying through the various sheets (or from sheet to sheet) whereas drying may go on rapidly from one part of the sheet to another. The foregoing explanation would appear at first sight incorrect in view of the fact that far more moisture exists at the edge of the middle sheets than at the top and bottom sheets of the bale; but this apparent conflict vanishes when we consider that that outside part of the bale which is the most damp is probably giving up its moisture to the air at the greatest speed. The tendency of blotting paper to absorb moisture more rapidly in the direction of the fibres than through superimposed layers is well known and we may reasonably expect that the drying of wool pulp bales may be explained in exactly reverse direction. If a further set of samples had been drawn from the most extreme edge of the sheets referred to (say, only 1/16th in. wide), it is highly probable that less moisture would have been found.

An attempt has been made with partial success to graphically describe the distribution of moisture in a

bale of pulp which has dried for some months. The bale is supposed to be in vertical section with the sheets in a horizontal position, and the lines are intended to show isohygrie. (Fig. II.)

Fig. II.



(5) It would have been interesting to have made comparisons between the results obtained from various methods of sampling, but although a few such tests have actually been made, none are quoted here for reference which it is, however, necessary to state. I am not aware that any one, other than the writer, has defined a precise position in the bale from which the sheet sampling are to be selected though it is true that the advisability of taking a large number of sheets at distances apart has been frequently and quite correctly advanced. Methods other than that of the "wedge" will give results less or greater than the truth according to the position in the bale from which the sheet is selected and, again, these methods have already been sufficiently discounted by other means. We will, however, briefly note the difference arising by selection of sheets from different positions.

Referring to Lot B tested after six months' storage we find that the "50 per cent. air-dry contents" is 107.4 per cent. by correct sampling of the bale showing practical agreement with the content of absolutely dry pulp found at the pulp mill. If the bale had been sampled by cutting wedges of equal size from the seventh sheet as well as from two representative inner sheets the figure would have been 110.0 per cent. To go to the other extreme, if the outer seven sheets of the top and bottom of the bales had been rejected and the rest of the bales properly sampled we should have found 105.5 per cent. These are the differences that must be expected to follow the adoption of incorrect methods of sampling; they are directly deduced from the results stated in the tables. They are different depending not upon the correctness or incorrectness of the wedge method, but simply upon the position of selection of samples from the bale and upon the size of the separate pieces.

We may now summarise conclusion No. 5 by stating that no method of sampling can give a correct or even a uniform result unless it defines the position in the bale whence the sheets are to be taken for sampling. Again, if the samples are to be of equal size it will be necessary to test a great number of sheets from each bale.

A few notes made at the pulp mill concerning circumstances which influence the amount of moisture in the pulp will not, I think, be out of place in conclusion. Many of them, perhaps all, are known to some pulp makers, but the list is made as full as may be with the object of showing a few of the difficulties which the producer experiences in meeting the requirements of the consumer for a uniform percentage of air-dry pulp. They may be of use to some pulp makers who have given special attention to the matter.

**CIRCUMSTANCES CONTROLLING THE MOISTURE CONTENT OF PULP.**—

(1) It is self-evident that if other conditions are equal the fineness of grinding of the pulp will influence the result, apparently causing a finely ground pulp to contain more moisture than if coarsely ground.



) The amount of water contained in the pulp before pressing is likely to have some influence upon the contents of the final product.

) The thickness of the sheet before pressing would tend to influence the result although a single test made with the object of proving this yielded a negative result. A ingenious device for obtaining uniformity of thickness involving the striking of a gong when the sheet has a given thickness has been introduced but was an unqualified success. If an even supply of pulp could be depended upon it is clear that the thickness of the sheet would be proportionate to the revolutions of the roller upon which it is taken up and an automatic device for stripping the roll or "doffing the blanket" could be devised. It is, however, probable that in some cases the flow of pulp is very far from uniform. Some mills have recently been made upon large consignments of pulp in which the sheets were distinctly thicker than in the past and a great excess of moisture has certainly been found. (A well-known paper maker attributes excess moisture in Canadian pulp to greater length of fibre compared with Scandinavian pulp.)

) The time of exposure of sheets to hydraulic pressure may be regarded in practice as of more importance than limits than the pressure itself. Economy of time is said to result from relieving the pressure for short moments during the operation as compared with continuous pressing. After the pressure has reached maximum and whilst it is maintained there, the water seems to pour out for many minutes at apparently the same rate, whereas slight increases of pressure have a marked effect upon the flow.

) The kind of cloth used for pressing certainly has an influence upon the moisture contents of the pulp. A casual inspection giving the impression that cocoanut fibre was preferable to cotton, wool or hemp cloths. It would be an easy matter to compare results from various materials. One of the Canadian mills appears to use wire but wire "cloths," the mesh being about  $\frac{1}{2}$  in. are used and the wire of about 12 B.W.G. It would appear that more uniform results as regards moisture should be obtained by the use of these wire cloths than where flannels are used and the Scandinavian mills would certainly be well advised to experiment in this direction. It must not be assumed for one moment that Canadian pulp is more uniform as regards moisture than Scandinavian.

) The size of the sheets or folds has a direct influence on the moisture, though this is another case where experimental proof is wanting. For the same pressure, it is obvious that small sheets are preferable to large sheets, the pressure per square inch of pulp being greater. Again, if the sheets are small the moisture will be able to get away much more rapidly than from large sheets. If the pressure per square inch of surface of pulp is the same. Bales packed from large sheets cannot withstand the rough usage to which they are subjected in transit and no sheets of moist pulp should measure more than 24 in. by 18 in. The depth of the bale may conveniently be 30 in. If well packed the above dimensions will yield a 4 cwt. bale that should lose nothing in transit. The canvas used for the purpose is too frequently of inferior quality. I may remark that the pulp upon which I carried out the above tests and answers to the above dimensions is equal to anything I have seen as regards appearance after shipping. I have known badly packed pulp to lose over 1 per cent. through the loss of pulp being broken off the bales at the quay side; the loss between the pulp and paper mills must have been considerable.

) It is clear that the condition of the mats as regards freedom from fibres of pulp will affect their efficiency in removing moisture from the sheets of pulp. These mats should be washed as often as possible, and it is much better to wash a few at a time frequently than to wash them altogether at long intervals. The latter procedure must result in the whole output varying in moisture contents according to the condition of all the mats.

(8) There is likely to be a little difference between the sheets turned out from the top and bottom of the press, but since sheets of iron are generally placed at intervals

between the sheets and the pressure is almost the same from top to bottom, this may be almost negligible. The edges of the lower sheets are of course exposed to more water trickling down from above.

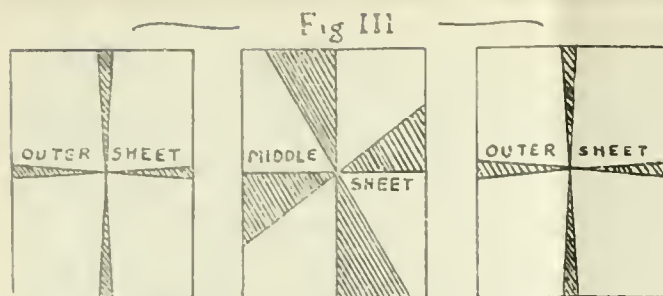
(9) I am told that some mills press a definite number of sheets until the table has risen to a given point, this method being supposed to yield uniform results as to moisture contents. The method is only mentioned to condemn it, the obviously correct course being to work to a given hydraulic pressure—varying, of course, with the size of the sheet.

CONCLUSION.—I have frequently been asked to state what I consider the best method of selecting samples of pulp, but I have always found much difficulty in giving a short answer to this question. Circumstances vary so greatly that it is difficult to lay down a hard and fast rule. The principles of sampling must be understood and applied to each case arising. It is therefore somewhat grudgingly, and as a concession to those who would have everything standardised or converted to a mere mechanical movement, that I attempt to describe the best practical means of testing pulp.

*Selection of bales.*—Bales from which pieces of pulp have been broken off, bales with all wires broken off, in short, all bales that are not "intact" must be rejected from the test. Bales that have obviously been carried as "deck cargo" should be rejected, and, according to the recommendations of the British Wood Pulp Association, all bales of abnormal weight should also be rejected. (The acceptance or rejection of bales should rest with the analyst, if an absolutely impartial test is required, since the exclusion of over damp light bales would be obviously unfair to the buyer.) The bales to be tested should be selected by the analyst who undertakes the test, and he may have to reject bales which have been specially put to one side for the purpose of testing. If the consignment has not all been delivered at the time of sampling, some of the selected bales may be taken from waggon loads arriving during the test. As far as possible, the sample bales should be taken from "all parts" of the stock available.

*Weighing.*—As a rule, a platform weighing machine will be provided for weighing the bales, and unless there is some good reason to the contrary, several bales should be weighed at the same time. This procedure reduces the error of weighing the bales singly. For instance, if the machine will only turn with 4 oz., we may suppose that error to apply to each weighing. If the bales are weighed singly, the error is 4 oz. per bale, but if in fours the error is only 1 oz. per bale. It is well to bear in mind that every error made in testing is multiplied 50 fold, as applied to the final result of the test—assuming that the usual 2 per cent. test is being made. When bales are numbered progressively, it is generally advisable to note the number of each weighed bale, this being often asked for by the pulp maker when too late. So far as the analyst is concerned, the progressive numbering of bales is of use in helping him to obtain representative bales; he should certainly avoid including several consecutively numbered bales in his test.

*Sampling.*—If many bales have to be sampled, a good deal of time can be saved by employing one person to weigh and another to cut samples. If it is convenient to open the bales close to the weighing machine, any intelligent person may be allowed to weigh the bales, but the analyst will see each one balanced and record the weight himself. If the bale under test is about 24 in. in thickness, the sheets for testing may be selected from the middle, and at  $1\frac{1}{2}$  in. from the top and bottom. Four "wedges" are cut from each of these sheets, the base length of these from the middle sheet being 6 in. and the base length of these from the outer sheet 1 in. (Fig. III.) If the sample produced in this manner would be too large to dry conveniently in the ovens at disposal, the wedges may have base lengths of 3 in. and  $\frac{1}{2}$  in., or two wedges only may be cut from each sheet. In very large consignments, it may be sufficient to take only one wedge from each sheet. The reasons for the above procedure have already been set forth (J.S.C.I., *loc. cit.*), though the practice advised is slightly simplified and modified in the light of results now given, particularly



in view of the ascertained fact of moisture travelling with difficulty through the several sheets, but readily along or across the sheets. It is now assumed that a sample sheet taken from near the middle of the bale will represent the moisture contained up to within 3 in. of the top or bottom of the bale. Occasions may arise when for some special reason it will be advisable to vary the above method, for instance, if only five bales of pulp have to be tested, it will be better to take a whole sheet from the middle of the bale and wedges from the outer sheets equivalent to one-sixth of that sheet. An extreme case would be that of sampling a single bale

where six entire sheets would be taken to represent the middle of the bale, a full sheet from points  $1\frac{1}{2}$  in. from top and bottom. This latter method is equivalent to the collection of six sheets from equal distances apart throughout the bale. Only one other extreme or exceptional case need be mentioned, and that is the case of sampling pulp where the excessive moistening or drying influence has only affected the extreme outside edge and outermost sheet of the bale. The outermost sheet may then be selected at  $\frac{1}{2}$  in. from top and bottom of the bale and the outer wedges must be about one-twentieth of the area of the wedge taken from the middle sheet.

The writer desires to acknowledge his indebtedness to the following gentlemen who have shown him great kindness, and without whose co-operation the paper would not have been written.

Mads Henrik Smith, Esq., T. Thommesen, Esq., Björnness, Esq., and Mr. Peterson, of the Rygene Træsæftfabrikker Aktieselskab, and Mr. Watson, of the Darwen Paper Mill Co. Particular mention should be made of the fact that the Rygene Company were not only willing but anxious for any information obtained in their mill to be used for the information of the industry as a whole.

*Tests made at the Pulp Mill in Norway:—*

TABLE I.

Method of sampling.	Moist Weight.	Abs. Dry Weight.	Abs. Dry Per Cent.	50% Air Dry.
A. Whole sheet .....	916 gr.	398.2 gr.	43.4	96.44
B. Mill test (extra large) .....	62 gr.	39.3 gr.	48.8	108.44
C. Mill test (ordinary) .....	10 gr.	4.85 gr.	48.5	107.76
D. Wedge Method .....	101 gr.	44.21 gr.	43.7	97.11

TABLE II.

A. II. Mill method .....	341 gr.	161 gr. (—)	47.2	104.0
B. II. Wedge method .....	725 gr.	333.7 gr.	46.02	102.3

TABLE III.

A. III. Mill method .....	485 gr.	231.03 gr.	47.63	105.84
B. III. Wedge method .....	879 gr.	405.7 gr.	46.27	102.82

TABLE IV.

A. IV. Edge .....	201 gr.	84.4 gr.	42.0	93.3
B. IV. Intermediate strip .....	304 gr.	160 gr.	52.6	116.9
C. IV. Middle .....	291 gr.	159.1 gr.	54.6	121.3
Whole sheet .....	796 gr.	403.5 gr.	50.7	112.7

*Bales Tested in Norway and again in Lancashire. Table of Results:—*

TABLE V.

	Lot A from average of 5 bales. Absolutely dry pulp.	Lot B from average of 5 bales. Absolutely dry pulp.
Wedge test samples collected at pulp mill and dried there.... Per bale .....	46.6% 208.8 lb.	45.28% 202.8 lb.
Check test on above from duplicate samples dried in Manchester Per bale .....	46.2% 207.0 lb.	45.15% 202.3 lb.
Samples collected from above bales at Lancashire paper mill and dried in Manchester after one month from time of packing, including time of shipment and storage at the paper mill Per bale .....	47.15% 207.3 lb.	
Samples collected from above bales at Lancashire paper mill and dried in Manchester after six months from time of packing, including time of shipment and storage at the paper mill Per bale .....	..	48.32% 203.3 lb.
Net weight per bale in Norway .....	448 lb. (moist)	448 lb. (moist)
Net weights at time of testing in Lancashire .....	435 426 437 444 446	415 422 425 418 424
Average .....	439.6 lb.	429.3 lb.



TABLE V. —continued.

	Lot A from average of 5 bales. Absolutely dry pulp.	Lot B from average of 5 bales. Absolutely dry pulp.
In weight of bales in one month .....	1.87%	
" " " six months .....	"	6.07%
The sheets of all bales tested as follows:—		
Middle of sheet .....	47.30%	Abs. Dry. 48.12%
Intermediate area .....	46.45%	47.42%
Outer parts or "edges" .....	44.09%	46.60%
Most sheets, average .....	64.36%	64.13%
Most sheets from top and bottom of bale .....	(not done)	57.64%
Most sheets from top and bottom of bale .....	48.69%	53.52%
Most sheets from top and bottom of bale .....	46.20%	47.41%

# DISCUSSION.

THE CHAIRMAN remarked that everyone was familiar with the difficulties attending the sampling of paper pulp, the various methods of testing for moisture. On comparing his notes of several tests which he had made he was inclined to think that the wedge-shaped sample suggested by Mr. Lester was more accurate, although he could not see why holes bored in the bale, similar to the hole adopted in sampling cheese, should not give a fair average result of the moisture.

MR. H. L. TERRY thought that the phenomena of segregation, as exhibited by metallic castings, formed an interesting parallel to the variable distribution of water in wood pulp. A non-expert in either case might easily fall into grave error when taking samples for analysis. He would like to know whether sulphate and sulphite pulp showed variations in water content, as marked as those seen by Mr. Lester to occur in the case of mechanical pulp.

MR. H. PORTER said he had had experience in testing for moisture in gun-cotton charges, which required to be very finely compressed, and it occurred to him that the difficulties were somewhat the same. There was a certain amount of spring after it had been under compression for some time. If a circular gun-cotton charge were halved the centre core was found to be much harder than the outside, and the springing was a very important factor with regard to the moisture evaporating, or being absorbed in the charge. In gun-cotton charges holes were pierced through the centre, and if it were possible to adopt this course with bales of wood pulp a much more uniform test for moisture would be possible.

MR. G. H. HURST said that the various methods of testing wood pulp had always been a bone of contention between the Norwegian pulp makers and the Lancashire paper manufacturers. He thought the wedge-shaped sample gave the most accurate results. Every parcel should be considered separately, as there was considerable difference in the condition of each parcel, and there were distinct cases that the pulp maker had mixed different batches of pulp together. Mr. Lester had done good in the direction of showing the Norwegian pulp manufacturer that taking samples from the middle of the bale did not give exactly the same results, and that, by using the wedge method, much more accurate results could be obtained. No doubt there was a want of agreement between experts as to the best methods of sampling, and he thought Mr. Lester's paper would contribute towards that end.

MR. JULIUS HÜBNER said that the question of pulp testing was of the greatest interest not only from a commercial point of view, but also from a scientific standpoint. He considered that it should not be impossible to establish a method, based on scientific principles, of sampling wood pulp by means of which the possible error would be reduced to a minimum. The testing of wood pulp was, after all, similar to the testing of cotton yarn, and it would, therefore, be only a question of exhaustive experimental research to establish a reliable method of sampling. As long as this remained an open question, it was, in his opinion, of great importance that those engaged in testing pulp should agree upon one

method of sampling. If this could not be conveniently brought about, then there was only one way to solve the question in a satisfactory manner, namely, the establishment, by those concerned, of a testing institute to which all the tests would be referred.

MR. WM. THOMSON was of opinion that it would be impossible to determine with absolute precision the quantity of water existing in a bale of wood pulp; but he was afraid that the sellers would not be satisfied with the form of test suggested by Mr. Hübner. It seemed to him that whilst the wedge-shaped cutting suggested by Mr. Lester might accurately give the percentage of water in the sheet, it would not necessarily give the percentage in the bale. It would be interesting as a test of the accuracy of water determination to take a certain weight of thoroughly dried wood pulp and make a bale of it, and then make tests by cutting samples from different sheets and comparing the result with the actual percentage known to be present.

MR. J. GROSSMANN thought that it would have been preferable if Mr. Lester had expressed his results in the usual graphic form of curves; and that it might be possible to select the samples always from a number of definite points in the bale, and that the positions of these points could be determined from a large number of samples taken from standard bales.

MR. J. H. LESTER, in reply, thought that the suggested parallel case of the segregation of metals had some bearing on the subject, and that further investigation on these lines would be profitable. As to testing of sulphite and sulphate pulp, they would be treated in precisely the same manner as mechanical pulp; the question being that of obtaining a correct proportion of the inside and the outside parts of the bale. The spring of gun-cotton charges was also an interesting parallel, and might have its application to pulp testing. With regard to the suggestion to bore holes through the bales to be sampled, he (Mr. Lester) referred to his previous paper where, in diagram No. 15, he showed that the samples must be of a conical form and must not be cylindrical. With regard to the testing of cotton yarn or bales of cotton, his methods might be applied to all materials packed in bales or cases where the outside of the goods were liable to be affected by moisture or dryness. The wedge method included more of the outside of the pulp than any other method, although it was shown in the previous paper that, if anything, the wedge method did not include quite sufficient of the outside pulp when considered geometrically. Investigation would have to be considerably extended to allow of graphic curves being used in illustration, inasmuch as numerous points on the curve would have to be found. [Mr. Lester here illustrated the probable character of the curve on the blackboard.] No definite point could be found in the bale which would apply to varying conditions of external drying. The method of testing suggested by Mr. Thomson was theoretically perhaps the best that could be devised; it was better than the wedge method. Unfortunately paper makers would not give the time and labour necessary to carrying out such a test. With regard to Mr. Thomson's assumption that a bale containing moisture only at the centre would be incorrectly sampled by the wedge method, he thought his method would apply correctly to such a case, as had been shown in the geometrical proofs of the previous paper.

## New York Section.

Meeting held on Friday, November 25th, 1904.

RUSSELL W. MOORE IN THE CHAIR.

### STANDARDS OF PURITY FOR FERMENTED AND DISTILLED LIQUORS.

BY PHILIP SCHIDROWITZ, PH.D., F.C.S.

The subject of these remarks forms only a small part of the important general question of the purity and composition of articles of food and drink as a whole. My reason, however, for confining these notes to the articles designated in the above title is that I prefer to speak only with regard to matters of which I have some special experience.

Broadly speaking, there are two main factors to be considered in the food problem, namely, adulteration proper and misdescription. To a certain extent these problems overlap, but on the whole they are fairly well differentiated. Practically there is very seldom any doubt in the mind, either of the food expert, of the merchant, or of the lawyer in cases of adulteration proper, but where misdescription, or alleged misdescription is concerned, serious and perfectly genuine differences of opinion are of frequent occurrence.

In such cases, the fixing of any standard, more particularly with respect to manufactured articles, such as beer and spirits, be it in regard to the nature of the raw materials, or to the method of manufacture, or to the composition of the ultimate product, is a matter of the greatest difficulty. Broadly speaking, the questions which have been raised in this connection in the fermentation and distillation industries have been concerned, firstly, with the source from which the alcohol is derived, and secondly, in the case of spirits, with the type of still employed. The discussions which have arisen in connection with these matters have, no doubt, in part, been due to or have been influenced by, various trade interests, by political motives or by an excess of zeal or by a lack of technical knowledge on the part of the hygienist or chemist, but on the whole, I think, they have been normal manifestations of the ceaseless struggle which is being waged with a view to the differentiation in every individual case between that which is legitimate and that which is an undesirable application of science. Before discussing the question of standards of purity as such, it may not be out of place to give a few instances of our experience in recent times in England in connection with these matters.

At the beginning of the nineties, a Royal Commission was appointed to inquire into the conditions of manufacture and storage &c., of British and foreign spirits. This commission chiefly devoted its labours to whisky. The practical outcome was that the Commission found it neither necessary nor equitable to restrict the term "whisky" to a product made from any one particular material, or to a spirit made in any specific type or still. It may be added that in Scotland, whisky, as the term is understood in that country, is made solely from cereal grains, and that no sugar nor essences of any kind are employed in its manufacture. The official regulations concerning the treatment of spirits in bond, in fact, preclude the possibility of passing out of bond as "Scotch Whisky" an article sophisticated in any way. Practically all the whisky exported is exported from bond.

The more or less recent experience of arsenical poisoning must be fresh in your minds, and the Royal Commission appointed to inquire into this found that with ordinary care brewing sugars and malts could be prepared practically free from arsenic, and they made recommendations as to the laying down of some fixed standards which should delimit the amount of arsenic permissible in any brewing material.

Coming to more recent times, it is of interest to allude to the prosecutions instituted during the past year in the

United Kingdom in connection with the sale of spur brandy. These prosecutions are mainly of interest inasmuch as they resulted in the practical establishment—for the first time, to the best of my knowledge—of a definite chemical standard in connection with a distilled liquor. It was held by the magistrate in a test case, that brandy should contain approximately 80 grms. of compound ethers for every 100 litres of absolute alcohol. This standard is now generally acted upon in England, although, of course, it has not the force of a statute. Persons I think it very regrettable that this standard should have been set up, my reason being that, in the first place, within my experience extremely unwise, in the majority of cases, to be guided as to the purity of a fermented distilled liquor by a single analytical figure, and that in the second place, such a standard is nothing more than a premium upon adulteration. In plain words it has led, as anyone versed in such matters must I foresee, to the direct addition, by unscrupulous parties, of compound ethers to spirits which certainly do deserve the name of "brandy." One could not have more striking example of the dangers to which food chemical standards, particularly when confined to a single figure, may lead.

I now come to the discussion of the general lines which, according to my opinion and experience, stand of purity for fermented and distilled liquors may be rationally considered. As this is a question of particular interest in this country at the present time, I take liberty of using, as a basis for my remarks, the suggestion made by the Chief of the Bureau of Chemistry of the Department of Agriculture to importers in Circular No. 18 (August, 1904). I hope it will not be considered presumptuous on my part, if, to begin with, I venture to congratulate Dr. Wiley and the U.S. authorities on their energetic and courageous efforts which they are making for the solution of the great problem of food adulteration and misdescription.

I take the different articles in the order enumerated in the circular alluded to.

**Wine.**—No honest or sensible person will object to the principle that wine should be correctly labelled as to its class, country or origin, &c. I doubt, however, whether the administrative machinery of all the countries concerned suffices for the provision of an absolute of guarantee or pedigree in all cases, and whether serious differences of opinion with regard to definitions, tending to dislocate international trade, may not arise, if any hard and fast, non-flexible regulations, are made in this connection. I do not doubt, however, that a thorough discussion of these matters between representative of the countries and industries concerned would lead to a good working arrangement.

With regard to the question of sulphurous acid in wines, I think that the limit for free acid suggested, namely, 20 mg. per litre is somewhat low. In the case of certain sweet wines, such as the Chateau Yquem, which require very frequent rackings, I do not think that a limit of 400 mg. of total sulphurous acid, and, of 30 to 40 mg. of free acid would be excessive. It must be remembered that these are very heavy wines, and that they are only consumed in small quantities. I understand that the French Government has recently adopted a standard of 440 mg. as their limit.

It is suggested in the circular alluded to, that all wines containing more than 14 per cent. of alcohol by volume shall be classed as "fortified." This, within my experience, would constitute an injustice to certain natural wines, such as some of the heavier Burgundies, Spanish and Italian wines. I may be excused for quoting a few figures from my note book for the past ten years in this connection. These wines, I have the best reason for believing, came to me in a natural state: Alicante 17 and 15.5 vol. per cent. of alcohol respectively; Burgundies 14.53, 14.01, 14.20, 14.05, 14.10, 14.38, 14.1 and 14.48 per cent. respectively.

Some of the clarets of the famous 1900 vintage obtained as much as 13.76, 13.71, and 13.40 per cent. of alcohol naturally. In a table, issued by the Italian Ministry of Agriculture (Rome, 1896), out of 11,999 wines, 1221, that is, somewhat over 10 per cent., contained



usually between 14 and 15 per cent. of alcohol, and at 2 per cent. of the wines contained over 15 per cent. alcohol.

It is within my experience extremely dangerous to use as a standard of purity for wine any single figure. Judging a wine it is necessary to make a complete analysis, to compare the figures so obtained with the published data, and finally to consider whether there are special circumstances affecting the case in point. In case of doubt I think it is desirable that the chemist should call in the assistance of an expert taster.

**Brandy.**—It is a matter for congratulation that Dr. Wiley has not suggested any minimum limit for any of secondary products such as the compound ethers.\* As we indicated above the evils which may result from a course. On the whole, I venture to think that proposed standards for brandy† are both fair and unobtainable, but I do not agree with Dr. Wiley that the effect of storage in wood is the elimination of fusel oil (higher alcohols). My experience is that, broadly speaking, mature spirits contain rather more of the higher alcohols than do raw spirits. I ascribe the maturation of spirits to the conjoint effect of a variety of circumstances, which I hope to allude in detail in a subsequent paper. It is sufficient to say that there is no experimental evidence in literature confirmative of the generally-held view that higher alcohols disappear during maturation, and, theoretically regarded, there is no particular reason why they should do so.

In my opinion the analysis of brandy, as generally carried out at present in France and in England, is useful in a negative sense; that is, if the figures as a whole fall below the limits indicated by experience as being normal for a genuine spirit, it may be regarded as prepositive evidence that the spirit is not genuine. For example, a sample having, say roughly, 150 mg. of total secondary products and 30-40 mg. of ethers,‡ and practically no furfural would obviously be open to grave suspicion. But each case should be considered on its merits, no conclusion should be drawn from a single figure. On the other hand, a sample which is analytically satisfactory is not necessarily genuine. In cases of doubt, a chemist's assistance should be requisitioned. If both the opinion of the analyst and of an unprejudiced taster are adverse to a sample, the merchant or distiller should be called on to give evidence as to the origin, &c.

**Whisky.**—The remarks with regard to fusel oil made for brandy apply also to whisky. I think on the whole the limit of 0.25 per cent. of fusel oil, suggested by Dr. Wiley, will not inconvenience the whisky distiller, I nevertheless fear that it may occasionally tend to cut a very fine, "big," genuine spirit. I would suggest per cent. as a safer limit. It should be remembered that the determination of fusel oil is by no means an easy matter, and that even the best processes are liable at times to give results open to suspicion. In a former paper (J. J., June, 1902) I stated that the official (German) method could not be used for whisky, and further experience since then has confirmed this view. A large number of experiments have indicated that the only

trustworthy method is that of Allen-Marquardt; but even this method occasionally gives somewhat anomalous results. I have recently found that the French colorimetric method, using an amyl alcohol standard, gives fair, though somewhat high, results in most cases.

With regard to the suggestion that "no artificial colour other than that derived from the wood in which it is stored is admitted in whisky," I am in thorough sympathy where this provision is intended to prevent the use of colouring matter employed to give a fictitious appearance of age. Sometimes, however, a small amount of colouring matter (caramel) is employed for the sole reason that the consumer will not buy a whisky that does not possess a certain standard of colour. To explain: in Scotland, the general method of imparting colour to whisky is storage in a sherry cask. As the consumption of whisky grew, it was found that there were not sufficient sherry casks obtainable for this purpose. The distiller, therefore, had to resort to the use of "plain" wood. Whisky stored in "plain" wood casks acquires very little colour as a rule, even after a number of years, and the result is that, although a spirit stored in this way may be quite as old and fine as that casked in sherry wood (apart from the distinctive sherry flavour), it cannot be sold unless it is brought up to the standard of colour demanded.

I am almost inclined to think that, under these conditions, the colouring, or part colouring, of the spirits with a harmless substance such as caramel can scarcely be considered to be an adulteration, and that it does not constitute "artificial colouring" in the practical sense of the term, any more than does the use of a charred cask. But I repeat that when colouring matter is added to a raw, neutral or cologne spirit, for the purpose of giving a fictitious appearance of age, then such colouring matter should be regarded as an adulteration, and that it should either be prohibited or be made subject to declaration. I would also point out that from an analytical point of view there is some danger that a perfectly genuine sherry cask coloured spirit might form the object of suspicion, inasmuch as the colouring matter of the sherry cask is apparently closely allied to some of the caramels of commerce, and that our tests for this class of bodies are by no means all that could be desired.

I think that the limitation of the solid matter to 0.25 per cent. will, on the whole, not interfere with the genuine whisky industry, but it may occasionally occur that a spirit stored in a cask that has contained a particularly heavy sherry might genuinely exceed this limit.

I venture to believe that the methods of analysis of whisky indicated by me in a former paper (*loc. cit.*) are likely to be of some practical value when a sufficient number of standard samples have been examined, and if the results be considered in connection with the opinion of an unprejudiced expert taster, and also, in case of doubt, with reference to such statements as to origin and manufacture as may be obtainable in any particular instance.

In conclusion, I wish to advert to one aspect of the pure food problem, particularly as it has a very practical bearing on the subject which has been treated in the above remarks. It has been suggested, both in England and here, that the solution of the food adulteration problem would be reached if every package were labelled with a detailed statement as to the exact nature of the contents, and the method of manufacture, and so on. I cannot help thinking that, in order that such a course should be successful, it would be necessary to make an expert chemist of every man, woman and child, otherwise such labelling, in my opinion, is only likely to lead to confusion and to cause serious injury to the manufacturers of superior articles. No one will venture to suggest that an article should not be correctly labelled, but I for one think it scarcely fair that full details in regard to the constituent parts and methods of manufacture should be published to the world at large. I take the liberty of suggesting an alternative method—a method that would secure perfect protection for the public, and at the same time would not possess the drawback of the detailed label. I suggest that every article of food or drink, either imported or manufactured at home, should, when first placed on the market, be submitted, together with a statement as to the origin, constituent parts, manufacture, &c., to a Board of Reference, composed of

\* NOTE.—In some recent, and as yet, unpublished work by F. Kaye, A.R.C.S., and myself, we have been able to show that the mere "breaking down" (i.e., dilution) of brandy in the normal commercial lines, especially if effected with a highly alkaline water, such as the excellent New River (London) water, is liable to seriously affect the ether value. This value so affected by the mixture of different brands, the resulting ether value of the mixture being by no means equal to the arithmetical mean. We have found that "breaking down" with water such as that indicated, may reduce the ether value related to alcoholic strength in each case) by more than 50 per cent. Under those conditions, a rigid legal ether standard will result in the condemnation of a perfectly genuine brandy.

† NOTE.—In connection with the 0.25 per cent. limit for solid matter, it is worthy of note that we have certain types of brandies in England to which small quantities of "sweet" matter are added. This is done with a view to producing a brandy of distinctive type and taste, and is not regarded in England as adulteration. I do not know whether these types are vendible here, but, if they are, possibly some modification might be made in the connection with the proposed standard of total solid matter where it is obvious that sweetening matter has not been added with a view to giving any fictitious value to the produce.

‡ NOTE.—Per 100 c.c. absolute alcohol.

expert hygienists, chemists, and representatives of various industries. This Board should decide whether the article is wholesome, and whether it is honestly labelled. If the contents of the package are decided to be injurious, or misdescribed, then the article should be prohibited or referred back to the manufacturer. If passed, as being genuine, samples should be taken from time to time in the open market and submitted for examination to ascertain whether its quality is kept up to the original standard, due allowance, of course, being made for ordinary commercial variations of quality, which naturally may be considerable in the case of an article such as a wine or a spirit. The details as to an article's nature submitted to the Board suggested would not be published, but would be available in case of subsequent action.

A Board of Reference of the nature indicated, would, if given powers to set up standards and definitions, I believe, be of the very greatest assistance to those entrusted with the local execution of the general food laws.

*Meeting held at Chemists' Club, on Friday, January 20th, 1905.*

RUSSELL W. MOORE IN THE CHAIR.

## PREPARATION OF VOLUMETRIC SOLUTIONS.

BY E. C. WORDEN AND JOHN MOTION.

The importance in volumetric analysis of solutions of easily determined accuracy, and the value of any observation tending to increase the facility with which such solutions may be prepared is, perhaps, a sufficient explanation for recording the following notes. These notes on the relation of specific gravity to composition were originally undertaken for sulphuric and hydrochloric acids and subsequently extended to oxalic acid, in order to obtain a delicate standard for the adjustment of permanganate, bichromate, thiosulphate, arsenite, sulphite, iodine, and other chemicals used in processes involving oxidation and reduction, because it had been felt that, in volumetric work, the methods of standardising the several solutions were often tedious, and not always satisfactory from the point of accuracy.

Higgins (*Am. Jour. Pharm.*, 1901, 200; this J., 1900, 958) has discussed the several substances proposed as standards in acidimetry. Moody (*J. Chem. Soc.*, 1898, 658) and subsequently Higgins (*loc. cit.*) and Raschig (*Z. angew. Chem.*, 17, 577) have described a method of preparing an accurate standard acid, by passing gaseous hydrochloric acid into a definite volume of water and weighing the amount absorbed. This requires a rather delicate arrangement of somewhat complicated apparatus, but, when properly executed, is without doubt capable of great accuracy.

Compared with the above, the electrolysis of a solution of copper sulphate is somewhat simpler and more easily carried out. [Kohn (this J., 1900, 962), Meade (*J. Amer. Chem. Soc.*, 1901, 12), Dauvé (this J., 1902, 1098).] On the other hand, it serves only as a basis from which the strength of other solutions may be determined, rather than for preparing actual solutions for use, as there is obviously a limitation to the quantity that can be conveniently prepared in this way.

Sørensen (*Z. anal. Chem.*, 42, 333) has investigated sodium oxalate, which, however, is inapplicable to acidimetry. Dietze has calculated the specific gravity of the preparations of the United States (*Pharm. Review*, 1897, 24; Merck's Report, 1897, 241; *Proc. Am. Pharm. Ass.*, 1897, 399), British (*Chem. and Drug*, 1897, 243), and German Pharmacopœias (*Phar. Zeit.*, 1897, 631), but the figures are limited to a definite concentration and the gravities extend to only three decimal places.

S. U. Pickering (*J. Chem. Soc.*, 1890, 64) has recorded a series of determinations of the density of sulphuric acid, considered by Richmond (this J., 1890, 479) "the

most complete ever published." He (Richmond, *Anal.*, 1892, 167) has compared Pickering's results with those taken by himself, in which the sulphuric acid was standardised by three gravimetric barium sulphate determinations of 6–9 grms. of a solution containing 30 concentrated sulphuric acid per litre.

From the same source, Marshall (this J., 1899, 4, 10, 1902, 1552) deduces a formula whereby strong sulphuric acid is mixed with an equal volume of water, the density obtained, and the mixture diluted to a definite amount, the final adjustment being made by volume. Later (this J., 1902, 1508) he has investigated the influence of impurities on the specific gravity of sulphuric acid, published a table for each 0.001 in gravity.

The following notes on the relation of density to composition of sulphuric, hydrochloric and oxalic acids have been made only between those limits of strength which appear in the normal and deci-normal solutions of the three acids, and to furnish the data for the construction of tables VI., VII. and VIII. In the course of this work, covering a period of three years, we have upwards of 450 density observations at the temperature 15.56° C. (60° F.), with a corresponding number of gravimetric determinations. The oxalic acid investigation being extended at other temperatures and to its maximum solubility in water.

*Purification of Chemicals.*—The water was distilled from alkaline permanganate in a copper retort with block tin condenser, then redistilled, the distillate condensed hot, and the first and last portions rejected. It had a very low electrical conductivity, showed no evidence of the presence of ammonium compounds or of chlorides. Each chemical was examined and exceeded in purity the standards as laid down by Krauch, "Testing of Chemical Reagents." They were from Kahlbaum, with the exception of the hydrochloric and sulphuric acids which were Merck's reagents, and the sublimed oxalic acid, which came from König. A semi-normal sodium hydroxide solution was prepared from metallic sodium purified by filtration through iron gauze in a vacuum, and this was gradually introduced in small pieces into recently boiled, distilled water cooled to 2–4°, finally covering the solution with paraffin oil purified by repeated boiling with nitric acid.

It may be contended that it is difficult to produce acids of sufficient purity to give results of such accuracy. To test the importance of this point: (1) a portion of the sulphuric acid used was further purified by recrystallisations from a freezing mixture, decanting and discarding the mother liquor each time; and (2) comparing oxalic acid with the sublimed acid to recrystallised, and containing no trace of formic acid, and also that obtained from the hydrolysis of methyl oxalate of b. pt. 162.5° at 757 mm., and m. pt. 50°. No variation in the results was found.

*Analytical Results.*—Veley (this J., 1903, 1227) and others consider it "doubtful if volumetric methods can be carried beyond an accuracy of one part in 1000 parts, whereas density determinations can be carried to an accuracy of +1 part in 75,000 parts," and this can be extended to +1 part in 100,000 parts without difficulty where weighing bottles of large capacity are used.

Our work throughout was gravimetric, and as weighing was not counter-indicated, greater accuracy was sought by working on larger quantities than usual. For this reason, all determinations were taken with 100 c.c. pycnometer, a determination being understood to include a density observation, and the estimation of the contents of the pycnometer by precipitation. Each result, as subsequently given, comprises at least three determinations. In those instances where both of the worked independently on the same solution, at least twelve determinations are included in one result.

A sample of acid from three different sources was obtained, and used interchangeably throughout the work. They were precipitated as barium sulphate, silver chloride, and calcium oxalate respectively. The temperature of the solutions during filtration was not allowed to rise above 10° C., and in washing the precipitate, each portion of wash water was returned several times in order to reduce the volume used. It would appear from the



ability determinations in water of silver chloride,\* especially of barium sulphate,† that these precautions not without value.

The sulphuric acid was emptied from the pycnometer into beaker, diluted with 250 c.c. of water for each gm. of dilute sulphuric acid present, the liquid brought to boil, and a 5 per cent. solution of barium chloride slowly sprayed with a fine atomiser into the boiling solution with constant stirring, the addition requiring 25 minutes. The strength of the acid being determined beforehand by titration, there was added an excess of 2 per cent. of barium chloride over the theoretical amount required to form the sulphate. The hot solution cooled by immersion of the beaker in cold running water, the liquid decanted through a Gooch crucible and the filtrate returned. The precipitate after being washed with 25 c.c. of water for each gm. of sulphuric acid present, was transferred to the Gooch crucible, washed free from precipitant, and very gently ignited.‡ Lange and Isler (Z. angew. Chem., 1890, 129) have pointed out that in the sulphuric acid determinations Kolb (Dingl. Polyt. J., 204, 322), no account is given any precautions observed.

The hydrochloric acid in 0.5 per cent. solution was precipitated in amber "Joliet" Erlenmeyer flasks, at 75°, with silver nitrate (containing 10 per cent. of nitric acid) in 5 per cent. excess. The flask was heated until the silver chloride had coagulated, leaving supernatant liquid clear, then filtered through a Gooch crucible and dried to constant weight at 120° C. including the drying, which was done at night, the entire operation, which usually occupied less than six hours, was conducted under red light in a dark room, and in instance was the chloride tinged with violet.

The oxalic acid was precipitated in a warm, slightly moniacal solution, reduced under the blast to constant weight and calculated as calcium oxide. Attempts to precipitate at 105° C. and weigh as the oxalate, to convert the oxalate into sulphate, did not yield concordant results in our hands. The loss of platinum during the several ignitions varied from 0.3—0.7 mgm. Ignition, the mean of the weights before and after being taken as the true weight (Hulett & Berger, Amer. Chem. Soc., 26, 1512).

**Density Methods.**—On account of the low coefficient of expansion of the solutions (practically the same as water), and their non-hygroscopic character, the following method was adopted:—Two 100 c.c. Geissler pycnometers were weighed, the weight or capacity of which did not differ in each other by more than a fraction of a gm., the water being used as a counterpoise. The external areas being nearly the same, the weighings are independent of barometric pressure, or the humidity of the air. They differed from the ordinary instruments in being provided with a capillary tube of but 0.2 mm. bore, and this tube is mounted by a ground glass cap. of about 30 c.c. capacity, the top being drawn to a capillary of less than 0.1 mm. internal diameter. In absorbing the overflow with filter paper, the advantage of the small bore in over-

coming capillary attraction is evident, the object of the large cap with capillary opening being to relieve the pressure incident to expansion and contraction during weighing, without evaporation.

The pycnometer was filled with the acid solution at about 12° C., placed under a bell jar until the bubbles had arisen, the thermometer inserted and the whole immersed in water, which was constantly stirred during the rise in temperature. The thermometer was frequently tapped as in calorimetric work. The tare was taken before and at the end of each series of densities, and the mean of any variation accepted as the true weight. The capacity of the weighing bottle was adjusted by weighing water at each interval of one degree from 10.5—19.5 inclusive. Three series of weighings, when plotted with weights as ordinates and temperature as abscissa, upon a scale of 1 mm. for 0.1° and 0.0001 gm., gave an extreme variation of 0.0005 at 15.56°. But two pycnometers were used throughout.

The temperature was recorded by an ordinary thermometer ground in the pycnometer and reading directly to 0.1°, and this was frequently compared with (1) a thermometer graduated in 0.1° and certified by the Reichsanstalt, (2) a standard Tonnclot thermometer at which the temperature 15.56° had been determined by the National (U.S.) Bureau of Standards. The temperatures are centigrade, and the calculations based upon the 1904 International Atomic Weights, with oxygen as 16. A Troemmer long arm balance was used, sensitive to 0.0001 gm., with a load of 200 gm. The brass weights were standardised among themselves, and the gm. weight adjusted by comparison with the standard at the National Bureau. All weighings were made by substitution, in the case of the Gooch crucible, a platinum tare being used.

The results obtained with the three acids are as follows:

TABLE I.  
Determinations of Sulphuric Acid.

Sp. Gr. 15.56° air.	Grms. acid solution taken.	Grms. BaSO <sub>4</sub> found.	Per cent. H <sub>2</sub> SO <sub>4</sub> .	Number of Determinations.
1.00689	101.3938	2.4958	1.005	10
1.00784	101.4796	2.7190	1.126	12
1.01000	102.0075	3.5160	1.448	8
1.02198	102.9021	7.9235	3.240	7
1.01226	102.9656	8.1375	3.320	6
1.02440	103.1501	8.8412	3.609	6
1.02794	103.4989	10.1198	4.114	6
1.03220	103.9222	11.7483	4.740	6
1.032756	103.9819	11.9957	4.842	10
1.032764	103.9898	11.9963	4.848	6
1.03393	104.1084	12.3731	5.012	6
1.03813	104.5288	13.9836	5.620	6
1.03923	104.6408	14.3927	5.782	12
1.04012	104.7297	14.7335	5.910	6
1.04220	104.9390	15.4828	6.213	6
1.04254	104.9733	15.6168	6.252	11
1.04280	104.9995	15.7213	6.290	6

\* Mulder, Silber Probirmethode, Leipzig, 1859, 62; Cooke, Sil. Am. Jour., (3) 21, 220; Stas, Comptes rend., 73, 998; m. ch. (5) 3, 323; Holleman, Z. phys. Chem., 2, 131; Kohlrausch, Z. phys. Chem., 12, 241; Reinsch, J. prakt. Chem., 13, 133; Z. anorg. Chem., (3) 12, 237.

† Holleman, loc. cit., 12, 131; Kohlrausch, loc. cit., 12, 241; Marguerite, Comptes rend., 38, 308; Kuster, Z. anorg. Chem., 261; Lassaigne, J. Chim. Med., 8, 526; Rose, Pogg. Ann., 95, 108; Calvert, Chem. Gaz., 1856, 55.

‡ Note on Sulphuric Acid.—The work involved some 225 determinations as barium sulphate, which afforded an opportunity of studying the method somewhat in detail, and operating on about 100 gm. quantities, slight variations became more apparent, without exception, higher and discordant results followed, if a concentrated (15—20 per cent. solution) of barium chloride was used, or a more dilute solution added quickly, and also if the concentration of the sulphuric acid be much above 0.5 per cent.

The addition of the barium chloride by spraying was due to an endeavour to obtain a crystalline precipitate of larger grain, by slower formation of crystals, and also one which enclosed the minimum of barium chloride (Richards & Parker, Z. anorg. Chem., 413; Am. Acad. Sci., 31, 67). The method of Hulett & Duschak (Z. anorg. Chem., 40, 196) of determining the "occluded" barium chloride by dissolving the barium sulphate in sulphuric acid, and aspirating the liberated hydrochloric acid into dilute silver nitrate as tried, but with negative results, thus indicating the sulphate to be free from all but inappreciable quantities of chlorides. The rate when allowed to remain at rest in tall beakers for several days, then filtered through a heavy layer of asbestos in a Gooch crucible, seldom gave as much as a mgm. of barium sulphate, an amount too small to affect the result.

The object in quickly cooling the hot solution is to induce convection currents in the liquid, thus causing the precipitate to sink and completely subside, and in doing so to take with it that fine "scum" of barium sulphate which floats on the surface, and is often in such a fine state of subdivision as to cause trouble in filtration.

No free hydrochloric acid was added, and no variation in the result or physical appearance of the precipitate was noted, when 2 gm. hydrochloric acid was added for each gm. sulphuric acid present. (2) The hydrochloric acid came entirely from liberation in the interaction with the barium chloride (which is equivalent to 75 per cent. of the sulphuric acid originally present and where a small amount of barium chloride was first added, then barium hydroxide, so that the total acidity did not exceed 15 per cent. of the sulphuric acid originally present. This differs somewhat from the experience of Richmond (Analyst, 1892, 167), who mentions that the solution must contain free hydrochloric acid in the proportion of at least 3 of hydrochloric acid to 1 of SO<sub>3</sub>.

TABLE II.—*Determinations of Hydrochloric Acid.*

Sp. Gr. 15.56° air.	Grms. acid solution taken.	Grms. AgCl found.	Per cent. HCl.	Number of Determinations
1.00314	101.0058	2.5058	0.619	12
1.00671	101.6745	5.3398	1.335	6
1.00743	101.4399	5.9187	1.484	6
1.00833	101.5895	7.1077	1.779	12
1.01012	101.7090	8.0081	2.002	6
1.01326	102.0251	10.5528	2.680	6
1.01580	102.2012	12.4920	3.106	6
1.01764	102.7787	14.2094	3.515	4
1.01842	102.5447	14.8492	3.682	6
1.02011	102.7149	16.2634	4.026	6
1.02167	103.1852	17.5935	4.335	6
1.02185	102.8901	17.7438	4.385	6
1.02726	103.4348	22.2750	5.476	6
1.02841	103.5535	23.2685	5.714	12

TABLE III.—*Oxalic Acid.*

Sp. Gr. 15.56 air.	Grms. acid solution taken.	Grms. CaO found.	Per cent. $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ .	Number of Determinations.
1.00361	101.0534	0.4643	1.032	6
1.00372	101.0649	0.4806	1.068	6
1.00374	101.0666	0.4815	1.070	10
1.00380	101.0720	0.4887	1.086	6
1.00532	101.2268	0.6850	1.514	8
1.00763	101.4583	0.9858	2.182	6
1.00775	101.4704	1.0075	2.220	9
1.00782	101.4774	1.0170	2.251	6
1.00800	101.4055	1.0363	2.293	6
1.01050	101.7479	1.3722	3.030	10
1.01591	102.2020	2.0908	4.590	6
1.01722	102.4240	2.2646	4.970	7
1.02177	102.8819	2.8883	6.805	6
1.02246	102.9518	2.9808	6.503	7
1.02450	103.1568	3.2702	7.126	5

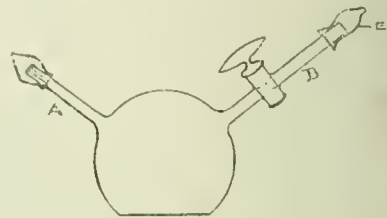
In order to judge if the above figures represent results more accurate than the methods employed, it is to be remembered that with a 100 c.c. pycnometer, a variation of 0.0001 grm. in weight is required to affect the fifth decimal place in gravity, while with a solution of acid of (say) 5 per cent., a difference of 0.0252 grm. barium sulphate, or 0.0436 grm. silver chloride, or 0.0465 grm. calcium oxalate is required to change the strength of the corresponding acid by 0.01 per cent. Most concordant results were obtained with the hydrochloric acid, where it was not unusual to obtain a series of six determinations with an extreme variation of not over 0.001 grm. The barium sulphate came next in point of accuracy, but the oxalic acid seldom varied more than 0.002 from the mean. These variations seldom affected the result by more than 0.004 per cent., and we believe it would not be unsafe to say that the 0.01 per cent. was established. No determination was left when the 0.005 per cent. was in doubt.

We append below a comparison of the figures of Pickering for sulphuric acid, as calculated by Marshall (this J., 1902, 1509), with our own:—

Sp. Gr.	Pickering.	W. and M.
	Per cent.	Per cent.
1.010	1.45	1.445
1.015	2.13	2.200
1.020	2.93	2.940
1.025	3.67	3.675
1.030	4.41	4.120
1.035	5.14	5.165
1.040	5.88	5.890

Marshall's figures are given for 15° C., in air, but would not appreciably affect the comparison. It was observed that the greatest difference in percentage value does not exceed 0.025 per cent., and that occurs at 5 per cent.

The specific gravity tables of hydrochloric acid of Marshall and Marchlewski (Z. angew. Chem., 1891, 133) and (Comptes rend., 74, 327), while, perhaps, correct for technical purposes, are not sufficiently concordant to be used as a basis for comparison with the present work. The hydrochloric acid determinations of Pickering (26, 277) are for values higher than appear in our tables. In order to obtain indirectly a comparison of the results as recorded in Tables II. and III., with those of Pickering on sulphuric acid, and incidentally to determine the accuracy with which the above acids could be interchanged as in volumetric processes, a series of comparisons were made by titration.



A weighing bottle (see figure), which may not inappropriately be called a "gravimetric burette," was constructed of a capacity of 130–135 c.c. and weighing 35–40 grms. The side arm A, having an internal diameter of 8 mm., ends in a ground stopper with a capillary portion, as in an ordinary pycnometer. The opposite side arm B contains a small one-way stop-cock, the end of which being enclosed in a ground cap E. The outlet beyond the stop-cock is constricted, so that the liquid may not run down the sides of the cap E. The capillary is to prevent evaporation, allowing the use of the instrument without removing the stopper. From several bottles produced from the same batch of glass, three were selected of nearly the same weight and capacity, the lightest being used as comparative. It was found that a volumetric rapidity combined with a gravimetric accuracy could be thus attained, and the work greatly facilitated.

Solutions of sulphuric, hydrochloric and oxalic acids were prepared of about equal strengths, and six determinations of each were made. A "burette" filled with acid, 10–15 grms. weighed out, and titrated from another burette with a weighed quantity of sodium hydroxide, using phenolphthalein, Azolitmin, or Methyl Orange as indicator. Ten portions of the same were thus neutralised, and after weighing, placed in the same beakers so that any excess of alkali in one estimation might be accounted for in the subsequent one. The neutral solutions were then precipitated as the barium, calcium and silver salts as previously indicated and weighed. Therefore the strength of each solution was determined twice, first by titration, and subsequently by precipitation. The caustic soda solution was adjusted in the same manner, by neutralising and precipitating ten portions of a 2 per cent. solution of hydrochloric acid using 20 grms. portions.

Five series of determinations with the three acids gave the following figures:—

TABLE IV.

Sulphuric Acid.				Hydrochloric Acid.			Oxalic Acid.		
No.	Sp. Gr.	Per cent. NaOH.	Per cent. BaSO <sub>4</sub> .	Sp. Gr.	Per cent. NaOH.	Per cent. AgCl.	Sp. Gr.	Per cent. NaOH.	Per cent. CaO.
1	1.00784	1.124	1.126	1.00671	1.335	1.335	1.00372	1.068	1.068
2	1.01000	1.450	1.448	1.00745	1.483	1.484	1.00532	1.517	1.517
3	1.02444	3.610	3.609	1.01842	3.680	3.682	1.00775	2.218	2.222
4	1.03393	5.013	5.012	1.02474	4.962	4.903	1.01722	4.668	4.670
6	1.03923	5.779	5.782	1.02844	5.712	5.714	1.02177	6.307	6.306



t would appear from the specific gravity determinations oxalic acid by Franz (J. prakt. Chem., [2] 5, 301) (em. Centralh., 1886, 769) and Gerlach (Fres. Zeit., 305), the authorities most frequently quoted in textbooks and works of reference, that additional observations are not be out of place. The specific gravity of crystalline oxalic acid as recorded by Franz (1832) for 12.6 per cent. strength, is less than that given by Gerlach (1835) for 10 per cent. strength, both being taken at 17.5°. Franz obtained his series of values from the titration of per cent., 10 per cent., and a saturated solution with normal sodium hydroxide.

Oxalic acid from four sources was procured, the sublimed acid recrystallised, and the oxalic ester hydrolysed. Specific gravity and strength were determined at about 15 per cent. and 6 per cent. concentrations. The methods employed were: (1) titration with standard soda as above, (2) evaporation of the resulting sodium oxalate to dryness and weighing the same, (3) titration of the sodium oxalate with permanganate, (4) titration of the original solution with permanganate, (5) precipitating and weighing the calcium oxide, and (6) by evolution in a Geissler's carbonic acid apparatus, and leading the carbon dioxide into a wash bulb. The permanganate was standardised (a) on a "chemically pure" iron wire, in which the carbon had been determined by combustion, and (b) by ferrous ammonium sulphate, purified by 8 recrystallisations and analysed for iron, nitrogen and sulphur.

The results follow:—

The results recorded were obtained at 15.56° compared with water at the same temperature, and are not corrected for air displacement, for, in actual practice, they must be determined relative to the same temperature, both being weighed in air.

The specific gravities and percentages as obtained from the tabulations in the previous tables, have been plotted on cross section paper, the former as ordinates and the latter as abscissa, upon a scale of 1 mm. for 0.00001 in density and 0.005 in percentage, the points have been connected by straight lines, except in a few instances where the lines have been smoothed to obtain a mean between results. To facilitate calculations, Table VI., VII. and VIII. have been prepared, in which percentages are given for the nearest 0.005 per cent., and for each variation of 0.0001 in gravity. If need be, the fifth decimal place can readily be obtained by interpolation. To prepare a normal solution, 27 c.c. sulphuric acid, sp. gr. 1.84, 95 c.c. hydrochloric acid, sp. gr. 1.19, or 63 grms. crystallised oxalic acid are dissolved in water to one litre. The specific gravity is taken with a Geissler's pycnometer at 15.6° C., and the figures obtained compared with the tables following, whereby the strength of the acid is found. With a pycnometer of known capacity, 15 minutes should suffice to prepare a solution of these acids, the strength of which will exceed in accuracy any estimation made with an ordinary burette. The normal factor would then be calculated in the usual way, by dividing the percentage found by the molecular weight of hydrochloric acid, or by half the molecular weights of sulphuric or oxalic acids respectively.

TABLE V.  
*Oxalic Acid.*

Kahlbaum "sublimed."		König "pro analyse."		Merck "guaranteed reagent."		From methyl oxalate.	
Sp. Gr. 1-00361.	Sp. Gr. 1-00300.	Sp. Gr. 1-00280.	Sp. Gr. 1-00782.	Sp. Gr. 1-00372.	Sp. Gr. 1-00775.	Sp. Gr. 1-00374.	Sp. Gr. 1-00763.
1-031	2-233	1-030	2-241	1-062	2-226	1-061	2-183
1-039	2-290	1-084	2-247	1-068	2-220	1-066	2-183
1-036	2-292	1-085	2-250	1-068	2-217	1-068	2-188
1-036	2-284	1-082	2-243	1-070	2-224	1-070	2-194
1-032	2-293	1-082	2-251	1-068	2-220	1-070	2-182
1-030	2-280	1-080	2-240	1-063	2-216	1-060	2-182
1-034	2-287	1-083	2-245	1-066	2-221	1-066	2-185

TABLE VI.  
*Percentage strengths of Sulphuric Acid Solutions of different specific gravities at 15.56° C. in Air.*

Sp. Gr.	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.
1-000	0-000	0-015	0-030	0-040	0-055	0-070	0-085	0-100	0-115	0-130
1-001	0-140	0-155	0-170	0-185	0-200	0-215	0-230	0-240	0-255	0-270
1-002	0-285	0-300	0-310	0-325	0-340	0-355	0-370	0-385	0-400	0-415
1-003	0-430	0-445	0-460	0-470	0-485	0-500	0-515	0-530	0-545	0-560
1-004	0-575	0-585	0-600	0-615	0-630	0-645	0-660	0-675	0-690	0-700
1-005	0-715	0-730	0-745	0-760	0-775	0-790	0-805	0-820	0-830	0-845
1-006	0-860	0-875	0-890	0-905	0-920	0-935	0-950	0-965	0-980	0-995
1-007	1-005	1-020	1-035	1-050	1-065	1-080	1-095	1-110	1-125	1-140
1-008	1-155	1-170	1-185	1-200	1-215	1-230	1-245	1-260	1-275	1-290
1-009	1-305	1-320	1-335	1-350	1-365	1-380	1-395	1-410	1-425	1-440
1-010	1-455	1-470	1-485	1-500	1-515	1-530	1-545	1-560	1-575	1-590
1-011	1-605	1-620	1-635	1-650	1-665	1-680	1-695	1-710	1-725	1-740
1-012	1-755	1-770	1-785	1-800	1-815	1-830	1-845	1-860	1-875	1-890
1-013	1-905	1-920	1-935	1-945	1-960	1-975	1-990	2-005	2-020	2-035
1-014	2-050	2-065	2-080	2-095	2-110	2-125	2-140	2-155	2-170	2-185
1-015	2-200	2-215	2-230	2-240	2-255	2-270	2-285	2-300	2-315	2-330
1-016	2-345	2-360	2-375	2-390	2-405	2-420	2-435	2-450	2-465	2-480
1-017	2-495	2-510	2-525	2-540	2-555	2-570	2-585	2-600	2-615	2-630
1-018	2-640	2-655	2-670	2-685	2-700	2-715	2-730	2-745	2-760	2-775
1-019	2-790	2-805	2-820	2-835	2-850	2-865	2-880	2-895	2-910	2-925
1-020	2-940	2-955	2-970	2-985	3-000	3-015	3-030	3-045	3-060	3-075
1-021	3-090	3-105	3-120	3-130	3-145	3-160	3-175	3-190	3-205	3-220
1-022	3-235	3-250	3-265	3-280	3-295	3-310	3-325	3-340	3-355	3-370
1-023	3-385	3-400	3-410	3-425	3-440	3-455	3-470	3-485	3-500	3-515
1-024	3-530	3-545	3-560	3-570	3-585	3-600	3-615	3-630	3-645	3-660
1-025	3-675	3-690	3-705	3-720	3-735	3-750	3-765	3-780	3-795	3-810
1-026	3-825	3-840	3-855	3-870	3-885	3-900	3-915	3-930	3-945	3-960

TABLE VI.—*continued.*

Sp. Gr.	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.
1.027	3.975	3.990	4.005	4.020	4.030	4.045	4.060	4.075	4.090	4.1
1.028	4.120	4.125	4.150	4.165	4.180	4.195	4.210	4.225	4.240	4.2
1.029	4.270	4.285	4.300	4.315	4.330	4.345	4.360	4.375	4.390	4.4
1.030	4.420	4.435	4.450	4.465	4.480	4.495	4.510	4.525	4.540	4.5
1.031	4.570	4.585	4.600	4.615	4.630	4.645	4.660	4.675	4.690	4.7
1.032	4.720	4.735	4.750	4.765	4.780	4.795	4.810	4.825	4.840	4.8
1.033	4.870	4.885	4.900	4.915	4.930	4.945	4.960	4.975	4.990	5.0
1.034	5.020	5.035	5.050	5.065	5.080	5.095	5.110	5.120	5.135	5.1
1.035	5.165	5.180	5.195	5.210	5.225	5.240	5.255	5.270	5.280	5.2
1.036	5.310	5.325	5.340	5.355	5.370	5.385	5.400	5.415	5.430	5.4
1.037	5.400	5.475	5.490	5.505	5.515	5.530	5.545	5.560	5.575	5.5
1.038	5.605	5.620	5.635	5.650	5.660	5.675	5.690	5.705	5.720	5.7
1.039	5.750	5.765	5.780	5.790	5.805	5.820	5.835	5.850	5.860	5.8
1.040	5.890	5.905	5.920	5.930	5.945	5.960	5.975	5.990	6.005	6.0
1.041	6.030	6.045	6.060	6.075	6.090	6.100	6.115	6.130	6.140	6.1
1.042	6.170	6.185	6.200	6.215	6.230	6.240	6.255	6.270	6.285	6.3

TABLE VII.

*Percentage strengths of Hydrochloric Acid Solutions of different specific gravities at 15.56° C. in Air.*

Sp. Gr.	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.
1.000	0.000	0.025	0.045	0.065	0.085	0.105	0.125	0.145	0.165	0.1
1.001	0.205	0.225	0.245	0.265	0.285	0.305	0.325	0.345	0.365	0.3
1.002	0.405	0.425	0.440	0.460	0.480	0.500	0.525	0.550	0.575	0.5
1.003	0.615	0.635	0.655	0.675	0.695	0.715	0.730	0.750	0.770	0.7
1.004	0.810	0.830	0.850	0.870	0.885	0.905	0.925	0.945	0.965	0.9
1.005	1.005	1.025	1.045	1.065	1.085	1.100	1.120	1.140	1.160	1.1
1.006	1.195	1.215	1.235	1.255	1.275	1.295	1.310	1.330	1.350	1.3
1.007	1.390	1.410	1.430	1.450	1.470	1.490	1.510	1.530	1.550	1.5
1.008	1.590	1.610	1.630	1.650	1.670	1.690	1.710	1.730	1.750	1.7
1.009	1.790	1.810	1.830	1.850	1.865	1.885	1.905	1.920	1.940	1.9
1.010	1.980	2.000	2.015	2.035	2.055	2.075	2.095	2.115	2.135	2.1
1.011	2.180	2.200	2.215	2.235	2.255	2.275	2.295	2.315	2.335	2.3
1.012	2.375	2.395	2.415	2.435	2.455	2.480	2.500	2.520	2.540	2.5
1.013	2.575	2.595	2.615	2.635	2.655	2.675	2.695	2.720	2.740	2.7
1.014	2.780	2.800	2.820	2.840	2.860	2.880	2.900	2.920	2.940	2.9
1.015	2.980	3.000	3.020	3.040	3.060	3.080	3.100	3.125	3.145	3.1
1.016	3.185	3.205	3.225	3.245	3.265	3.285	3.305	3.325	3.345	3.3
1.017	3.385	3.405	3.425	3.445	3.465	3.485	3.505	3.525	3.545	3.5
1.018	3.530	3.610	3.630	3.650	3.675	3.695	3.715	3.735	3.755	3.7
1.019	3.800	3.820	3.840	3.860	3.880	3.900	3.920	3.940	3.960	3.9
1.020	4.005	4.025	4.045	4.065	4.085	4.105	4.125	4.150	4.170	4.1
1.021	4.210	4.230	4.250	4.270	4.290	4.310	4.330	4.350	4.370	4.3
1.022	4.415	4.435	4.455	4.475	4.495	4.515	4.535	4.555	4.575	4.5
1.023	4.615	4.635	4.655	4.675	4.695	4.715	4.735	4.755	4.775	4.7
1.024	4.815	4.835	4.855	4.875	4.895	4.915	4.935	4.955	4.975	4.9
1.025	5.015	5.035	5.055	5.075	5.095	5.115	5.135	5.155	5.175	5.1
1.026	5.215	5.235	5.255	5.275	5.295	5.315	5.335	5.355	5.375	5.3
1.027	5.415	5.440	5.460	5.480	5.500	5.520	5.540	5.560	5.580	5.6
1.028	5.620	5.640	5.660	5.680	5.700	5.720	5.740	5.760	5.780	5.8
1.029	5.820	5.840	5.860	5.880	5.900	5.920	5.940	5.960	5.980	6.0

TABLE VIII.

*Percentage strengths of Oxalic Acid Solutions of different specific gravities at 15.56° C. in Air.*

Sp. Gr.	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.
1.000	0.000	0.030	0.060	0.090	0.115	0.145	0.170	0.200	0.230	0.2
1.001	0.280	0.310	0.340	0.370	0.400	0.430	0.455	0.480	0.510	0.5
1.002	0.565	0.590	0.620	0.650	0.680	0.710	0.740	0.770	0.800	0.8
1.005	0.855	0.880	0.905	0.935	0.965	0.995	1.025	1.055	1.085	1.1
1.004	1.140	1.170	1.195	1.225	1.255	1.285	1.310	1.340	1.370	1.4
1.005	1.430	1.460	1.490	1.515	1.545	1.575	1.605	1.630	1.660	1.6
1.006	1.720	1.750	1.780	1.805	1.835	1.865	1.890	1.920	1.950	1.9
1.007	2.010	2.040	2.065	2.095	2.120	2.150	2.180	2.210	2.235	2.2
1.008	2.295	2.325	2.355	2.385	2.410	2.440	2.470	2.500	2.525	2.5
1.009	2.585	2.615	2.645	2.670	2.700	2.730	2.760	2.790	2.815	2.8
1.010	2.875	2.905	2.935	2.965	2.990	3.020	3.050	3.085	3.105	3.1
1.011	3.165	3.190	3.220	3.250	3.280	3.305	3.335	3.365	3.390	3.4
1.012	3.450	3.480	3.510	3.540	3.570	3.600	3.625	3.655	3.685	3.7
1.013	3.745	3.775	3.805	3.835	3.860	3.890	3.915	3.945	3.975	4.0
1.014	4.035	4.065	4.090	4.120	4.150	4.180	4.205	4.235	4.265	4.2
1.015	4.325	4.355	4.385	4.410	4.435	4.465	4.495	4.525	4.555	4.5
1.016	4.615	4.645	4.675	4.705	4.730	4.760	4.790	4.815	4.845	4.8
1.017	4.905	4.935	4.965	4.995	5.025	5.055	5.085	5.115	5.140	5.1
1.018	5.200	5.230	5.260	5.290	5.315	5.345	5.375	5.405	5.435	5.4
1.019	5.495	5.525	5.555	5.585	5.615	5.645	5.675	5.705	5.735	5.7
1.020	5.790	5.820	5.850	5.880	5.905	5.935	5.965	5.995	6.025	6.0
1.021	6.085	6.110	6.140	6.170	6.200	6.230	6.255	6.285	6.310	6.3
1.022	6.375	6.405	6.435	6.465	6.495	6.525	6.550	6.580	6.610	6.6
1.023	6.670	6.700	6.730	6.760	6.790	6.820	6.850	6.880	6.910	6.9
1.024	6.970	7.000	7.030	7.060	7.090	7.120	7.150	7.180	7.210	7.2
1.025	7.270	7.300	7.330	7.360	7.390	7.420	7.450	7.480	7.505	7.5



## STANDARD METHODS OF SAMPLING: REVIEW WITH SOME SUGGESTIONS.

BY MARTIN L. GRIFFIN.

My object in presenting some aspects of this subject is to review in part what has been done during the past years, and to show from it how meagre the work has been, how very few valuable contributions have been made, to enforce the importance of correct sampling, and to suggest a few suggestions.

The work on standard methods of analysis has received considerable attention of late, and the New York Section of the Society of Chemical Industry has made some very valuable contributions in this line. Standard methods of sampling, if it may not precede the analytical work, should at least go hand in hand with it. Its importance should not be overlooked or under-estimated.

About 20 years ago this subject was discussed at some length by several of the English sections of the Society of Chemical Industry. At that time the discussion was limited with that of standard methods of analysis, under the title International Methods of Sampling and Testing Commercial Products. The scope of the inquiry was so small that it is no wonder that there was a wide divergence of views and no practical results. More would have been accomplished if only one reliable plan of sampling one commercial product had been recognised for individual

The discussion was started by Dr. Lunge making inquiries of prominent chemists and manufacturers in many, France and England. The answers were comparatively few and unsatisfactory. Less prominence was given to methods of sampling than to standard methods of analysis. Some declared the time was not opportune to approach so difficult a question, others that uniform methods of analysis were desirable, but could suggest no way to bring it about; but that anything like uniform methods of sampling was an impossibility, that sampling will have to be left to the intelligence of the sampler, or to the agents of the buyer or seller. However, sufficient interest was felt in the matter to cause the adoption of a resolution to appoint a committee to confer and discuss the subject further. The subject was further discussed at length by other sections a few months later, when many personal experiences in analytical work were detailed. Many expressions were expressed that uniformity in practice by fixed rules would stifle improvement and original work, and that many trade usages and customs would be opposed to it. The idea seemed to be more or less current, also, that a coercive power was to be associated with the establishment of uniform methods, and it does appear that some moral obligation at least existed to use them, provided they could be established.

There seemed to be no bounds to the question; some advocated courts of appeal to settle differences between analysts reporting tests on the same sample of so simple a substance as soda ash.

As the discussion advanced, the advocates of uniform methods of sampling gained more prominence at the expense of uniform methods of analysis, and at this point Mr. Mellor gave as his contribution to the conference a method of sampling minerals. The discussion of his time closed with a resolution, endorsing standard methods of sampling ores, raw products and chemicals, with no reference whatever to uniform methods of analysis, saying that, as one gentleman said, to take the course of the Darwinian law of the survival of the fittest.

At a subsequent discussion before another section, when very similar arguments were advanced, two incidents could be noted. John Miller declared, from his experience, that it was possible to sample accurately rich antiferous ores, and that the difficulty supposed to be in sampling bolts of various kinds did not apply to the precious metals. John Hutchinson said in his experience of 10 or 12 years analysing samples of manures carefully drawn and apportioned to their different chemists, in case of discrepancy or difficulty with the results had occurred. If these gentlemen had then and there detailed their knowledge as to any peculiarities in the make-up

of cargoes of these goods and the method by which they were accustomed to be sampled, a nucleus from which to proceed would have been formed. It seems to me strange that the remarks of these two gentlemen should not have suggested a more rational and simple approach to the solution of the problem than the cumbersome and impracticable plan of passing resolutions to appoint committees to consider, and courts of appeal to judge. These men knew how to sample precious ores and manures, and they were competent to disclose a plan of sampling which would have been valuable to the trade and many young chemists, who must learn many things by trying experiences. The disposition of these gentlemen toward a helpful undertaking of the task was in marked contrast with that of him who advanced obstructive examples of the difficulties in sampling deliveries of fifty boxes of Italian olive oil soap, a few thousand boxes of Japanese fish oil, containing some water, a cargo of Spanish iron ore, varying in quality and size of lumps. He could have given a just and practical way of sampling these commodities, or else he should have welcomed this information from any reliable source, even by rules.

A little later, after having presented an excellent paper before the Liverpool Section on Methods of Sampling (this J., 1884, 339), Norman Tate, when asked how many casks in a lot of goods should be sampled, replied that when he had been able to draw samples from every single package, there had been no disputes. This was not a scientific answer, and leads to an absurdity. Suppose a lot of goods in casks or boxes were sub-divided and repacked to the practical limit without his knowledge, and he were asked to sample and test at intervals, would he employ the laborious method of sampling every single package? His answer implied that he did not, as a rule, sample every package, and that, therefore, he had had disputes.

Sampling is a matter of practical mathematics, of mean values, and the theory of errors, and may be accomplished on this line with accuracy. It does not even require discriminating intelligence, when once the plan of procedure is correctly determined.

The discussion at that time closed with a set of recommendations by the committee, the matter was dropped, so far as concerted action was concerned, and the records of the Society contain nothing of importance since.

The Association of Official Agricultural Chemists in the United States was organised about 1883, and had for its object the securing of uniformity and accuracy in the methods, results and modes of statements of analyses of fertilisers, soils, and cattle foods, dairy products and other materials connected with agricultural industry, &c. While uniformity in taking and preparing samples is not specifically stated, I think it is implied, and the results of the work of the association go to show that this has not been neglected, though not receiving the attention which it deserves. An examination of their published records on methods of analysis reveals some directions as to how samples should be taken, and rather more on the preparation of the sample for analysis. They have learned to their sorrow how much depends upon the preparation of their sample for concordant results, especially in fertiliser and soil analysis. If they had been called upon to test the commercial worth of their services individually to the fertiliser trade, by each man drawing his own samples from a cargo of raw stock, the matter of sampling would have been vigorously dealt with at once. On the contrary, the Association has given itself up very largely to the determination of how concordant results may be reached when one uniform sample has been divided and distributed among several chemists. This is extremely important, but no matter how accurately the analytical work may be performed, if the sample is not representative, the results are worthless.

The results of the Association's work are almost entirely summed up in the bulletins, "Methods of Analysis," and whatever conclusions we draw from the contents of these will represent the work it has done on the subject of sampling. I find this covers the sampling of butter, cheese and soils. The recommendations for sampling butter and cheese are not of much value, scientifically; in the case of cheese, they are open to criticism (Bulletin

No. 46, revised). The alternate methods there detailed are not in harmony. The sampling of soils has, apparently, engaged their attention to a much greater degree, and quite lengthy instructions are given in the bulletin referred to.

At the seventeenth annual convention, Dr. B. Dyer, of London, made a forcible plea for uniform methods of sampling soils. On motion, this was referred to the referee on soils. At the next convention the referee offered several criticisms of Dr. Dyer's method, and suggested placing the matter in the hands of a committee. At the same convention, Mr. C. G. Hopkins submitted a method of soil sampling which was finally adopted as a provisional method.

The referee for the following year, in sending out instructions how to sample to other chemists, who were to co-operate in the work, paid no attention to this provisional method, though he gave his own very explicit instructions. No further reference to this subject has appeared.

Dr. H. W. Wiley, chief chemist of the Department of Agriculture, in his work, "Principles and Practice of Agricultural Analysis, 1895," has described at length the principal methods of soil sampling at home and abroad, but does not summarise their essential features. To the taking of samples of fertilisers he has devoted one short paragraph, which might just as well have been omitted. The more difficult and impractical it is to give directions as to the drawing of samples of any particular commodity, the greater the reason for pointing out what the peculiar difficulties are. To say that generally the samples, which are brought to the chemist, have been taken without his advice or direction, and he is simply called upon to make an analysis of them, is not a happy disposition of a question in which the chemist must share some responsibility.

I have reviewed this matter here in some detail to show the exact position of a body of exclusively Government chemists organised for the purpose of promoting uniformity in their class of work. It seems to me this subject is one of the first which should have engaged their attention, and that they have unfairly spent their time on other things to the detriment of this which involves their whole work. It is not enough to give a plan of sampling one cheese, one tub of butter, or the soil of a few pots of oats.

As an illustration of the need of a shrewd, careful, and experienced knowledge in drawing samples, the Department of Agriculture of the State of New York, not long since, had a case against a milk dealer in New York city. The Department's inspector had sampled the milk from the various cans as it was received by the dealer at the station. Milk not up to the legal standard was found, and a case entered against the dealer. At the trial counsel for the defence admitted the correctness of the samples as taken, and the accuracy of the analyses, but demurred that the samples were improperly taken and did not represent the product his client sold, in that he mixed his milk before delivery, and that such milk had not been sampled at all. The case was dismissed.

In this connection I will refer to a case cited recently in the "Analyst" (London), which is the only reference I find in their published records on samples or sampling.

The case was this. A Government agent purchased from a small shopkeeper six twopenny bottles of camphorated oil, all bearing the same label, and apparently the same in all particulars. He divided them up into three lots of two bottles each without opening, mixing or dividing the contents of any, and sealed each separate lot. One of these he delivered to the respondent, another to the analyst, and the third he kept. The analyst found his sample did not meet the test required by the Government. The appellant contended that he had complied with the Food and Drug Act in the division of the sample. The justices thought differently, and were not satisfied that the two bottles analysed by the analyst were identical in nature and substance with the other two sets. They accordingly dismissed the summons. On appeal, their lordships held that this was a purchase of six separate articles, and dismissed the case.

In looking over the work of chemists in the American Chemical Society, I find two important papers pertaining to sampling. The first—"Some Experiments on Sampling

by Quartation," Vol. XV. The object of the experiment detailed by the authors was to determine the degree of accuracy obtainable by quartation, as well as to discover the best way of mixing. The authors have in mind sampling of ores. They prepared a mixture of equal parts of lead shot of one size, magnetic iron ore of another and crushed glass of still another size. After repeated mixing and quartering, they determined the relative proportions, and from many experiments finally drew useful conclusions.

In Vol. XIX. we find a most excellent paper by Edwin Keller on the Distribution of the Precious Metals and Impurities in Copper and Suggestions for a Ratio Mode of Sampling. His paper deals at length with the behaviour of these elements in copper when changed from a molten to a solid state. A large number of samples from different portions of the pig were drawn and analysed, and from these results he draws valuable conclusions as to how the whole operation of sampling should be conducted.

Such information as this must be very helpful to chemists who are engaged in this kind of work, and who may have had the requisite experience. These two papers comprise all that has been contributed to this Society in 25 years. It is not much, but still a very creditable contribution.

Turning to the Transactions of the American Institute of Mining Engineers since its organisation over thirty years ago, I find two valuable scientific papers dealing with general principles of ore sampling, and one of special application. The first of these will be found in Vol. X. Sampling Ores without the Use of Machinery, by W. Glenn. Regarding the importance of sampling, Mr. Glenn says—"There is no metallurgical or chemical establishment which does not frequently receive samples representing nothing. The work of sampling is often looked upon as within the realm of boys and pensioners only. At least, though the manual labour be left to subordinates, the principles on which it is conducted, the safeguards with which it is surrounded are unworthy of the study of experts; and experts should be ready to teach these principles and enforce them in practice. Expert sampling is the indispensable first step towards learning the value of any boxful, car-load or shipload of ore."

Mr. Glenn's method rests essentially upon a mathematical basis, a plan of drawing the first rough sample, the crushing and quartering to final sample. He says and truly—"It does not matter in the slightest what solid a sample may consist of, or how much or how little it may be, it should be worked down in the manner detailed." By this he means, of course, this underlying principle must be the framework, and the details to be suited to the particular case. Machine sampling may be more practical when possible as at the mines and smelters, but it must rest upon the principles here detailed. This paper is a valuable contribution to the subject.

Vol. XXV. of the Transactions, Mr. D. W. Brnnton has a paper on The Theory and Practice of Ore Sampling. He says—"The object of the investigations and experiments here recorded was to obtain such information as data as would make it possible to determine the factors to which crushing must be carried, in sampling gold and silver ores, in order to obtain results within an allowable limit of error." His work is graphically illustrated to determine these limits mathematically, and the same plan may be applied to determine the allowable limits for other ores and materials which must be crushed and sifted or screened in the preparation of a representative sample. He shows the importance of re-crushing after each successive "cutting down," so that as the sample diminishes in weight, there may be a nearly constant ratio between the weight of the sample and that of the largest particle of ore contained therein.

The last reference in the Transactions is that of a paper by Mr. C. M. Roberts, Vol. XXVIII.—Experiments in the Sampling of Silver-lead Bullion. The work detailed in this paper is similar in character to that of Mr. Keller, described above. He states that his "series of tests seem to establish the fact that there is no regularity in the distribution of the silver inside the bar, but that the



rt of the bar which lies directly against the sides of the dd is the richest;" he also shows how reliable samples y be taken.

Having now reviewed at some length how the subject s been regarded and what has been done to the present e, we can see how many things have been accomplished ich once seemed impracticable.

Many standard methods of analysis have been worked and are recognised to-day. We do not need to attach y coercive influence to use any standard method. do not need to stamp any such method with the seal the Society, or with any authority except the plan ts upon which the methods rest. These constitute their n claim to recognition. Not long since, Dr. R. W. ymond, Secy. of the American Institute of Mining gineers, said in effect, that the Institute gave no warrant to the truth or accuracy of statements made by its mbers in their publications contained in the Trans- sions, but that it was coming to be so well understood it the Transactions were so reliable as to constitute them authority upon the subjects with which they dealt. is it seems to me is the true test of authority.

The Association of Official Agricultural Chemists have played the rational plan of dealing with this subject, has selected a number of its own qualified chemists to estigate and report upon a particular subject, and has n eliminated all the defects and probable errors as far possible.

Very valuable work has been done on many subjects of e, including proximate analyses of coals, cements, and nent making materials, and still other subjects are being estigated. The question of drawing and preparing iable samples involves no such amount of research as is essary for the analytical work, but a knowledge of how do it is extremely important and a similar method of eedure may be followed. I would suggest that a few emists working along the same lines undertake to dis- se directions how samples of raw materials with which y are familiar should be drawn. Indeed, if chemists ividually would contribute what they know from ir own individual experience, it would be very sugges- e and helpful oftentimes.

Another question closely allied to this is—How many ples shall be drawn from a cargo of goods in barrels, les, or separate packages, in order to get a true repre- sntative sample? Upon this question, I have already pared something which I trust will prove valuable. d I expect to present at this session.

## Nottingham Section.

eting held at Derby on Wednesday, January 25th, 1905.

MR. S. F. BURFORD IN THE CHAIR.

### TANKS FOR CARRYING TAR AND GAS LIQUOR BY RAIL.

BY F. J. R. CARULLA.

There are four interests involved in the construction of railway tank wagon, viz. :—

1. That of the railway company.
2. That of the gas company selling the tar and liquor.
3. That of the maker of the tank wagon ; and
4. That of the chemical manufacturer or owner of the agon.

The first three interests are so powerful that the owner practically effaced as regards the construction of the ehicle.

The railway company over whose line the wagon has to avel is concerned with the proper construction of the ader carriage, and that the tank shall be strong enough o carry a quantity not exceeding 10 tons of tar or liquor, ing quite indifferent as to the shape of the tank. For ne not very obvious reason the railway companies ject to tanks of larger capacity than 10 tons.

The gas company selling the tar and liquor really decides the shape of the tank. To meet the convenience of the gas company the shape of the tank may have to be that of a parallelogram instead of the possibly more econ- omical and certainly stronger form of a cylinder. Small gas works inconveniently situated frequently send their liquid residuals to be loaded in petroleum barrels, which are lifted to the top of the railway tank and emptied into it. In this case the roof of the tank has to serve as a floor on which the barrels are rolled so that the flat form becomes indispensable.

The maker of the tank naturally gives the lightest structure consistent with the requirements of the railway company, and the owner or chemical manufacturer will feel quite satisfied that he has done his best by getting the cheapest tank that the railway company will pass.

Now, the railway company is not concerned with the construction of the tank itself, although it carefully examines the tank. Steel plates are very strong, even when thin, and a tank made from  $\frac{1}{4}$ -in. plates will last many years without leaking.

A time is sure to come, however, when the tank begins to give trouble on account of its construction, and it is then that the chemical manufacturer or owner awakes to his real interest in the matter.

Any loss through leakage he has to pay for, and the railway company immediately asks the owner to have the tank repaired. The maker of the tank wagon patches the tank up and thus gives it a further lease of life.

What the cause for the necessity of such a repair in a flat tank may be was most instructively illustrated not long ago by one that leaked in several places at the bottom, and which, on examination, was found to require renewal practically all round the seating. The plates forming the bottom of the tank were taken out, and some 9 or 10 in. sheared off all round, and narrow plates rivetted on, forming a frame for the middle of the old bottom, which was quite sound and almost of the original thickness everywhere except at the edges.

How this came about will readily be understood from the fact that the iron or steel bottom of a flat tank rests on the wooden frame of the wagon body, and, however strongly stayed together the two portions of the com- bined structure may be, a certain amount of abrasion is constantly going on whenever the wagon is in motion, which rubs off any protective coating in contact with the wood exposing the metal to oxidation. The rust thus formed becomes imbedded in the wood, which, when the vehicle is in motion, acts as an emery stick, so that in the case referred to through this action the bottom of the tank was in many places not more than  $\frac{1}{8}$ th of an inch thick at the edges.

The object of the present note is to suggest to chemical manufacturers that when ordering new tank wagons they should specify the addition of what may be called an abrasion strip to be rivetted to the tank to take up this wear in all those places in which the plates come in contact with wood, and to be attached in such a manner that when worn out such strips may be easily renewed.

The owner will then find that at the cost of a few shillings he has nearly doubled the life of the tank.

### DISCUSSION.

MR. J. F. KEMPSON said that Mr. Carulla's method might prevent a certain amount of wear at the angle of the tank, but he doubted whether it would be of any very great value. A flat-bottomed tank, settled down on a good wooden framework, lasted a long time. He had had one or two tanks running for considerably over 16 years, and they were not bad ones yet. He detailed a form of setting for flat tanks, which they had found satisfactory. At each end of the tank a strong baulk is placed on edge, going from one side to the other of the wagon frame, to which the two baulks are securely fastened. The frame with these baulks across it form a cradle to hold the tank in its place, and, with the tie rods of proper strength, there is very little of the wear referred to in the paper.

MR. CARULLA approved of the form of setting described, but thought that even in that case the abrasion strips he advocated would be an improvement.

Meeting held at Derby, on Wednesday, January 25, 1905.

MR. S. F. BUTFORD IN THE CHAIR.

# EFFECT OF SULPHUR ON SILICIOUS PIG IRON.

BY G. J. WARD AND A. H. LONGDEN.

Mr. O. F. Hudson, in his paper on the "Glazing of certain kinds of Silicious Pig Iron and its Causes" (this J., 1904, 595-598), draws the following conclusions:—

(1) The glazing of certain kinds of silicious irons is caused principally by an increase in the percentage of sulphur.

(2) The difference is the appearance of the fractures is due to the small size of the graphite plates in the case of glazed iron.

It is somewhat doubtful if sulphur is always present in high proportions in glazed pig iron.

For instance, two analyses of Stanton "glazed" pig iron give sulphur, 0.033 and 0.046 per cent., and silicon, 5.13 and 4.50 per cent. Assuming that glazed pig iron does contain high percentage sulphur, then it follows that either (1), the glazing is due to sulphur, or (2), the glazing and the sulphur are due to the same cause.

If (1) is true the addition of sulphur to pig iron containing high percentage silicon should give "glazed" iron.

To test this, about 112 lb. of molten metal were put in each of two clean hand ladles. Test bars were made with the metal, and the molten metal was also treated with a weighed quantity of iron sulphide and mixed well, and test bars were run from the alloy.

Any of the alloy which was not required for the test bars was run into a small pig; by the analysis of this pig it could be seen if the sulphur had been mixed up.

The quality of the iron was especially noted in the pig bed at the time the two ladles were taken from the furnace. Thus, from the above we had three different specimens of iron from each experiment, i.e., two sets of test bars 36 in. by 2 in. by 1 in., and a small pig of the sulphur alloy. The name "sulphur alloy" will be given throughout this paper to the pig run from the spare metal after running the test bars.

*Experiment 1.*— $\frac{1}{2}$  lb. iron sulphide was added to the molten pig iron, which was of a good grey No. 1 quality, and mixed in with a carbon rod; test bars were then poured from the alloy. The fracture of the "sulphur alloy" was light coloured.

*Experiment 2.*—In this experiment and the remaining experiments, the iron sulphide was put into the ladle before adding the molten metal, as it was found to mix better thus than by adding the iron sulphide to the molten metal;  $\frac{1}{2}$  lb. of iron sulphide was put into the ladle, and the molten metal added; the quality of the iron run in the pig bed was glazed in part of the cast, and No. 2 iron in the other part.

*Experiment 3.*—2 lb. of iron sulphide was put into the ladle and the molten metal added; the quality of the iron run in the pig bed was good open No. 3 iron. This was mixed with an iron bar covered with slag and test bars poured from the alloy; these bars drilled very hard indeed. The fracture of the "sulphur alloy" was light coloured and "blowhole" in one end of the pig.

*Experiment 4.*—1 lb. of iron sulphide was put into the ladle and the molten metal added. The quality of the iron run in the pig bed was over-grey, fracture No. 3 iron, but not a satisfactory iron. These cast iron test bars drilled harder than all the other test bars, and the fractures of all the bars looked as if some small dirt had got into them. The alloy test bars drilled rather soft, and also looked to have got a little dirt into them.

The fracture of the sulphur alloy was good No. 3 iron and "blowhole" in one end of the pig; the best colour as regards "sulphur alloy pig" good grey.

In none of these experiments with an iron fairly high in silicon could we produce a glazed iron by addition of sulphur, consequently if it be true that "glazed" always contains high sulphur this must be because the same cause which produces glazing in the iron tends also to increase the sulphur.

	No. 1.	No. 2.	No. 2.	No.
Cross breaking strains—	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr.
Untreated test bars	27 3 2	23 3 10	28 0 4	26 1
Alloy test bars ..	27 2 20	26 1 20	15 1 12	21 3
Deflection—				
Untreated test bars	0.191%	0.443%	0.532%	0.49
Alloy test bars ..	0.495	0.473	0.392	0.40
Sulphur—				
Untreated test bars	0.036%	0.056%	0.076%	0.03
Alloy test bars ..	0.060	0.097	0.319	0.10
Alloy pig .....	0.095	0.083	0.339	0.08
Silicon—				
Untreated test bars	3.46%	3.91%	3.72%	3.35
Alloy test bars ..	3.50	3.38	3.52	3.24
Alloy pig .....	—	3.28	3.16	3.16

Wedding, in his standard book on Iron, page 171, says "it seems certain that free silica, where accompanied by no other mineral which can form slag with it, such as calcium carbonate, tends to the production of iron rich silicon, especially where the temperature is very high and there is much carbon present."

Glazed iron is made where the temperature of the blast is high, there is an excess of fuel, and where the furnace working on an acid slag. There is undoubtedly a tendency for the sulphur to get into the iron where the slag is acid, and these high sulphurs are in our opinion due to the same cause as the glazing, and not the glazing due to the extra sulphur.

Turner (Metallurgy, page 198) expresses the opinion that the bright crystals in glazed iron are silicides of carbon or of iron.

Carnot and Gontal (this J., 1898, 1150) said silicious iron containing little manganese treated with 5 per cent. of sulphuric acid leave a residue which consists of carbon, silicon hydroxide, and different combinations of iron and silicon. The hydroxides of iron and silicon are removed by potassium hydroxide. The manganese and iron are removed by sulphuric acid. The residue contains 19 to 19.86 per cent. of silicon and 79.63 to 79.84 per cent. of iron; this corresponds to  $\text{SiFe}_2$ . This was a compound prepared by Moissan in an electric furnace, and thus prepared it consisted of glittering scales.

It is probable that the glazing of iron is due to the presence of this  $\text{SiFe}_2$  produced by high temperature, the presence of an acid slag, and that under these conditions there may be a tendency for the sulphur to unite with the molten pig iron.

## DISCUSSION.

Mr. O. F. HUDSON considered the results of the experiments of great interest, especially as showing the influence of a small increase of sulphur has upon the fracture of cast iron. With reference to the author's failure to glaze iron by the addition of sulphur, he pointed out that glazing only occurred when the silicon was over 3.5 per cent. and was not commonly seen when it was much below 4 per cent. From the analyses given of the remelted iron it was seen that the silicon varied from 3.15 per cent. to a maximum of 3.52 per cent. It could, therefore, hardly be expected that such irons would be glazed. The fracture of the irons remelted with addition of sulphur was, in the majority of cases, light coloured, a change in the direction of glazing, and pointing, no doubt, to graphite of a small size. It would have been interesting to have had full details of the composition of the iron used.

He gathered that the high blast temperature and a slag, the conditions under which glazed iron is made were suggested as being in themselves the cause of glazing. It seemed more probable that those conditions or indirectly caused glazing by favouring an increase of sulphur in the iron, and that an open grey silicious iron of suitable composition could be glazed outside the furnace by the addition of sulphur.

With reference to the presence of the compound  $\text{SiFe}_2$  in the free state in cast iron, Carnot and Gontal in a memoir



ent paper\* than the one quoted by the authors, stated that although ferrosilicons contain both  $\text{SiFe}$  and  $\text{SiFe}_2$ , they had been unable to isolate silicides of iron from ordinary cast iron. Moreover, during the repeated microscopic examination of glazed iron no indication had been obtained of the presence of a free silicide of iron. On the other hand, it was very probable that silicon played an important part in giving a glazed fracture, the iron containing upwards of 4 per cent. of silicon in solution (in which condition silicon doubtless existed in cast iron) was easily fractured, the fractured crystals presenting bright shining surfaces. Therefore, given a cast iron, with the necessary amount of silicon and with all graphite, the fracture would pass through the silicite as easily as along the graphite, and, indeed, it is just to a large extent so; hence its light-coloured, flaking appearance.

Mr. L. ARCHBUTT said the silicon in the irons under observation was not exceptionally high. He suggested at further experiments should be made on pig irons attaining higher percentages of silicon.

Mr. J. O'SULLIVAN said that boiled sulphur and silica, when mixed together, set very hard, and he had even noticed that this mixture was used in fastening studs in fls.

Dr. R. M. CAVEN was under the impression that Mr. Hudson previously said it was an increase of sulphur which caused glazing; now he was inclined to say it was iron.

Mr. G. J. WARD said that before he made the test he would want to know how much silicon he would need in the iron. He thought that Mr. Hudson's remarks about  $\text{SiFe}_2$  bore out what he (Mr. Ward) had already said. About 4 per cent. of silicon there was a sudden change in the iron which was not accounted for by the elementary analysis, and this was probably due to the fact that the substance which up to that point had been present as a silicide in solution was changed into the silicide. It was hardly possible that the addition of 2 per cent. of ferrous sulphide would alter the nature of the iron. From 3½ to 4 per cent. of silicon must be present. The point was that iron with this quantity was sometimes glazed and sometimes not, and there was nothing in the analysis to show any difference. Mr. Hudson's argument was that 0.05 per cent. of the addition of sulphur was the cause of glazing; it seemed more likely that some change in the  $\text{SiFe}_2$ , which formed the 20 per cent. of the pig iron, could result in this complete alteration in the character of the iron. He agreed with Mr. Archbutt that it would be more conclusive if further tests were made with the iron containing more silicon. The difficulty was that as the samples were taken immediately from the blast furnace, it was impossible to tell the percentage of silicon in the iron after the experiments were made. The breaking strains given, though good for an iron containing so much silicon, were lower than would be obtained from a harder iron, say No. 4.

Meeting held at Derby on Wednesday, January 25th, 1905.

MR. S. F. BURFORD IN THE CHAIR.

## MINERAL CONSTITUENTS OF SUMACH AND ITS ADULTERANTS.

BY M. C. LAMB.

The writer, having for several years been particularly interested in sumach and its more common adulterants, has read with a considerable amount of interest the paper communicated to the Nottingham Section of the Society by Mr. Trotman on "The Mineral Constituents of Sumach."

The writer can confirm from personal experience the results of the analyses of the ash of samples of commercial sumach given by Mr. Trotman, and his remarks as to the

want of care evidently taken by the sumach grinder in carrying out the winnowing process, as shown by the high percentage of mineral matter usually found.

A sample of pure sumach leaf (*Rhus Coriaria*) was found to contain: Fleishy substance of leaves, 72.5 per cent.; leaf stems (mid rib, &c.), 6.6 per cent.; stalks, 20.9 per cent.

This sample was one obtained from a grower by a disinterested person, and shows the relatively large proportion of leaf stalks contained in the sample as sold to the grinder, and which are presumably all ground up with the leaves.

Ash determinations of the above gave the following results:—Fleishy substance of leaves, 6.3 per cent.; leaf stems (mid rib, &c.), 8.1 per cent.; stalks, 3.9 per cent. The sample as a whole gave 5.89 per cent. ash.

The above are chiefly remarkable for the very small amount of ash found in the stalks, and the large percentage given by the leaf stems (mid rib, &c.).

Ash determinations made upon leaves of the two most common adulterants of sumach, *Pistacia Lentiscus* and *Tamarix Africana*, are interesting on account of the large amount found in the latter. The average amount of ash found in two different samples of *Tamarix* and three samples of *Pistacia* (all these samples being in the unground form) were 10.6 per cent. and 4.8 per cent. respectively. The average percentage of ash found in three samples of ground *Tamarix* was 10 per cent., and in three samples of ground *Pistacia Lentiscus* 6.8 per cent.

## DISCUSSION.

Mr. S. R. TROTMAN said that Mr. Lamb's paper appeared to bear out the remarks which he made at the last meeting, when he suggested that 6.5 per cent. should be an outside limit for the ash of sumach. He had further received a communication from A. A. Barrett, of Messina, who mentioned that the grinder usually stipulated for not more than 5 per cent., or occasionally 7 per cent. of sand and stones. If this were so, it was evident that the ash given by Mr. Lamb for ground leaf, namely, 5.89 per cent., should be easily attained. There was no doubt that this question would shortly become important, as adulteration was very prevalent.

Mr. JAMES O'SULLIVAN inquired if the chlorides and sulphates were given in the analysis of the ash of sumach. It was his experience that the sulphate and chloride found in the ash of plants was no index to the quantity present, since the process of ashing destroyed these constituents. This was more noticeable if magnesium sulphate was also present. He believed that the determinations of ash of plants, so far as the chlorine and sulphuric acid present in the plants were concerned, were worth nothing.

## Scottish Section.

Meeting held at Glasgow on Tuesday, January 31st, 1905.

MR. G. H. GEMMELL IN THE CHAIR.

## THE DETERMINATION OF SMALL PROPORTIONS OF BROMINE AND CHLORINE IN IODINE.

BY R. R. TATLOCK AND R. T. THOMSON.

The method we propose is a gravimetric one, which we have used for several years, and is the result of an inquiry and investigation made with the object of determining bromine and chlorine in commercial iodine. We examined many of the processes recommended, but were unable to obtain one which was sufficiently accurate, and, as there is still a demand for a good method, we have thought it desirable that this should be put on record. In recent text books there are methods given for the determination of bromine in presence of iodine, but small quantities (0.5 gm.) of the sample are operated upon, as the iodine is liberated and boiled off, which is troublesome

\* Annales des Mines, Oct., 1900; Metallographist, Oct., 1901.

and disagreeable, especially if large quantities are treated. Now, the detection and estimation of small percentages (from, say, 0.1 to 1.0 per cent.) of bromine in such small quantities of sample is not at all satisfactory, and, therefore, we have adopted the plan described below.

From 5 to 10 grms. of the sample are treated with 50 to 100 c.c. of water, and zinc finely granulated or in the form of dust is added in small quantities at a time, with frequent agitation, until the iodine is all converted into zinc iodide. Great care must be taken not to allow the temperature to rise to any sensible extent which would occur if the zinc were added too rapidly. The solution is now filtered, the insoluble portion washed two or three times, and finally 3-5 grms. of pure sodium nitrite added if 5 grms. of the sample have been operated upon, and 7 grms. if 10 grms. have been employed. The mixture is next carefully acidified with diluted sulphuric acid, when the iodine is all liberated according to the well-known reaction, and is nearly all precipitated. If the precautions referred to are taken, no bromine is liberated, and this can only take place if the solution becomes strongly acid and hot, owing to the careless addition of strong sulphuric acid in place of the diluted acid. The precipitated iodine is removed by filtration, washed two or three times with cold water, and the filtrate treated in a separator with benzene, which will remove the small proportions of iodine left in solution. The lower layer is run off into another separator, a little more sodium nitrite and sulphuric acid added in case there should be any traces of iodine still left, and the mixture again shaken up with benzene. If benzene happens not to be available, either chloroform or carbon bisulphide may be used to remove the iodine, and any of the solvents may be purified for further use by shaking up in a separator with zinc dust and water.

If thought necessary the solution may be heated to expel any traces of the solvent, and the bromine and chlorine precipitated as the silver compounds by adding silver nitrate in excess, and then adding some nitric acid, and heating to boiling. The silver salts are now collected on a weighed filter, and washed well with hot water, the filtrate and washings being of no further use. In order to remove the silver chloride a solution containing 2 grms. of silver nitrate, 90 c.c. of water, and 10 c.c. of ammonia of 0.880 sp. gr. is prepared. About 60 c.c. of this solution are poured backwards and forwards through the filter containing the precipitate, and the latter washed with the remaining 40 c.c. of ammoniacal silver nitrate. We have found that by this treatment any silver chloride derived from chlorine present even in much larger proportion than is usually the case in commercial iodine, is easily dissolved out, and the silver bromide is left perfectly insoluble. The latter should now be washed with dilute warm nitric acid, then with hot water, dried and weighed. The ammoniacal solution is next acidified with nitric acid, heated, and the silver chloride precipitate collected as usual.

The only other point that is necessary to attend to the identification of the silver bromide precipitate, is the application of a test which will show that there is no iodide left in it. The test we have found most convenient is as follows:—The precipitate is treated with dilute sulphuric acid and zinc dust until decomposition is complete, then filtered, a limited quantity of chlorine water added to the filtrate, and the mixture shaken up with a small quantity of carbon bisulphide or chloroform. If iodine present a violet tint will be communicated to the solvent but if bromine only the colour will be reddish-brown.

There is no necessity to give figures proving the accuracy of the method, but we may just state that we have not used the process for about ten years with the most satisfactory results.

## Obituary.

CARL OTTO WEBER, Ph.D.

MEMBER OF THE SOCIETY OF CHEMICAL INDUSTRY.

Carl Otto Weber was born in Pforzheim, South Germany, October 26th, 1860, and was partly of German and partly of Scottish extraction. He studied chemistry at Heidelberg, and under Fehling at Zürich, receiving his Doctor of Philosophy degree at Heidelberg in 1880. He became engaged in the pigment colour industry, and rose to take the management of a large chemical factory in Silesia. In 1892 he went into the manufacture of india rubber, and became chemist at the Greengate Rubber Works, Salford, Manchester. He also acted as abstractor for this Journal, principally for the subjects of indiarubber and gutta-percha during a period of about ten years. By extensive researches in the peculiarly difficult field of the chemistry of indiarubber, Dr. Weber at length obtained recognition throughout Europe and America, as one of the foremost authorities on the subject, a position confirmed by the publication of his work on "India Rubber and its Analysis" (this J., 1903, 51). Two years ago he went to America, and at the time of his death acted as consulting chemist to the Hood Rubber Company, as well as to several other firms representing the same industry. Shortly before this he had made an extensive study on the spot of the methods employed in obtaining and curing rubber in Central America, and he then proposed important improvements in those branches, as well as in the difficult subject of rubber analysis. Dr. Weber was also associated with Messrs. Cross and Bevan in collaboration on the subject of cellulose acetate and the problem of solid emulsions of cellulose and rubber. He was a man of wide reading, and also of considerable repute as a musician. He died suddenly from heart failure, on Saturday evening, January 14th.

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English.—8d. each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1s. each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3°).



**I.—PLANT, APPARATUS, MACHINERY.****ENGLISH PATENTS.**

*parators; Centrifugal Liquid* —. J. H. F. Dierks and C. J. Möllmann, Osnabrück, Germany. Eng. Pat. 16,855, Aug. 2, 1904.

IE U.S. Pat. 778,406 of 1904; this J., 1905, 123.—T. F. B.

*ating or Vaporising Water or other Fluid; Apparatus for* —. B. W. Davis, Phillips, Wis., U.S.A. Eng. Pat. 25,966, Nov. 29, 1904.

IE U.S. Pat. 777,083 of 1904; this J., 1905, 77.—T. F. B.

**UNITED STATES PATENTS.**

*parator; Centrifugal* —. C. J. Pihl, Cambridgeport, Mass., Assignor to United States Dairy Manufacturing and Machine Co., Kittery, Me. U.S. Pat. 780,441, Jan. 17, 1905.

ROTATING bowl has an inner unperforated wall. The ed-pipe passes through the centre of the inner body, om which radial wings project into the annular space tween the inner and outer walls. The liquid to be parated passes as a thin film of slight "radial depth," ough the vertical annular passage, which is situated the field of greatest centrifugal force, so that the articles have only a short horizontal distance to travel order to be separated.—W. H. C.

*vaporating and Distilling Liquids; Apparatus for* —. B. F. Brooke-Sewell, Skien, Norway. U.S. Pat. 781,045, Jan. 31, 1905.

Two or more vessels, with bottoms formed of a series of ockets with inclined sides are arranged one above the ther. The vapours rising from the liquid contained in the lowest vessel condense on the under surface of the ockets of the vessel next above, giving up their heat to hem and collecting in a trough placed below the pockets. he liquid to be evaporated can be passed from one vessel o another by suitable pipes, and the solids deposited uring the evaporation can be withdrawn, without break- ing the vacuum, which is maintained in the apparatus.

—W. H. C.

**II.—FUEL, GAS, LIGHT.**

*Joke and Volatile Matter yielded by Coals; Determination, in a Platinum Crucible, of the Percentage of* —. G. Arth. XXIII, page 212.

**ENGLISH PATENTS.**

*Peat and Peat Charcoal; Apparatus for the Production of Dry* —. G. T. Zohrab, Glasgow. Eng. Pat. 1628, Jan. 22, 1904.

THE peat is placed in a suitable receptacle, and conveyed by means of an endless band provided with knives or blades, to a plate heated by gas. Above the hot plate are arranged a number of endless bands mounted on rollers so as to incline downwards towards the rear end of the hot plate. These bands are fitted with knives, the peat being carried along to the end of the hot plate, and any moisture squeezed out in transit. The heated peat is then delivered into a number of hoppers, from which it falls into the pulping cylinders. Inside these cylinders are arranged Archimedean screws and knives mounted on rotating shafts, as well as stationary knives, by which means the peat is cut up, kneaded, pressed forward and out through a mould on to trays. While on the trays it is cut up by suitable apparatus, and the trays are then conveyed to drying chambers. A blowing and exhausting apparatus for forcing air of any desired temperature into the drying chambers, is provided.

After drying, the peat blocks are discharged, and may be conveyed to, and charred in a retort, and afterwards cooled by jets of steam in a cooling chamber.—L. F. G.

*Peat Fuel; Apparatus for the Manufacture of* —. J. MacGregor and G. C. Pearson, Old Charlton, Kent. Eng. Pat. 2268, Jan. 29, 1904.

THE claim is for apparatus suitable for carrying out the process described in Eng. Pat. 19,719 of 1902 (this J., 1903, 943). The peat is charged through a hopper into the basket of a centrifugal machine, which has a sliding contact electrode on its periphery, and another situated in the interior of the basket. The latter expands or extends under the influence of the centrifugal force, and so maintains electrical contact with the peat as it shrinks. From the centrifugal, the peat, when deprived of its superfluous water, is delivered into a kneading trough, provided with blades which reduce it to a suitable state of plasticity for forming into blocks. The peat is then turned out into the hoppers of the moulding machine, where by means of rams or plungers, actuated by a "rotating cam groove," it is forced into the moulds, and eventually expelled on to a conveyer.—W. H. C.

*Briquettes; Manufacture of* —, for Fuel and other Purposes. W. Simpkin, Westminster, and J. B. Ballantine, Richmond, Surrey. Eng. Pat. 14,213, June 23, 1904.

BLOOD is mixed with a solution of potassium nitrate, about 15–20 lb. of nitrate being taken per ton of blood. Instead of potassium nitrate, carbonates and acetates of the alkalis, or weak acids, may be used to prevent coagulation. 100 to 200 lb. of the treated blood are then mixed with a ton of powdered coal, to which are also added 10 lb. of powdered rosin for every 100 lb. of blood used. The mixture is then formed into briquettes, and heated in an oven for a suitable time to 250° F. If extra strong briquettes are desired, 20 to 30 lb. of slaked lime may be added to every ton of coal used.—L. F. G.

*Fuel; Artificial Composition* —, and Process of Producing same. C. H. Carpenter and S. L. Davis, South Bend, Ind., U.S.A. Eng. Pat. 24,336, Nov. 10, 1904.

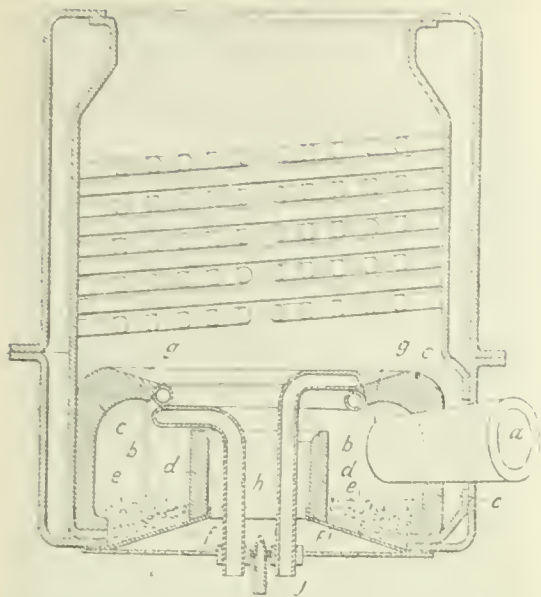
1950 lb. of dried common peat, decayed vegetable matter or soil, are mixed with 10 lb. of common salt, and 40 lb. of powdered rosin. The mixture is then compressed into briquettes, a pressure of 24,000 lb. per sq. in. being used to properly distribute and retain the rosin throughout the mass.—L. F. G.

*Liquid Fuel; Use of* —, and Apparatus for Burning the same. Sir W. G. Armstrong, Whitworth & Co., Ltd., E. L. Orde, and W. H. Sodeau, Newcastle-on-Tyne. Eng. Pat. 3089, Feb. 8, 1904.

THE steam or hot air spray burner described in Eng. Pat. 23,568 of 1899 (this J., 1900, 1094) is combined with a mixing chamber. The apparatus is so designed that sufficient air, amounting to not less than four times the weight of the oil, may be drawn in and intimately mixed with the oil spray before the mixture ignites, so that a practically smokeless flame is produced. This is attained by constructing the mixing tube so that the "suction-plane" is in advance of the inlet for the induced current of air, and by extending the mixing tube into the furnace. —W. H. C.

*Liquid Fuel; Burning of* —. J. Badger, Harlesden, Middlesex. Eng. Pat. 5218, Mar. 2, 1904.

THE liquid fuel is fed into the conical tube *a*, of refractory material, which in turn projects into an annular, regenerative track *b*, built of segmental bricks *c*, which are formed with a falling arch *g* in order to reduce the size of the outlet. The inner wall of the track is formed by the upright tube *d*, and a layer of broken refractory material *e*, introduced through the flanges *f*, is placed on the bottom of the track. A coil *h*, which serves for preheating the water or superheating the steam, also helps to support the inner edges of the bricks, sufficient space being left for the passage of the gases. A



pipe or jet *j* passes through the perforated bottom plate *i*, and serves to introduce the secondary supply of air.

—W. H. C.

**Gas Producers.** J. B. Smith, Glasgow, and R. Grant, Wishaw, Scotland. Eng. Pat. 5535, March 7, 1904.

WITHIN the combustion chamber of a rectangular producer there is provided a bridge of arched cross-section, extending from the front to the back of the chamber at some distance above the floor, for the purpose of supporting the fuel, so that it may form an arch extending from one side wall to the other, the side portions being unsupported. The arrangement is such that a clear central raking run is formed below the bridge, and made accessible to the raking and poking irons from the front end of the chamber. The bridge may be provided with apertures to allow steam, or steam and air, to pass up through it from a pipe extending beneath it.—H. B.

**Gas Producers.** B. Talbot, Leeds, and L. Mond, London. Eng. Pat. 6719, March 19, 1904.

A gas producer, having the general form of shell and grate described in Eng. Pat. 12,440 of 1893 (this J., 1894, 938), and stirring arms and central blast, as described in Eng. Pat. 10,049 of 1900, is provided with separate blast-inlets for the central blast and the circular grate, so that the air, or mixture of air and steam, may enter partly through the grate and partly through the central blast in any desired proportions. Stirring arms may be arranged in the fuel bed, as well as in the main body of the producer.—H. B.

**Air Gas; Process and Apparatus for Generating** — [from Hydrocarbons, Alcohol, &c.]. E. Gersabeck, Berlin. Eng. Pat. 14,355, June 25, 1904.

SEE Fr. Pat. 344,205 of 1904; this J., 1904, 1082.—T. F. B.

**Filaments for Electric Lamps; Machines for Treating** — The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 2456, Feb. 1, 1904.

THE machine is designed for the automatic "flashing" of carbon filaments, and comprises a number of "flashing" bottles, each of which in succession is, by means of an automatically operated valve, placed in connection first with a vacuum pump, whereby air is withdrawn, then with a measuring vessel from which it receives a predetermined charge of "flashing vapour," and, lastly, with the atmosphere, to remove the remainder of the vapour.

For safety, the vapour supply is drawn from a reservoir distant from the machine. The circuit through filaments is made, and broken when the resistance reached a predetermined value, by means of automatic switches. The starting of one operation in one bottle causes other operations of the cycle to be performed on the other bottles.—H. B.

**Incandescence Bodies for Electric Incandescence Lamp; Process for the Formation of [Osmium]** — W. Thompson, London. From Deutsche Gasglühlicht A.-G. (Auer Ges.), Berlin. Eng. Pat. 27,713, Dec. 1904.

INCANDESCENCE filaments which are brittle in the cold, especially those of metallic osmium, are brought to the desired shape by heating them to incandescence with electric current in an indifferent atmosphere, and bend them whilst in the softened state. For example, an osmium filament is laid across, or attached to, two terminals inside a vertical tubular vessel, which is open at the bottom for the insertion of the necessary instrument, and at the top is closed with the exception of an inlet for hydrogen gas. A gentle stream of hydrogen, flowing down the tubular vessel, prevents the ingress of air at the bottom. The filament is raised to incandescence and then is bent to the desired shape by pushing suitably formed wires, or by raising the frame, carrying the terminals and filament, until the latter presses against a fixed stop and is bent as desired.—H. B.

**Arc Light Electrodes and Methods of Making the same** — C. F. Lindsay, Schenectady, U.S.A. Eng. Pat. 26,919, Dec. 9, 1904. Under Internat. Conv., Dec. 10, 1904.

ELECTRODES, suitable for giving a steady flaming arc, are made from a partially reduced mixture of oxides of iron and titanium. For example, 70 parts of magnetic oxide of iron, 30 parts of rutile, and 1 part of potassium carbonate are ground together and mixed with 10 parts of coke, and heated in crucibles to about 1200°. The partially reduced mixture obtained is ground moistened with glycerin and water, and moulded, squirted into pencils or the like; the pencils are dried in coke, and again fired at about 1200° C.—H. B.

**Cement for Use in Electric Lamps and for other Purposes; Manufacture of** — Cleminson Electric Lamp Attachment, Ltd., and W. King. Eng. Pat. 660, Mar. 18, 1904. IX., page 198.

#### UNITED STATES PATENTS.

**Heating Composition.** E. Kafka, Assignor to Fireless Heating Co., New York. U.S. Pat. 780,352, Jan. 1, 1905.

THE claim is for a mixture of about 25 per cent. of lead acetate, 50 per cent. of sodium sulphate, and 25 per cent. of sodium acetate, for the purpose of retaining and gradually emitting heat.—W. H. C.

**Coke; Electrical Apparatus for Separating** — from Cinders, &c. H. Lclarge, Liege, Belgium. U.S. Pat. 781,437, Jan. 31, 1905.

SEE Eng. Pat. 5799 of 1904; this J., 1904, 653.—T. F. B.

**Gas Producing Apparatus.** R. S. Craig, Chicago. U.S. Pat. 780,026, Jan. 17, 1905.

A GAS-PRODUCER, provided at the top with a feed hopper for solid fuel, and an inlet pipe for hydrocarbon vapour is connected to a fixing chamber and thus in its turn, and at its bottom part with the bottom part of a second fixing chamber, from which second chamber the gas passes down through a receptacle comprising: (1) at its top, a vaporising chamber within which depends a coiled pipe serving to vaporise the hydrocarbon on its way to the producer; (2) a vertical tubular condenser to which air and water are admitted; and (3) at the foot a collecting box. The hot air from the condenser is passed into the producer beneath the grate-bars.—H. B.



*Generating Furnace*, J. H. Foster, New York. U.S. Pat. 781,141, Jan. 31, 1905.

FURNACE chamber, having double walls, is provided in lower portion with a horizontal partition, extending from the front to the back of the chamber, but leaving openings at the sides which communicate with air ducts beneath the partition. A "burner or retort," supported above the horizontal partition, extends from the front to the back of the chamber; it consists of a shell, having closed ends, and provided with side apertures, and an inlet tube extending into the shell from the front end to a point near the rear end thereof.—H. B.

*Gas and Coke from Crude Oil; Method of Manufacturing* — J. H. C. Stut, Oakland, Cal. U.S. Pat. 81,242, Jan. 31, 1905.

Oven, having a layer of incombustible porous material at the bottom, and a relatively large empty space above this is heated, and crude oil is sprayed in a horizontal direction into the space in such manner as to prevent its splashing upon the walls or upon the porous material. The heat is sufficient only to separate the more volatile portions of the oil, which pass off as illuminating gas. The heavier portions fall upon the porous bed. In succeeding heating period air is admitted above and below the porous bed, consuming the lighter hydrocarbons and converting the deposited residue into coke. The making and coking operations succeed one another alternately. (Compare U.S. Pat. 766,554; this J., 1904, 2.)—H. B.

*Illuminating Gas; Process of Manufacturing* — J. H. C. Stut, Oakland, Cal. U.S. Pat. 781,380, Jan. 31, 1905.

AL, contained in several contiguous ovens, is raised to incandescence; fresh coal is added to a higher level of certain of the ovens, and, whilst the coal-gas is disengaged from the fresh coal, oil is introduced upon the incandescent surface of the fuel in the intervening ovens, and simultaneously steam is passed up through the fuel in the latter ovens. The mixture of water-gas and oil from the latter mingles with the coal-gas from the former ovens, and is led through a fixing chamber. The ovens are used alternately for producing coal-gas, and a mixture of oil- and water-gas.—H. B.

*Ethylene; Process of Treating — for Facilitating its Transportation and Storage*. E. A. le Sueur, Ottawa, Canada. U.S. Pat. 781,009, Jan. 31, 1905.

ETHYLENE is obtained in a form convenient for transit by condensing it, by refrigeration at atmospheric pressure, in liquid or solid form, or it may be "condensed into solution" in a suitable solvent by refrigeration. It may subsequently be transferred to a storage receiver, which is maintained at a comparatively high temperature, or may be admitted to a receiver containing a liquid or solid absorbent for acetylene.—T. F. B.

#### FRENCH PATENTS.

*Agglutinant; Agglomerant or — for the Manufacture of Briquettes*. D. Elis. Fr. Pat. 346,675, Sept. 30, 1904.

THE agglutinant is prepared by working up paper with hot or cold water, and finally boiling the mixture so as to form a paste. This paste or pulp is then mixed with al. charcoal, wood shavings, coke dust, or similar materials, and the mixture formed into briquettes and dried.—L. F. G.

*Alcohol for Heating, Lighting, or Motive Purposes; Treatment of Carburetted or Non-carburetted* — H. Rosalt. Fr. Pat. 346,606, Sept. 27, 1904.

SATURATED alcohol of any kind, or alcohol carburetted with benzine, benzene, petroleum ether, turpentine, or terpenes, is treated with ammonia gas, to prevent or neutralise acidity in the products of combustion. Instead of ammonia gas, the weak compounds of ammonia with ethyl, methyl, and especially amyl alcohol, may be

used, as also ammonium carbonate, methyl and ethylamine, or the distillation products from beetroot molasses.

—L. F. G.

*Gas Retort (Continuously Fed)*. J. Verdier and P. Teulon. First Addition, dated Sept. 8, 1904, to Fr. Pat. 335,001, Sept. 2, 1903. (See this J., 1904, 1081).

INSTEAD of the continuous rotatory movement of the charging and discharging plugs mentioned in the principal patent, each plug is caused to rotate or oscillate alternately from right to left, and left to right. One charging hopper may be connected to shoots leading to two retorts, the oscillating plug delivering the fuel to each shoot alternately. The discharging plugs are provided with two cavities, placed symmetrically on opposite sides of the axis, instead of with one, so as to be balanced better.—H. B.

*Gas for Motive Power; Apparatus for the Manufacture of* — A. Saurer. Fr. Pat. 346,526, Sept. 10, 1904.

THE apparatus consists of a gas-generator for the combustible (anthracite, coal, coke, lignite or liquid fuel) lined with refractory material, and provided at the top with a tubular heater, closed by a valve. The generator is surrounded by two concentric hollow cylinders, forming two annular spaces, closed at the top and bottom. Air enters through an opening and passes up the outer annular space, whilst the Dowson gas produced in the generator, when the apparatus is working, passes down the inner annular space, and to the motor. The air is heated in its passage, and passes through a pipe into the tubular heater, and then downwards into the bottom of the generator. The admission of the air is controlled by a valve. Water drops through a tube into the tubular heater, becomes vaporised, and mixes with the air supplied to the generator. The amount of water supplied is accurately regulated by means of a suitable thermo-regulator actuating a cock, and a Dowson gas of uniform composition is thus produced, the high temperature obtained inside the generator making it very rich in hydrogen.—L. F. G.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

*Petroleum from Boryslaw; Determination of Impurities in Crude* — M. Wielezyski. XXIII., page 212.

*Mineral Oils; Determining the Flashing Point of* — W. Herbig. XXIII., page 212.

#### ENGLISH PATENT.

*Anthracene; Process for Obtaining Pure — from Crude Anthracene*. V. Vesely and E. Votocek, Prague, Bohemia. Eng. Pat. 27,596, Dec. 17, 1904.

CONCENTRATED sulphuric acid is found to extract the whole of the basic impurities from a solution of crude anthracene in a solvent immiscible with sulphuric acid. The most suitable solvents are mineral and coal tar oils but carbon bisulphide or chloroform may be used. For example, 100 parts of crude (35 per cent.) anthracene are dissolved in 300 parts of solvent naphtha, 100 parts of concentrated sulphuric acid are added, and the mixture is heated and at the same time vigorously agitated for a few minutes. The sulphuric acid having been drawn off the solution is freed from acid by agitation with calcium carbonate, filtered, and allowed to crystallise. By this process it is stated to be possible to obtain an 85 to 90 per cent. anthracene, perfectly free from carbazole.—T. F. B.

#### UNITED STATES PATENT.

*Asphaltic Oils; Method of Rendering — more "Limpid."* E. A. Starke, Alameda, Cal. U.S. Pat. 781,240, Jan. 31, 1905.

HEAVY mineral oils are rendered more "limpid" and "limpid" by subjecting them to a partial distillation at a

temperature of 500°–650° F., so that the residue is not coked. The distillate and residue are then mixed together.

—T. F. B.

#### FRENCH PATENT.

*Petroleum; Solidification of* —. Y. E. F. Brun. Fr. Pat. 346,619, Sept. 29, 1904.

PETROLEUM may be solidified by incorporating with it either 3 to 10 per cent. of soap, or 3 to 6 per cent. of soap and 1 per cent. of wax.—T. F. B.

### IV.—COLOURING MATTERS AND DYE STUFFS.

*Quinone; The Imines of* —. R. Willstaetter and A. Pfannenstiel. Ber. 1904, 37, 4605–4609.

QUINONE DI-IMINE previously obtained (this J., 1904, 542) by reduction of quinone-dichlorodi-imine with hydrochloric acid, may also be prepared by oxidation of *p*-phenylenediamine with silver oxide in ethereal solution. The same reaction applied to *p*-aminophenol leads to the formation of quinone-mono-imine which cannot be obtained by the reduction method.

The mono-imine is less stable than the di-imine, readily soluble in ether, benzene and carbon bisulphide, and insoluble in petroleum ether. Both the mono- and di-imine are colourless. Comparison of these compounds with quinone and fulvene, proves that the groups C:NH have a weaker chromophoric power than C=O and C:C groups, which is contrary to the view usually adopted. Graebe's imino-formula for the auramine salts, becomes also less probable.—R. L.

*Dimethylaniline *p*-sulphonic Acid and new Azo Dye stuffs prepared from it.* L. Lefevre. Rev. Gen. Mat. Col. 1905, 9, 35.

DIMETHYLANILINE *p*-SULPHONIC acid can be prepared by heating dimethylaniline at 100° C. with six times its weight of fuming sulphuric acid (containing 50 per cent. of sulphur trioxide). It combines with tetrazobenzidine forming a substantive dyestuff which dyes cotton a reddish bordeaux. If only a single molecule of the acid be taken, an intermediate product is formed which gives off nitrogen on boiling and acquires a yellowish-brown colour. This dyes cotton direct in dark yellow shades.—A. B. S.

*Azo Dye stuffs from Phenetol; New* —. L. Lefevre. Rev. Gen. Mat. Col., 1905, 9, 35–36.

CONTRARY to the usual opinion that phenolic ethers do not combine readily with diazo compounds, it is found that phenetol unites with tetrazobenzidine to form an insoluble dyestuff, which dyes cotton direct from an aqueous-alcoholic solution. By using phenetol-*p*-sulphonic acid, a soluble dyestuff is produced which dyes cotton direct an orange yellow. Direct dyestuffs are also produced by combining one molecule of tetrazobenzidine with one molecule of dimethylaniline-*p*-sulphonic acid and one molecule of phenetol or of phenetol-*p*-sulphonic acid.—A. B. S.

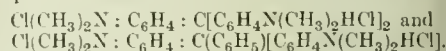
*Nitrosophenol Dyestuffs.* H. Decker and B. Solonina. Ber. 1905, 38, 64–68.

THYMOL methyl ether and crude nitric acid react in acetic acid solution to form a dark blue liquid. On reduction with stannous chloride and hydrochloric acid this is decolorised with formation of the hydrochloride of dithymolylamine of the dimethyl ether [(CH<sub>3</sub>O)(C<sub>3</sub>H<sub>7</sub>)(CH<sub>3</sub>)C<sub>6</sub>H<sub>2</sub>]<sub>2</sub>NH. On oxidation in alcoholic solution with ferric chloride, this forms the red methyl ether of thymoquinone-thymolide (C<sub>3</sub>H<sub>7</sub>)(CH<sub>3</sub>)(O)C<sub>6</sub>H<sub>2</sub>:N.C<sub>6</sub>H<sub>2</sub>(CH<sub>3</sub>)(C<sub>3</sub>H<sub>7</sub>)(OCH<sub>3</sub>). This is reduced by stannous chloride to the leuco compound dithymolaminemethyl ether HO.C<sub>10</sub>N<sub>2</sub>.NH.C<sub>10</sub>H<sub>12</sub>.OCH<sub>3</sub>. Purified thymoquinone-thymolide obtained from thymol and sulphuric acid containing nitrous acid (Ber. 1903, 36, 2886) is converted by means of dimethyl sulphate in alkaline solution into the above-mentioned thymoquinone-thymolide methyl

ether. The *n*-butyl ether of thymol yields with concentrated nitric acid in acetic acid solution bronze-coloured crystals of the formula C<sub>22</sub>H<sub>34</sub>O<sub>9</sub>N<sub>3</sub> which are quite analogous chemical behaviour to the product obtained from the ethyl ether of thymol. On reduction it forms the dibutyl ether of dithymolamine, which yields on oxidation the *n*-butyl ether of thymoquinone-thymolide. Analogous products are obtained from the isopropyl ether of thymol and from the methyl and ethyl ethers of *p*-xylene.—E. F.

*Malachite Green and Crystal Violet.* R. Lambrecht and H. Weil. Ber. 1905, 38, 270–282.

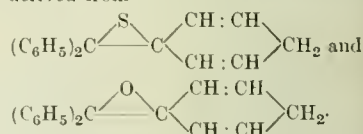
WEAKLY acid alcoholic solutions of both Malachite Green and Crystal Violet yield with hydrogen sulphide and with alkali sulphides and polysulphides colourless solutions containing the carbothiols HS.C(C<sub>6</sub>H<sub>5</sub>)[C<sub>6</sub>H<sub>4</sub>N(CH<sub>3</sub>)<sub>2</sub>]<sub>2</sub> and HS.C(C<sub>6</sub>H<sub>5</sub>)[C<sub>6</sub>H<sub>4</sub>N(CH<sub>3</sub>)<sub>2</sub>]<sub>3</sub>. On warming with excess of dilute acetic acid or with theoretical amount of dilute sulphuric acid, hydro-sulphide is evolved and the ordinary quinonoid salts the original dyestuffs are formed. With excess of mineral acids, on the other hand, no hydrogen sulphide is evolved and the solutions remain colourless, even warmed for some time on the water-bath. They contain the carbothiol hydrochlorides HS.C(C<sub>6</sub>H<sub>5</sub>)[C<sub>6</sub>H<sub>4</sub>N(CH<sub>3</sub>)<sub>2</sub>]<sub>2</sub> and HS.C(C<sub>6</sub>H<sub>5</sub>)[C<sub>6</sub>H<sub>4</sub>N(CH<sub>3</sub>)<sub>2</sub>]<sub>3</sub>, which can be isolated in the form of double salts with stannic chloride, heating the dried salts, or boiling in aqueous solution the ordinary quinonoid salts of the original dyestuff are formed with evolution of hydrogen sulphide. Analogous colourless salts of the carbinols of the dyestuffs, HO.C(C<sub>6</sub>H<sub>5</sub>)[C<sub>6</sub>H<sub>4</sub>N(CH<sub>3</sub>)<sub>2</sub>]<sub>2</sub> and HO.C(C<sub>6</sub>H<sub>5</sub>)[C<sub>6</sub>H<sub>4</sub>N(CH<sub>3</sub>)<sub>2</sub>]<sub>3</sub> can be isolated from solutions of excess of mineral acid as double salts with stannic chloride. On boiling the carbothiol or carbinol salts from either dyestuff with excess of mineral acid, deep-orange-red solutions are obtained from which orange-red double salts can be isolated with stannic chloride. They correspond to the formula—



The authors further succeeded in obtaining, in the form of a zinc chloride double salt, a grass-green salt of Crystal Violet, of the formula—



In view of the stability towards oxidising agents of carbothiols, they suggest formulae for carbothiols and carbinols derived from—



—E. F.

*Alizarin Dimethyl Ether.* C. Graebe. Ber. 1905, 38, 152–153.

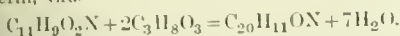
ALIZARIN cannot be directly converted into its dimethyl ether, nor have purpurins containing two hydroxyl groups in the 1:2 positions been hitherto completely methylated. By reducing alizarin to desoxyalizarin and methylating the latter with dimethyl sulphate in alkaline solution, and oxidising the resulting product with sodium chromate and acetic acid, alizarin dimethyl ether is obtained and forms golden-yellow needles. The product is identical with that obtained by Meister, Lucius and Brünning from 2-hydroxyanthraquinone, by converting it first into 1-nitromethoxyanthraquinone and boiling this product with a solution of potassium hydroxide in methyl alcohol. By direct methylation of flavopurpurin a dimethyl ether was obtained, whilst reducing, methylating and oxidising, as described above, flavopurpurin trimethyl ether was prepared.—E. F.

*New Vat Dyestuffs of the Anthracene Series.* O. Baer. Ber. 1905, 38, 194–196.

By the action of glycerin on 3-aminoanthraquinone in the presence of a dehydrating agent, the reaction does not



on the formation of a quinoline derivative, but a molecule of glycerin enters into the reaction. The product crystallises from toluene in yellow needles, melting at 251° C.; it has the composition  $C_{20}H_{11}ON$ , apparently formed by the condensation of one molecule of  $\beta$ -aminoanthraquinone with two molecules of glycerin, thus—



The same product is formed by heating Graebe's anthra-quinoline with glycerin, so that the second molecule of glycerin must have reacted with a ketone oxygen to form a new ring, the "benzanthrone" ring. By heating anthraquinone with glycerin in sulphuric acid solution, the simplest representative of this new class of bodies is



namely, benzanthrone,  $C_{17}H_{10}O$  or  $\text{CO}$ , m.p.t.

A number of these bodies on melting with caustic alkalis form vat-dyestuffs of great fastness. The blue stuff Cyananthrene is formed in this manner from anthrone-quinoline. This is the first case of a compound which does not contain nitrogen, behaving as a vat dyestuff.—A. B. S.

#### ENGLISH PATENTS.

*Derivatives of certain Aromatic Bases [Arylsulphamides]; Manufacture of the —.* C. D. Abel, London. Rom. Act.-Ges. f. Anilinfabrikation, Berlin. Eng. Pat. 141, March 19, 1904.

**SULPHAMIDES** obtained by condensing benzenesulphoride or *p*-toluenesulphochloride with primary or secondary aromatic amines, may be converted into mononitro compounds having the nitro group in the *p*-position of the sulphamino group, by nitrating with dilute nitric acid (c.g., of sp. gr. 1.18), with or without the use of a solvent. The nitro derivatives of *p*-toluenesulpho-*o*-aniside, benzenesulpho-*o*-aniside, *p*-toluenesulpho-ethylamide, *p*-toluenesulpho-anilide and *p*-toluenesulpho-*o*-toluidide are described. These compounds may be reduced to the corresponding amino-derivatives, which are suitable for the production of dyestuffs, or may be converted into nitro-amino compounds by the action of concentrated sulphuric acid, which splits off the arylsulpho-group.—T. F. B.

*Acraene Dyestuffs suitable for Dyeing and Printing; Manufacture of —.* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 7692, March 31, 1904.

Fr. Pat. 343,608 of 1904; this J., 1904, 1026.—T. F. B.

#### UNITED STATES PATENT.

*Aligo; Process of Purifying —.* R. Hutzler, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 780,886, Jan. 24, 1905. Eng. Pat. 7395 of 1903; this J., 1904, 248.—T. F. B.

### —PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

*Woolen Materials; Scouring of Milled — by the aid of Electricity (Baudol's Process).* E. Justin-Mueller. Soc. Ind. de Rouen, Dec. 16, 1904. Chem.-Zeit., 1905, 29, 102—103.

Milled cloth is passed in the open width through a vat divided into several compartments and fitted with rollers. The compartments in the first portion of the apparatus contain a solution of sodium carbonate (5 T) and are also provided with electrodes by which an electric current is passed through the liquid.

The remaining divisions are filled with hot water. The action appears to be as follows:—The electric current decomposes the sodium carbonate, forming caustic soda and carbon dioxide. The caustic soda facilitates the removal of the soap from the material and also saponifies any oil present in the state of an emulsion in the soap. The carbon dioxide decomposes the liberated soap and sets free the oleine which rises to the surface and is removed. The same action is repeated continuously. The bath is kept at about 40° C., and the process is said to be very rapid.—A. B. S.

*Paranitraniline Red on Cotton Yarn.* L. Sander. Z. Farben- u. Textil-Ind., 1905, 4, 13—14.

To avoid the difficulties usually experienced with diazotising baths, the use of stable diazo compounds such as Azophor Red has been largely tried. The yarn must first be well boiled out, preferably under pressure. For 50 kilos. of yarn, 2 litres of caustic soda (66° T) are required. The boiling is continued for 4 hours, and the yarn is then washed well, dried and treated with a solution of naphthol in alkali. Twelve litres of the naphthol solution as given below are taken and 1 kilo. of yarn worked in it, the duration of treatment depending on the tightness of the twist, &c., of the yarn. For each further 1 kilo.,  $\frac{2}{3}$  litre of the naphthol solution is added. The yarn is dried at 50°—60° C. without too much exposure to light. After cooling, it is treated in a similar manner in 1 kilo. portions in the Azophor Red developing bath. This consists of 7½ litres of Azophor Red solution (see below), 11½ litres of cold water, and 1½ litres of dextrin solution (1:3). Each further 1 kilo. of yarn requires the addition of  $\frac{2}{3}$  litre of the Azophor Red solution. After squeezing, the yarn is left for 1 hour and then soaped for  $\frac{1}{2}$  hour at 40°—50° C. with 2½ kilos. of soft soap and 200 grms. of soda ash, for 50 kilos. of yarn. It is finally washed. To make the shade bluer it may be topped with Rhodamine B.

*Naphthol Solution.*—Dissolve 1110 grms. of Naphthol R. in 12 litres of boiling water and 2.225 kilos. of caustic soda (36° T). Also dissolve 3.33 kilos. of Turkey Red oil (60%) in 31.25 litres of warm water and enough caustic soda to give a clear solution. Mix the two solutions and make up to 50 litres.

*Azophor Red Developer.*—Stir 3715 grms. of Azophor Red P.X. with 22 litres of cold water, allow to stand 1 hour and filter through a cloth, washing the residue on the cloth with 9 litres of cold water. To the clear solution add slowly, with constant stirring 1960 grms. of caustic soda (36° T) diluted with 5 litres of cold water. Then add 5½ litres of dextrin solution (1:3), allow to stand 10 minutes before using. The shade on bleached yarn is brighter than that on unbleached.—A. B. S.

*Diamine Dyestuffs Printed on Cotton; Fixing —, by Moist Steam.* E. Justin-Mueller. Rev. Gen. Mat. Col., 1905, 9, 36—38.

If the direct cotton dyestuffs be steamed in the dry condition after printing, they do not develop well and are not so fast to washing as the dyed colours. To remedy this, the pieces should be damped before steaming by wrapping in damp cloths or by any other suitable method, and glycerin should be added to the printing colour so as to attract moisture. The resulting colours are better developed and faster to washing.—A. B. S.

#### ENGLISH PATENTS.

*Animal Fibres; Bleaching of —.* T. Graham and F. Cope, Dewsbury, Yorks. Eng. Pat., 8851, April 18, 1904.

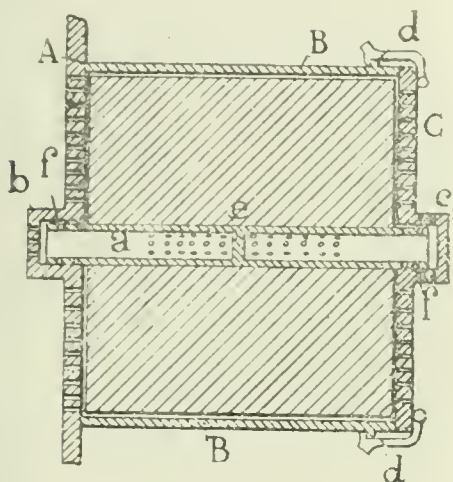
Zinc powder (56 parts) are mixed with sodium bisulphite (1000 parts) and, after settling, the liquid is drawn off. Barium chloride (10 parts) are added to the solution and the material is soaked in this for  $\frac{1}{2}$ —3 hours at 100° F. It is then washed with tepid water and treated with a solution of potassium permanganate (1:1000), washed and dried. Instead of barium chloride, calcium sulphate, magnesium sulphate, aluminium sulphate, or alum may be employed.—A. B. S.

*Vegetable Fibres; Mordanting — for Dyeing or Printing [with Direct Dye stuffs].* The Calico Printers' Assoc., Ltd., Manchester, and W. Warr, Staleybridge, Lanes. Eng. Pat. 25,165, Nov. 19, 1904.

THE material is first padded with a solution of a magnesium salt, such as magnesium sulphate. The strength of the solution is varied according to the depth of colour required. The material is then dried and the magnesium fixed on the material as hydroxide by means of a solution of caustic soda. The mordant may also be fixed as silicate by using a solution of sodium silicate. After washing, the material is ready for dyeing or printing with the substantive dyestuffs.—A. B. S.

*Dyeing, Mordanting, Bleaching, &c., of Textile Materials in Bobbin or like form.* L. Detré, Reims, France. Eng. Pat. 4787, Feb. 26, 1904.

THE machine consists of a suitable tank fitted with a number of hollow vertical columns or supports, preferably of triangular section. On the vertical faces of these supports are placed a number of horizontal receptacles B



to contain the bobbins. The end A is formed by the perforated face of the support; the cover C, which is secured by bolts d, is also perforated. Through the centre passes a tube a of special construction (see Eng. Pat. 4596 of 1904; this J., 1904, 487). The hollow supports are connected to a pipe, and by means of a pressure or exhaust pump, the dye-liquor contained in the tank can be circulated through the bobbins in either direction.—A. B. S.

*Tube for use in Dyeing, Bleaching, and the like Operations.* J. Brandwood, Elton, Lanes. Eng. Pat. 6456, March 17, 1904.

SEE Fr. Pat. 342,109 of 1904; this J., 1904, 899.—T. F. B.

*Hydrosulphite Compounds [with Ketones]; Manufacture of Stable —.* O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst on the Maine, Germany. Eng. Pat. 6216, March 14, 1904.

STABLE compounds of hydrosulphites and ketones are obtained by the reaction of the two substances in presence of alkalis, especially caustic soda and ammonia together. A solution of the acetone-hydrosulphite compound is obtained by adding 1 part of acetone, 1 part of caustic soda lye (40° B.), and 1 part of 35 per cent. ammonia solution to 10 parts of a 13 per cent. solution of sodium hydrosulphite. By evaporating the solution *in vacuo* at a low temperature, the compound is obtained in solid form, in which it is very stable. These compounds are suitable for use in printing, particularly in the processes

described in Eng. Pats. 13,116 of 1903 (this J., 1904, and 6848 of 1904. (See next abstract.)—T. F. B.

*Printing with Indanthrene and Flavanthrene.* O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst on the Maine, Germany. Eng. Pat. 6848, March 21, 1904.

THE method described in Eng. Pat. 13,116 of 1903 (this J., 1904, 544) for printing with indigo by the aid of stable aldehyde-hydrosulphite compounds described in Eng. Pat. 5867 of 1903 (this J., 1904, 369) is also applicable to printing with Indanthrene or Flavanthrene; instead of using the aldehyde-hydrosulphite compounds, ketone-hydrosulphite compounds of Eng. Pat. 6216 of 1904 (see above) may be used. As an example of method, a solution of formaldehyde-sodium-hydrosulphite (120 grms.) in water (80 c.c.) is stirred into an alkali thickener (650 grms.) consisting of British gum (1 part) and caustic soda lye 40° B. (9 parts), and a 20 per cent. Indanthrene paste (120 grms.) is added. The fabric printed with this mixture, steamed, washed, soaped if necessary, and dried.—T. F. B.

*Centrifugal Machine [for Textiles, &c.].* A. J. B. London. From The A. T. Hagen Co., Rochester, U.S.A. Eng. Pat. 26,487, Dec. 5, 1904.

A CENTRIFUGAL machine is fitted with an arrangement of springs to balance the journal box and with an automatic lubricating apparatus.—A. B. S.

*Woollen Fabrics, Flannel, Wadding, Muslin, Cambric, and the like; Process or Dressing for Rendering them Unflammable.* M. Lindsay, Dalton in Furness, Lancs. Eng. Pat. 6568, March 18, 1904.

THE material to be fireproofed is impregnated with a solution of "salt-petre" (2 parts); borax (2 parts); alum (4 parts); and ammonium chloride (1 part); water (120 parts).—T. F. B.

#### UNITED STATES PATENTS.

*Dyeing Silk [after Weighting]; Process of —.* Weidmann, Paterson, N.J. U.S. Pat. 780,924, Jan. 24, 1905.

SEE Eng. Pat. 6728 of 1904; this J., 1904, 899.—T. F. B.

*Printing Textile Materials; Method of —.* J. Cadzow, Zurich, Switzerland. U.S. Pat. 780,636, Jan. 24, 1905.

THE pattern is printed on the fabric with a mastic, the colour is then sprayed on by jets of steam or compressed air, the mastic being subsequently dissolved off. Compare Fr. Pat. 319,342 of 1902; this J., 1903, 25.—T. F. B.

#### FRENCH PATENTS.

*Artificial Silk; Manufacture of —.* P. Cazeneuve, Fr. Pat. 346,693, Oct. 1, 1904.

NITROCELLULOSE is dissolved in acetone (b.pt. about 56° C.) without any additions. The solvent can afterwards be completely recovered. To de-nitrify the product a solution of sodium nitrite is used to which formaldehyde has been added.—A. B. S.

*Scouring [Linen]; Machine for —.* F. E. Thiele, Fr. Pat. 346,687, Sept. 29, 1904.

THE linen is placed in trucks with perforated bottoms which are run into a vessel with perforated false bottoms and spraying pipes, through which the scouring liquid is delivered on to the linen in the trucks. The liquid passes through the material and collects below the false bottoms of the chamber, whence it runs through a pipe into a heating tank from which it is again forced by means of steam pressure through the spraying pipes fixed to the top of the closed chamber.—A. B. S.

*Dyeing Fabrics in the Piece; Machine for —.* J. Cadzow, Fr. Pat. 346,694, Oct. 1, 1904.

SEE Eng. Pat. 21,397 of 1904; this J., 1905, 24.—T. F. B.



# VII.—ACIDS, ALKALIS, AND SALTS.

**Potassium Hydroxide Solutions and solid Caustic Potash; Limits of Carbonate in Electrolytic** — F. Winteler, *Electrochem. and Metall. Ind.*, 1905, 3, 16–17.

ANALYSES of 19 samples of European electrolytic caustic sh are given, which show a variation in the potassium oxide from 73.3 to 81.8 per cent., and in carbonate 2.4 to 18.4 per cent. As the solution produced in electrolytic process is free from carbonate, the carbonate these samples must have been formed during the operation and casting. Care should be exercised in operations to protect the product as completely as possible from carbon dioxide. It was found by experiment that potassium hydroxide solutions of about 1 p. gr., shaken while hot with solid potassium carbonate, then allowed to cool to 20°–22° C., contained from 50 to 55 grms. of carbonate per litre (with 700 to 760 grms. hydroxide); this then is the maximum amount which a concentrated solution can form by absorption of carbon dioxide, and any greater amount present in solid must have been formed during the casting process. When the hydroxide containing carbonate is left to solidify in the melted state for some time, most of the carbonate settles to the bottom, and the upper clear part, when poured off into drums, gives a product containing more than 3–5 per cent. of carbonate. The sediment on the bottom of the pots is dissolved and precipitated by lime, then evaporated down and fused.

—J. T. D.

**Magnesia; Formation of** — from Magnesium Carbonate by heat, and Effect of Temperature on the Properties of the Product. W. C. Anderson, *Chem. Soc. Proc.*, 1905, 21, 11.

THE author heated specimens of native magnesite, and of the forms of artificial magnesium carbonate, viz., "light," "crystal" and "heavy"; and determined: (1) the temperature at which carbon dioxide was first evolved; (2) the rate of evolution of the carbon dioxide; (3) the solubility in water of the magnesia produced. Native magnesite yielded 0.4 per cent. of its weight of carbon dioxide in 20 hours at 350° C., and the rate of evolution increased rapidly with rise of temperature. In the case of the artificial carbonates, the carbon dioxide was completely expelled at about 750° C. from the "light" and "crystal" forms, but only above 810° C. from the "heavy" carbonate. The magnesia prepared by heating "heavy" carbonate at a temperature not much above that needed for complete decomposition, dissolved in water more readily than the specimens prepared from the "light" and "crystal" forms under similar conditions. When the temperatures of preparation were increased, the rate of solution diminished in every instance, but much more rapidly in the case of the "heavy" oxide than in the case of the other two. The author concludes that magnesia becomes polymerised on heating, and that the oxide proceeds faster in the dense "heavy" oxide than in the lighter specimens. The rate of solution is probably a measure of the rate of hydration, and this appears to be most rapid in the magnesia prepared by heating the "heavy" carbonate at 810° C.—A. S.

**Ammonium Salts; Hydrolysis of** — V. H. Veley, *Chem. Soc. Trans.*, 1905, 87, 26–33.

SOLUTIONS of ammonium salts were boiled under a reflux condenser and the loss of ammonium determined. The results indicate that the evolution of ammonia is due to direct dissociation, but to hydrolysis of the salts. Three cases are presented: (1) the hydrolysis is *nil* or inappreciable—with the bromide, chloride and benzenesulphonate; (2) the hydrolysis is dependent upon dilution—with the nitrate and sulphate; and (3) the hydrolysis is independent of the dilution when beyond a certain limiting value—with the chlorate, mono- and di-phosphate, and acetate and other salts of weak organic acids. The persistence with which the several acids retain ammonia in combination corresponds to their activity in causing hydrolysis of methyl acetate, and inversion of cane sugar, the relative order of magnitude

being the same in all three chemical changes. In the following table, which gives the results obtained with N/10 solutions,  $K = 10$  times the percentage molecular loss of ammonia or  $\frac{P}{M} \times 10^3$ , where P=loss of ammonia, and M=amount of ammonia originally combined:—

Salt.	Value of K.	Salt.	Value of K.
Bromide .....	<i>nil</i>	Acetate .....	94.0
Chloride .....	1.4	Oxalate .....	22.3
Benzenesulphonate .....	4.0	Succinate .....	243.8
*Nitrate .....	38.9	Citrate .....	275.0
Sulphate .....	14.3	Ethyl-sulphate ..	11.1
Chlorate .....	20.3	Benzoate .....	10.6
Monophosphate ..	22.3	Salicylate .....	16.0
Diphosphate .....	40.0	Naphthalene - a -	
*Formate .....	20.1	sulphonate ....	15.0

\* In the case of the nitrate and formate, the results are probably complicated by secondary reactions.

—A. S.

**Oxygen; Withdrawal of** — by Platinum. A. Magnus, *Physik. Zeits.*, 1905, 6, 12–13. *Chem. Centr.*, 1905, 1, 337.

THE author considers that the method described by Goldstein (see this J., 1904, 1147) for the removal of oxygen from gases is not quite trustworthy, and he recommends proceeding as follows:—Platinum or iridium is heated electrically nearly to whiteness; the current is led through wires that dip into mercury. The decrease of pressure in the case of air amounted to 20.7 per cent. in 20 minutes. Greater pressures can be used than in Goldstein's method, as the mercury can, if necessary, be placed in long barometer tubes. The absorption ceases after the withdrawal of the oxygen, whereas in discharge tubes, other gases also are absorbed, although more slowly. Iridium is more active than platinum. Palladium disintegrates too rapidly, the disintegration being due to a chemical process, not to sublimation.

—A. S.

**Chlorine, Electrolytic; Utilisation of** — O. Nagel, *Electrochem. and Metall. Ind.*, 1905, 3, 16.

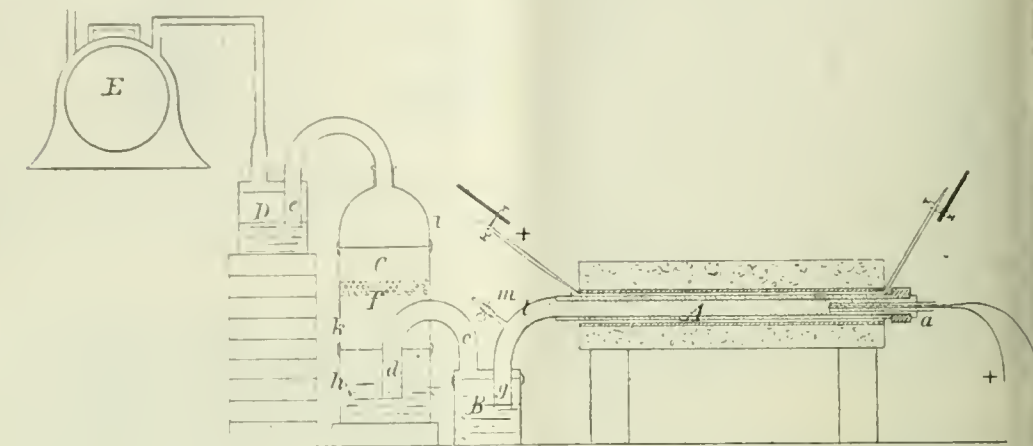
IT is more profitable to convert electrolytic chlorine into hydrochloric acid than to make it into bleaching powder. The plan suggested is to blow the chlorine, mixed with steam, through glowing coke. The reaction is expressed by the equation:  $Cl_2 + 3H_2O + 2C = CO_2 + CO + 2HCl + 2H_2$ ; the excess of hydrogen secures that there shall be no free chlorine in the acid. The mixture of gases is led through absorbing towers, and the gas escaping from these can be used for fuel or for power. In practice, two coke-columns would be used alternately, one being blown up by air to the requisite temperature (about 1000° C.), while the reaction is going on in the other. After one minute's blowing, hydrochloric acid can be made for seven or eight minutes.—J. T. D.

**Phosphorus; Manufacture of** — W. Hempel, *Z. angew. Chem.*, 1905, 18, 132–136.

THE author has investigated the Pelletier process for the manufacture of phosphorus (conversion of tricalcium phosphate into monocalcium phosphate by means of sulphuric acid, and reduction of the product by charcoal). To render the whole of the phosphate soluble, a considerable excess of sulphuric acid over that needed for the conversion of the tricalcium- into the monocalcium salt must be used. If the excess acid be neutralised by barium hydroxide, more free acid is formed on concentration, the monocalcium salt forming the dicalcium salt and free phosphoric acid. As the liquors containing sulphuric acid are concentrated, the amount of sulphuric acid retained diminishes, though not in inverse proportion to the concentration; and when by concentration a specific gravity of 1.28 is reached, corresponding with a sulphuric acid content of 4.2 per cent., phosphates begin to crystallise, so that further concentration is impracticable. Great difficulties were found in devising an apparatus in which to study the reduction of phosphorus, as fireclay vessels

were found to be very porous to the vapour (probably an important cause of the loss in the process as actually worked), while porcelain retorts were liable to choke and explode. The complete collection, too, of the phosphorus could not be ensured by any number of washings through liquid, but was eventually accomplished by filtering the gases upward through a bed of a uniform fine-grained solid (small garnets).

The experimental apparatus is shown in the figure:—



The furnace is a porcelain tube A, surrounded by a spiral wrapping of nickel wire (8.5 m. long, 1 mm. diameter), and jacketed by an outer fireclay tube, the whole packed in kieselguhr in a wooden box. At one end a thermo-electric pyrometer passes air-tight through a plug *a*; at the other the wide tube *l* (provided with the small side-tube *m* for taking samples of the gas) dips under the water in the wash-bottle B, through the lid of which passes the tube *c d* leading into the gas-filter, built up of the glass portions *h* and *i* and the sheet metal portion *k*, the last carrying a sieve *l* on which is laid a layer of garnets of 2-3 mm. mean diameter. From the filter the gases pass through the final wash-bottle D, and the meter E into the atmosphere. The mixture for reduction having been placed in the tube and all made tight, the temperature was gradually raised by passing a current through the nickel wire. From 300° to 600° C. all the sulphuric acid present was evolved as sulphur dioxide. At 700° C. the evolved gas became combustible. At 740° C. traces of phosphorus could be detected, but it did not come away in quantity till 960°, and at 1170° C. the distillation was practically over. Early in the process, the gas evolved was a mixture of carbon dioxide, carbon monoxide, and hydrogen; but the amounts of the first and last gradually lessen, and during the distillation of the phosphorus the accompanying gas consists almost entirely of carbon monoxide. There was accounted for in the condensing apparatus about 92.5 per cent. of the phosphorus contained in the experimental mixture; but a considerable proportion of it refused to melt together, and had to be determined (after separating and directly weighing the portion that would do so) by oxidation and weighing as magnesium pyrophosphate. The cause of this behaviour is probably a slight admixture with solid or liquid hydrogen phosphide, though no gaseous hydrogen phosphide was detected amongst the gases. An experiment with metaphosphoric acid showed that a good yield of phosphorus is not obtainable by reducing this substance with charcoal.

Wöhler long ago proposed to reduce a mixture of tricalcium phosphate and silica with charcoal, according to the equation  $\text{Ca}_3\text{P}_2\text{O}_8 + 3\text{SiO}_2 + 5\text{C} = 3\text{CaSiO}_3 + 5\text{CO} + 2\text{P}$ ; but the process never succeeded owing to the difficulty of attaining the requisite temperature or of finding vessels to withstand it. Electric heating, however, has lessened or removed these difficulties, and an experiment was made on this process in the apparatus. Gas began to be evolved at 700° C., and became inflammable

at 1000° C.; phosphorus was detected at 1150°, began to distil in quantity at 1200°, and the distillation ended at 1450° C. The yield was 92 per cent. (another experiment at higher temperatures gave no higher yield) very little was in the "killed" condition. Electric heating has lately been adopted in German works, the retorts are sheet-iron cylinders lined with fireclay, the lower part of which carbon electrodes are introduced. The materials are fed in continuously, and the residue

slag continuously removed. Perfect dryness of materials is an important factor in increasing the yield.—J. T.

*Diamonds; New Technical Method for Cleaning*—M. C. Schuyten. *Handelingen van het achtste Vlaamsche Natuur- en Geneeskundig Congres, gehouden te Antwerpen op Sept. 25, 1904.* Chem. Centr., 1905, 1, 411.

In order to avoid injuring the health of the workmen, the author recommends that the diamonds after being ground, be cleaned by treatment with fused potassium bisulphate, instead of, as is usual, by boiling with sulphuric and nitric acids.—A. S.

*Alkali Heptamolybdates; New Iodometric Method for the Determination of —*. B. Glassmann. XX, page 211.

#### ENGLISH PATENTS.

*Sulphuric Acid; Concentration of — and Apparatus therefor.* J. Mackenzie, Middlesbrough, Yorks. Pat. 26,278, Dec. 2, 1904.

THE dilute acid from a tank supported on the top of a tower, passes into a lead coil or coils, set in the path of the hot gases issuing from the tower. The latter is filled with acid-resisting bricks, down which the acid issues from the lead coil flows, and meets an upward current of waste fire-gases from a furnace. The acid then passes into a cast-iron concentrating pot, the lid of the upper part of which are lined with stoneware, and which is heated, in part or wholly, by waste gases from a pyrolytic kiln or furnace. A current of hot air is passed through the acid in the concentrating pot.—E. S.

*Neutral Sulphate and Sulphurous Acid; Manufacture of — from Bisulphate.* C. Bollé, Manchester. F.A. the Chem. Fab. Grünau Landshoff and Meyer Actieng., Berlin. Eng. Pat. 6898, March 22, 1904.

THE bisulphate is heated in a cast-iron retort, provided with a mechanical agitator, with about 12 per cent. of wood shavings and 2 per cent. of coke dust, until the sulphurous acid formed (which is collected) is expelled, and only normal sulphate remains.—E. S.



*Carbonate of Ammonia; Impts. in, and Apparatus for, the Manufacture of* ——. F. Lennard, Hove, Sussex. Eng. Pat. 5603, March 7, 1904.

In order to manufacture ammonium carbonate free from oil, the sublimers, condensers, and other vessels are formed of aluminium, or have those parts which come into contact with the ammonium carbonate formed of aluminium.—E. S.

*Substances [Peroxides] containing easily liberated Oxygen; Preparation of* ——. G. F. Jaubert, Paris. Eng. Pat. 1,387, Oct. 5, 1904. Under Internat. Conv., Oct. 14, 1903.

Fr. Pat. 336,062 of 1903; this J., 1904, 323.—T.F.B.

*Sodium Perborate; Manufacture of* ——. G. W. Johnson, London. From the Deutsche Gold und Silber-Scheideanstalt vorm. Rosler, Frankfurt-on-Maine, Germany. Eng. Pat. 22,004, Oct. 12, 1904.

Molecular proportions of boric acid and sodium or lithium-potassium peroxide, are mixed in cold water, and an equivalent proportion of an acid that forms an easily soluble salt (such as hydrochloric acid) is added, the temperature being kept at or below 5° C. The sodium perborate settles as a crystalline powder, which is washed with ice water, and dried.—E. S.

*Ferric Sulphate; [Electrical] Manufacture of Basic* ——. W. Garroway, Glasgow. Eng. Pat. 26,314, Dec. 2, 1903.

A ferrous sulphate solution is placed in cathode compartments provided with iron cathode plates, whence it passes to anode compartments (separated from the former by wood porous earthenware partitions), at the bottom of which a number of lead anode pipes, in which latter compartments basic ferric sulphate is formed by the action of the electric current derived from a suitable source. The product is applicable to the precipitation of sewage, and to other purposes.—E. S.

#### UNITED STATES PATENTS.

*Tin Oxide; Process of Making* ——. H. Foersterling, Perth Amboy, N.J., Assignor to The Roessler & Hasslacher Chemical Co., New York. U.S. Pat. 780,984, Jan. 31, 1905.

A molten bath of tin is maintained in a suitable furnace with its surface swept by a current of previously heated air, at a temperature above that at which the "lower coloring tin oxides" are formed, and tin is gradually added as the bath is depleted. The tin oxide is removed as it forms.—E. S.

*Aluminium and Sodium; Making the Double Sulphate of* ——. G. E. Hipp, Buffalo, N.Y. U.S. Pat. 781,341, Jan. 31, 1905.

A solution of nitre cake is treated with a small proportion of an alkali sulphide, and an "aluminous product" is added to the filtered solution, which is then again cleared, and aluminium sulphate solution is added in proportion suitable to form the double sulphate. About 0.5 per cent. of free acid is then added, and the whole is concentrated and calcined.—E. S.

*Cyanides; Process of Making* ——. J. Tcherniac, Freiburg, Germany. U.S. Pat. 781,472, Jan. 31, 1905.

Eng. Pat. 17,449 of 1903; this J., 1904, 714.—T.F.B.

*Graphite; Separating* — from Wollastonite. S. R. Krom, Plainfield, and S. V. Krom, Jersey City, N.J. U.S. Pat. 780,297, Jan. 17, 1905.

The wollastonite (calcium silicate) ore carrying graphite is crushed, and the greater part of the graphite is concentrated in the dry way. The concentrate passes by gravity into a bath of dilute sulphuric acid, which decomposes

the wollastonite with formation of calcium sulphate, from which the product is washed free. The residual mixture of graphite with insoluble silica is dried, and is then subjected to mechanical treatment for the separation of pure graphite.—E. S.

#### VIII.—GLASS, POTTERY, AND ENAMELS.

*China; Bone as a Flux in English* ——. H. W. Edwards. Trans. Engl. Ceramic Soc., 1903-4, 32-36.

The author made a series of experiments on the action of calcium phosphate in china bodies. It was found that mixtures containing pure precipitated tricalcium phosphate yielded ware quite as translucent and showing no greater fusibility or tendency to warp than that obtained with the ordinary bone mixture; also that addition of calcium fluoride to the phosphate had no effect on these properties. When mixtures containing commercial precipitated phosphate was used however, the ware completely lost its shape in firing, probably owing to the phosphate containing alkali, in consequence of deficient washing. The author considers that in the ordinary china body, about one-third (15 per cent.) of the total calcium phosphate (45 per cent.) acts as a flux, whilst the remainder by reason of its translucency and whiteness, improves the quality of the ware. The action of the phosphate as a flux is considered to be due to the formation of a calcium disilicate,  $\text{CaO} \cdot 2\text{SiO}_2$ , or of a fusible double silico-phosphate. The loss on firing is reduced, because the uncombined phosphate in excess remains infusible, and holds up the body even beyond the temperature at which the fusible constituents melt.—A. S.

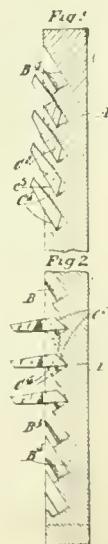
*Underglaze Pink; Colouring Agent in* ——. W. A. Lethbridge. Trans. Engl. Ceramic Soc., 1903-1904, 9-15.

The author prepared a series of "pinks" by moistening equal portions of, in one case, calcium stannate and in the other mixtures of tin dioxide and whitening with varying proportions of a solution of ammonium bichromate. The mixtures were dried, fired, cooled, and washed with hot water. It was found that all the products contained a fairly constant amount of chromium, notwithstanding the varying quantities of ammonium bichromate added. The author concludes from his results that Petrik's view that the colouring agent is chromium oxide resting on a base of tin dioxide is correct. (See this J., 1892, 748; also 1903, 28.)—A. S.

#### ENGLISH PATENT.

*Pottery Ware; Manufacture of* ——. J. H. Fleming, Tunstall. Eng. Pat. 8602, April 14, 1904.

In the stacks which support the ware in the glost oven are formed a series of preferably rectangular or approximately parallel sided pockets. Into each of these a supporting arm or pin slips in such a way (see figure) that the pins can readily assume either of two positions, viz., one a substantially horizontal position when in use supporting the ware, and the other an inclined position with the long axis of the pin practically in line with the pocket so that the articles can easily be lifted out. The pins may have their back portions bevelled to allow for the turning movement, and two bevelled shoulders are formed on each pin to assist in taking the weight of the article, and are themselves protected by the front edge of the pocket. Three stacks are preferably employed together to form a triangular "crank" in which the ware is placed.—A. G. L.



## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

*Portland Cement: Detection of Free Lime in —.* A. Baikof. XXIII., page 210.

### ENGLISH PATENTS.

*Kilns: Construction of and Method of Firing —, for use in Firing Bricks, Tiles, Pipes, and other Earthenware Goods.* N. Reid, Loughton, Staffs. Eng. Pat. 1339, Jan. 19, 1904.

UPON a suitable foundation is fixed a metallic footstep for supporting an upright shaft securely bolted, centrally, at its upper end to the underside of a horizontal iron plate, which carries a toothed metallic ring or rack underneath. Nearer to the centre of the plate, are bolted the upper ends of a number of brackets at suitable distances apart, each supporting a wheel vertically at the lower end. The wheels run on a metal plate or on rails secured to the foundation. On the upper surface of the revolving plate is erected an iron casing, within which is placed a number of fire-brick firing chambers furnished with flues. A fire-box and flue are also provided, mounted on a metal truck with wheels travelling on rails. The goods in a firing-chamber are heated by bringing this fire-box close up to the chamber and opening the sliding door.—A. G. L.

*Macadamised Roads and the like, and Solutions to be Employed therein.* J. C. Butterfield, London. Eng. Pat. 1776, Jan. 23, 1904.

THE road is watered during construction with water containing 20 to 40 per cent. of a mixture prepared as follows: crude Texas oil, or other oil of a similar nature, is heated to 180 to 190° F. in a tank, either steam-jacketed or with an internal copper coil. About 6 in. above the bottom of the vessel is placed an iron or copper coil provided with  $\frac{1}{8}$ -in. or  $\frac{1}{4}$ -in. trumpet-shaped holes on its under side, causing air blown through the coil to strike against the bottom, and then bubble upward, oxidising and agitating the oil at the same time. Heating and blowing of the oil are carried on for two or three hours to drive off some of the volatile compounds and improve its odour. A solution of asphalt or pitch, made by heating it together with oil or benzine in an autoclave, under a pressure of 40 to 50 lb. per sq. in., is then added in such quantity that the finished product shall contain 10 to 20 per cent. of asphalt, the whole being mixed by blowing for 20 or 30 minutes, after which from 15 to 25 per cent. of water is run in together with 6 per cent. of rosin oil, 4 of oleine, 4 of "soda," and 10 of sodium silicate solution of 120 Tw. (all calculated on the finished product). After further blowing for 30 minutes, 1 per cent. of ammonia (sp. gr. 0.880) is added and the blowing continued very gently for another 10 to 15 minutes. The contents of the tank are then run into coolers and when cold are ready for use.

Instead of adding the sodium silicate solution to the mixture, it may be applied directly to the road, in the form of a solution at 28 Tw. This is allowed to nearly dry and then the asphalt mixture, made as above, but without any sodium silicate, is sprinkled on the road.—A. G. L.

*Line and Sand Bricks or Blocks: Manufacture of —.* E. Stöffler, Zürich, Switzerland. Eng. Pat. 11,523, May 19, 1904.

A MIXTURE of sand and caustic lime (dry) is ground in open or closed vessels with the addition of water or steam, and the ground product made into bricks; these are then placed in drying frames, and may be steam-hardened if sufficient silicate of lime has not been formed in the preliminary process.—A. G. L.

*Bricks and other Clay Products: Hot Air Driers for Drying —.* F. Richards, Rochester, Pa., U.S.A. Eng. Pat. 26,279, Dec. 2, 1904. Under Internat. Conv., June 20, 1904.

A NUMBER of parallel tunnels is provided, each having an underlying flue extending substantially for its whole

length, and a paved floor radiating heat, composed of bricks and T-bars separating the tunnel from the flue. An arched furnace-chamber and furnace are placed under the delivery end of the tunnel, into which heated air led through ducts along the top and sides of the furnace-chamber. The flue is divided to form a central flue, a parallel return side flues, a flue provided with a damper being placed near the inlet end of the tunnel into which the side flues empty. The tunnels have floor-openings communicating with a duct connected with the stack whereby heavy moisture-laden air may be withdrawn, and they are also provided with openings in their roofs leading to a breeching connected with the stack.—A. G. L.

*Binding Material or Plastic Composition: Manufacture of —, for use in the Production of Moulded Articles or for Other [Electrical] Purposes.* L. Grote and Perry, both of London. Eng. Pat. 21,842, Oct. 1903.

A SOLUTION of chloride of lime (chlorinated lime) is treated with magnesium sulphate, and the solution of magnesium hypochlorite obtained is concentrated to about 20° to 40° B., and mixed with a vegetable gum, such as tragacanth, 10 parts of gum being used to 200 of the above liquid. The composition is allowed to stand for 12 to 24 hours, afterwards sieved and mixed with an alkali silicate, preferably a double silicate of sodium and potassium, 10 to 25 parts of the latter at 10° to 20° B. being mixed with 210 parts by weight of the composition, though for some purposes a stronger or weaker solution of the double silicate may be advantageously employed. A non-hygroscopic material, which is obtained, is used as a binding organic or inorganic pulverisable material in order to produce moulded articles, or the composition may be used as a fire-proof, water-proof, and if necessary acid-proof insulating material for electrical purposes.—B. N.

*Magnesia Cement Composition, and Process of Making same, applicable to Making Artificial Stone and the like.* E. Bittel and G. K. Nutz, West Hoboken, N.J., U.S.A. Eng. Pat., 57, March 8, 1904.

SEE U.S. Pat. 757,252 of 1904: this J., 1904, 491.—T. F.

*Cement for use in Electric Lamps and for other Purposes: Manufacture of —.* Cleminson Electric Lamp Attachment, Ltd., and W. King, Manchester. Eng. Pat. 4600, March 18, 1904.

A NITRATED cotton or cellulose, such as dinitrocellulose or collodion-cotton, is dissolved in a suitable solvent, which is added a solution in spirit of sandarac, shellac, or other gum. Mica, slate, or other inert, non-conducting powder and sulphur or calcium sulphate are then mixed with the liquid, to which aniline or other colours may also be added. Suitable proportions are 20 per cent. mica, 34 of sandarac, 45 of sulphur, and 1 of nitrated cotton.—A. G. L.

### UNITED STATES PATENTS.

[Brick] *Drier.* J. M. Rumbaugh, Wilkinsburg, Pa. U.S. Pat. 780,914, Jan. 24, 1905.

A FURNACE with a flue leading to a stack has a drying chamber situated above. By an arrangement of dampers operated from without the furnace, the heat from the furnace may be directed through the flue to the stack, or the heating may be directed through the flue to the drying chamber by radiation, or the hot gas may be taken directly through the drying chamber, which they are cut off from the flue. A separate stack is then provided to maintain sufficient draught to keep the furnace alight. From the roof of the drying chamber are hung heat retarders or deflectors, and on the bottom thereof a track for trucks carrying the bricks to be dried. The claim extends to the combination of two or more furnace flues and drying chambers into a battery.—W. H. C.

*Roadways: Method of Forming or Treating — [for the Prevention of Dust].* F. W. A. Loebell, Muenchen, Germany. U.S. Pat. 781,079, Jan. 31, 1905.

SEE Fr. Pat. 345,067 of 1904; this J., 1904, 1218.—T. F.



## X.—METALLURGY.

*and its Alloys; Effect of Liquid Air Temperatures the Mechanical and other Properties of —.* J. A. Haw and R. A. Hadfield. Roy. Soc. Proc., 1905, 326—336.

The effect of liquid air temperatures on iron and iron alloys, with certain exceptions, is to increase greatly their tensile stress, and to decrease their ductility to practically nothing. This holds good for the softest light irons, as well as for steel with from 0.10 to 1.50 per cent. of carbon. Specimens of Swedish charcoal iron immersed in liquid air, and immediately struck with a hammer, broke instantly. The hardness number of the iron, as found by the Brinell hardness ball test, varied from 90 at ordinary temperature to 266 at  $-196^{\circ}\text{C}$ . Nickel, on the other hand, shows not only increased tenacity, but also increased ductility, at low temperatures, although at ordinary temperatures the ductility of iron is greater than that of nickel. Hence the addition of nickel prevents iron from becoming brittle at low temperatures. Thus, with an alloy containing 10 per cent. of carbon, 24.30 of nickel, and 6.05 of manganese, the elongation increased from 60 at ordinary temperature to 75 per cent. at the low temperature, whilst the yield point rises from 51 to 84 tons. This result is all the more remarkable since the presence of manganese alone renders iron still more brittle at low temperatures than the case with iron free from manganese.—A. G. L.

*Ferrous [Gold] Ores and Tailings; Use of Ammonia and its Compounds in Cyaniding —.* A. Jarman and Le Gay Brereton. Inst. of Mining and Metall., v. 16, 1905.

The authors made a series of experiments mainly along the lines of Hunt's process (see this J., 1903, 95). They found that for quartzose gold ores containing cyanides, especially copper carbonate, ammonium cyanide is a more efficient solvent for the gold than potassium cyanide, but not so good as the latter in presence of a small amount of ammonia. The amount of ammonia required to protect potassium cyanide solutions from dissolving quantities of copper increases with the strength of the cyanide solution, but is not affected by the amount of copper up to 3 per cent. With more than 3 per cent. of copper, a larger amount of ammonia is necessary to obtain a good extraction of the gold. With ores containing from 1.5 to 3 per cent. of copper, and with a 0.25 per cent. solution of potassium cyanide, the best extraction is effected in presence of 0.1 per cent. of ammonia. A mixture of ammonia and potassium cyanide can be prepared which dissolves less copper carbonate than either the components alone; and the composition of this mixture is very near that of the solution which gives the best gold extraction (i.e., when using small percentages of ammonia). During the treatment, the amount of dissolved copper first rapidly rises to a maximum, but afterwards diminishes steadily, while at the same time the quantity of gold dissolved, increases.—A. S.

*White Precipitate"; Formation of the — in the Precipitating Bases of Cyanide Works.* B. Bay. J. Chem., Metall. and Mining Soc., S. Africa, 1904, 5, 8—149. (See this J., 1904, 1031, 1149.)

The author finds that if a solution of zinc cyanide in potassium cyanide be allowed to stand in contact with shavings, a white precipitate is produced if the shavings be only partly covered and thus remain exposed to the air, whilst the solution remains clear if the shavings be completely covered by it. The precipitate produced, contains zinc and cyanogen, and probably consists of a mixture of zinc cyanide and hydroxide.—A. S.

*Material [Slimes, &c.]; Preparation of — for Smelting.* T. J. Greenway. Eng. and Mining J., 1905, 1, 73.

The preparation, for smelting, of the silver-lead con-

centrate and slime resulting from the concentration of Broken Hill complex sulphide ore, the author obtained good results by a briquetting process, similar to that followed in making ordinary bricks by the semi-dry brick-pressing process. It is stated that the material is converted into hard, semi-fused lumps, and that most of the sulphur, arsenic, &c., is expelled; the cost, with labour at 25 cents per hour, and wood or coal at 4 dols. per ton, amounts to from 1 to  $1\frac{1}{2}$  dols. per ton of material.—A. S.

*Zinc Retort; Metallurgy of Sulphur Compounds in the —.* W. M. Johnson. Electrochem. and Metall. Ind., 1905, 3, 14—16.

A PROPERLY roasted ore should not contain as much as 0.1 per cent. of sulphur as zinc sulphate. The dissociation-temperature of zinc sulphate being  $739^{\circ}\text{C}$ ., and the temperature in the roasting furnaces  $200^{\circ}$ – $300^{\circ}$  higher, any notable quantity of zinc sulphate in the roasted ore implies faulty roasting. Ferrous sulphate decomposes at a still lower temperature than zinc sulphate. Lead sulphate exists in the roasted ore; but, though he has not made conclusive experiments on the point, the author is strongly of opinion that by no means all the sulphur combined with lead is present as sulphate. Lime, and under the ordinary conditions of roasting, magnesia, too, fix sulphur as sulphates. A roasted ore, too, will usually contain from 0.05 to 0.5 per cent. of sulphur as sulphides. It is uncertain with what metals this sulphur is combined, but for practical purposes it may be assumed to be present as zinc sulphide. This sulphide yields metallic zinc under the action of iron (action begins at  $1167^{\circ}\text{C}$ ., and is very rapid at the melting point of cast-iron), or of carbon ( $1300^{\circ}\text{C}$ .), though the latter reacts much less rapidly than the former. The reaction with iron produces ferrous sulphide, which is left in the retort; but the carbon bisulphide formed in the other reaction goes forward and tends to render the condensation of the zinc more difficult. Moreover, the reaction is to some extent reversed at the temperature of the condenser, and the fine carbon formed prevents the coalescence of the droplets of liquid zinc. The only disadvantage of the ferrous sulphide is that it acts somewhat rapidly on the fireclay of the retorts. The reactions of sulphates in the distillation are very complex, but in general it may be stated that all the oxygen and some of the sulphur they contain are converted into gaseous compounds, which act prejudicially on the condensation of the zinc, and also possibly cause some loss by reaction on the zinc at the lower temperature of the condenser with formation of oxide and sulphide.—J. T. D.

*Cadmium; Method of Preparing Metallic —.* C. Goldschmidt. Chem.-Zeit., 1905, 29, 79.

ALUMINIUM possesses the property of quantitatively precipitating the cadmium from solutions of soluble cadmium salts in presence of a trace of chromium nitrate.—T. F. B.

*Copper, Tin, Antimony and Lead; Separation and Determination of —.* Application to the Determination of Antimony in Bronzes. M. Dinan. XXIII., page 211.

*Phosphorus in Bronzes; Determination of —.* M. Dinan. XXIII., page 211.

*Rhodium and Palladium; Comparative Absorption of Hydrogen by —.* L. Quennessen. XXIV., page 213.

### ENGLISH PATENTS.

*Nickel Steel; Manufacture of —.* A. de Dion and G. Bouton, Puteaux, France. Eng. Pat. 24,175, Nov. 8, 1904. Under Internat. Conv., June 17, 1904.

SEE Fr. Pat. 344,095 of 1904; this J., 1904, 1095.—T.F.B.

*Silicated Ores (Simple or Complex) of Nickel; Treating —.* M. Malzac, Paris. Eng. Pat. 1556, Jan. 21, 1904.

NICKEL ores, and especially such as those of New Caledonia or of Silesia, are digested with sulphuric acid (or other strong acid) and the mass is lixiviated, in some cases

with addition of ammonia to the washing water. The filtered solution is heated with lime, the ammonia expelled is recovered, and the product, freed from the precipitated calcium sulphate, &c., by filtration, is electrolysed, preferably with addition of ammonia to facilitate the cohesion of the metals deposited.—E. S.

*Gold or other Metal-Bearing Solutions; Precipitating Boxes for —.* R. Kanicke, London, Eng. Pat. 7658, March 31, 1904.

THE precipitating boxes charged with zinc or other metal shavings are formed of a number of separate units, or in pairs, mounted on wheeled trucks. These units are provided with suitable lips, so that the metal-bearing solution may flow from one unit to the next throughout the series. The units are interchangeable in position. To prevent tampering with the slime on the bottoms of the boxes, the frames and screens are locked in position, but the tops of the boxes are open.—E. S.

*Metallic Materials; Vibrating Trough for Concentrating Fully Divided —.* E. J. Swyny and S. G. Plucknett, Sydney, Australia. Eng. Pat. 19,141, Sept. 5, 1904.

THE vibrating trough or tank is divided into a series of connected channels in which the material, mixed with water, flows in a direction transverse to that of the vibratory motion and is agitated in a direction transverse to that of the flow. The first run or channel is supplied from a hopper chamber having inclined faces. Each channel is provided with a baffle plate at the end where it communicates with the adjacent one, and the mixture of water and mineral flowing over the baffles is met by a water-spray from a perforated pipe.—E. S.

*Slimes, Tailings, and like Metalliferous Materials; Extraction of Normally Buoyant Mineral Particles from —.* E. J. Swyny and S. G. Plucknett, Sydney, N.S.W. Eng. Pat. 19,142, Sept. 5, 1904.

THE process is intended specially for the extraction of the valuable sulphides and mineral particles from the waste slimes and tailings which have accumulated at Broken Hill, N.S.W. The material is thoroughly "pugged" and then transferred to a shaking screen which separates the larger particles, stones, &c. The finer material is conveyed together with water to an ore-classifier, such as is described in Eng. Pat. 19,140 of 1904 (this J., 1904, 1150), where it is separated into two grades, each of which passes to a separate concentrator of the type described in Eng. Pat. 19,141 of 1904 (see preceding abstract).—A. S.

*Sulphide Ores; Reduction of —, and Recovery of [Precious and other] Metals therefrom.* H. R. Angel, Ealing. Eng. Pat. 24,136, Nov. 8, 1904.

THIS is an improvement on Eng. Pat. 1034 of 1897 (this J., 1898, 159), and consists mainly in the use of sodium sulphate combined with carbonaceous matter for the reduction of a mixture of raw and roasted sulphide ores containing lead. When the charge is at a red-heat, zinc oxide is added, which reacts so as to form "caustic soda," "and the latter attacks the lead present in the raw ore, and this in turn will take up the lead from the roasted ore," and both will be precipitated, carrying down the precious metals. With wholly calcined ores, the use of zinc oxide may be dispensed with. (See also Eng. Pats. 861 of 1895; 9409 of 1897; and 14,523 of 1898; this J., 1896, 119; 1898, 461; and 1899, 769.)—E. S.

*Furnaces for Roasting and Smelting and Analogous Uses.* U. Wedge, Ardmore, Pa., U.S.A. Eng. Pat. 27,073, Dec. 12, 1904.

SEE U.S. Pat. 777,577 of 1904; this J., 1905, 93.—T.F.B.

#### UNITED STATES PATENTS.

*Metal-Leaching Process.* T. B. Joseph, San Francisco, Cal. U.S. Pat. 780,293, Jan. 17, 1905.

GOLD, silver, copper, zinc and nickel, are extracted from

their ores by leaching them with a solution containing sodium cyanide and ammonium bicarbonate, and which may also contain "bromocyanide," and calcium hydroxide with or without barium dioxide, the ores being simultaneously agitated by injection of compressed air. (Compare U.S. Pats. 718,633, 728,397, and 732,639 of 1903, and 758,367 of 1904; this J., 1903, 214, 747, and 1904, 547.)—E. S.

*Iron-Pyrites Briquette and Mode of Making same.* U. Wedge, Ardmore, Pa., U.S. Pat. 780,464, Jan. 17, 1905.

POWDERED pyrites is moistened, mixed with pyrites "smalls" or "fines" and the mass moulded into briquettes which are subjected to the action of air and heat to effect the production of sulphates from the oxidation of powdered pyrites, which sulphates act as a binding material.—E. S.

*Magnetic Ore; Method of Agglomerating —.* E. G. Chevy Chase, Md., Assignor to T. J. Mayer, Washington, D.C. U.S. Pat. 780,716, Jan. 24, 1905.

THE ore is fed from hoppers down two oppositely inclined channels, so mounted on metal supports serving as electrodes to a source of electricity, that the two streams of ore falling from the lower ends of the channels meet, an arc being thus established between the streams, whereby the particles are fused into small lumps varying in size from that of a wheat grain to that of a bean. The fused lumps fall into an inclined cylinder upon an accumulation of previously fused and partly cooled particles with which further agglomeration takes place before discharge.—E. S.

*Roasting Furnace.* A. R. Mayer, Assignor to The Union Zinc and Chemical Co., both of Kansas City, Mo. U.S. Pat. 780,115, Jan. 17, 1905.

THE furnace has a number of superposed hearths, all of which hollow stirrer arms extend from a central vertical shaft or pipe. Water is supplied at the top and is directed by means of conduits along the inner face of shaft, in which it is discharged through a series of perforated gutters placed at intervals within it. There are plates to close the communication between the arms and shaft, and inlet and outlet pipes extend through packing boxes in such plates. The hollow arms are detachably fitted to hollow bosses on the shaft. There are air inlets at the bottom, and air outlets at the top of the shaft. A tank is placed outside, which receives the flow of water passing down the shaft and circulating in the stirrer arms.—E. S.

*Furnace for Roasting Ores, &c. —.* W. W. Toole, Iowa, Kans. U.S. Pat. 780,387, Jan. 17, 1905.

THE claim is for a kiln for roasting ores, &c., with which a furnace is combined, and travelling mechanism arranged adjacent to the kiln, by which bars to which rakes are attached, are set in motion and operated. The rake bars are protected from excessive heat by shields which encircle them as they enter the furnace.—E. S.

*Alloys [Aluminium-Zinc]; Manufacture of Metallic —.* T. Prescott, Huddersfield. U.S. Pat. 781,300, Jan. 1905.

SEE Eng. Pat. 5683 of 1903; this J., 1904, 443.—T.F.B.

#### FRENCH PATENT.

*Lead (or Lead and Copper) Ores; Methods of Desulphurising and Smelting —.* Soc. Anon. d. Mines Borromettes, and A. Lotti. Fr. Pat. 346,527, Sept. 1904.

THE crushed ore is added in suitable proportion to slag, as the latter flows from the furnace, and is agitated therewith, whereby the heat of the slag is utilised and sulphur of the ore is partly expelled and partly oxidised to sulphur dioxide and trioxide. In some cases it is preferred that pyritic ore should undergo a prior partial roasting. The product of the described process is a spoy



containing lead, partly as metal, and partly as oxide and as sulphate, in a suitable condition for sublimation and smelting.—E. S.

## **XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.**

### **(A.)—ELECTRO-CHEMISTRY.**

*Potassium Hydroxide Solutions and Solid Caustic Potash: Methods of Carbonate in Electrolytic* —. F. Winteler. *Chim. Ind.*, page 195.

*Zinc, Electrolytic: Utilisation of* —. O. Nagel. *Chim. Ind.*, page 195.

*Iron Materials: Scouring of Milled* — by the aid of Electricity (Baudouin's Process). E. Justin-Mueller. *Chim. Ind.*, page 193.

### **ENGLISH PATENTS.**

*Insulating Material or Plastic Composition for use in the production of Moulded Articles or for other [Electrical] purposes: Manufacture of* —. L. Grote and E. G. G. Eng. Pat. 21,842, Oct. 10, 1903. IX., page 198.

*Painting Compositions: Electric* —. The British Electric Co., Ltd., London. From Gen. Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 22, March 16, 1904.

*Material made for an insulating compound consisting of an material such as ground slate (say 67 parts), a fibrous substance such as asbestos (10 parts), and a resinous composition (23 parts) containing kauri, copal, gilsonite or rosin.*—A. S.

*Electric Sulphate; [Electrical] Manufacture of Basic* —. Garroway. Eng. Pat. 26,314, Dec. 2, 1903. VII., page 197.

*Systems: Impts. in, and Apparatus for, Producing Reactions in* —, by means of Electricity. J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 5688, March 8, 1904.

This invention comprises a process of producing reactions, such as the combination of nitrogen and oxygen, subjecting the gases to the action of an electric arc or in the magnetic field of an inductive resistance or in a coil, or inductive resistances or choking coils, being excited by, and regulating, an alternating current or currents of electricity feeding the arc or arcs. Several methods of constructing the apparatus are shown, such as a single-phase, two-phase and three-phase dynamo employed, also a single-phase dynamo with an auxiliary magnet and an arrangement of two three-phase dynamos supplied by one furnace.—B. N.

### **(B.)—ELECTRO-METALLURGY.**

*Platinum; Electrolytic Solution of* —. R. Ruer. *Z. Elektrochem.*, 1905, 11, 10–12.

The author raises objections to the application by Brochet and Petit of their explanation of the solubility of platinum in the influence of alternating currents to the case of sulphuric acid containing an oxidising agent is the electrolyte. Brochet and Petit have studied the solubility of platinum solutions (this J., 1904, 1222; 1905, 33) which, however, give anomalous results. The author describes further experiments in confirmation of his view, that the solubility is favoured by the oxidising agent so weakening

the cathodic impulse, that the alternating current becomes unsymmetrical, and the anodic action, which is really answerable for the solution, is able to manifest itself. By using a solution of sulphuric acid containing a reducing agent, and alternately connecting a platinum electrode with the positive terminal of a source of current and allowing it to remain disconnected, he proves that the anodic action is alone necessary for the solution of the metal.—R. S. H.

*Zinc Coatings: Properties of* —. C. F. Burgess. *Electroch. and Metall. Ind.*, 1905, 3, 17–22.

The copper sulphate test for galvanised iron was found to be of little value in comparing hot galvanised and electrolytically galvanised plates; a corroding agent much more nearly imitating the conditions of actual practice was found in 2N/3 sulphuric acid. In resistance to this agent, electrolytic zinc is far superior to the metal applied in the molten condition, an electrolytic coating of 12 grms. per sq. ft. being as good as the ordinary galvanised coating of 28 grms. per sq. ft. An electrolytic coating of the latter weight is extremely durable. The electrolytic process is somewhat slow, and cannot be hurried without injuring the character of the coating; the best results are got with a current density of 14.4 amperes per sq. ft. The coating, too, cannot be deposited more heavily than about 30 grms. per sq. ft., or the outer layers become rough and crystalline. The area and distribution of the anode surface were found to have some influence on the deposit. Even distribution of current over corrugated and other irregular surfaces, and avoidance of thickness and roughness at the edges, are difficult to attain. The best results are got in solutions as nearly neutral as possible; free acid both decreases the current efficiency, and lowers the quality of the zinc as a protection. Tests of the strength of adherence of the coating to the iron have shown that the two metals are chemically separate, and that neither in the electrolytic nor in the hot galvanising process does any alloying occur.—J. T. D.

*Muntz's Metal: Mass Analysis of* — by Electrolysis, and some Notes on the Electrolytic Properties of this Alloy. J. G. A. Rhodin. XXIII., page 211.

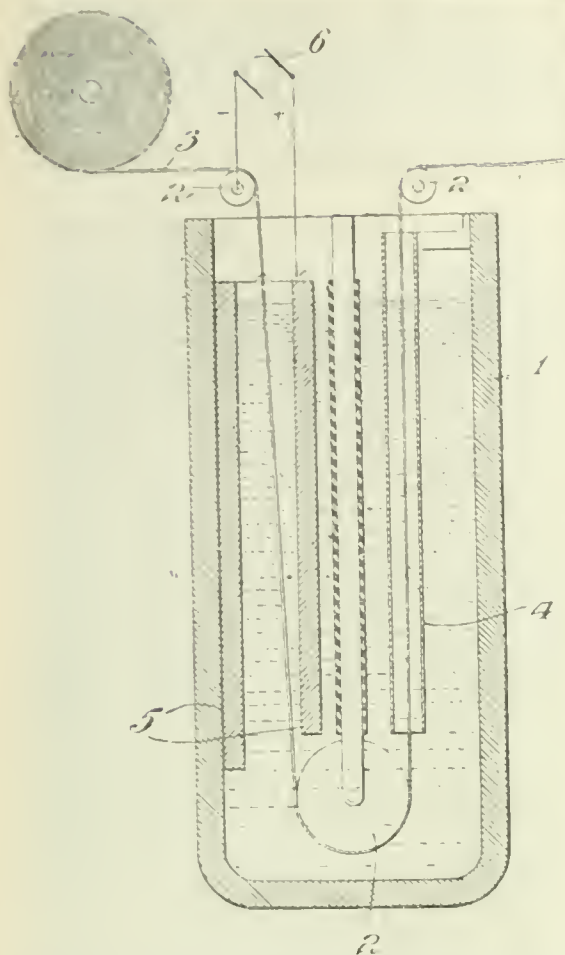
### **ENGLISH PATENTS.**

*Metals of the Alkali Group: Production of* —, by Electrolysis. E. A. Ashcroft, London. Eng. Pat., 7056, Mar. 23, 1904.

This invention comprises the process of producing an alkali metal, and consists in electrolysis a fused salt other than the chloride, such as the nitrate, sulphide, sulphate or hyposulphite, in an electrolytic cell over a cathode of fused lead which forms a fusible alloy with the alkali metal. The fused alloy is removed to a second electrolytic cell, where it is used as the anode with an electrolyte, such as sodium hydroxide or the like, which yields only the alkali metal at the cathode, the electrolyte not being consumed. Instead of using two separate cells, a combined two compartment cell may be employed with an intermediate electrode of fused lead.—B. N.

*Metallic Surfaces: [Electrolytic] Method and Apparatus for Cleaning* —. B. J. B. Mills, London. From T. A. Edison, Llewellyn Park, Orange, N.J. Eng. Pat. 26,947, Dec. 10, 1904.

The specification relates to a method of preparing metallic surfaces for the deposition upon them of a permanent metallic coating. The article to be cleaned is constituted the cathode in an electrolytic bath, an unattainable anode, as of carbon being used. Hydrogen is generated on the articles and mechanically carries off foreign matters therefrom, leaving a clean surface. The apparatus, as applied in cleaning long endless strips of thin sheet iron, intended to be nickel-plated for use in the construction of Edison's storage batteries, is shown in the figure in which the iron strip 3 passes over the insulated rollers 2–2, and leaves the solution through the tube 4 of glass



or hard rubber. 5 is the anode, which is preferably of graphite, with a 10 per cent. solution of potassium cyanide as the electrolyte.—E. S.

*Nickel Plating; Continuous Apparatus for* —. B. J. Mills, London. From T. A. Edison, Orange, U.S.A. Eng. Pat. 26,949, Dec. 10, 1904.

SEE U.S. Pat. 765,371 of 1904; this J., 1904, 828.—T. F. B.

#### UNITED STATES PATENTS.

*Metals; Process of Separating —, from their Ores [Electrically].* J. M. A. Gérard, Assignor to Syndicat de l'Acier Gérard, Paris. U.S. Pat. 780,651, Jan. 24, 1905.

SEE Eng. Pat. 26,470 of 1901; this J., 1903, 149.—T. F. B.

*Magnetic Separator for Ores or similar Materials.* J. T. Dawes, Liverpool. U.S. Pat. 780,870, Jan. 24, 1905.

SEE Eng. Pat. 27,298 of 1903; this J., 1905, 96.—T. F. B.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*Calophyllum Inophyllum Seed Oil.* G. Fendler, Apoth. Z. 1905, 20, 6; Chem.-Zeit., 1905, 29 [Rep.], 15.

THE fruit examined was round, yellowish-brown to dark grey in colour, and 2.5 to 4 cm. in diameter. The seeds were yellowish white and soft, and contained from 50 to 55 per cent. of a greenish-yellow oil of bitter pungent

taste, which was soluble in all proportions in the usual solvents for oils, but was insoluble in absolute alcohol. It gave the following values:—Sp. gr. at 15° C., 0.91; Reichert-Meißl value, 0.13; acid value, 28.45; saponification value, 196; and iodine value, 92.8. By treatment with a solution of sodium hydroxide the oil yielded greenish resin of semi-liquid consistency, and soluble in alcohol. The fatty acids consisted, in the main, of palmitic, oleic and stearic acids. It is stated that the oil could be used in the manufacture of soap.—C. M.

*Fats; Investigation of Insolated and Rancid* —. Winckel. Z. Untersuch. Nahr. u. Genussm., 1904, 90—96.

EXPERIMENTS described in detail have led the author to the following conclusions:—The changes that take place in sunlight differ from those that take place in the dark (without development of rancidity), both processes of decomposition being due to chemical changes. In the case of fats become rancid, however, micro-organisms play a part in the process. The appearance of substances that give Kreis's reaction (violet colour with phloroglucin and hydrochloric acid) does not coincide with the development of rancidity in the fat. For instance, butter exposed to sunlight for an hour gave a faint reaction in this test without having the slightest odour or taste of rancidity. On the other hand, butter that had been strongly rancid in the dark gave no reaction, but did so after exposure to sunlight. The chemical changes in the decomposition of butter are of a different nature to those that occur in other fats. Rancidity in fats is best detected by means of the senses, since the reactions recommended for the detection of decomposition are not reliable in the case of butter and are too sensitive with other fats. The acid is the principal constituent taking part in the decomposition, and its decomposition products are the cause of the above-mentioned reactions. (See this J., 1903, 359, 610; 1900, 356; 1903, 575; 1904, 988).—C. M.

*Cottonseed Oil; Investigation of Halphen's Reaction* —. K. Fischer and H. Peyan. Z. Untersuch. Nahr. u. Genussm., 1905, 9, 81—90.

IT has been shown by previous observers (this J., 1904, 611, 711, 865; 1900, 73) that the coloration given by Halphen's reaction is considerably weakened by heating the oil to 200° C. and that the active substance is destroyed at 250° C., though the oil is then so altered as to be unfit for food. In the authors' experiments no weakening of the reaction was produced by treating the oil with reducing agents, such as zinc and sulphuric acid, or by treatment of the oil with chlorine or with sulphuric acid rendered it completely inactive, though as treated with chlorine could not be made fit for food again. The treatment with sulphurous acid followed by thorough washing with alcohol yielded inactive products that could not be distinguished from normal cottonseed oil. The authors' general conclusion is that it is possible to treat cottonseed oil so that it gives no reaction in either Halphen's or Beechi's test, and that phytosterol is the only reliable means of detecting the addition of small quantities of such oil to lard.—C. M.

*Oils; Influence of Moisture on the Oxygen-absorption* of —. H. W. Lippert. Z. angew. Chem., 1905, 18, 94—95.

IN continuation of his former experiments (this J., 1904, 358, and 1903, 562) on the absorption of oxygen by oils the author has experimented with oils to which no preservatives had been added, using for this purpose: (1) fresh linseed oil; (2) very old linseed oil; and (3) hempseed oil, about 4 years old. Each of the oils was found to dry up more rapidly in absolutely dry air than in moist air. However, even traces of manganese are present, and this reverse is the case. The drying of a varnish, therefore, depends not only upon the method of manufacture and quality of materials used, but upon the conditions of the atmosphere. Chemical analysis is therefore insufficient for judging of the quality of a sample, unless supplemented by drying tests such as those suggested by the author.—H. B.



### XIII.—PIGMENTS, PAINTS ; RESINS, VARNISHES ; INDIA-RUBBER, Etc.

#### (A.)—PIGMENTS ; PAINTS.

##### ENGLISH PATENT.

from Sulphur [Sulphide] Dye-stuffs ; Manufacture of Colour —. C. D. Abel, London. From Act. of Anilinfabr., Berlin. Eng. Pat. 6217, March 14, 1904.

Fr. Pat. 341,246 of 1904 ; this J., 1904, 873. —T.F.B.

#### (B.)—RESINS ; VARNISHES.

Study of some African —. C. Coffignier. Bull. Soc. Chim., 1905, 33, 169—176

author has examined three specimens of African resins known commercially as Kissel (*Gomme caillou*), Kimerin (Cameroon), and Accra, adopting the same methods as in previous researches (this J., 1903, 808).

	Kissel.	Kamerun (Cameroon).	Accra.
at 27° C. ....	1.066	1.052	1.033
ing point .....	110°C	150°C.	120°C.
value .....	70.4	159.7	97.8
hydration value .	117.8	70.0	140.0

solubility of the resins in various solvents was determined.

though the resins are practically completely soluble in oil and amyl acetate, these solutions are not true varnishes. The Cameroon copal is the only one of the three from which satisfactory varnishes can be manufactured.—M. J. S.

#### (C.)—INDIA-RUBBER, &c.

Dinitro-Caoutchouc, Weber's —. C. Harries. Ber., 1905, 38, 87—90.

author has studied the action of nitrogen peroxide on caoutchouc, but has not been able to obtain a product of the composition of Weber's so-called dinitro-compound nitrosate,  $C_{10}H_{18}(NO_2)_2$  (see this J., 1903, 47, 1211). The composition of the product corresponds much better to that of the author's "nitrosite c" ( $C_{10}H_{15}N_3O_7$ )<sub>2</sub>, obtained by the action of nitrous acid on caoutchouc (this J., 1901, 1123 ; 1902, 1404 ; 1903, 103, 875). The results of the action of nitrogen peroxide and of nitrous acid on caoutchouc are quite similar, the product of the reaction becoming more soluble in ethyl acetate and in benzene, and also more stable as the action of the reagent is prolonged ; but with nitrogen peroxide it is much more difficult to obtain the final product of constant composition than with nitrous acid. These results show that Weber's "dinitro" method for the determination of caoutchouc (this J., 1903, 1211) may lead to incorrect results.—A. S.

Caoutchouc ; Nitrosites of —, and their Application in the Analysis of Raw Rubber and Rubber Goods. P. Alexander. Ber., 1905, 38, 181—184.

author has obtained satisfactory results in the determination of caoutchouc in vulcanised rubber goods by Weber's method (this J., 1903, 1211), but on preparing the so-called dinitro compound from numerous specimens of raw rubber, it was found that not in a single case did the composition of the product agree even approximately with Weber's formula,  $C_{10}H_{16}N_2O_4$ . In general the products corresponded more closely to Harries' "nitrosite c" ( $C_{10}H_{15}N_3O_7$ )<sub>2</sub> (this J., 1902, 1404 ; 1903, 103, 875), which contained more carbon and less nitrogen than this. The author concludes that the product obtained from raw rubber by Weber's method consists chiefly of Harries' "nitrosite c," mixed with varying quantities of oxidation products formed by the action of the oxygen, which is reduced along with nitrogen peroxide by the decomposition of lead nitrate.—A. S.

##### ENGLISH PATENT.

Caoutchouc [from Guayule] ; Production of —. M. Marx, Heidelberg, Germany. Eng. Pat. 28,051, Dec. 21, 1904. Under Internat. Conv., Sept. 21, 1904.

The Mexican plant known as guayule is finely divided and heated with an alkaline solution, e.g., a 6 per cent. solution of caustic soda. After cooling, the caoutchouc is skimmed from the surface of the liquid and washed.—A. S.

##### FRENCH PATENT.

Cork Substitute [from India Rubber] and Process of Manufacturing the same. F. H. Brooks. Fr. Pat. 346,662, Sept. 28, 1904.

SEE U.S. Pat. 774,645 of 1904 ; this J., 1904, 1154.—T. F. B.

### XIV.—TANNING, LEATHER, GLUE, SIZE.

Skin Structure ; Microscopic Study of —. H. Boulanger. Bull. Soc. d'Encouragement, 1905, 107, 51—54.

By using reflected light photo-micrographs of sections of tanned skin can be prepared, showing the fibres in their natural position. In the preparation of the sections, the leather is first washed in two or three changes of water, until the greater portion of the excess of tannin has been removed. The water is removed from the leather by treatment with successive portions of alcohol, and the dehydration is completed by means of absolute alcohol. The leather is then steeped in xylene for 8 hours, and afterwards embedded in a mixture of paraffin wax and tallow ; finally the section is cut, and is freed from fat by means of xylene or carbon bisulphide.

Photomicrographs prepared from sections of different parts of a hide tanned with oak bark, show that the fibres are larger and less entangled in the flanks and neck, and smaller and more compact in the butt.

The reason for the characteristic differences between leather tanned with vegetable materials and chrome-tanned leather is clearly seen by microscopic examination. The fibres of a chrome-tanned leather appear contracted and clean ; the spaces between the fibres are not filled up. These differences afford an explanation of the soft, pliable nature of chrome leather, its tendency to stretch and great strength as compared with the vegetable-tanned product.—M. C. L.

##### ENGLISH PATENTS.

Tanning Extracts ; Preparation and Use of —. E. E. M. Payne, Aylesbury. Eng. Pat. 22,156, Oct. 14, 1903. SEE Fr. Pat. 346,406 of 1904 ; this J., 1905, 143.—T.F.B.

Glue and Gelatin ; Manufacture of —. O. Schneider, Nürnberg, Germany. Eng. Pat. 1477, Jan. 20, 1904. SEE Fr. Pat. 333,277 of 1903 ; this J., 1903, 1300.—T.F.B.

### XV.—MANURES, Etc.

##### ENGLISH PATENTS.

Fertilisers ; Manufacture of —. J. Crone, D. C. Taylor and F. Williams, all of St. Helens, Lancashire. Eng. Pat. 6101, March 12, 1904.

Shoddy, hair, hide scrap, or the like, are saturated in vats with dilute sulphuric acid, and the mixture is removed and subjected to pressure in perforated vessels having movable tops, whereby a portion of the dilute acid is removed. The material is then heated to about 250° F. in a revolving furnace heated externally, and provided with suction means for drawing off the vapour, until it is "reduced" by the concentrated acid, and the mass is finally ground or granulated.—E. S.

Manure or Fertilisers ; Manufacture of Artificial —. J. Hammerschlag, Strassburg, Germany. Eng. Pat. 13,664, June 16, 1904.

SEE Fr. Pat. 340,449 of 1904 ; this J., 1904, 831.—T.F.B.

## XVI.—SUGAR, STARCH, GUM, Etc.

*Sugar Cane; Cause of Yellow Gum Disease of the —.*  
E. F. Smith. Centralt. Bakteriolog., 1904, 13, 729.  
Chem.-Zet. 1905, 29 Rep., 18.

In 1893 Cobb gave a description of the so-called gum disease of the Australian sugar cane, and concluded that it was due to a species of bacterium, *B. saccharum*, which he discovered in the yellow gum within the vascular fibres, but his attempts to infect healthy plants were inconclusive. These bacteria were also described by Greig-Smith, and the author was able to grow them in pure cultivations without difficulty, and succeeded in inoculating healthy common green sugar canes with the cultures, so as to produce all the symptoms of the Australian gum disease, and then preparing pure cultivations again from the characteristic gum in the cane. He designates the micro-organism *Pseudomonas vascularum* (Cobb). Two other varieties of sugar cane—Louisiana, No. 74, and the common purple cane, offered much greater resistance to infection, and culture media prepared from them were unsuitable for the growth of the *Pseudomonas*. The author attributed the greater suitability of the juice of the common green cane for the purpose to its smaller acidity. In practice Cobb's advice to plant varieties of sugar cane offering greater resistance to the disease has already given good results in the sugar plantations.

—C. A. M.

*Cane-Sugar; Influence of Metals on the Hydrolysis of —.*  
R. Vondráček. XXIV., page 213.

*Methyl-Pentosans in Presence of Pentosans; Determination of —.*  
W. B. Ellett and B. Tollens. XXIII., page 212.

*Starch; Saccharification of —.*  
J. Moreau. XVII., below.

*Starch and Malt Grist; Heat Evolved on Wetting —.*  
J. T. Hoffmann and M. Philippe. XVII., next col.

## UNITED STATES PATENT.

*Evaporating Apparatus [for Sugar Solutions, &c.]*  
F. Meyer, London. U.S. Pat. 780,612, Jan. 24, 1905.

See Eng. Pat. 19,962 of 1903; this J., 1903, 1301.—T.F.B.

## XVII.—BREWING, WINES, SPIRITS, Etc.

*Starch, Saccharification of —.*  
J. Moreau. Ann. Soc. Roy. med. et nat. de Bruxelles, 64; through Woch. f. Bran. 1905, 22, 37—39, 49—52, 72—75.

The author has improved and applied the method proposed by Bülow for the separation of the various conversion products of starch by precipitation by baryta water in aqueous and dilute alcoholic media. He determined the lower and upper limits of precipitation of the various products when the proportions of barium hydroxide were varied, under standard conditions, the quantity of starch products and total volume being constant. In one series the precipitations were made in presence of water only, and in another series in presence of 10 per cent. of alcohol by volume. The progress and nature of the precipitations were determined from the iodine reactions of the filtrates. The results showed that amylopectin and erythropectin were precipitated in aqueous solutions, whilst achroopectin and sugars were only precipitated in presence of alcohol, the limits of precipitation being sufficiently far apart to enable a complete separation of the different constituents to be effected by repeated fractional precipitation by barium hydroxide. When the products of the transformation of starch by malt-diastase, ptyalin, pancreas, blood-serum and mineral acids were subjected to fractional precipitation by the above method, it was found that in all cases, even in the very earliest stages of the reaction, all three forms of dextrins as well as sugar were present in the products. This observation affords a confirmation of Mittelschäfer's theory of starch-conversion, namely,

that the starch molecule is immediately hydrolysed by all these products under the strain induced by the hydrolytic agent, although it is possible that the subsequent hydrolysis of the dextrins first formed may take place in successive stages.

The author describes in detail the process by which prepared erythropectin and amylopectin in the paste state, by repeated precipitation with baryta, starting from the dextrin of commerce. These two dextrins were finally obtained absolutely devoid of cupric reducing power, although the achroopectin obstinately retained reducing sugar through many successive precipitations. The author, therefore, concludes that sugar, although it is intimately associated with dextrins, does not form an integral part of the dextrin molecule.—J. F. B.

*Starch and Malt Grist; Heat Evolved on Wetting —.*  
J. F. Hoffmann and M. Philippe. Woch. f. Bran. 1905, 22, 71—72.

EMSLÄNDER and Freundlich, in discussing the behaviour of solid surfaces when brought in contact with water, stated that when malt grist is mixed with water, the evolution of heat on hydration is such that the temperature of the mixture is the same whether the temperature of the water employed be 0° C. or 7°—9° C. The present authors attribute the evolution of heat to the production of enormous pressures by the penetration of the water into the capillary orifices of the granules. Capillary attraction is diminished when the temperature is increased, but the following experiments show that a decrease in capillarity with increased temperature is sufficient to make the temperature of the mixture independent of the initial temperature of the water. In series, 200 grms. of dried starch, containing 4.8 per cent. of moisture, were mixed with 200 c.c. of water at temperatures increasing from 0° to 30° C. at intervals of 10° C., the temperature of the starch being constant at 15° C. The temperatures of the mixtures obtained showed differences of 4.5°—5.5° C. for every increment of 10° C. in the temperature of the water. A similar series of tests made with air-dry starch containing 14 per cent. of moisture, showed differences of about 6.5° in the temperatures of the mixtures for every 10° increment in the temperature of the water. The starch being more absorbent than the moist starch evolved more heat than the latter, but since the capillary phenomena predominate more strongly in the dry starch, they are more strongly affected by increase of temperature, and the differences between the temperatures of the mixtures for an increase of 10° C. in the temperature of the water are consequently less. Other experiments were made with malt with varying proportions of water and varying proportions, but the mixture never showed the same temperature.—J. F. B.

*Lactase, the Enzyme which causes the Formation of Lactic Acid in Plant Cells.*  
J. Stoklasa. Ber. Dtsch. Bot. Ges., 1904, 22, 460—466. Chem. Centr., 1905, 1, 265.

In studying anaerobic respiration the author observed that more sugar was decomposed than corresponded to the amount of alcohol and carbon dioxide produced, that after protracted fermentation the acidity of the solution had increased; and that this acidity corresponded to the amount of lactic acid present. Further experiments showed that in the anaerobic respiration of sugar beets and other plants, under aseptic conditions, a certain amount of lactic acid is produced besides the chief products, alcohol and carbon dioxide. The enzyme which causes this formation of lactic acid was isolated in the crude condition. In solutions of dextrin containing 1—2 per cent. of toluene, it causes vigorous alcoholic fermentation and formation of lactic acid. The fermentation continues for more than 24 hours, hydrogen is evolved. The alcohol produced is oxidized by special enzymes to acetic acid. Formic acid is also formed, from which, by the separation of carbon dioxide, hydrogen is produced. This nascent hydrogen probably plays an important part in the assimilation of carbon dioxide in the cells containing chlorophyll.—A. S.



*Mors; Respiration and Alcoholic Fermentation of* ——. Kostytschew. Centr.-Bl. f. Bakter. u. Parasitenk., 04, 13, 490—503, 577—589. Chem. Centr., 1905, 390.

The rule that true alcoholic fermentation can be recognised by the high value of the ratio  $\frac{\text{CO}_2}{\text{O}_2}$ , even with aeration, is true according to the author's results, not only of yeasts, but also of other micro-organisms, the mucors. The production of a large quantity of carbon dioxide by an organism when oxygen is excluded, however not a proof of alcoholic fermentation, as in the case of some organisms (e.g., *Mucor stolonifer*) carbon dioxide is produced very abundantly by intramolecular respiration. Intramolecular respiration can be distinguished from alcoholic fermentation by the fact that the former has no maximum; the amount of carbon dioxide evolved decreases uniformly with the time. In the case of all the mucors examined (*stolonifer*, *mucedo*, and *racemosus*), there was observed, after continued withdrawal of oxygen, a considerable increase in the value of the ratio  $\frac{\text{CO}_2}{\text{O}_2}$ , this increase lasting, however, but for a short time. Warming the "Zymin" to 100° C. has no influence with regard to above coefficients. The dry preparation develops as much carbon dioxide with exclusion as with admission of oxygen. Thus a sharp line of distinction can be drawn between zymin and acetone preparations of the yeast aerobes. *Mucor stolonifer* differs from the typical yeasts merely by its greater capacity of becoming accustomed to temporary anaerobic conditions; *M. racemosus* is a fermenting organism, and *M. mucedo* occupies a medium position between the oxidising and fermenting organisms.—A. S.

*As, Bottom Fermentation; Comparative Investigations Four ——. Forms of Growth on Solid Media; Giant Colonies.* H. Will. Z. ges. Brauw. 1904, 27, 1—866 and 882—883. (See also this J., 1904, 450; also 1905, 28, 71—75 and 93—97.)

The author has continued his studies on the forms of growth assumed by "giant colonies," i.e., colonies grown by sowing macroscopic quantities of cells on solid media. The present section deals with the forms of growth of the "giant colonies" developed by sowing film-cells of the second generation, as compared with those developed by cells of the fermentative sedimentary form of yeast film-cells of the first generation. The forms of the "giant colonies" during the whole period of their existence and their anatomical structure are described for sowings in cultures of various ages and varieties of yeast, on 10 per cent. wort gelatin; (b) on 10 per cent. beer-gelatin.

The author next describes the forms of growth of colonies developed from the single cell elements of which "giant colonies" grown from the various generations of yeasts are composed. Concluding with a general summary of the results of the whole investigation, the author states that the "giant colonies" on solid media and the film-formations on liquid media are equivalent and identical. This is proved by the history of the development of both forms and the physiological and morphological equivalence of the various cell elements composing both forms at various stages of their development. Both "giant colonies" on solid media and film-formations on liquids show two phases of developments, distinguished by distinct cell elements and in the case of "giant colonies" by definite forms of growth. In films, the two phases develop evenly, and are sharply defined; in both cases the cell elements characteristic of the two phases are produced similarly from different mother-cells which are equivalent both in films and "giant colonies." In spite of many similarities, the elongated, sausage-shaped cells characterising the two phases of development are morphologically and physiologically different. The forms of growth assumed by "giant colonies" developed by sowing film-cells of the first generation coincide in general with the forms assumed during the first phase of their development by the "giant colonies"

developed by sowing cells of the fermentative form. Similarly the "giant colonies" developed from film-cells of the second generation correspond, especially on beer-gelatin media, with the second phase of the development of "giant colonies" from the fermentative form. The film generations are those which constitute the characteristic forms of the "giant colonies," and in which the morphological habit of the species of yeast is expressed. The form of growth is influenced by the nature of the nutrient and the nature of the solidifying medium, but the same law of development is followed in all cases. With "giant colonies" on wort-gelatin, the first phase of development predominates, whilst the second phase is only slightly developed since the gelatin generally liquefies before it is very pronounced. On beer-gelatin, the first phase is restricted and the second phase predominates. In film-formations the various cell-elements are mixed up without regularity, but in "giant colonies" the distribution of the various cell-elements follows a definite organisation, comprising "pith" layers (chains of elongated mycelial cells), "bark" layers (roundish and oval cells rich in oil) and "root hairs" consisting of the same elements as the "pith layers."—J. F. B.

*Fermentation and Yeast Reproduction.* A. Fernbach. Ann. de la Brass., 1904, 7, 553—555.

The individual cells in pitching yeast, store up reserve material, largely glycogen, from the wort, this reserve being afterwards consumed as required. These changes cause an alteration in the total weight of the yeast, but do not influence the number of cells present, this latter factor being determined by considerations of space. Each cell requires a certain amount of room for the normal discharge of its functions, failing which it dies off, so that where an excessive quantity of pitching yeast is used, there is no corresponding increase in the yeast crop. Consequently, the practice of stimulating sluggish fermentation by increasing the quantity of the pitching yeast is erroneous, since not only is reproduction checked, but fermentation is retarded as a result of the enfeebled condition of the yeast cells, which have been forced to draw on their own store of material. Moreover, the weakened cells have a low specific gravity and retard clarification; and lacking a full store of reserve material are unsuitable for stock yeast, even if they do not entirely lose their power after a short storage. C. S.

*Beers; Reddening of Pale Bottom-fermentation — on Pasteurisation.* F. Schönfeld. Woch. f. Bran. 1905, 22, 64—67.

It is frequently observed that bottom-fermentation beers, especially the pale varieties, are darkened by the process of pasteurisation, and that in extreme cases they acquire a red colour approaching that of the Munich type of beer. The degree of darkening and the formation of the reddish tint vary greatly with different beers, and the composition of the beer is certainly the primary determining factor. The coloration is greatly exaggerated if the beer be pasteurised in open bottles. In exceptional instances pale beer may even darken perceptibly when kept in closed bottles without pasteurisation. A high proportion of carbon dioxide considerably reduces the liability to darkening. The production of the colour is probably brought about by albuminoids, e.g., by oxidising enzymes. The materials of which the bottles are composed also have an influence in inducing oxidation. Glass condenses water in the pores of its surface, and this water would contain dissolved oxygen, probably in a highly active condition capable of reacting through the medium of the oxydases. Glass also contains soluble alkalis which favour oxidation, and the darkening of the beer is especially marked in new bottles; it also frequently contains other bases which may act as oxygen carriers, such as manganese or chromium. The red colouring matter produced in the beer is probably an oxidation product of a phenolic body, perhaps tannin. Although certain bottles induce the coloration more strongly than others in beers liable to this defect, the same bottles have no perceptible influence on other beers, which are not sensitive to oxidation.—J. F. B.

*Potato Mashers [Distillery]: Regulating the Speed of Fermentation of —.* W. Christel. Z. Spiritusind., 1905, 28, 41.

POTATO mashers sometimes continue to ferment long after the time when fermentation should be finished, without, however, reaching their proper degree of attenuation. Prolongation of the time allowed for fermentation from 3 days to 4 or even 5 days, does not lead to much better results. In a case cited by the author, mashers made from potatoes with 5 per cent. of malted grain at the relatively low concentration of 19–20 Bg. were pitched at a temperature of 20° C. with pure yeast acidified by the usual lactic fermentation. After 3 days' fermentation, the mash was not ready for distillation, the density still being 1.5 Bg. with an acidity of 0.8 and carbon dioxide still coming off in considerable quantities. The presence of the gas retarded the speed of distillation and the alcohol showed a strength of only 87 per cent., as against 90–92 per cent. under normal conditions. This unsatisfactory fermentation was finally remedied by reducing the acidity of the yeast-mash, and stopping the acidification at an acidity of 1.8–2.2 instead of at 2.8–3.0. This caused a more intense primary fermentation, in consequence of which the artificial cooling of the mash in the fermentation tun must be more intense and prolonged. The results were, however, perfectly satisfactory; the mashers attenuated down to 0.5 Bg. with an acidity of 0.8–0.9, and the strength of the alcohol distilled rose again to 90–92 per cent.—J. F. B.

*Apples and Cider: Chemical Composition of —. II. Composition of Cider as Determined by Dominant Fermentation with Pure Yeasts.* W. B. Alwood, R. J. Davidson, and W. A. P. Moncure, U.S. Dept. Agric., Bureau of Chemistry, Bull. No. 88, 20–46.

APPLE juice was transferred straight from the presses into 50 gal. casks, and pitched as soon as possible with 1 pint per cask of cultures of pure yeast in vigorous condition. By this means it was easy to obtain fermentations under the dominant influence of the culture yeasts, without any previous sterilisation of the must. The yeasts employed were selected varieties from the best American and French cider and wine stocks. The fermentation and maturing in bottle were carefully studied and the finished ciders were tested by experts and by analysis. Results are tabulated for 15 samples of cider made from three different musts fermented by eight different varieties of pure yeast. They show remarkable uniformity as regards specific gravity, acidity and non-sugar extract, but the three musts were so nearly alike in their original composition that no general deductions can be drawn from this fact. On the other hand, there were striking differences in the proportions of alcohol; even in two samples prepared from the same must, with the total exhaustion of all the sugar, the proportions of alcohol produced by two different yeasts differed by as much as 1 per cent. Such differences greatly affect the other characters of the ciders, such as effervescence, aroma and flavour, which varied largely with the different yeasts. In all the samples the percentage of residual sugar was low, and in several the sugar was practically exhausted. No saccharose ever remains in a properly fermented cider, since it is readily inverted during primary fermentation. These ciders are compared with one fermented by "wild" fermentation and with several samples of commercial ciders. In these latter, fluctuations in the sugar contents from 0 to 13.56 per cent. are recorded, and in the alcohol from 0 to 6.87 per cent. This shows the extraordinarily wide limits between which the composition of this beverage is liable to vary. Many samples contained preservatives, since it is very difficult to bottle and retain more than 1.5 or 2 per cent. of sugar without either sterilisation or antiseptics.—J. F. B.

#### ENGLISH PATENT.

*Mashing and Converting Processes.* C. H. Caspar and J. P. Fitzgerald, Scranton, Pa., U.S.A. Eng. Pat. 26,554, Dec. 6, 1904.

SEE U.S. Pat. 776,999 of 1904; this J., 1905, 39.—T.F.B.

#### FRENCH PATENTS.

*Amylaceous Materials: Process of Malting and Mashing —.* J. Eflront. Fr. Pat. 346,509, Aug. 7, 1904.

GRAIN for malting is improved by treatment with a dilute solution of a resin soap, e.g., colophony or the resin of spent hops extracted by alkali. The solution may be added to the steeping waters or sprinkled on the grain in the malting floor, or before the crushing of the green malt in the case of distilleries. In certain cases the use of rosin may be supplemented by that of hypochlorite. (See also this J., 1903, 223.)—J. F. B.

*Alcohol for Heating, Lighting and Motive Purposes: Treatment of Carburetted or Non-Carburetted —.* H. Rosalt. Fr. Pat. 346,606, Sept. 27, 1904. page 191.

### XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

#### (A).—FOODS.

*Cheese: Volatile Acids in —, and Biology of Cheese Ferments.* O. Jensen. Centr.-Bl. f. Bakt. u. Pflanz. 1904, 13, 161–170, 291–306, 428–439, 552, 604–615, 687–705, 753–765. Chem. Zentr., 1905, 1, 397–398.

SOME cheeses contain volatile acids that cannot have been produced by hydrolysis of the fat contained in the cheese; these acids occur most abundantly in the interior of cheese. The morphological characters of the bacteria present in Emmenthaler cheese are described. The bacteria, with the possible exception of *Micrococcus liquefac.*, are all true lactic acid ferments. Acetic acid was detected in all the cheeses examined, as also formic acid, but frequently only in traces; both are produced by all the cheese ferments. In those cheeses the ripening of which is effected mainly by mould fungi the volatile acids present, besides those produced by hydrolysis of the cheese-fat, consist of only small quantities of acetic and formic acids. In these cases the mould fungi cause only hydrolysis, not fermentation of the fat. In all other kinds of cheese propionic acid is present frequently in considerable amounts. As the odour of a volatile fatty acid is stronger the higher the molecular weight, it follows that in most cheeses the volatile acids produced by hydrolysis of the cheese-fat, have a much greater influence on the aroma than the volatile acids formed from other constituents: capric, caprylic and caproic acids are of most importance in this respect, then valeric and butyric acids. Cheeses in which hydrolysis of the fat has been considerable, nearly always contain ammonia. Certain cheeses have characteristic aromas produced mainly by special constituents, e.g., sweetish amino-acids in Emmenthaler cheese, butyric acid esters of very sharp taste in Roquefort, certain products of putrefaction in Limburger, and the aromatic constituents of sweet-scented clover, *Melilotus coccineus*, in Schabzieger cheese.

The action of pepsin, added along with the rennet, on paracasein was examined, and it was found that the latter was strongly attacked, the action being moreover considerably increased in presence of *Bact. lactis acid.* In the case of *limburgensis*, when it acts alone on casein and paracasein, forms only primary albumoses; pepsin in presence of lactic acid ferments, forms also secondary albumoses and peptones.—A. S.

#### ENGLISH PATENTS.

*Milk and Milk-like Products; Manufacture of — [Digested] —.* J. R. Hatmaker, Paris. Eng. Pat. 3531, Feb. 12, 1904.

MILK is treated with a digestive agent such as pepsin or pancreatin, or it may be subjected to the hydrolytic action of superheated steam. The milk is then dried.



suitable quantity of cream may be added to the digested milk, and also, before or after drying, a certain amount of milk sugar, in order to make the product a substitute for human milk. Milk may be used, of which the natural proportions of the constituents have been increased or diminished. —W. P. S.

*Milk Preparation: Process for Making an easily Digestible.* — *Free from Germs.* S. Székely and E. Kovács, Buda-pesth. Eng. Pat. 25,624, Nov. 24, 1904.

IMMEDIATE milk is heated to a temperature below 67° C., and the casein precipitated by means of carbon dioxide under high pressure, in a suitable pressure vessel. The curd is then carefully run off from the spongy mass of whey (rejecting the first turbid portion), the pressure of carbon dioxide gas serving to force the whey out of the vessel. If the casein is allowed to leave the vessel, the whey will be approximately sterile. This whey is mixed with pasteurised milk or cream to form a food for infants. From 0.2 per cent. of sterilised sugar may also be added.

—W. P. S.

*Food Stuffs and the like; Method of Sterilising* — J. Preisz, Copenhagen. Eng. Pat. 22,927, Oct. 25, 1904. Under Internat. Conv., Oct. 28, 1903.

THE process is one for sterilising the foods by means of ultraviolet light rays, and is chiefly applicable to liquids, though solids in the form of threads, scales or shavings, may also be treated. In the case of liquids, these may be passed into a centrifugal apparatus where they are in the shape of a thin film on the corrugated walls of the drum. At the centre of the drum are placed one or more arc or spark lights, preferably uncovered. The treated liquid is withdrawn from the top of the drum. A stationary vessel may be employed, the liquid being sprayed on to the walls by a sprinkling arrangement or suitable spreader. The chamber may be partly filled with air, or a current of nitrogen, carbon dioxide, hydrogen, steam, &c., can be passed through it, if desired.

—W. P. S.

*Food Products containing Iron; Process for Preparing* — C. Aufberg, Wiesbaden, Germany. Eng. Pat. 27,266, Dec. 14, 1904.

A COMPOUND of iron and cane-sugar or other carbohydrate is added to the food. This compound is prepared by mixing together 555 grms. of sugar and 1900 grms. of a dissolved iron solution ("liquid iron oxychloride") of sp. gr. 1.05. To this is added 120 grms. of "soda lye" of sp. gr. 1.172. The resulting precipitate is re-dissolved by constant stirring and heating, and the solution then concentrated to a weight of 1000 grms. It contains 6.6 per cent. of metallic iron, but if completely dried, the pulverulent mass will contain 10 per cent. of iron. The preparation may be added to dough (for bread, biscuit, cake, &c.), to soup, meal, feeding meal and the like, in such quantity that the iron content of these is increased to 0.25 or even 0.1 per cent. —W. P. S.

#### FRENCH PATENT.

*Incubator; Alimentary Phosphated* — R. Combret. Fr. Pat. 346,604, Sept. 27, 1904. Under Internat. Conv., Sept. 28, 1903.

Eng. Pat. 20,885 of 1904; this J., 1905, 39.—T. F. B.

#### (B.) SANITATION; WATER PURIFICATION.

*Water Supplies; New Method of Purifying* — G. T. Moore. Amer. J. Pharm., 1904, 76, 553—564.

During the last two years copper sulphate has been extensively used by the water companies in many parts of the United States to destroy the blue-green algae (pond scum) that form on the reservoirs and impart an offensive odour and taste to the water, or, in some instances, the water in the reservoir at Winchester, N.Y., which was constructed in 1890, had become so offensive from this cause as to render its use for any purpose intolerable. Filtration and aeration effected no improvement, and eventually the addition of copper

sulphate in the proportion of 1 part to 5,000,000 was tried, with the result that after three days the odour had disappeared and the water was perfectly clear. Another similar treatment was made in 1904, but with this exception no copper has been added since the original addition in June, 1903. Similar experiments were made on water-cress beds in the Southern States, where it had been found that after the cress had been cut, a mat of algae would form in sufficient thickness to prevent to a large extent the new growth of the plants. Copper sulphate added to the water in the proportion of 1 part to 50,000,000 entirely prevented the algal growth without in any way injuring the cress, and since the first application in 1901 it has only been necessary to repeat this treatment once a year. As regards the influence of the copper on bacteria, experiments showed that the micro-organisms found in sewage were destroyed to the extent of 95 per cent. by one treatment of the water containing them.—C. A. M.

*Water; Copper Treatment of* — H. Kraemer. Amer. J. Pharm., 1904, 76, 574—581.

THE author's explanation of why minute quantities of copper sulphate, such as 1 part to 5 or 50 millions of water should be able to kill algae without injuring higher plants is that the former being unicellular, are entirely surrounded by the copper solution, and the whole of their functions simultaneously affected. It has been shown by Moore that typhoid and cholera organisms are destroyed by copper sulphate solutions (1 part in 100,000) within 3 to 4 hours. In the author's experiments with ordinary tap water, copper sulphate was used in the proportion of 1 part to 100,000, and 1 part to 1,000,000, the solutions being kept for 48 hours at the ordinary temperature. It was found that in the first case the total number of micro-organisms had been reduced by 99 per cent. and in the second case by 90 per cent. Further experiments to determine the action of metallic copper on colon and typhoid bacilli showed that both were completely destroyed within four hours at the ordinary temperature, by immersing clean copper foil in the water containing them. Colloidal copper also effected complete destruction of the micro-organisms. For household purification the author recommends the use of strips of copper about 3½ sq. in. to each quart immersed in the water for six to eight hours.—C. A. M.

#### ENGLISH PATENTS.

*Ferric Sulphate [Sewage Precipitant]; Manufacture of Basic* — W. Garroway. Eng. Pat. 26,314, Dec. 2, 1903. VII., page 197.

*Filters for Water and other Liquids*. C. E. Chamberland, Paris. Eng. Pat. 27,180, Dec. 13, 1904. Under Internat. Conv., Feb. 20, 1904.

SEE Fr. Pat. 340,587 of 1904; this J., 1904, 834.—T. F. B.

#### FRENCH PATENT.

*Water, particularly Sewage Water; Apparatus for the Biological Purification of* — C. Kremer and R. Schilling. Fr. Pat. 346,679, Sept. 29, 1904.

SEE Eng. Pat. 20,889 of 1904; this J., 1904, 1158.—T. F. B.

#### XIX.—PAPER, PASTEBOARD, Etc.

*Printing Papers; Absorbent Properties of* — P. Kleum. Wochenbl. f. Papierfab., 1905, 36, 18—19.

THE absorbent properties of paper for the oily medium of printers' ink do not correspond exactly with the absorption of aqueous inks; e.g., certain soft-sized papers absorb the oil of printers' ink no more readily than hard-sized papers. The quantity and ink-resisting power of rosin sizing have no influence on the absorbent properties of the paper towards oil, since rosin is easily wetted by oil. Gelatin hinders the absorption of the oil, as is shown in the case of coated papers, but mineral matters are favourable. The structure of the paper, as determined by the nature of the fibres and their behaviour on beating,

is also an important factor. The denser the structure the less oil-absorbent is the paper, since the fibre substance itself resists oil but not water; the absorptive powers of different papers towards oil do not vary so widely as towards water. When paper is printed, the oil-varnish medium distributes itself between the pigment and the paper, according to the relative absorptive powers of each; if the paper be too absorbent the medium may be withdrawn from the pigment to such an extent that the latter rubs off. This effect will vary according to the thickness of the oil-varnish; with very absorbent papers it may be necessary to employ a thicker varnish, or else a certain excess of varnish which will fix the pigment after the paper has absorbed as much as it is capable of. The elasticity of the paper is of greater importance than the porosity on which the absorptive power depends. It is desirable that any inequalities and pores in the sheet should be capable of being evened up by the pressure during printing; the good printing qualities of coated "art" papers are due to the uniformity of the surface, and their deficient absorptive power is of little importance. One great advantage of a highly porous paper is that the access of air is facilitated and the varnish dries more rapidly; this is of great importance than a high absorptive power. A drawback of high porosity, however, is the liability of the oil to penetrate to the back of the paper, and show the printing on the reverse side.

—J. F. B.

## UNITED STATES PATENTS.

*Cotton Plant; Method of Utilising Waste Substances of the —, and Product thereof* [Paper]. M. W. Marsden, Philadelphia. U.S. Pat. 781,612, Jan. 31, 1905.

THE stalks, stems and roots of the cotton plant are comminuted, washed, and heated under pressure with steam in a closed retort to dissolve the pectin and convert the starch into sugar, and to dissolve out the tannin and colouring matter, and to "start an initial separation"; the extractive matter is drawn off, and the stock is treated with alkali under pressure to remove the cementing or encrusting matter and to complete the separation. The residual fibrous matter, which consists of long fibres with a large proportion of short, woody fibres, is suitable for the manufacture of paper, which is specially claimed.

—T. F. B.

*Separating and Sizing Wood-Pulp; Apparatus for —*. W. Ruth, Karhula, Assignor to H. L. Orrman, Borga, Finland. U.S. Pat. 781,097, Jan. 31, 1905.

A DRUM provided with "wings," having channels inclined outwardly from the top to the bottom of the "wings," is arranged so that it can be rotated within a cylindrical sieve. The material is fed through a pipe at the top of the apparatus, which is provided with an outer casing and an inner adjustable hood.—W. H. C.

*Applying Solutions or Fluids to Travelling Webs* [Paper Manufacture]; *Method of and Apparatus for —*. R. Kron, Goltzern, Germany. U.S. Pat. 780,670, Jan. 24, 1905.

SEE Fr. Pat. 345,832 of 1904; this J., 1905, 102.—T. F. B.

*Resin Soap; Process of Emulsifying — in Water*. M. Erfurt, Straupitz, Germany. U.S. Pat. 781,506, Jan. 31, 1905.

SEE Fr. Pat. 325,901 of 1902; this J., 1903, 757.—T. F. B.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Monazite Earths*. W. Feit and K. Przibylla. Z. anorg. Chem., 1905, 43, 202–214.

A DETAILED account is given of the separation of the earths contained in monazite residues, the method being based upon the fractional crystallisation of the magnesium

double nitrates, in neutral, or very slightly alkaline solution. The volumetric determination of the atomic weight of the fractions is recommended as a speedy and convenient method of following the progress of the separations. About 0.5 gm. of the earth, which has been ignited until constant in weight, is placed in a beaker, Jena glass, along with a little water and a measured quantity of N<sub>2</sub>O sulphuric acid, and warmed until dissolved. The excess of acid is then determined by cautious titration with sodium hydroxide solution, methyl orange being used as indicator. With care, the atomic weight found should be correct within 0.3.—H. B.

*Nitro-Derivatives; Preparation of Organic —*. Matschek. Chem.-Zeit., 1905, 29, 115.

IN preparing magnesium or zinc nitrite by his process (this J., 1902, 705) the author detected an ethereal odor in the alcoholic filtrate; and on heating the alcoholic mixture of sodium nitrite and magnesium sulphate under a reflux condenser for some time, ethyl nitrite was formed. The reaction doubtless depends on the hydrolysis of the magnesium nitrite—



the nitric oxide escapes, while the peroxide at the moment of formation reacts with the alcohol to form ethyl nitrite. Many other metallic salts mixed with sodium nitrite react similarly, particularly ferric chloride; with this mixture nitro- (and in some cases also nitroso-) derivatives of phenols, and of aromatic amines and aldehydes can be prepared. Even benzene is partially converted into nitrobenzene; the process may prove to be of service industrially. Nitrosobenzene appears to be an intermediate product.—J. T. D.

*Quinine Hydrochloride, Neutral —* [Composition of the Crystallised from Alcohol]. C. Erba. J. Pharm. Chim., 1904, 20, 550.

THE author finds that neutral quinine hydrochloride as crystallised from 95 per cent. alcohol, contains 1 m. each of alcohol and of water of crystallisation, responding to the formula  $\text{C}_{20}\text{H}_{24}\text{N}_2\text{O}_2 \cdot 2\text{HCl} + \text{C}_2\text{H}_5\text{O} + \text{H}_2\text{O}$  and to the salt containing  $1\frac{1}{2}$  mols. of water of crystallisation as stated by Carette (this J., 1904, 1041).—J. O. B.

*Eucalyptus Polybractea; Essential Oil of —*. J. Umney and C. T. Bennett. Pharm. J. 1905, 74, 143.

THE oil of the Blue Mallee, *Eucalyptus polybractea* is found to have the following characters. Sp. gr. 0.929;  $\alpha_D^{20}$  = Eucalyptol content, by Scammell's process, 79 to 80 per cent. Since the oil contains no appreciable amount of aldehydic constituent, it is free from any irritating action when inhaled. It is considered to be at least equal to oil of *E. globulus* in medicinal value.—J. O. B.

*Thorium Dioxide; Precipitation of and Separation — from Cerium, Lanthanum and Didymium Oxides by means of Organic Acids*. A. Kolb and H. Ahl. XXIII., page 212.

*Methyl Alcohol in Formaldehyde; Determination of —*. R. Gnehm and F. Kauffler. XXIII., page 213.

*Cryogenin [m-Benzaminosemicarbazide]; New Color Reactions of —*. G. Péguier. XXIII., page 212.

*Opium; Valuation of —* [Determination of Morphine in —]. A. and Albert Petit. XXIII., page 211.

## ENGLISH PATENTS.

*Camphors; Manufacture of [Artificial] —*. J. Richardson, London. Eng. Pat. 5549, March 7, 1904. A SOLUTION of pinene hydrochloride, alkali hydroxide and an alkali formate or oxalate in alcohol and water heated in an autoclave for 10 hours at about 120°. As much of the alcohol as possible is then distilled off the water-bath, and the residue acidified and distilled



steam. The "borneol or isoborneol" which distils or is dissolved in benzene, and oxidised to camphor by potassium permanganate. —T. F. B.

*Glycerol from Isoborneol*; *Manufacture of* —. A. Immermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 6652, March 18, 1904.

Fr. Pat. 341,513 of 1904; this J., 1904, 881.—T. F. B.

*Alkaline Phosphates*; *Manufacture of* — [from Phosphorus]. Gross, Rastenberg, Germany. Eng. Pat. 9893, April 30, 1904.

Fr. Pat. 343,174 of 1901; this J., 1904, 1010.—T. F. B.

*Odoriferous Compounds or Perfumes*; *Manufacture of* —. E. Knoevenagel, Heidelberg, Germany. Eng. Pat. 23,578, Nov. 1, 1904. Under Internat. Conv., Nov. 10, 1903.

Compounds of the citral series, such as are obtained by condensation of citral with acetone, acetylacetone, are treated with hydrogen halogen acids, and the halogen compounds thus formed are treated with alkali to split off the halogen acid, when isomerisation takes place, odoriferous compounds being produced. For example, 2 parts of a 20 per cent. solution of hydrobromic acid in glacial acetic acid are added to one part of pseudocitral, and the mixture is allowed to stand. The citric acid is neutralised, and the hydrobromide, which separates, is decomposed by boiling with dilute sodium carbonate solution. (Compare Fr. Pat. 335,380 of 1903; this J., 1904, 204.)—T. F. B.

#### UNITED STATES PATENT.

*Morphine Compound* [Codeine Bromomethylate] and *Process of Making same*. R. Pschorr, Assignor to the Firm of J. D. Riedel, Berlin. U.S. Pat. 780,619, Jan. 24, 1905.

A alcoholic solution of 1 mol. of morphine, 1 mol. of dihydroxide and 2 mols. of methyl bromide is heated several hours at 50° to 60° C. in a closed receptacle; a crystalline paste, which separates on cooling, is extracted with alcohol, and the solution evaporated. By crystallising the residue from hot water, pure codeine-methylate,  $C_{18}H_{21}NO_3(BrCH_3)$ , is obtained, of m.p. 261° C. It is easily soluble in water, moderately soluble in warm methyl alcohol, sparingly soluble in benzene, and insoluble in ether or benzene. It yields a crystalline picrate, and gives a yellowish precipitate with mercuric chloride and a flesh-coloured precipitate with phosphomolybdic acid. It is decomposed by concentrated sulphuric acid, hydrobromic acid being evolved. —T. F. B.

#### FRENCH PATENTS.

*Urethyl Tetrachloride*; *Process of Making* —. Confortum f. Elektrochem. Ind. Ges. m. b. H. Fr. Pat. 463,62, Sept. 24, 1904.

Eng. Pat. 18,602 of 1904; this J., 1905, 150.—T. F. B.

*Thio-ureas*; *Synthetic Preparation of Cyclic* —. G. Jacquemin. Fr. Pat. 346,565, Sept. 24, 1904.

SEVENTY-THREE grms. of aniline are dissolved in 500 c.c. of 95 per cent. alcohol, and an excess of carbon bisulphide is added, together with a few grms. of caustic alkali. The mixture is boiled under a reflux condenser until sulphuretted hydrogen is no longer evolved. The reaction takes place according to the equation:  $2C_6H_5NH_2 + CS_2 = (C_6H_5NH)_2 + H_2S$ . It is a general reaction for amines of the aromatic and naphthalene series, and by employing various amines in molecular proportions the corresponding mixed thio-ureas are obtained.—J. F. B.

*Alkylbarbituric Acids*; *Process for Obtaining* —. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 346,588, Sept. 27, 1904. Under Internat. Conv., Oct. 1, 1903.

U.S. Pat. 780,421 of 1905; this J., 1905, 151.—T. F. B.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*Emulsions made with Adhesive Substances*. Lüppo-Cramer. Phot. Kor., 1905, 42, 12. Chem.-Zeit., 1905, 29, Rep., 40.

AN emulsion of mercuric iodide in gum is very much more sensitive to light than a gelatin mercuric iodide emulsion; in the former case, the mercuric iodide is obtained in the red form, in the latter, in the yellow. A gum arabic silver iodide emulsion is similarly found to be 60 to 100 times more sensitive to light than a gelatin silver iodide one. The grains of the former emulsion are very much coarser than those of the gelatin emulsion. "Ripening" at 50° C. for some hours does not diminish the difference in sensitiveness. On the other hand, a gelatin silver bromide emulsion is four or five times more sensitive to light than a gum silver bromide emulsion, but a gum silver chloride emulsion is two to three times more sensitive than a gelatin emulsion. Casein silver iodide emulsions are about  $\frac{1}{100}$ th part as sensitive as gelatin silver iodide. Mercurous iodide, when emulsified in gelatin, is 3—4 times more sensitive than when emulsified in gum. When emulsified in albumin, mercuric iodide is obtained in the yellow form; in dextrin emulsions the red modification is formed if the mercuric chloride be added first, but the yellow, if the soluble iodide be introduced before the mercuric salt. —T. F. B.

*Panchromatic Plates*; *Bathing Formula for* —. Valenta. Liesegang's Almanac. Brit. J. Phot., 1905, 52, 89.

A TREATMENT of dry plates with a solution of Ethyl Violet, Erythrosin, and monobromofluorescein is recommended for producing panchromatic plates of even sensitiveness throughout the spectrum. A mixture is made of Ethyl Violet solution (0.02 per cent.), 10 parts; Erythrosin solution (0.2 per cent.), 2 parts; monobromofluorescein solution (0.02 per cent.), 3 parts. The plate is bathed for three minutes in a solution containing 15 parts of the above solution, and two parts of ammonia in 500 parts of water. —T. F. B.

*Developing Agents*; *Solubility of* — [in Water and Sodium Sulphite Solution]. Gravier. Brit. J. Phot., 1905, 52, 90.

THE following table of solubilities is given for various developers in common use:—

	Solubility in 100 parts of:		
	Water at 15° C.	Water at 45° C.	10 per cent. sodium sulphite solution at 15° C.
Adarol .....	100	over 100	65
Amidol .....	3.0	33	28
Eikonogen ....	7.8	17	4
Glycin .....	0	0.2	trace
Quinol .....			
(Hydroquinone)	6	14	4
Metol .....	5	9	2
Ortol .....	36	52	0.75
p-Aminophenol hydrochloride	7.4	11	0.8
Pyrogallol ....	59	over 100	59

—T. F. B.

*Toning by Means of Lead and Cobalt*; *New Method of* —. A. and L. Lumière and A. Seyewetz. Monit. Scient., 1905, 19, 104—105.

SILVER images may be toned a brilliant green by bleaching in a solution made up of water, 1 litre; potassium ferri-cyanide, 60 grms., and lead nitrate, 40 grms., washing, and then immersing for a few minutes in a solution of cobalt chloride, 100 grms., hydrochloric acid, 300 grms., water, 1 litre. In the first bleaching, formation of double silver lead ferrocyanide occurs, but is not complete, the image having a composition intermediate between those repre-

sented by  $\text{Pb}_3\text{Ag}_5\text{Fe}_2(\text{CN})_{12}$  and  $\text{Pb}_2\text{Fe}(\text{CN})_6$ . On immersion in the cobalt chloride solution, part of the lead is substituted by cobalt, with the result that a cobalt lead silverferrocyanide is formed, the composition of which lies between those represented by the formulae:  $\text{Co}_2\text{Ag}_2\text{PbFe}_2(\text{CN})_{12}$  and  $\text{Co}_2\text{Fe}(\text{CN})_6$ .—T. F. B.

*Toning Photographic Images Blue by Catalysis; Method of —.* R. Namias. *Monit. Scient.*, 1905, 19, 106.

THE blue coloration produced by the reduction of molybdic acid solutions can be utilised for toning silver "bromide" prints. A solution of 10 grms. of molybdic acid in 50 c.c. of ammonia (sp. gr. 0.940) is added to 100 c.c. of dilute nitric acid (1:1). 50 c.c. of this solution and 10 grms. of potassium metasulphite are dissolved in 150 c.c. of water, and the prints immersed until the desired blue tone is obtained. The toned image contains no silver salts; in fact, the silver may be dissolved out, leaving a rather faint blue image, hence it is concluded that the silver only aids in the reduction of the molybdic acid. This method has the disadvantage that pure whites are difficult to obtain; treatment with acids has no beneficial effect, whilst treatment with alkali solutions destroys the blue image.—T. F. B.

#### ENGLISH PATENTS.

*Lighting [Flash lights] for Photographic Purposes; Powders or Compositions for use in Artificial —.* G. Krebs, Offenbach-on-Maine, Germany. Eng. Pat. 27,267, Dec. 14, 1904.

"FLASHLIGHT powders" for photographic purposes, which burn with practically no smoke, are obtained by mixing finely powdered aluminium or magnesium, or a mixture of both, with an equal weight of chrome alum, potash alum, or other alum, or with copper sulphate, or the sulphate of an alkali or alkaline earth, or of cerium, thorium, iridium or caesium. By mixing these flashlight powders with about 10 per cent. of alkaline earth oxides or carbonates, or with a silicate, slow burning powders are obtained. (Compare Fr. Pat. 337,901 of 1903; this J., 1904, 560.)—T. F. B.

*Lighting especially for Photographic Purposes; Powders or Compositions for use in Artificial —.* G. Krebs, Offenbach-on-Maine, Germany. Eng. Pat. 27,268, Dec. 14, 1904.

SEE Fr. Pat. 337,901 of 1903; this J., 1904, 560.—T. F. B.

*Light for Photographic and other Purposes; Flash Powder for Producing Artificial —.* H. Lüttke, P. Arndt, and E. L. Löwengard, Wandsbek, Germany. Eng. Pat. 27,465, Dec. 16, 1904.

IRON or copper compounds, which act as oxygen carriers, are added to magnesium or aluminium, or a mixture of these, to produce flash light powders. For example, a suitable mixture consists of magnesium, 100 parts; aluminium, 50 parts; ferric oxide, 30 parts; copper carbonate, 20 parts, and magnesium sulphate, 5 parts. —T. F. B.

#### UNITED STATES PATENTS.

*Sensitising Dye [for Photographic Purposes].* R. Behrens, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 780,741, Jan. 24, 1905.

SEE Fr. Pat. 337,704 of 1903; this J., 1904, 486.—T. F. B.

*Photographic Plate or Film.* J. H. Smith, Zürich, Switzerland. U.S. Pat. 781,469, Jan. 31, 1905.

SEE Eng. Pat. 19,940 of 1904; this J., 1904, 1112.—T. F. B.

## XXII.—EXPLOSIVES, MATCHES, Etc.

*Phosphorus; Manufacture of —.* W. Hempel. VII., page 195.

## XXIII.—ANALYTICAL CHEMISTRY.

### APPARATUS, Etc.

*Micro-Balance; Some Experiences in the Use of the —.* O. Brill. *Ber.*, 1905, 38, 140—146. (See this J., 1905, 925.)

IT was found that the variation of the zero point was due principally to the hygroscopic character of the water-glass cement used for fastening the beam to the quartz fibre. By using sealing-wax or a celluloid cement instead of water-glass, much better results were obtained. The author also gives several other details with regard to the construction and mounting of the balance if very accurate results are desired.—A. S.

### ENGLISH PATENT.

*Pyrometers; Impts. in —.* C. Féry and Comp. pour la Fabric. des Compt. et Matériel d'Usines à Gaz. Paris. Eng. Pat. 18,382, Aug. 24, 1904.

THE inventors claim the combination of an optical sight apparatus containing two prisms having an aperture opposite the junction of a thermo-couple, with a galvanometer and recording apparatus. The prisms distort the image of the object sighted, unless it is directly in the plane of the aperture. When in this position, the heat rays concentrated upon the junction of the thermo-couple by the mirror, actuate a moving coil galvanometer. Clockwork mechanism is so arranged that an advancing band of paper is pressed at regular intervals against a pen held in an arm attached to the coil of the galvanometer, and a series of marks or dots forming the record, is obtained. The galvanometer can be cut out of circuit by a commutator, whilst the pen is being dipped into the ink.—W. H.

### INORGANIC—QUALITATIVE.

*Portland Cement; Detection of Free Lime in —.* Baikoff. *Zement*, 1904; *Tonind. Zeit.*, 1904, 2, 1713—1715, 1747—1749.

ON applying an alcoholic solution of phenolphthaleïn to slag-cement, Roman cement, and Portland cement, the author found the first named gave a red coloration immediately, due to the presence of free calcium hydroxide, the second after a little while, but with the Portland cement no colour change at all occurred, either in the cement or in the solution. From this difference it was assumed that Roman cement contains calcium alumina which undergoes hydrolysis, whilst in Portland cement the lime is combined as silicate. Further,—it was found that Portland cement decolorised the alcoholic phenolphthaleïn stained red by calcium hydroxide, the color being restored by re-exposure to hydroxide after filtration. This behaviour indicates the possession by anhydrous Portland cement of the power of absorbing calcium hydroxide, thus reversing the process occurring with the same cement is mixed with water. This double character of Portland cement is attributed to the presence of the intimate mixture of basic silicate and puzzolane, of which the cement is composed. Owing to the high fusing point of the silicate (over 1700° C.), it could not be formed at the ordinary kiln temperature (1500° C.) without a flux, such as is afforded by the presence of oxides of alumina, iron and alkalis in the clay. The basic silicate is slightly less soluble than lime; and when formed in the presence of an excess of lime is strongly basic, and resembles blast-furnace slag. Finally, a sample of Portland cement which failed to pass the boiling test was proved to contain free calcium oxide, by the coloration given with aqueous alcoholic phenolphthaleïn.—C. S.

### INORGANIC—QUANTITATIVE.

*Normal Hydrochloric Acid; Table for the Preparation of —, according to Specific Gravity.* F. W. Küstner and S. Münch. *Ber.*, 1905, 38, 150—152.

PURE concentrated commercial hydrochloric acid, mixed with about twice its volume of water, and the specific gravity of the diluted acid is determined at 18° C. by weighing



stoppered Erlenmeyer flask, the amount delivered by 0.00 c.c.-pipette, the exact "water-value" of which has been previously determined in a similar manner. The following table is shown the number of c.c. of hydrochloric acid of sp. gr. between 1.05 and 1.14, which will yield  $N/1$  acid when diluted to 1 litre with distilled water.

Table for the Preparation of  $N/1$  Hydrochloric Acid.

Sp. gr. of acid at 18° C.	c.c. of acid to be measured off and diluted to 1 litre.	Difference per 0.0001 of sp. gr.	Log.
1.0500	343.3	0.64	8062
550	311.3	0.54	7324
600	284.3	0.46	6628
650	261.3	0.398	5909
700	241.4	0.344	5566
750	224.2	0.296	4713
800	209.4	0.260	4150
850	196.4	0.230	3617
900	184.9	0.206	3139
950	174.6	0.184	2648
1.1000	165.4	0.165	2175
050	157.15	0.150	1761
100	149.65	0.138	1399
150	142.75	0.126	1004
200	136.45	0.116	0645
250	130.65	0.109	0374
300	125.20	0.103	0128
350	120.05	0.098	9912
1.1400	115.15		

The figures in col. 3 give the difference in the number of c.c. to be measured off for each 0.0001 difference of sp. gr., and the figures in col. 4 are the logarithms of the numbers in col. 3. As an example, to prepare  $N/1$  acid from acid of sp. gr. 1.1037,  $165.4 - 37 \times 0.165 = 159.3$  c.c. must be added to 1 litre. This method of preparing standard acid is specially suitable in works, where large quantities are required.—A. S.

*Kali Heptamolybdates; New Iodometric Method for the Determination of —.* B. Glassmann. Ber., 1905, 38, 193—4.

KALI heptamolybdates may be determined by ascertaining the amount of iodine liberated on boiling with solution of potassium iodide and iodate. 0.2—0.3 gram. of the heptamolybdate is placed in the distilling flask of Bunsen's iodine apparatus, together with 0.5 gram. of potassium iodide, and 0.1 gram. of potassium iodate. Still water is added, and the mixture distilled. The line is collected in the usual way, and titrated with standard thiosulphate. The author proposes to adapt the method to the determination of polytungstates.

—B. J. S.

*Copper, Tin, Antimony and Lead; Separation and Determination of —.* Application to the Determination of Antimony in Bronzes. M. Dinan. Monit. Scient., 1905, 19, 92—94.

0.5 gram. of the alloy is heated with nitric acid, the solution is evaporated, the residue treated with dilute nitric acid and the solution filtered; the precipitate, which contains the antimony and tin, with a small quantity of copper and lead, is boiled with 7 grams. of oxalic acid and 5 grams. of ammonium oxalate in 150 c.c. of water for 45 minutes and diluted to 250 c.c.; a current of hydrogen sulphide is then passed through the solution for 2½ to 3 hours (the temperature being kept at 90°—95° C.). After filtering, the solution is boiled, concentrated and electrolysed in presence of 10 grams. of oxalic acid, at 65°—70° C., with a current of 0.5 to 0.7 ampère per sq. decim., at an E.M.F. of 3.5 to 4 volts. The deposited tin is dried and weighed. The precipitate of sulphides is heated with potassium hydroxide solution, the liquor decanted, and the precipitate washed with hot water free from air. The potassium hydroxide should not be used in great excess. The antimony solution may be electrolysed, after adding sodium sulphide, at 50°—60° C., using a current density of 1 ampère per sq. decim., at 1.5 to 2

volts., or it may be treated by Thompson's method (converting into pentachloride, adding excess of potassium iodide, and determining the iodine by means of thio-sulphate). The precipitate of copper and lead sulphides is incinerated, dissolved in nitric acid, and added to the solution obtained after the first treatment with nitric acid. Excess of sulphuric acid is added and the solution evaporated until evolution of sulphur trioxide commences, when it is diluted and filtered, and the lead sulphate washed with 10 per cent. sulphuric acid. The filtrate is electrolysed in the cold, in presence of nitric acid, with a current of 0.5 to 0.7 ampère per sq. decim., at an E.M.F. of 3.5 to 4 volts.

This method can be extended to the analysis of bronzes containing antimony, the method of treatment being the same, with the addition that the zinc is determined in the usual way in the solution from which the copper has been removed by electrolysis.—T. F. B.

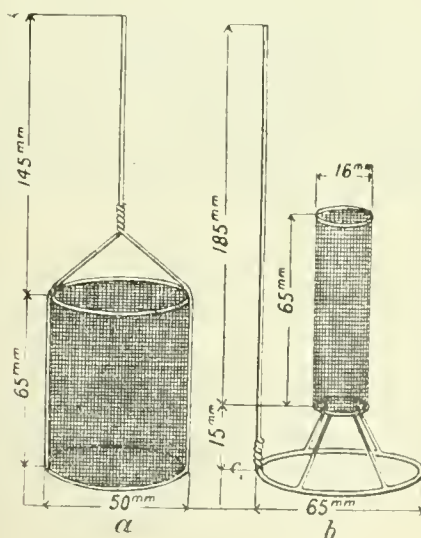
*Phosphorus in Bronzes; Determination of —.* M. Dinan. Monit. Scient., 1905, 19, 94.

THE bronze is treated with nitric acid, the precipitate (which contains the phosphorus as stannic phosphate) is dissolved in ammonium oxalate and oxalic acid, and the solution electrolysed as indicated in the preceding abstract. The solution, which becomes alkaline when electrolysis is complete, contains the phosphorus as ammonium phosphate, which may be determined by precipitation with molybdic acid.—T. F. B.

*Muntz's Metal; Analysis of — by Electrolysis, and Some Notes on the Electrolytic Properties of this Alloy.* J. G. A. Rhodin. Paper read before Faraday Soc., Jan. 30, 1905.

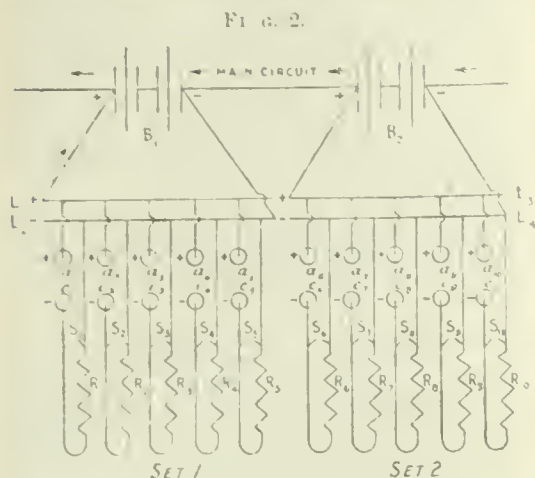
THE author has devised a compact arrangement of electrolytic apparatus for the gravimetric determination of copper in copper-zinc alloys on a large scale. Some 25 separate analyses are simultaneously carried out, and by employing a higher current density during the day than during the night, the plant can deal with 75 samples in the 24 hours. The arrangement of electrodes is shown in Fig. 1., the smaller anode being concentric with the

FIG. 1.



cathode when both are placed in a beaker which serves to contain the solution of the alloy. The gauze of the electrodes is made of platinum wire, No. 36, B.W.G., 90 meshes to the in., and is supported by a frame of stouter platinum wire. With these electrodes, currents of 0.5 or 2.0 ampères are employed, in the former case the deposition takes 12 to 15 hours, in the latter it is complete in three hours. Five electrolytic vessels are connected in

parallel, all with their own resistances, to a pair of accumulator cells: the several pairs of accumulators being



charged in series. This arrangement is shown in Fig. 2. A mean probable error of 0.07 per cent. is claimed.—R.S.H.

**Thorium Dioxide: Precipitation of and Separation of — from Cerium, Lanthanum and Didymium Oxides by means of Organic Acids.** A. Kolb and H. Ahrlé. *Z. angew. Chem.*, 1905, 18, 92—93.

CINNAMIC, benzoic, salicylic, and *m*-nitrobenzoic acids, particularly the last-named, have been found suitable for the separation of thorium from ceria, lanthana and didymia, by precipitation. To the neutralised solution containing the thorium salt there is added, hot or cold, an aqueous solution of *m*-nitrobenzoic acid, and then a small quantity of a solution of *m*-nitrobenzoate of aniline to prevent the liberation of free mineral acid, the thorium being thrown down quantitatively as a white, flocculent precipitate which can be collected, dried, and converted into thorium dioxide by ignition. Lanthanum, didymium and cerous salts give no precipitate under these conditions; but as ceric salts give a yellow precipitate, it is necessary, in separating thorium from other earths, first to reduce any ceric salts which may be present to the cerous condition by means of sulphuretted hydrogen. If small proportions only of other earths are present, a single precipitation yields the thorium in a pure state; in other cases the thorium is obtained in a pure state by a second precipitation. The process may be used with good results in determining the thorium in monazite sand.—H. B.

#### ORGANIC—QUALITATIVE.

**Eryogenin [m-Benzaminosemicarbazide]: New Colour Reactions of —.** G. Péguier. *Ann. Chim. anal. appl.* 9, 456—457. *Chem. Centr.*, 1905, 1, 406.

ERYOGENIN gives a chestnut-brown colour with potassium permanganate. When a few crystals of eryogenin are heated in a test-tube, they become coloured dark brown, and ammoniacal vapours are evolved. With a drop of sulphuric acid and of potassium bichromate solution, the crystals are coloured red. (See also this J., 1903, 712.)

—A. S.

#### ORGANIC—QUANTITATIVE.

**Coke and Volatile Matter yielded by Coals: Determination in a Platinum Crucible, of the Percentage of —.** G. Arth. *Bull. Soc. Chim.*, 1905, 33, 127—129.

THE percentage of coke obtainable from a coal by the method of Muck is not only larger than that yielded in practical manufacture, but varies with the size of the crucible employed. These errors are mainly due to the fact that the temperature, especially at the bottom of the

crucible, is too low. The author prefers to heat with ordinary laboratory blowpipe, giving a steady flame 28—30 cm. long. The crucible, which is placed about 10 cm. above the orifice of the blowpipe, is furnished with a lid into which it fits to a depth of 5—6 mm. The lid is constructed with a central platinum tube, 15 mm. long and 4—5 mm. in diameter, with a loose cap. The cap, on the tube when the heating is commenced, but is removed as soon as a luminous flame appears, and is replaced when the flame is on the point of disappearing. The heating of the crucible may be prolonged for more than a minute after the disappearance of the flame, without any error being caused. The results are 1—2.25 per cent. lower than with a Bunsen burner, and the coke contains about 1 per cent. less hydrogen. M. J. S.

**Petroleum from Boryslaw: Determination of Impurity in Crude —.** M. Wielezyski. *Chem.-Zeit.*, 1905, 29, 77.

ON account of its high paraffin content, crude Boryslaw petroleum contains considerable quantities of water and dirt, which it is very difficult to remove. The method usually adopted for the determination of these impurities is to add to the crude oil an equal volume of benzene, allow the mixture to stand in a graduated vessel for 24 hours at a temperature of 45°—50° C.; the volume of the emulsion which separates is a measure of the amount of impurity. An error arises in this method due to the loss of water which necessarily occurs at the temperature employed. It is therefore proposed to accelerate the separation of the emulsion precipitated by the benzene by a short treatment in a centrifugal machine; after 5 or 10 minutes the separation is said to be complete. This method gives results from 0.4 to 2.0 per cent. higher than the usual method.—T. F. B.

**Mineral Oils: Determining the Flashing Point of —.** W. Herbig. *Chem. Rev. Fett- u. Harz-Ind.*, 1905, 12, 26—30.

IN comparing the results of flashing point determination of heavy mineral oils by the Pensky-Martens and open cup tests (Kissling modification), the author found differences of 10°—14° C. in ten experiments, and 15°—25° in seven others, the oil vapours being carried away by the current set up by the heating flame for the open cup, and thus giving higher results than the closed cup method. The discrepancy can, however, be obviated by covering the open cup with a fireclay lid, containing a central orifice 15 mm. in diameter, the results furnished by this modification agreeing with the Pensky-Martens test to within about 4°. It is recommended that when the Pensky-Martens test is to be applied, a preliminary test should be performed with the semi-closed cup, in order to obtain an approximate idea of the flashing point since the test is more easily applied and saves the time spent in cleaning the Pensky-Martens apparatus.

—C. S.

**Dinitrocaoutchouc; Weber's —.** C. Harries. *XIII C.*, page 203.

**Caoutchouc; Nitrosites of —, and their Application in the Analysis of Raw Rubber and Rubber Goods.** Alexander. *XIII C.*, page 203.

**Methyl-Pentosans in Presence of Pentosans; Determination of —.** W. B. Ellett and B. Tollens. *Z. V. deutsch. Zuckerind.*, 1905, Jan., 19—30.

WHEN materials containing both pentosans and methylpentosans are distilled with hydrochloric acid, sp. gr. 1.40 the distillates contain both furfural and methylfurfural which are precipitated and weighed together as phloroglucides. The authors have determined the weight of methylfurfural phloroglucide obtained by the distillation of pure rhamnose under standard conditions (Kröber method). The end point of distillation is recognised by the fact that a few drops of distillate containing methylfurfural give a yellowish-red coloration with one drop of a solution of phloroglucinol in hydrochloric acid, sp. gr. 1.06. The results are calculated from the formula  $Rhamnose = Ph.1.65 - Ph.21.84 + 0.01$ , where Ph. = weight



phloroglucide in grms. When weighed quantities of glucose and rhamnose were distilled together, the phloroglucides were separated by extraction with 5 per cent. alcohol, in which the furfural compound is sparingly soluble. The Gooch crucible containing dried and weighed mixture of phloroglucides is placed in a small beaker; 15–20 c.c. of alcohol are introduced into the crucible, and the beaker is heated on the water-bath for 10 minutes at about 60° C. The alcohol is then drawn off by aid of the pump and the extraction is repeated 2 or 3 times more, in the same manner; the residue is then dried for 2 hours and calculated as pentose by Kröber's tables.—J. F. B.

*Methyl Alcohol in Formaldehyde: Determination of —*. — Gnehm and F. Kaufler. *Z. angew. Chem.*, 1905, 18, 1—94.

BERGER has stated (this J., 1904, 914) that the authors' process (this J., 1904, 626) for the determination of methyl alcohol in formaldehyde gives results which are too low. If, however, the quantity of sodium sulphite (used by increased from 90 grms. (as originally employed) to 110 grms., the results are satisfactory even in formaldehyde of high strength. The occurrence of an appreciable quantity of reducing substance in the distillate is probably not due to a partial liberation of formaldehyde from the condensation product, as suggested by Bamberger, but to the presence in commercial formaldehyde of unsaturated compounds of unknown character, which apparently, in Bamberger's method (*loc. cit.*), give rise to some extent with the bisulphite and lead to lower high results. On account of its cheapness and convenience, the authors admit that Bamberger's method is to be preferred to theirs.—H. B.

*Opium; Evaluation of —* [Determination of Morphine in —]. A. and Albert Petit. *J. Pharm. Chim.*, 1905, 1, 107—111.

The committee appointed to investigate current processes for the determination of morphine in opium have recommended the following for adoption as the official method in the forthcoming edition of the French Codex:— Fifteen grms. of the opium are intimately mixed with 100 grms. of slaked lime; 150 c.c. of distilled water are then added, and, after thorough mixing, left in contact, with occasional stirring, for 2 hours. The mixture is filtered, and 100 c.c. of filtrate, equivalent to 10 grms. of the opium, are collected. To this, 30 c.c. of ether of sp. gr. 0.725 are added, with thorough shaking, so as to saturate the aqueous layer; 2 grms. of pure ammonium chloride are then dissolved in the liquid, agitation being continued until a distinct precipitate becomes evident. The whole is then transferred to a precipitating glass, covered with a sheet of glass to prevent undue volatilisation of the ether, and set aside for 24 hours. The ethereal layer is then decanted on to two small counterpoised filters, the remaining aqueous portion being again agitated with another 30 c.c. of ether; this is also decanted on to the filters, followed by the aqueous solution containing the morphine precipitate; when all the morphine has been collected, it is washed with 25 to 30 c.c. of water saturated with morphine, distributed over the precipitate on the filters by means of a fine-pointed pipette. The morphine is then dried in the filters, at 100° C., for 2 hours. The dry filters and their contents are then washed with about 20 c.c. of pure, alcohol-free chloroform, until the chloroform filtrate passes colourless. The morphine is then again dried and weighed. The statement of Dott Hesse that morphine dried at 100° C. retains 1 mol. of water of crystallisation is confirmed.—J. O. B.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Alkaline Hydroxides; Solubility of — in Glycerol.* A. Müller. *Z. anorg. Chem.*, 1905, 43, 320—325.

In aqueous solutions of various metallic salts there is added a large proportion of glycerol, and then an excess of ammonia, different effects are observed. Several of

the hydroxides remain in solution, whilst others are precipitated. The effects vary with the concentration and other conditions; but, under the conditions obtaining in the author's experiments, beryllium and ceric salts gave an immediate turbidity, whilst aluminium, chromium, ferrous, ferric, cerous and neodymium salts gave clear and variously-coloured liquids. Cerous hydroxide is remarkably soluble under these conditions. If the proportion of salt present, is about sufficient to satisfy completely the retentivity of the glycerol, then, on dilution with water, the glycerol solution is gradually hydrolysed, and the hydroxide is precipitated, the hydrolysis proceeding more rapidly, the greater the dilution. H. B.

*Rhodium and Palladium; Comparative Absorption of Hydrogen by —*. — L. Quennessen. *Bull. Soc. Chim.*, 1905, 33, 191—193.

WILM has stated (Ber., 1881, 629) that rhodium has a greater power of absorption for hydrogen than palladium has. This appears to be inaccurate in view of the author's work, in which pure specimens of rhodium ammonium chloride and palladium ammonium chloride were reduced at a dull red heat by means of a current of hydrogen; in each case, when air was admitted to the cooled spongy metal (after replacing the hydrogen atmosphere by one of carbon dioxide), condensation of the oxygen of the air and the hydrogen absorbed by the metal occurred. However, when the metals were heated subsequently at 440° C. *in vacuo*, no evolution of hydrogen from the rhodium was noticed, neither was water formed on admitting air to the metal after cooling; in the case of palladium, abundant formation of water was observed. It thus appears that rhodium behaves more like platinum sponge than like palladium in presence of hydrogen.—T. F. B.

*Cane-Sugar; Influence of Metals on the Hydrolysis of —*. — R. Vondráček. *Z. physik. Chem.*, 1905, 50, 560.

The author draws attention to the fact that authorities differ as to the effect of metals on the well-known slow inversion of saccharose by boiling water, and proves experimentally that strips of platinum foil do not appreciably influence the rate of inversion; this confirms the results of Lindet (this J., 1904, 330). On the other hand, saccharose is rapidly inverted by boiling water in presence of platinum-black. Sugar solutions acquire a decidedly acid reaction by heating with platinum-black for 15 minutes, and the filtrates undergo inversion on further heating. If, after inverting a sugar solution by treatment with platinum-black for eight hours, the powder be immediately heated with a fresh solution, the latter develops no acidity and is not inverted more rapidly than by water alone; but the inverting property of the platinum-black is restored by exposure to air. Again, platinum-black which has been previously deoxidised by treatment with ammonia has no influence on the rate of inversion by pure water. From these data it is concluded that the inversion by platinum-black is due to the oxygen contained in it, which oxidises a part of the saccharose to one or several organic acids, and thus supplies hydrogen ions to the solution.—W. A. C.

*Organo-magnesium Compounds; Action of — on Phthalic Anhydride.* H. Bauer. *Ber.*, 1905, 38, 240—241.

The author combined 2 molecules of different organo-magnesium compounds with 4 molecules of phthalic anhydride. Phenylmagnesium bromide formed phthalophenone of m. pt. 115° C. Benzylmagnesium chloride yielded dibenzylphthalide of m. pt. 203—204° C. From *p*-tolylmagnesium bromide a compound of m. pt. 189°—190°, but of uncertain constitution, was obtained, but no crystallised body resulted from the action of *p*-bromoanisole and magnesium on phthalic anhydride.—R. L.

## New Books.

CHEMISCHE TECHNOLOGIE UND ANALYSE DER ÖLE. FETTE UND WACHSE. VON DR. J. LEWKOWITSCH. In Zwei Bänden. Friedrich Vieweg und Sohn's Verlag, Braunschweig. 1905. Price M.32, bound M.34.

This is the German version of the work referred to in this J., 1904, 802-803. It consists of two volumes. Vol. I. containing 458 pages of subject matter, and Vol. II. 458 pages, and also the alphabetical index, followed by tables of errata for both volumes. The work contains a tabulated sheet, 92 illustrations and 748 tables. The entire subject is systematised by the following classification:—Vol. I. (i) Classification of Oils, Fats and Waxes, with Chemical and Physical Properties; (ii) Saponification of Fats and Waxes; (iii) Their Constituents; (iv) Preparation of Fatty Matters for Examination—Preliminary Tests; (v) Physical Methods for Examining Oils, Fats and Waxes; (vi) Chemical Methods; (vii) Qualitative Methods; (viii) Examination of Fatty Acids; (ix) Of Unsaponifiable Matters; (x) Detection and Quantitative Determination of Rosin; (xi) Application of the Foregoing Methods to the Systematic Examination of Oils, Fats and Waxes; (xii) Examination by Strictly Scientific Methods. Vol. II. (xiii) Commercial Preparation of Oils, Fats and Waxes; (xiv) Description of the Natural Oils, Fats and Waxes: Methods of Preparing and Examining them and Detecting Adulterations; (xv) Technology of Oils, Fats and Waxes, Technical Investigation of the products of the Oil and Fat Industries; (xvi) Technology of Waste Fats.

THE PRINCIPLES OF CHEMISTRY. By D. MENDELEEFF. Third English Edition. Translated from the Russian (7th edition) by George Kamensky, A.R.S.M., and edited by Thomas H. Pope, B.Sc. Two Volumes. Longmans, Green and Co., 39, Paternoster Row, London; New York and Bombay. 1905. Price 32s. nett.

This work is complete in two volumes. Vol. I. contains 639 pages of subject matter with 88 illustrations, and a frontispiece representing Lavoisier. Vol. II. contains 470 pages of subject matter with 22 illustrations, 3 appendices covering 59 pages and alphabetical indexes of Authors and Subjects. The subject matter is systematised and classified as follows:—Vol. I. The Periods of the Chemical Elements. Periodic System of the Elements in Groups and Series. Introduction. (i) Water and its Compounds; (ii) Composition of Water, also Hydrogen; (iii) Oxygen and Saline Combinations; (iv) Ozone and Hydrogen Peroxide, Dalton's Law; (v) Nitrogen and Air; (vi) Compounds of Nitrogen with Hydrogen and Oxygen; (vii) Molecules and Atoms. Gay Lussac and Avogadro's Laws; (viii) Carbon and Hydrocarbons; (ix) Compounds of Carbon with Oxygen and Nitrogen; (x) Sodium Chloride. Berthollet's Laws. Hydrochloric Acid; (xi) The Halogens; (xii) Sodium; (xiii) Potassium, Rubidium, Cesium and Lithium. Spectrum Analysis; (xiv) Valency and Specific Heat of the Metals. Magnesium, Calcium, Strontium, Barium and Beryllium. Vol. II. (xv) Grouping of the Elements, and the Periodic Law; (xvi) Zinc, Cadmium and Mercury; (xvii) Boron, Aluminium, and the Analogous Metals of the Third Group; (xviii) Silicon and the other Elements of the Fourth Group; (xix) Phosphorus and Other Elements of the Fifth Group; (xx) Sulphur, Selenium and Tellurium; (xxi) Chromium, Molybdenum, Tungsten, Uranium and Manganese; (xxii) Iron, Cobalt and Nickel; (xxiii) Platinum Metals; (xxiv) Copper, Silver and Gold. Appendix I. Attempt to Apply to Chemistry one of the Principles of Newton's Nat. Philosophy. II. Periodic Law of the Chemical Elements. III. Attempt towards a Chemical Conception of the Ether.

CONVERSATIONS ON CHEMISTRY. FIRST STEPS IN CHEMISTRY. By W. OSTWALD. Authorised Translation by E. C. RAMSAY. PART I. GENERAL CHEMISTRY.

John Wiley and Sons, New York; Chapman and H Ltd., London. 1905. Price 6s. 6d.

SMALL 8vo volume, containing 250 pages of subject matter with 46 illustrations. The author refers, as of the causes leading him to write this book, arranged on the dialogue principle, "to the feeling of thankfulness with which he even now regards the 'Schule der Chemie' of Stöckhardt," which was the first text-book of Chemistry that was placed in his hands. It is classified as follows: (1) Substances; (2) Properties; (3) Substances and Mixtures; (4) Solutions; (5) Melting and Freezing; Boiling and Evaporation; (7) Measuring; (8) Density; (9) Forms; (10) Combustion; (11) Oxygen; (12) Compounds and Constituents; (13) Elements; (14) and Light and Heavy Metals; (16) More about Oxygen (17 and 18) Hydrogen, &c.; (19-21) Water, Ice; Steam; (22) Nitrogen; (23) Air; (24) Continuity; Exactness; (25) Expansion of Air by Heat; (26) Water in the Air; (27) Carbon; (28 and 29) Carbon Monoxide and Dioxide; (30) The Sun.

THE MINERAL INDUSTRY DURING 1903. Founded by the late RICHARD P. ROTHWELL. Prepared by the Editorial Staff of the Engineering and Mining Journal Under the Supervision of D. H. NEWLAND. Vol. 2. The Engineering and Mining Journal, New York and London. 1904.

This volume of 8vo size contains 498 pages of subject matter, with 20 illustrations, and 13 pages of Divisions and Assessment Tables, followed by the Alphabetical index. The contents are classified as follows, names of special compilers being given:—Introduction. Aluminium. II. Antimony. III. Arsenic. IV. Ashes. V. Asphaltum. VI. Barytes. VII. Bauxite. VIII. Bromine. IX. Carborundum. X. (By R. W. Leslie) Cement. XI. Chromium and Chrome Ore. XII. Coke and Coke (By S. Sanford). XIII. Copper (By D. Newland). XIV. Copperas. XV. Fluorspar (in parts F. J. Fohs). XVI. Garnet. XVII. Gold and Silver (T. A. Rickard, R. H. Richards, C. H. Fulton and A. James). XVIII. Graphite. XIX. Iron and Steel (Fr. Hobs). S. F. Luty and G. W. Cushing). XX. Lead (D. H. Newland and H. O. Hofman). XXI. Manganese. XXII. Monazite. XXIII. Nickel and Cobalt (By A. McCharles). XXIV. Petroleum (C. T. Deane). XXV. Phosphor Rock and Phosphorus (C. C. Schnatterbeck). XXVI. Mercury (By D. H. Newland). XXVII. Zinc (W. Ingalls). XXVIII. Review of General Literature. Ore Deposits (J. F. Kemp). XXIX. Review of Literature on Ore Dressing (R. H. Richards). XXX. Reviews Mining Progress in 1903. XXXI. Mining Companies.

FOREIGN IMPORT DUTIES, 1904. Prepared by the Commercial Department of the Board of Trade. Cd. 23 Eyre and Spottiswoode, London. Price 2s.

SMALL 8vo VOLUME of 490 pages, being a statement of the rates of import duties levied in European countries, United States, Japan, China, and Persia upon the produce and manufactures of the United Kingdom. The rates of duties given are those in force up to November, 1904. The work includes a table of weights, measures and money, and a table of conversions of Foreign into English weights, measures and money. The import duties are given under the following heads: Yarns and thread; woven manufactures; metals, unwrought and wrought; earthenware and porcelain; glass and glasswares; hides, skins and leather; india-rubber and gutta-percha; paper, & stationery and books; painters' colours and materials; chemicals; salt; oils, fats and resins; earthen stores, minerals, &c.; articles of food; miscellaneous articles (including ammunition, candles, perfumery and soap).



## Trade Report.

### I.—GENERAL.

#### CANADIAN CUSTOMS DECISIONS ON ARTICLES EXEMPT FROM AND SUBJECT TO SPECIAL DUTY.

*Board of Trade J., Feb. 9, 1905.*

The following have been decided by the Canadian Department of Customs to be exempt from "special duty" under the Tariff Amendment Act No. 11 of 1904:—sodium bicarbonate, hydrogen peroxide, hydrozone.

The following are subject to special duty (if sold at a reduced price for export):—Writing ink, ammunition, gum, mastic, mucilage, photographic dry plates, soap, baking powder, linoleum and oil cloth, linseed oil, paper, potassium iodide, white lead, refined sugar imported after Jan. 23, 1904 (except sugar refined in a British country entitled tariff preference by Canada).

#### WATER POWER USED FOR GENERATING ELECTRICITY: AMOUNT OF —.

*Eng. and Mining J., Jan. 26, 1905.*

The world's water-power installation, generating electricity, is approximately as follows: United States, 4,467 h.p.; Canada, 228,225 h.p.; Mexico, 18,470 h.p.; Venezuela, 1,200 h.p.; Brazil, 800 h.p.; Japan, 3450 h.p.; Switzerland, 133,302 h.p.; France, 161,343 h.p.; Germany, 81,077 h.p.; Austria, 16,000 h.p.; Sweden, 71,000 h.p.; Russia, 10,000 h.p.; Italy, 210,000 h.p.; India, 60 h.p.; South Africa, 2100 h.p.; Great Britain, 906 h.p.; total, 1,483,390 horse power.

### II.—FUEL, GAS, AND LIGHT.

#### COAL PRODUCTION OF GERMANY IN 1904.

*Board of Trade J., Feb. 9, 1905.*

The subjoined particulars of the coal production of Germany in 1904, as compared with the previous year, are taken from the "Nachrichten für Handel und Industrie" of the 21st January:—

	Coal.		Lignite.		Coke.		Briquettes.	
	1903.	1904.	1903.	1904.	1903.	1904.	1903.	1904.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Russia .....	108,989,879	112,808,409	38,460,232	41,126,856	11,446,652	12,268,436	9,173,681	10,102,478
Austria .....	1,360,901	1,341,314	16,539	52,318	—	—	—	—
Germany .....	4,698,458	4,794,295	1,828,159	1,915,135	62,607	62,727	277,190	300,897
Other States .....	1,615,138	1,750,080	5,650,628	5,405,913	—	—	1,025,299	1,010,092
Total .....	116,664,376	120,694,098	45,955,558	48,500,222	11,509,259	12,331,163	10,476,170	11,413,467

NOTE.—The ton mentioned is the metric ton of 2,204 lbs.

The total imports of coal from the United Kingdom amounted to 5,808,032 tons in 1904, as compared with 393,828 tons in 1903 and 5,191,869 tons in 1902.

#### ANNUAL REPORT OF THE ROYAL COMMISSION ON COAL SUPPLIES. Part I. General Report. [Cd. 2353.] Price 4d.

This report of the Royal Commission appointed on 21st December, 1901, deals with the following subjects:—(1) the resources of our coalfields; the probable duration of our coal resources; possible economies (1) underground, (2) in the preparation of coal for sale, (3) in transportation from the collieries to the users in the United Kingdom, (4) in use; possible substitutes for coal (alcohol, natural gas, oil, water and windmill power, tides and peat); effect of exports of coal on British consumers and the Royal Navy; the maintenance under existing conditions of the competitive power of our coal mining industry with the coalfields of other countries.

Tables are appended showing:—(a) the total available

coal resources of the proved coalfields of the United Kingdom; (b) the total coal resources of the proved coalfields of the United Kingdom—exceeding 4000 feet in depth; (c) the resources of the concealed and unproved coalfields at depths less than 4000 ft.; (d) the output of coal in the United Kingdom, its pit-mouth value, the quantity shipped for foreign countries in the form of coal, coke, and patent fuel, the total quantity shipped, including coal shipped for the bunkers of steamers engaged in the foreign trade, the quantity remaining for home consumption, and its proportion per head of the population for the years 1870 to 1903.

### III.—TAR PRODUCTS, PETROLEUM, Etc.

#### PETROLEUM; CANADIAN —.

*U. S. Cons. Rep., No. 2165, Jan. 24, 1905.*

The law by which a bounty of one-half cent a gallon is granted for the production of crude petroleum in Canada, came into effect on June 8, 1904, and between that date and December 1 the sum of 123,088 dols. has been paid out on 365 applications. This represented a total production of 18,063,200 gals. The bounty has greatly stimulated the industry.

#### PETROLEUM; CALIFORNIA —.

*Eng. and Mining J., Jan. 26, 1905.*

Of the 13 recognised oil districts in California four produced over a million barrels each in 1904. These were the Kern River, 17,500,000 bbl.; Coalinga, 4,544,160 bbl.; McKittrick, 1,650,000 bbl.; Los Angeles, 1,080,000 bbl.; Four others report between half a million and a million each; viz., the Fullerton, 876,000; Whittier, 780,000; Santa Maria, 750,000; Newhall and Ventura, 540,000 bbl. The five remaining districts have the following record: Sunset and Midway, 376,000 bbl.; Puente, 204,000; Summerland, 80,000; Sargents, 42,700; Half Moon Bay, 1000 barrels. The total output of the State in 1904 was 28,423,860 barrels of crude oil.

#### PYRIDINE; U.S. CUSTOMS DECISION.

*Jan. 16, 1905.*

Pyridine, produced from coal tar, is dutiable at 20 per cent. *ad valorem*, as a "preparation of coal tar, not a colour or dye," under paragraph 15 of the present tariff. The assessment of duty at 25 per cent. *ad valorem*, as a "chemical compound," was overruled.—R. W. M.

### IV.—COLOURING MATTERS, Etc.

#### INDIGO CROP OF 1904.

*Chem. Trade J., Feb. 11, 1905.*

The final general memorandum on the indigo crop of the season 1904, issued by the Statistical Department of the Government of India, and published by the Bengal Chamber of Commerce, states that the area under cultivation has diminished by nearly one-third since last year, and the estimated out-turn is lower by 46 per cent.

In Bengal the area sown this year is estimated at 223,100 acres, against 249,700 acres sown last year. The season was so very unfavourable that the estimated out-turn for Lower Bengal, including the minor Bihar districts, is 69 per cent., and of North Bihar 53 per cent. of a normal crop, the provincial average being 56 per cent. The yield in North Bihar may amount to 24,700 factory maunds, and in Lower Bengal, including the minor Bihar districts, to 8,340 factory maunds, giving a total for the province of 33,040 maunds. The production in 1903 was 47,630 factory maunds (3 factory maunds = 2 cwt.).

In the United Provinces the total indigo area in 1904 amounted to 74,200 acres, compared with 140,800 acres, the ascertained area of 1903, and is the lowest since the decline of this crop began. The prospects of the indigo crop were good when the first forecast was issued, but the heavy and continuous rain of July and August caused serious damage. The total out-turn of indigo is estimated at 12,000 factory maunds (Benares 5250 and Doab 6750), which is 37 per cent. below the last year's estimate. The trade figures of past years indicate that a considerable proportion of the reduced yield is consumed locally or exported to other provinces; the amount of indigo available for the Calcutta market is, therefore, likely to be considerably less than the out-turn indicated above.

In the Punjab the area under indigo continues to decline and has fallen from 74,200 to 53,000 acres. In three out of the four reporting districts, namely, Rohtak, Muzaffargarh and Dehra Ghazi Khan, heavy decreases are reported. A larger area, though still 15 per cent. below the decennial average, was sown in the Multan Division, but the yield was somewhat below the normal. The out-turn of seed is estimated at 1,673,800 sers (28,021 cwt.) and of dye at 589,700 sers (9872 cwt.).

In Madras the total area sown with indigo in the Faiyatuari villages up to the end of November, 1904, is 99,800 acres, which is less than the averages of five and ten years by 49 and 63 per cent. respectively, and than the area in the corresponding period of the preceding year by 49 per cent. The decrease is marked in Guntur, Nellore, Chingleput, North Arcot, and the Deccan districts, and is attributed to scanty rains and the fall in the price of the dye.

## VII.—ACIDS, ALKALIS, Etc.

### BORAX; U.S. CUSTOMS DECISION.

Jan. 13, 1905.

A mixture of borax and sal soda, containing 91.65 per cent. of crystallised borax, was held to be dutiable as "borax" at 5 cents per lb. under paragraph 11 of the present tariff. Although the content of anhydrous boric acid was only 33.56 per cent., the Board held that it was in fact borax, though adulterated, and not dutiable as "borate of soda containing less than 36 per cent. of anhydrous boric acid" at 3 cents per lb. under the same paragraph.—R. W. M.

## X.—METALLURGY.

### MINES AND MINERALS OF CANADA.

U.S. Cons. Report, No. 2163, Jan. 21, 1905.

The report on the mining industry of Canada by the director of mines states that the total mineral products of the year were valued at 12,870,593 dols., and the wages paid amounted to 4,222,386 dols. Of the total value, 7,628,018 dols. represents products of the non-metallic class and 5,242,575 dols. metallic products. The total production of gold was 10,383 oz., valued at 188,036 dols.; the industry gave employment to 493 persons, who were paid in wages 245,490 dols. Including the cost of supplies it required an expenditure of almost 2 dols. to extract 1 dol. worth of ore. The same story is told of silver mining; the total quantity produced was 16,688 oz., valued at 8949 dols., and the wages paid out 8000 dols. The production of lead was still more unprofitable, although restricted. The amount mined was 25 tons,

valued at 1500 dols., at a cost of 5189 dols. Copper and nickel properties on the whole gave excellent returns. The value of the products was 3,215,794 dols., and wages paid aggregated 872,302 dols., leaving a margin for supplies and a satisfactory profit.

The wages paid for the production of petroleum amounted to 165,700 dols., while the value of the product was 1,586,674 dols. The expansion of the cement industry is a marked feature of the mineral development of the province. The rapid growth in output is indicated by the figures supplied in the report. In 1899 the increase was 45 per cent. over 1898; in 1900 it was 38 per cent. over 1899; in 1901 it was 14 per cent.; in 1902 it was 49 per cent. over the previous year; and in 1903 it was a further increase of 33 per cent. over 1902, withstanding this remarkable expansion there were imported in the year ended June 30, 1903, 2,572,088 lbs. valued at 901,063 dols., upon which the duty paid 271,004 dols. As the uses to which cement is put multiplied and the industry grown the price has fallen. It was 2.50 dols. a barrel in 1901, and 1.70 dol. in 1902. The erection of new plants is proceeding in Canada at a rate that seems to promise an era of overproduction in Ontario, with attendant curtailment or extinction of profits.

### PIG IRON IN THE UNITED STATES IN 1904.

Eng. and Mining J., Feb. 2, 1905.

The total production of pig iron in 1904 was 16,497,033 gross tons, against 18,009,252 tons in 1903, 17,822 tons in 1902, 15,878,354 tons in 1901, 13,789,242 tons in 1900, 13,620,703 tons in 1899, and 11,773,934 tons in 1898. The production in the second half of 1904 was 150,157 tons more than that of the first half, the last months of 1904 showing increasing activity in production. The production of bessemer and low-phosphorus iron in 1904 was 9,098,659 tons, against 9,989,908 tons in 1903. The production of basic pig iron in 1904 including charcoal of basic quality, was 2,483,104 tons, against 2,040,726 tons in 1903. The production of charcoal pig iron in 1904 was 337,529 tons, against 50 tons in 1903 and 378,504 tons in 1902. The production of spiegeleisen and ferro-manganese in 1904 was 21 tons, against 192,661 tons in 1903. The production of ferro-manganese alone in 1904 amounted to 57,076 tons. One company produced 946 tons of ferro-phosphorus in 1904. The whole number of furnaces in blast on Dec. 31, 1904, was 261, against 182 on Dec. 31, 1903.

The total production, classified according to fuel used, with the number of furnaces in blast on Dec. 31, was as follows:—

	Number.	Tons made.
Coke .....	206	14,931,364
Anthracite .....	38	1,228,140
Charcoal .....	17	337,529
Totals .....	261	16,497,033

The number of furnaces reported idle at the close of the year was: Coke, 94; anthracite, 35; charcoal, total, 168.

## XII.—FATS, FATTY OILS, Etc.

### GREASE; BROWN —. U.S. CUSTOMS DECISION.

Jan. 25, 1905.

Brown grease obtained from hogs was assessed for duty as "brown wool grease" at  $\frac{1}{2}$  cent per lb. under paragraph 279 of the present tariff. The importer claimed it to be free of duty as a "grease commonly used in soap making, &c.," under paragraph 568. It was held that the evidence was insufficient to justify the classification of the importer, and also that the classification was erroneous. An analysis of the merchandise indicated it was dutiable at 20 per cent. *ad valorem* under Section



"manufactured article unenumerated," but as this was not made, the assessment of duty at  $\frac{1}{2}$  cent per lb. was allowed to stand.—R. W. M.

OLIVE OIL; U.S. CUSTOMS DECISIONS.

Dec. 31, 1904, and Jan. 6, 1905.

Olive oils containing 2.5 and 2.9 per cent. of free fatty respectively were held to be edible and subject to a duty of 40 cents. per gallon under paragraph 40 of the present tariff act. The claim of the importer for free import under paragraph 626, as "olive oil fit only for manufacturing and mechanical purposes," was overruled.—R. W. M.

BENZENE SOAP; U.S. CUSTOMS DECISION.

Dec. 29, 1904.

Soap composed of soap 72.4 per cent., benzol 10.8 per cent. and the balance water, and not soluble in water, was held to be dutiable at 20 per cent. *ad valorem* as a soap not specially provided for," under paragraph 72 of the present tariff. The assessment of duty at 30 per cent. *ad valorem*, as "alizarin assistant," was overruled.—R. W. M.

W.—TANNING; LEATHER; GLUE, Etc.

OENOTANNIN; U.S. CUSTOMS DECISION.

Jan. 16, 1905.

Oenotannin, used to clarify wine, was held to be dutiable as "tannin" at 50 cents per lb., under paragraph 1 of the present tariff, since tannin is the component material of chief value.—R. W. M.

QUEBRACHO CHIPS; U.S. CUSTOMS DECISION.

Jan. 16, 1905.

Quebracho wood in fragments and chips is dutiable at 10 cents per lb. and 10 per cent. *ad valorem*, as "wood increased in value" under paragraph 20 of the present tariff.—R. W. M.

XVI.—SUGAR, STARCH, GUM, Etc.

SUGAR; POLARISCOPIC TEST OF — U.S. CUSTOMS DECISION.

The United States Supreme Court having denied an application for a writ of *certiorari* from the decision of the Circuit Court of Appeals, which held that the system of temperature corrections applied to the polariscopic test of sugar was correct and within the power of the Secretary of the Treasury, the protests of the importers have been uniformly overruled by the Board of General Appraisers in numerous cases.—R. W. M.

XVII.—BREWING, WINES, SPIRITS, Etc.

TARTARIC MATERIALS: EXPORTS OF — FROM ITALY.

Foreign Office Annual Series, No. 3323.

Below are given the quantities and values of the various tartaric materials exported from Italy from October 1, 1903, to September 30, 1904:

	Quantity.	Value.
	Tons.	£
Refined argols .....	668.5	40,100
Viccia argols .....	2977.5	157,800
Cis argols .....	3116.0	152,700
Wine lees .....	3728.0	85,800
Total .....	10,490	436,400

The total product the United Kingdom took 1386 tons, the United States 3459 tons, the remainder being consumed mostly on the Continent.

XX.—FINE CHEMICALS, Etc.

ACETYSALICYLIC ACID; U.S. CUSTOMS DECISION.

Jan. 17, 1905.

Acetylsalicylic acid was held to be dutiable at 55 cents per lb. under paragraph 67 of the present tariff, as a "medicinal preparation in the preparation of which alcohol is used."—R. W. M.

RHODINOL; U.S. CUSTOMS DECISION.

Jan. 13, 1905.

Synthetic oil of rose, known also as rhodinol, was held to be free of duty as "otto of roses" under paragraph 626 of the present tariff. The assessment of duty at 25 per cent. *ad valorem*, as an "essential oil" under paragraph 3, was overruled.—R. W. M.

SACCHARIC PREPARATIONS; U.S. CUSTOMS DECISION.

Dec. 14, 1904.

The United States Circuit Court reversed a decision of the Board of General Appraisers, which held that benzoic acid sulphinate and sodium benzoic sulphinate were dutiable as "saccharin." The Court decided that they were properly dutiable at 20 per cent. *ad valorem* as "preparations of coal tar not colours or dyes," under paragraph 15.—R. W. M.

RADIUM BROMIDE AND RADIUM BARIUM BROMIDE: U.S. CUSTOMS DECISION. Jan. 25, 1905.

The above articles were held to be dutiable at 25 per cent. *ad valorem* as "chemical salts," under paragraph 3 of the present tariff. The claims of the importers that they were dutiable either as a "metal unwrought" or as a "manufactured article unenumerated" were overruled.—R. W. M.

GADUOL: U.S. CUSTOMS DECISION.

Jan. 13, 1905.

The United States Circuit Court of Appeals has sustained a decision of the Circuit Court reversing the Board of General Appraisers which held gaduol to be dutiable as a "medicinal preparation, in the preparation of which alcohol is used" at 55 cents per lb. under paragraph 67 of the present tariff. The article is an extract of cod liver oil obtained by the use of alcohol. The Courts held that, in the form imported, it is not prepared for the use of the apothecary or physician, and is not dispensed in this form; hence it is dutiable at 25 per cent. *ad valorem* as a "chemical compound" under paragraph 3. The Treasury Department has acquiesced in the foregoing decision, which is now final.—R. W. M.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

- [A.] 1769. Wilkinson. Means for and method of carrying out secret manufacturing processes of chemical treatment.\* Jan. 30.  
 „ 2097. Stocker. Drying of clay and similar materials. Feb. 2.  
 „ 2102. Stocker. Drying of various substances, such as clay, &c. Feb. 2.

- [A.] 2372. Ullrich. Apparatus for cooling fluids.\* Feb. 6.  
 „ 2520. Fieldhouse. Tanks for producing a liquid free from suspended solids. Feb. 8.  
 „ 2653. Jones. Furnaces. Feb. 9.  
 „ 2791. Stocker. *See under IX.*  
 „ 2825. Crosthwaite. Furnaces. Feb. 11.  
 [C.S.] 3763 (1904). Newton (Worthington). Condensor systems. Feb. 15.  
 „ 3764 (1904). Newton (Worthington). Injection condensers. Feb. 15.  
 „ 3795 (1904). Imray (Meister, Lucius und Brüning). Extraction of water or other liquid from mineral, vegetable, or animal substances. Feb. 15.  
 „ 7078 (1904). Reeves and Bramwell. Apparatus for filtering liquids. Feb. 15.  
 „ 11,979 (1904). Sellenscheidt. Filters. Feb. 15.  
 „ 20,031 (1904). Gaskell and Day. Drying apparatus for distillery refuse and other liquids. Feb. 15.  
 „ 26,625 (1904). Mélotte. *See under XVIII. A.*

## II.—FUEL, GAS, AND LIGHT.

- [A.] 1843. Grice. Gas producing plants. Jan. 31.  
 „ 1917. Otto-Hilgenstock Coke Oven Co., Ltd. (Otto and Co.). The coking of coal. Jan. 31.  
 „ 1947. Strenge, Strenge, Strenge and Strenge. Process of and apparatus for the manufacture of peat briquettes, &c.\* Jan. 31.  
 „ 2053. Ewing and Metgé. Manufacture of fuel briquettes. Feb. 2.  
 „ 2124. Bell. Gas producers. Feb. 3.  
 „ 2564. Tcherniac. *See under VII.*  
 „ 2652. Jones. Fuel. Feb. 9.  
 „ 2684. The Chalk Power Gas Syndicate, Ltd., and Stonham. *See under VII.*  
 [C.S.] 2578 (1904). Roux and Gonin. Carbonisation and drying of peat, &c. Feb. 15.  
 „ 6314 (1904). Green and Martin. Process of consolidating peat. Feb. 15.  
 „ 6863 (1904). Darling. Separating carbon from pulverised carbonaceous materials. Feb. 15.  
 „ 7079 (1904). Whitworth. Gas producers. Feb. 15.  
 „ 7668 (1904). Wien and Mintz. Incandescence mantles for gas and like illuminants and process of manufacturing same. Feb. 8.  
 „ 10,344 (1904). Gerdes. Gas producers. Feb. 8.  
 „ 20,845 (1904). Wilson. Gas producers. Feb. 15.  
 „ 24,694 (1904). Nusch (Mortimer-Sterling). Incandescent light mantles. Feb. 15.  
 „ 25,404 (1904). Marconnet. Process of and apparatus for producing gas from pulverisable fuel. Feb. 8.  
 „ 26,915 (1904). Dempster. Electrodes for arc lamps. Feb. 8.  
 „ 26,916 (1904). Steinmetz. Arc lamp electrodes. Feb. 8.  
 „ 26,918 (1904). Härden. Arc lamps and electrodes therefor. Feb. 8.  
 „ 26,919 (1904). Härden. Arc light electrodes. Feb. 8.  
 „ 27,519 (1904). Viarmé. Apparatus for the manufacture of producer gas. Feb. 15.

## III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [A.] 2840. Pettigrew. Self discharging saturator for sulphate of ammonia and other salts. Feb. 11.  
 [C.S.] 28,997 (1904). Meyer. Process of treating creosote and product of the same. Feb. 8.

## IV.—COLOURING MATTERS AND DYESTUFFS.

- [A.] 1817. Johnson (Badische Anilin und Soda Fabrik). Manufacture of new compounds of the anthracene series. Jan. 30.  
 „ 1818. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Jan. 30.  
 „ 2228. Shillito (Aniline Colour and Extract Works formerly J. R. Geigy). Manufacture of colouring matters. Feb. 4.  
 [C.S.] 8282 (1904). Newton (Bayer und Co.). Manufacture of new anthraquinone derivatives. Feb. 15.  
 „ 11,317 (1904). Schmitt. *See under V.*  
 „ 28,596 (1904). Lake (Oehler). Manufacture of mordant azo dyes. Feb. 15.

## V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 2188. Pearson. *See under XII.*  
 „ 2192. Lacroix. Manufacture of artificial [Belg. Appl., Feb. 6, 1904.]\* Feb. 3.  
 „ 2316. Lye and Lye. *See under VI.*  
 „ 2711. Lodge and Barker. Padding machines in dyeing and like operations. Feb. 10.  
 „ 2811. Cass. Apparatus used for dyeing woollen fabrics. Feb. 11.  
 „ 2873. Greenwood and Harper. Mechanism for dyeing wherein the material is continuously merged within the dye without exposure to atmosphere during the dyeing process. [Belg. Appl., Feb. 12, 1904.]\* Feb. 11.  
 [C.S.] 3529 (1904). Pick and Erban. Bleaching and cleaning of vegetable fibres. Feb. 15.  
 „ 5247 (1904). Goddard. Apparatus for dyeing warps for weaving and otherwise treating with liquids. Feb. 15.  
 „ 8288 (1904). Johnson (Badische Anilin und Soda Fabrik). Production of blue to blue-black shades on wool. Feb. 15.  
 „ 11,317 (1904). Schmitt. Method and apparatus for recovering sulphur colouring matters from dye liquids and washing liquids. Feb. 15.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

- [A.] 2013. Lafitte. *See under IX.*  
 „ 2316. Lye and Lye. Apparatus employed in dyeing or colouring chip, chip plait, straw plait, and such like materials. Feb. 11.  
 [C.S.] 9175 (1904). Kron. *See under IX.*

## VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 1816. W. and J. George, Ltd., and George. Apparatus for generating sulphuretted hydrogen and other gases.\* Jan. 30.  
 „ 1974. Scott. Recovery of chlorine and iron from waste pickling liquors. Feb. 1.  
 „ 2174. De Stucklé. Apparatus for the manufacture of alkali or alkali hydrates and zinc sulphate. [Ger. Appl., May 21, 1904.]\* Feb. 3.  
 „ 2463. Piva. Process for treating leucite and substances containing the same.\* Feb. 7.  
 „ 2564. Tcherniac. Manufacture of sulphocyanides from crude coal gas. Feb. 8.  
 „ 2684. The Chalk Power Gas Synd., Ltd., and Stonham. Lime burning and the recovery of power gas as a bye-product. Feb. 9.



- [ 2840. Pettigrew. *See under III.*
- [S.] 24,297 (1903). Price. Processes for manufacturing nitrate, nitrite, or sulpho-nitrate or -nitrite of lime, soda, or potash. Feb. 15.
- 5540 (1904). Paulding and Paulding. Production of nitric oxide and nitric acid from air or other mixture of oxygen and nitrogen. Feb. 15.
- 8377 (1904). Leslie. Apparatus for the manufacture of carbonic acid gas. Feb. 8.

## VIII.—GLASS, POTTERY, AND ENAMELS.

- [ 2857. Wakelin and Weston. Production of painted glass, cloisonné glass and other material from the effects of heat. Feb. 11.

## —BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [ 2013. Lafitte. Impregnation and coloration of timber. [Fr. Appl., March 16, 1904.]\* Feb. 1.
2097. Stocker. *See under I.*
2102. Stocker. *See under I.*
2343. Heintzel and Cramer. Method of improving gypsum mortar and utilising dead burnt gypsum. [Ger. Appl., March 21, 1904.]\* Feb. 6.
2467. Brown. Manufacture of mortar cement building composition. Feb. 7.
2654. Reinhertz. Treatment of earthy materials for increasing their specific gravity. Feb. 9.
2791. Stocker. Drying of various substances, such as clay, &c. Feb. 10.
2856. Drogseth. Apparatus for the impregnation of wood. [Appl. in Norway, Feb. 12, 1904.]\* Feb. 11.
- [S.] 8504 (1904). Glossop. Manufacture of artificial stone. Feb. 15.
- 9175 (1904). Kron. Apparatus for impregnating and dyeing wood. Feb. 15.
- 14,183 (1904). Conti-Vecchi. Impregnation of wood with antiseptic and like substances or liquids. Feb. 15.
- 18,699 (1904). Pryor. Wood preserving composition. Feb. 15.
- 18,804 (1904). Brunson. Composition of matter for artificial stone. Feb. 8.

## X.—METALLURGY.

- [A.] 1821. Sulman, Picard and Ballot. Wet separation of minerals. Jan. 30.
1916. Hendryx. Process for treating ores.\* Jan. 31.
1928. Hendryx. Apparatus for treating ores.\* Jan. 31.
1941. Danziger. White metallic alloy. Jan. 31.
1974. Scott. *See under VII.*
2160. Steinhart and Vogel. Treatment of tin ores. Feb. 2.
2286. Rollason. Treatment of auriferous refractory or base ores. Feb. 6.
2337. De Souza. Processes for the extraction of metallic aluminium and its alloys.\* Feb. 6.
2532. Rumbold and Patchin. Process for treating complex sulphide and oxidised ores for the recovery of copper, nickel, cobalt, zinc, gold and silver. Feb. 8.
2619. Gutensohn. Means for reducing metallic oxides and their combinations to metal. Feb. 9.
2798. Sulman, Picard and Ballot. Wet concentration of ores and similar processes. Feb. 10.

- [A.] 2861. Boulé (Soc. Anon. des Mines de Bormettes, and Lotti). Treatment of lead and like ores. Feb. 11.
- [C.S.] 9384 (1904). Haddan (Elektrodon-Ges. m. b. H.). Process for obtaining metals in a pure state and apparatus for executing same. Feb. 15.
- 23,290 (1904). Mennickeheim. Means for removing slag and other impurities from metal for castings. Feb. 15.
- 24,781 (1904). Blackmore. Process of reducing aluminium and other metals and making alloys thereof. Feb. 8.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- [A.] 2001. Wood and Oaksford. Apparatus for the agitation of solutions used in electro deposition of metals. Feb. 1.
2022. Vickers, Sons, and Maxim, Ltd., and Hall. Electric accumulators or secondary batteries. Feb. 1.
- [C.S.] 4512 (1904). Nehmer. Generating electricity by the use of moist chemicals which are mechanically pressed upon zinc. Feb. 8.
- 12,707 (1904). Thompson (Chem. Elekt. Fabrik Prometheus). Production of electrical resistance bodies from amorphous or crystalline carbide of silicon or boron, or of silicon or other like suitable materials. Feb. 8.
- 26,948 (1904). Mills (Edison). Storage batteries. Feb. 15.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

- [A.] 2139. Jarvis and Jarvis. Composition of lubricants.\* Feb. 3.
2188. Pearson. Recovery of fatty matters from the effluents of wool washing and other processes. Feb. 3.
- [C.S.] 9638 (1904). Nusch (Chem. Werke G. m. b. H. vorm. Dr. C. Zerbe). Manufacture of a soap preparation for use in preventing poisoning by compounds of lead, copper, arsenic, mercury, and other metals. Feb. 15.
- 20,474 (1904). Boulé (Burton). Process of manufacturing hydroxystearic acid from oleic acid. Feb. 15.

## XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

## (A.)—PIGMENTS, PAINTS.

- [A.] 1822. Restiaux. Paint. Jan. 30.
- [C.S.] 7963 (1904). Newton (Bayer und Co.). Manufacture of colour lakes. Feb. 8.

## (B.)—RESINS, VARNISHES.

- [C.S.] 7256 (1904). Shaw. Machinery for printing the pattern on linoleum, oilcloth, &c. Feb. 8.

## (C.)—INDIA-RUBBER.

- [A.] 2234 Henry and Lugo. Processes and methods of manufacturing artificial india-rubber and vulcanites. Feb. 4.
2575. Gubbins. Method of, and apparatus for, treating rubber waste and the like. Feb. 8.
2655. Steenstrup and A/S Gummi-Regenerations Societet. Process of devulcanising india-rubber.\* Feb. 9.
- [C.S.] 15,436 (1904). Kittel. Process for regenerating vulcanised waste rubber. Feb. 15.

## XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

- [A.] 2070. Lambert. Glue, and process for manufacturing the same. Feb. 2.  
 „ 2441. Hunter. Process for treating bone.\* Feb. 7.  
 „ 2455. Hunter. Process for treating bone.\* Feb. 7.  
 [C.S.] 7761 (1904). Taylor. Treatment and finish of leather. Feb. 15.  
 „ 363 (1905). Lake (Schoellkopf, Hartford and Hanna Co.). Depilatory composition. Feb. 15.

## XVI.—SUGAR, STARCH, GUM, ETC.

- [C.S.] 2928 (1904). Naudet. Process and apparatus for the diffusion and extraction of saccharine juices. Feb. 15.

## XVII.—BREWING, WINES, SPIRITS, ETC.

- [A.] 2738. Free. Malting apparatus. Feb. 10.  
 [C.S.] 3196 (1904). Vignier. Fermentation of wines, wash, or beer, and the making of yeast for distillers. Feb. 15.  
 „ 20,031 (1904). Gaskell and Day. *See under I.*

## XVIII.—FOODS; SANITATION, WATER PURIFICATION; &amp; DISINFECTANTS.

## (A.)—FOODS.

- [A.] 2020. Simpson and Jackson. Milk products and process and apparatus for producing same. Feb. 1.  
 „ 2166. Stern. Process of preparing non-alcoholic fruit juices.\* Feb. 3.  
 „ 2176. White. Treatment of farinaceous substances.\* Feb. 3.  
 „ 2535. Yates, and Jas. Robertson and Sons. Fruit juice products. Feb. 8.  
 [C.S.] 8129 (1904). Fürst. Dietetic food preparation. Feb. 15.  
 „ 26,623 (1904). Mélotte. Centrifugal cream and other liquid separators. Feb. 15.  
 „ 26,905 (1904). Weitzmann. Process for refining and purifying coffee. Feb. 15.

## (B.)—SANITATION; WATER PURIFICATION.

- [A.] 1776. McLean and Paterson. Process of treating and utilising sewage.\* Jan. 30.

- [A.] 2219. Hamilton. Compound for removing scale from boilers.\* Feb. 4.  
 „ 2430. Bell. Anti-incrustation fluid for steam boilers. Feb. 7.  
 [C.S.] 6516 (1904). Beckett. Water purifying apparatus applicable also to other liquids. Feb. 8.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 2031. Imray (Meister, Lucius und Brünig). Manufacture of dialkyl barbituric acids. Feb. 6.  
 „ 2304. Oberländer and The Alliance Chemical Co. Ltd. Manufacture of *o*-toluene sulphochloride. Feb. 6.  
 „ 2348. Johnson (Badische Anilin und Soda Fabrik). Manufacture of new derivatives of aldehydes and obtainment of the sulphite salts in the manufacture. Feb. 6.  
 „ 2566. Zimmermann (Chem. Fabr. auf Actien, von E. Schering). Manufacture of dialkylbarbituric acids. Feb. 8.  
 „ 2666. Newton (Bayer and Co.). Manufacture of pyrimidine derivatives. Feb. 9.  
 „ 2787. Mayer. Method of preparing diethylmalonurea. (Ger. Appl., June 17, 1904.)\* Feb. 9.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 1906. Davidson. Preparing colour sensitive plates for a process of colour photography. Jan. 31.  
 [C.S.] 24,774 (1904). Bry. Films for photography. Feb. 8.

## XXII.—EXPLOSIVES, MATCHES, ETC.

- [A.] 1940. Gribble. Manufacture of a new explosive. Jan. 31.  
 „ 2776. Centralstelle f. Wissenschaftlich-Techn. Untersuchungen Ges. m. b. H. Manufacture of nitro-glycerine. [Ger. Appl., Feb. 12, 1904.] Feb. 10.  
 „ 2859. Upton. Explosive compounds. Feb. 11.  
 „ 2875. Thompson (Saginaw Match Co.). Lucifer matches. Feb. 11.  
 [C.S.] 7893 (1904). Wetter (J. D. Riedel). Sulphur compounds and priming or igniting composition suitable for the manufacture of matches. Feb. 15.  
 „ 837 (1905). Jacob. Matches. Feb. 15.



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### ANNUAL GENERAL MEETING, 1905.

The Annual General Meeting will be held in London in July next, and the proceedings will commence on Monday, July 10th. Full particulars will appear later.

### THE BRITISH SCIENCE GUILD.

The British Science Guild, which was founded some months ago by Sir Norman Lockyer, with the object of bringing home to the people of this country the necessity of applying scientific methods to all branches of human activity, has now published a first list of its members, which includes Professor Atfield, Dr. James Bell, Sir John Brunner, Professor Church, Sir William Crookes, Professor E. Divers, Dr. Gore, Dr. Griffiths, Professor Japp, Professor Liversidge, Professor Meldola, Mr. Müller, Mr. Neville, Professor Odling, Mr. Pedler, Professor Pope, Sir W. Ramsay, Mr. Shenstone, Professor Wertheimer, Mr. Whetham, and Professor Sydney Young.

One of the principal aims of the Guild is the promotion and extension of the application of scientific principles to industrial and general purposes—an object closely allied with that of the Society of Chemical Industry. The education, not only of the classes interested, but of public opinion in general, on this subject, is very desirable, and, though its progress may be slow, perhaps no surer means can be devised than that of enlisting in a single organisation all those whose sympathies are in favour of the application of exact methods in every department of life.

The annual subscription to the Guild is 2s. 6d., with an entrance fee of 2s. 6d., payable to Lady Lockyer, 16, Penywern Road, S.W. Life member's subscription is £2 2s. Information may be obtained from the Honorary Secretary, Mr. C. Cuthbertson, 9, York Terrace, N.W.

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## London Section.

Meeting held at Burlington House, on Monday,  
February 6th, 1905.

MR. A. GORDON SALAMON IN THE CHAIR.

### THEORY OF DYEING.

#### PART II.\*

#### PSEUDO- AND DE-SOLUTION.

BY W. F. DREAPER, F.L.C., ETC.

In connection with the attractive values of fibres, &c., dyes, acids, and other substances, the investigations of Linder and Picton (J. C. S., 61, 148 and 1895, 63), and others, which are mentioned in this paper, seem to indicate a clearer explanation of the action of dyeing than we have at present before us. Linder and Picton's work on pseudo-solution seems to have been overlooked by those interested in this subject, or else its value has not been realised in its application to these phenomena. A bold dividing line between solution and suspension disappeared. The difference between the two states is only one of aggregation. Arsenious sulphide can exist in such a fine state of division or suspension that it easily pass through a porous pot. The action of metallic salts on these "solutions" of arsenious sulphide is an interesting one. In their action, these salts divide themselves into sharply defined groups, according to the salts they contain. Tervalent metals have the highest coagulating power. Bivalent metals only possess 1/10th of this action, and univalent metals 1/500th part. This difference even holds with the same metal when it varies valency. If this action is studied in detail, the results are even more instructive.

When barium chloride is used as a precipitating agent, barium is carried down, and the chlorine remains in solution. In the figures given, 10 per cent. of the barium sent is removed in this way. The actual nature of the reaction is indicated further on. Similar results are obtained with calcium chloride. The metal is held in solution by severe washing, but another metal in solution will replace it. This action is a reversible one, depending on the proportion of the second salt in solution. It is, therefore, a case of mass action. Calcium and cobalt will, in fact, both act in this way. They both precipitate sulphide, yet each can replace the other, if present in sufficient quantity in the solution.

Grimaux (Comptes rend., 98, 1434) pointed out that a large proportion of sodium chloride at 100° is necessary to precipitate a specially soluble solution of silica he prepared. He does not indicate that the salt was decomposed, and we do not know whether such an action takes place in this case. He considered that the action was a hydrating one. It is known, however, that in some cases the presence of a salt has the opposite effect (Tomassoni, Comptes rend., 99, 87).

The presence of a salt is not necessary to produce this precipitating action. Separation may take place by dyeing in some cases. Antimony trisulphide is entirely separated in this way. Albumin is not, or if so, the action is reversible (Luhavik, J. Russ. Chem. S., 21, 397). Blake (Amer. Journ. Sc., 16, 381) also denies that the precipitating action of salts is a universal one.

Colloidal gold precipitated by barium salts does not carry down with it any appreciable amount of the salt. In this case, however, it may be that the gold is no longer in the colloidal state.

These quantitative experiments may, from their nature, have a disturbing influence on any chemical theory of dyeing, when we consider that the action is not an infinite one, but is directly connected with, and governed by, the valency of the precipitating metal.

Regarding this arsenious sulphide solution as equivalent to an "artificial fibre substance," an affinity which is

able to disturb a system like a solution of barium chloride in this way may clearly take the place of a so-called chemical action; and give rise to a theory of dyeing which may replace the usual chemical one. If we can have such an action with barium chloride, a similar action with a basic hydrochloride, or even a sulphonic acid salt, is quite possible. Also, the experiments of Mills indicate that in mixtures of dyes, each dyestuff is absorbed in proportion to its own mass, and inversely as the mass of the other colour.

Linder and Picton, experimenting with porous pots, and such basic dyes as Hofmann's Violet and Magenta, found that these dyes were non-filterable. The particles of these dyes in solution are so small that they do not scatter light, and according to the scale of sizes adopted for arsenious sulphide solutions, they should have filtered readily. By separate experiments, they noticed that broken pieces of the same porous material, placed in the dye solution, absorbed the dyes. They did not, however, carry the experiments to their logical conclusion, and recognise, as we now know, that decomposition also takes place.

We probably have here a liberal surface, of a slightly soluble nature, and, therefore, in a state of pseudo-solution, playing a similar part to the arsenious sulphide. The basic hydrochloride is decomposed into a basic salt, or even the base itself, either of which is very insoluble. The particles are thus degraded in the scale of solubility, and remain fixed in the colloid substance.

I am aware that recently (Suida, Ber. der K. Akad. d. Wissen. in Wien, 1904, 113, 725) attempts have been made to confirm the chemical theory of dyeing, on the grounds that only basic dyes are precipitated by silica and acid silicates. The action, however, is probably caused by the relative instability of the hydrochlorides, as compared with the sulphonic acid salts.

We find indeed that acids are absorbed by silica, and the absorption of acids and salts is also proportional to the degree of hydration (von Bemmelen, J. für. Chem. 23, 324), in this case. Yet this same fact is put forward to prove that the specific attraction of (hydrated) silica for basic dyes is a function of, and due to, the presence of OH groups. But it is equally the cause of the absorption of acids.  $\text{SnO}_2 \cdot 2.3\text{H}_2\text{O}$  also will absorb more acid than  $\text{SnO}_2 \cdot 1.2\text{H}_2\text{O}$  (Gorgan, Am. Chem. and Phys., 3, 66). The collected evidence on this point is, therefore, distinctly against, and not for, a chemical theory.

Dyeing a porous material in mixtures of, say, alcohol and water, should give interesting results, and this will be undertaken. It is interesting to note that many dyes are easily removed from wool by alcohol containing 5 per cent. of water, but are quite insoluble in either absolute alcohol or water (Pokornig).

Sodium chloride has a direct action on arsenious sulphide solution. It becomes non-filterable. The particles are, therefore, degraded in the scale of solution. This is interesting from the dyeing point of view. It indicates the action of such salts on "direct" dye solutions. It also shows, as Linder and Picton have pointed out, that this coagulating action increases the size of all the aggregates present. The "direct dye" aggregates are, therefore, degraded in the scale of solution, and therefore increased in size. This will be directly determined by the percentage of salt present in the solution.

The experimental results which follow lead me to put forward the following law:—"Within certain limits of concentration, and when once an equilibrium has been established, and in the case of a solution where this action is a reversible one, the aggregates in any solution system are of equal size." This agrees with the views I put forward some months ago (Chem. News, 90, 53 and 179).

With these larger aggregates we get increased dyeing effect in this case. The size of the dye aggregates will, therefore, be determined by:—

- (1) Some mutual attraction of the dye molecules for one another, or else the osmotic pressure of the solution.
- (2) Solvent action of the solution, or the relative attraction of the solution molecules for those of the solute.

An equilibrium being established between these two forces.

\* Part I. of this paper appeared in this J., 1894, 95—101.

The fact that the molecular weight of alcohol in benzene increases with the amount present, and that the number of double molecules of nitrogen peroxide varies with different solvents, lends indirect support to this theory for pseudo-solutions. Aggregation in the latter case also decreases with increased temperature, which might be anticipated.

In the case of a true solution, the relative attractions between the solvent and solute molecules are normal. In the case of a pseudo-solution a balance is held between this and, either the attraction of the solute molecules for one another, or the condition of intermolecular strain of the solvent.

At certain points of a curve obtained with mixtures of alcohol and water, breaks have been observed. (Mendeleeff, *J. Chem. Soc.*, 1887, 702.) It is suggested that these are the relative strengths at which the system arranges itself into definite order, due to an accurate balancing of these forces, which under these conditions seem to have a definite direction. This balance persists even into the solid state, and gives what we term definite hydrates.

The substances said to most readily form complex molecules are those containing OH, COOH, or CN groups.

Although in practice we are confined to one solvent, yet by the addition of acids, salts, &c., we can modify its physical properties towards dyes in a remarkable way. The action, for instance, of excess of acids on solutions of acid dyes may induce aggregation. At any rate, the chemical theory quite fails to explain the action of these substances on the rate of dyeing. The relative value of "assistants" will, therefore, be a measure of the modification of the pseudo-solution state of the dye. Their influence on the fibre state will be considered later on. From this point of view there will clearly be a point of maximum absorption, and then, possibly, a reverse action due to the aggregates being too large to enter the fibre system. This point may never be reached in practice. The dye may be thrown out of solution instead.

Still arguing from these sulphide experiments, the increased action of strong solutions is easily explained.

My second law, founded on these experiments, is that:—

"The aggregates in a stronger pseudo-solution are larger in direct relation to the number of molecules present, and that, when once a certain point is reached, they increase in size rather than in number." This point of molecular "saturation" is either a function of the intermolecular space, or else of the attraction of the solution for the solute.

We have therefore alternative means of increasing the size of aggregates, by increasing strength of solution, or by addition of salts, &c., which either act by partly neutralising the molecular affinity of the solvent, or reducing the available molecular space, or both.

When these aggregates reach a certain size, their relations to the solvent assume a new phase. A critical point is reached when it is easier for part of the mass of the solute to be thrown out than for it to remain in the system. We then get actual precipitation and a rearrangement in size of particles.

In the cases we have to deal with here, with increased temperature we get reduced size of aggregates and therefore more of them, and a higher point of saturation. This may be due to the increase of volume in the solution, and consequent increased volume of the inter-solution space.

It is suggested that all substances, in passing from the solution to the solid state, go through a state of progressive aggregation, whether they take the crystalline or amorphous form. This may either help, or prevent the former state according to circumstances. It is probably at this stage that salts are held so tenaciously by some precipitates.

I base these conclusions primarily on the fact that Linder and Ficton have shown that a 4 per cent. solution of arsenious sulphide is non-filterable and on the experiments which follow.

If we accept the above laws, we arrive at a simple explanation of the "one bath" method of dyeing. So far as I know no explanation of this process has been attempted. The case of logwood black is taken as typical. The dye solution consists of a logwood iron lake, which is dissolved in a weak solution of oxalic acid. The particles

of this lake in its ordinary condition are so large that the form a precipitate. They are outside the limit of pseudo-solution. This lake is soluble in oxalic acid. In some way or other, the aggregates are reduced in size and are able to enter the system of the fibre. Under these conditions, as explained further on, these reduced aggregates are once more degraded and held in the fibre substance. Ultimately, an equilibrium is established in which the lake is insoluble in the fibre and soluble in the solution. With an increased percentage of oxalic acid, a fair perfect solution may be obtained. The size of the aggregates may become so small, that they are not easily degraded by the fibre, and a reverse dyeing action will result. This actually occurs in practice.

Again, when we have this acid solution, we can increase the size of the aggregates by reducing the percentage acid present, or by increasing the amount of lake present. Both these methods answer in practice. The action is a reversible one. The colour of the liquid changes with the addition of more acid, and is also subject to reversal.

The reversibility of this process is a necessary adjunct to the above laws of size. The fact that the lake is brown in solution and black in the fibre also shows that the state of aggregation is greater in the latter. Even if dissociation occur in acid solution, which is not upheld by the writer, the effect is still the same.

There is no hard and fast line between pseudo-solution and the solid state. The existence of liquid crystals also confirms this. This theory of the constant size of aggregates in pseudo-solution may also be tested by some recent experiments on dyeing with indigo (Binz and Bing, *Zeit. f. angew. Chem.*, 25).

It has been pointed out that an increase in alkali gives a corresponding decrease in colour intensity on the fibre. Addition of neutral salts does not intensify the colour, so long as the alkali is not present in excess.

The presence of excess, the addition of salts is a direct one and darker shades are produced on the fibre; 1.8 per cent. NaCl will double the percentage of indigo fixed. In the presence of a large excess of alkali, the effect produced by the salt is reduced.

The above theory will explain the action of the salt and alkali, especially when we know that the latter is not fixed on the fibre, but only the indigo white. (Georgievich *Der Indigo*, 1892, 55.) The action varies with the size of aggregates as determined by the relative proportion of alkali and salt. In this way, a satisfactory state of the fibre, and point of maximum effect, due to aggregation may be made to coincide and produce the best dye effect.

As a third example, the absorption of certain amines in a state of pseudo-solution or suspension, by silk or wool is given. Naphthylamine, (Pokorny, *Bull. Soc. Ch. Mulh.*, 1893, 282) if dissolved in a small quantity of alcohol and poured into water, will impregnate wool or silk at ordinary temperatures. This action would all probably take place with mercerised cotton. From the "amido acid" theory point of view, this might indicate chemical action, but such is not the case.

The proportion of alcohol to water determines the percentage of amine absorbed. With the above and the amount absorbed increases with the alcohol, as it increases from 5 to 30 per cent. Beyond this a reverse action sets in. Once more this theory offers a simple explanation, depending on the size of aggregates and the limit of fibre action, or absorption.

It may be noticed at this point, that these experiments have a direct bearing on the phenomenon known as osmotic pressure. There is undoubtedly some connection between this and the size of aggregates in a pseudo-solution. It is not correct to say that the difference between a crystalloid and a colloid may be ascertained by the accompanying phenomena of reduced freezing point and increased boiling point. There is no hard and fast line between the two, any more than there is between a crystalloid and a colloid in the solution state. It is simply a question of aggregation.

Rowney's water colour indigo, (finely ground) gave slight osmotic pressure in Adie's apparatus (L. and I.) but ordinary indigo with larger particles gave none. In the same way, it may be expected that a colloid solution



ndigo (Möhlau and Zimmermann's method) would give a higher figure still. The osmotic pressure of substances in pseudo-solution should be a measure of their state of aggregation, if the other conditions are identical. It should be a measure of the relative attraction between the molecules of the solvent and solute.

Osmotic pressure has been found to decrease in many concentrated solutions (Traube, *Phil. Mag.*, 1904, 8, 158). It would follow if we assume increased aggregation in stronger solutions and a corresponding decrease in the action between the solution and solute, as explained above.

The latest results seem to show that the theoretical conclusions of van t'Hoff and others, connecting diffusion and conductive phenomena directly with osmotic pressure, require modification. With an extension of the experimental work to other solvents than water, serious discrepancies have come to light. In many cases, osmotic pressure indicates association, and the electric phenomena dissociation. The cause of osmotic pressure is not understood, nor can it, I believe, be brought to agree with any association theory. The cause of this phenomenon will, I believe, be found when these pseudo-solution effects are more closely studied. For instance, in the above case, the particles of indigo must not be too large. If no osmotic pressure is observed; the particles cannot occupy the intermolecular space. When the size of the aggregates is reduced gradually, until they become monomolecular, they correspondingly occupy this space and the solution system more or less perfectly as the case may be; but a corresponding state of strain as indicated by the increase in volume is a direct result.

With this closer contact between the molecules of the solution and solute, we have an increased attraction coming into play, but this is not of so definite an order as some, at least, of the molecules do not pass on, being attracted by fresh units of the solvent.

This condition of migration was first put forward by Thomson, and developed by Maxwell. Given this state I would suggest that osmotic pressure is not so much a question of mere migration as suggested by Poynting, as of direct attraction, and the tendency to relieve local intermolecular strain, and set up a normal condition of equilibrium over the entire system.

In strong solutions, aggregation comes in rather than multiplication of units, which is resisted by the solution state. An actual reverse in osmotic pressure may take place as the aggregates are gradually withdrawn from the solution state.

The reason why the weaker solution will diffuse into the stronger one is due to the greater mobility of the former. This also indicates association. Pickering's experiments with alcohol and water mixtures clearly indicate this. Either alcohol or water will diffuse into a mixture of the two, but the reverse action will not take place. The theory of migration of individual molecules, from whatever cause, is a necessary adjunct to the law of equilibrium in pseudo-solutions. It does not, however, seem to be necessary to assume that these roving molecules suffer dissociation. The fact that these molecules are in a state of greater freedom is against this idea.

To return more directly to our subject. This attraction of colloids for substances in solution seems to depend on the relation between the size of aggregates and the state of the fibre. A case of this action is seen in the estimation of tannic acid by "collin" (Dreaper, *Chem. News*, 9111); collin will not precipitate gallic acid, but when added in the scale of solution by tannic acid it will do readily.

The experimental data available concerning the absorption of acids, phenols, &c., alone and in mixtures, shows how difficult or even impossible it is to accept any chemical theory of dyeing.

For instance, Gardner and Carter (*J. Soc. Dyers and Colourists*, 1898, 143) have shown that the relative absorption of different aromatic phenols by cotton varies between 100 per cent. and zero. The results obtained should be related against solubilities. Cotton saturated in a 0.2 per cent. solution of tannic acid will still absorb tannic acid in a 0.2 per cent. solution. This also indicates a reversal in strong solutions, and the inference is that

this too is due to aggregation. The state of aggregation or attraction by the cotton fibre in this case seems to be just balanced by a 0.02 per cent. solution, for in this it begins to lose tannic acid again (Koeblin). It is shown also that in the presence of acetic acid the absorption of tannic acid is greatly increased (Gardner and Carter). How can this possibly indicate any chemical action?

*Surface Concentration.*—It has been shown by J. J. Thomson (*App. of Dynamics to Phys. and Chem.*, 251) that, on dynamical grounds, the most stable arrangement of any solution will be accompanied by minimal surface energy. I wish to apply this to the action of dyeing. It seems also to agree with the above ideas on osmotic pressure.

In most cases the surface tension of the surface separating a solution from air increases with the amount of salt in it, and for a similar reason, salts are more soluble in capillary spaces than in bulk. In the case of potassium sulphate, the increased solubility in the case of graphite or micro-schaum is nearly 25 per cent. If we apply this to the fibre state, we may expect a concentration of dye in the pores of the fibre, and this will lead, in the case of pseudo-solutions, to larger aggregates. As the salt in solution will also be concentrated, the dye may even be thrown out of solution and replaced by other smaller aggregates from the general solution. The experiments of Gore (*Bghm. Nat. Hist. and Phil. Soc.*, IX., 1, 1893) confirm this. For instance, all the acetic acid in a dilute solution may be removed by filtering through fine white sand.

The following results, chosen at random from this work, will indicate the results in other cases: 10 per cent. solutions were used in each case:—

HCl	lost	2.88 %	Tartaric acid	lost	1.42 %
HI	"	1.0 %	Citric acid	"	Nil.
HNO <sub>3</sub>	"	2.5 %	CaCl <sub>2</sub>	"	3.1 %
HClO <sub>4</sub>	"	4.4 %	NaCl	"	2.77 %

We have here a purely physical reason for the concentration of substances in solution at surfaces. In some cases, from the opposite cause, there is a tendency for the substance to leave the surface.

The influence is proportional to the surface, and temperature has little effect on it, so that increased dyeing effect at higher temperatures is not to be traced to this cause. Salts, acids, &c., may therefore concentrate at the surfaces of fibres, or in their pores, and their action be intensified in this way.

This action should lead to abnormal concentrations in the case of pseudo-solutions, if the theory of solution strain is a correct one. This is so pronounced in the case of substances with very high molecular weight that these surface concentrations may be heaped up by mechanical means, and form visible films of solid or very viscous matter (Ramsden, *Proc. Roy. Soc.*, 72, 156).

There is a distinct tendency for liquids to throw out of solution all substances in a state of high aggregation. The dissolving solution trying to resume its original volume. These concentrations occur also at the inter-surfaces of two solutions, and give rise to distinct surface tension phenomena at the junction of aqueous colloid solutions of different concentrations (Quincke, *Drudes. Ann.*, 10, 478). "The explanation of these de-solutions must be sought in the reduction of surface tension, and therefore surface energy," says Ramsden. We may perhaps go further back, and refer it to the play between the secondary attraction of the solution moles, for those of the solute, the osmotic pressure effect, and the attraction of the solute moles, for each other.

The size of the aggregates undoubtedly alters the effect. Some experiments of Gore will confirm this. He found the surface results to vary as follows:—

Pieric acid in solution	.....	No result.
do. in suspension	.....	Result.
Salicylic acid in solution	....	No result.
do. in suspension	.....	Result.
Methyl Orange	.....	Result.
Orange G.	.....	Result.

We have here perhaps an indication that salts which "salt out" dyes act by a preferential attraction for the solution molecules, being in a finer state of aggregation.

These mechanical surface aggregations with substances in pseudo-solution have been obtained with a dilution of 1/1,000,000.

These separated solids vary greatly in the rapidity of their resolubility. They are sometimes even insoluble. The action of aggregation is non reversible in these cases. They may be membranous, membrano-fibrous, or fibrous, as the case may be, or they may even consist of particles lying side by side.

This special surface viscosity develops at very different rates in different solutions, and is accompanied in many cases by a resistance to "shear," showing that the coating is solid or highly viscous. Even a bubble of air passing up through such a solution will carry with it, and persistently hold, any particles in suspension.

In this action, coupled with the above laws of aggregation, we have a purely mechanical theory of dyeing which will satisfy the dyeing conditions in a great many cases, including the "one bath" method, indigo, and "sulphide" dyeing, "direct" colours, &c.

Some experiments of Chabrie (Comptes rend., 115, 57) roughly indicate the limits at which such action takes place in a capillary tube. If a solution of albumin (mol. wt., 10,000—15,000) be passed slowly through a capillary tube with an internal diameter of 0.07 mm., a separation takes place, and only pure water passes through. The albumin is concentrated in the tube, and ultimately prevents all flow. The molecules or aggregates of urea or Congo Red are not large enough to cause this action.

The molecular weight of the latter is only 826, against 10,000—15,000, but on the same lines a tube with an internal diameter of 0.0041 mm. might stop the flow in the same way. This stop in the flow will correspond with the point of saturation in any dyeing system, and we get an indication of the different actions of fibres also.

In addition to this action we have an indication in the arsenious sulphide experiments that there may be a secondary but active attraction between the dye particles and the fibre substance. In the case of basic dyes, decomposition may take place with the formation of very insoluble basic compounds.

It is known that molecular attraction increases enormously at very close quarters. This is said by Hawkesbee (Trans. Roy. Soc. XXVI. and XXVII., 1709 and 1713) to be the key to capillary attraction. This subject has been worked out mathematically by Laplace and Gauss.

This special attraction does not become sensible to our measurement at distances greater than 50 micro-millimeters. It becomes really sensible at 1  $\mu$  and becomes enormous before the molecules come into actual contact.

Assuming intensely dense molecules moving in space, the aggregation of which constitutes a mass, an intensification of Newton's law may explain this result. Some such secondary effect as this may have led to the belief that an action of the first order may take place between the fibre and the dye.

*Action of Assistants.*—The best experimental evidence we have of the action of these reagents on the fibres is perhaps contained in some work of Spiro (Science Abs., 1904, 922). According to this investigator, the swelling of colloids is accelerated by the presence of hydrogen or hydroxyl ions; in other words, in that of acids and alkalis. Such substances as dextrose, on the other hand, will retard the swelling. The maximum swelling with dextrose takes place, when gelatin is the colloid, with a 3 per cent. solution of dextrose. With a 25 per cent. solution no water is absorbed by the gelatin. With still more concentrated solutions the gelatin actually loses water and shrinks. It is therefore necessary that the fibre substance must be in a hydrated or "open" condition. This has been recognised for some time past.

Brown (J. Soc. Dyers and Col., 17, 92) has shown that there is generally speaking a critical point at somewhere about 80° C., and beyond this a decreased dyeing effect is produced.

This may be due either to the too perfect nature of the dye solution, or else to a dehydrating action on the fibre substance, similar in nature to that on aluminium hydroxide. When we consider the action of solutions on, say, silk or wool at temperatures above 100° C., the former reason is more likely to be the correct one.

If cotton is boiled for some hours with water an increased affinity for certain dyes is noticed (Hübner and Pope, this J., 1904, 404). The extra effect noticed with mercerised cotton is also probably due to this effect.

This action of temperatures on rate of dyeing (up to 80°) and the difficulty in dyeing fibres in solutions that do not "hydrate" them may probably be explained on these lines.

Even colloids, like egg albumin, are said to slowly pass through plates of gelatin; and recently de Mosenh (this J., 1904, 296) has shown that a 5 per cent. solution of nitrated cotton will dialyse on long standing.

Salts are said to increase the viscosity of gelatin (v. Schroeder, Zeit. Phys. Chem., 1903, 77). This indicates that the aggregates are increased.

Boiling colloids at 100° leads to a non-reversible hydrolytic action. The "tendering" of animal fibres in this way may be due to such an action. This action of hydroxyl compounds is even extended to colloidal ferrie hydrate (Spiro), but the action is much weaker in the dialysis solution, showing the influence of the presence of a small quantity of an electrolyte.

The relative rate of diffusion of a substance in different states of pseudo-solution is unknown.

The rate of diffusion of crystalloids through a colloid like agar-agar is greatly increased by increase in temperature (Voigtlander, Zeit. Phys. Chem. 3, 316), as we see from the following table:—

Substance.	At 0°	At 20°	At 40°
Formic acid .....	0.47	0.86	1.4
Acetic acid .....	0.31	0.64	1.04
KOH .....	1.01	1.75	2.36
KCl .....	0.78	1.4	2.2

The generation of heat which accompanies the wetting of cotton must, apparently, not be ascribed to hydration. It has been long known that a rise in temperature takes place when finely divided solids are immersed in water or other inorganic or organic solids (Pouillet, Ann. Chem. and Phys. 20, 230). Masson (Proc. Roy. Soc., 7, 230) considers that this is a distillation effect through layer of air. There is no definite limit to this effect, which sometimes goes on for hours, and gives an increased temperature of 8°—12° in the case of cotton. Similar results were obtained with glass wool and water vapour. This investigator considers that if the solid is wetted no temperature effect is obtained, and that the action is not a chemical one.

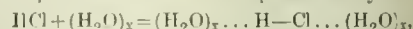
Martinis' experiments (Phil. Mag. (5), 47, 329) do not seem to confirm these results. With pure silica he got a great increase in temperature with such substances, distilled water (22.6°), absolute alcohol (26°), sulphur ether (31.5°). Under exceptional circumstances the silica was raised from 17° to 80° C. All powders do not give this effect; calcium carbonate is an exception.

Martinis' explanation was that the liquids are absorbed by solids, and enter the solid state themselves (*Ibid.*, (5), 618). Later on he considered that the action was physico-chemical one. Silica will abstract water from a mixture of three parts alcohol and one part water.

He notes that a reverse action is obtained in the case of mercury, which does not wet the solid. There clearly cannot be any chemical action here, or any distillation effect. The whole subject seems very involved in the present state of our knowledge. All the results do not seem to favour association rather than dissociation of the dyestuff.

+ —

If  $\text{HCl} = \text{H} + \text{Cl}$  represents dissociation, association from the above point of view will be represented by



the secondary or residual attraction between the water molecules and the atomic constituents of the HCl weakening to a corresponding extent the primary attraction between the H and Cl.

This secondary attraction may be identical with molecular attraction, which at close quarters is known to



great, whatever relation it may bear to primary or chemical attraction. In the case of dissociation the positive and negative ions are said to be independent of one another; but if the molecular system be broken down in solution it must be by some force equivalent to, or greater than, the primary bond.

Great as we know molecular attraction to be, yet we have no evidence that it approaches in intensity the forces which hold the molecule together. The limited power over which molecular attraction is of a sensible order is too preclude the idea that a smaller pull from an overwhelming number of solvent molecules might produce the effect.

At the same time such a state of affairs will explain how that we might have a "dissociation effect" in dilute solutions, and an "association effect" in strong ones.

From this point of view dissociation does not exist. It is a secondary phenomenon, and due to a weakening of the primary bonds by association with the solvent liquid.

The action is equivalent to a certain percentage of the "ions" or inter groups being in the free state. If it is so, the forces which we know as molecular and chemical are unified, and brought within the range of the phenomena which, in their collected effect, we call gravity.

In the case of actual decomposition, as in the case of  $\text{Sn(OH)}_4$ , I think there is evidence that the metal is present as hydrate. Silk, for example, abstracts  $\text{Sn(OH)}_4$  from solution, even when the latter is in a highly acid medium (Heermann, *Färb.-Zeit.*, 15, 325 and 345), the composition of the absorbed substance being given as  $\text{Sn}_4 + 619\text{Sn(OH)}_4$ . Actual decomposition certainly takes place here. Mutual association seems to render this possible in the presence of a colloid, and this secondary action may induce chemical change, as indicated.

In conclusion, therefore, the conditions of dyeing would seem to be as follows:—

1. A solution state of dye, or mordant, within certain limits of aggregation.

2. State of fibre corresponding to this degree of aggregation.

3. Effective "localisation" of the dye, with subsequent concentration of the dye in the fibre substance.

4. De-solution, due to secondary attraction between fibre substance and dye, or "concentration" effect.

In rare cases, primary, or chemical attraction may play some part in the process at this stage.

There is no evidence in favour of solid solution in any of the above results, even in its recent and wider aspect. Molecular configuration still plays too large a part for the numerous actions in dyeing to be included under such a theory.

As it is seen, dyeing may take place on purely physical grounds, and anyway, any chemical action would seem to be of a secondary nature and not essential to the process.

## DISCUSSION.

Mr. W. H. PERKIN (senior) said he agreed with the author in thinking that in a large number of cases dyeing was not a chemical process. When he was first interested in his subject there was very little known about the theory of dyeing, but the idea occurred to him that if wool could be obtained in the liquid state many dyes would be found very soluble in them. He tested this by first taking a solution of albumin, which was known to be coagulated to absorb many dyes freely, and he found that by shaking it up with Murexide or rosaniline dyes dissolved them more easily than water. He then took naphthylamine ( $\beta$ -naphthylamine was not then known), and he found that crystals of this, if shaken up with these dyes, were quickly dyed, and also that the dyes were freely soluble in fused naphthylamine. He also obtained a similar result with phenylacetamide. Like others who had since worked on the subject, his idea was that dyeing in many cases was due to what had been called "solid solution." No doubt in some instances there was a chemical combination, for example, with mordant such as tannin and tin on cotton, because

one could get a compound of colouring matter, tannin and tin without cotton, and there were other cases, in which no doubt it was chemical, but where the pure dye and the pure fibre was used, when it was very questionable whether chemical action had anything to do with it. He remembered making some experiments on the surface character of cotton, wool and silk, and being very much struck with the difference between them. He worked a quantity of cotton for some time in an emulsion of olive oil and carbonate of potash, such as Turkey-red dyes used, and rinsed it well in clean water; on wringing it out afterwards, nothing but pure water ran from it, the cotton being practically free from oil. He then did the same with silk, and the water was nearly pure, but the silk was quite moist with oil. He did the same with wool, and after rinsing that out in clean water and then wringing, the oil ran from the wool in quantity. He did not know that that had much connection with the dyeing character of those materials, but, speaking generally, the behaviour of these different fibres in relation to the oil corresponded closely to their dyeing power.

Mr. R. J. FRISWELL said that the author had very carefully studied the ground-work of what was an extremely complex subject. There was no doubt that the chemical explanations commonly given were no explanation of dyeing phenomena, and he felt very much inclined to say that the true explanation would not be arrived at even on the theory of solid solution or of osmotic action, because the whole subject was so exceedingly complex, and in so many cases there was interference of one of these actions with another. Take for instance the case of a dye like the lower sulphonic acids of phenylated rosanilines; these bodies were extremely soluble in sodium carbonate: to dye wool with them it would follow that the percentage of sodium carbonate in solution should be reduced as far as possible to get the best dyeing effect. But if instead of beauty of shade, depth or concentration was the test, the contrary was the truth. The greater the amount of sodium carbonate present, the greater was the dyeing effect on the wool. He had carried that on until he had reduced the wool to a state in which it was perfectly rotten, almost beginning to dissolve, simply by increasing the amount of sodium carbonate. There were other cases such as the dyeing of resins, in which there seemed to be a definite chemical combination between the dyeing substance and the resin. The same was true with regard to certain soaps, some of the most beautiful effects in dyeing cotton when the soluble blues—the sulphonated the triphenylrosaniline compounds were not used—were obtained by dyeing in water from very dilute alcoholic solutions of the basic blues on alumina soaps, which were obtained by first treating the cotton with Castille soap and then with acetate of alumina. Again, they had the extraordinary fact that bodies like precipitated ignited silica could be dyed with a great number of dyes both basic and acid in character, and the fact that the dyeing solutions themselves would even dye silicates, glass and porcelain. Then they came at last to a fact which had not been mentioned that evening—the action of light. If some of these dyes, especially those which possessed the power of dyeing bodies like glass and silicates, were exposed to light in a bottle, the side of the bottle which was exposed would be dyed to an enormously greater extent than the side away from it; in fact, the whole question was extremely complex. He hoped this was merely a preliminary to a series of experimental papers on dyeing from the author, which would place their knowledge on a much sounder footing than it was at present.

Mr. F. EVERSHED said that Mr. Dreaper had referred to a number of experimental results, some of which were extremely interesting and apparently novel. For example, it was stated that alcohol containing 5 per cent. of water would remove certain dyes from fibres but not others: what dyes were referred to, and what were the conditions of the experiments? Then Mr. Dreaper had said that naphthylamine could be fixed on wool and cotton from a solution in alcohol and water, and that the fibre would take up from 5 to

30 per cent. of the amine. That was very extraordinary, and the details of those experiments would be interesting. He asked for particulars of the action of certain salts in increasing the affinity of indigo for cotton, and a description of the very remarkable experiment in which indigo, although not in solution, exerted osmotic pressure. Surely it was a new and startling fact, if true, that a substance not in solution could exert osmotic pressure.

Then, again, the action of boiling water on cotton was said to increase its affinity for certain dyes. To what extent was the affinity increased, what were the dyes in question, and what ground was there for supposing that the increased affinity of mercerised cotton for dye-stuffs was due to the same kind of action? That idea seemed rather illogical, for cotton was not heated in the mercerising process, and in the other case no alkali was used, so that the likeness between the two processes was not obvious. It struck him that Mr. Dreaper had expounded a great deal of speculative ingenuity in endeavouring to arrive at a new theory of dyeing, but the connection between theory and fact did not come out very clearly in his discourse.

Mr. C. F. Cross said Mr. Dreaper had a very difficult task in endeavouring to generalise these phenomena of dyeing, which rested on the borderline of molecular physics, but the use of mere terms, such as "mechanical," "physical," or "chemical" was really quite beside the mark.

He had been in correspondence with a school of German chemists who were working on the whole subject of colloids, and he would not pretend to go into such a range of research as their literature covered, but they all agreed that at the moment they were entitled to assume that cellulose was a solution in an important sense of the term: so far in effect that we could apply to cellulose the modern ideas of solution; that cellulose did not contain pre-formed dextrose molecules in any sense, but was an aggregate of ions which took their origin under the special conditions obtaining in the plant cells of which celluloses were mass aggregates; that it was necessarily a mixture of ions of varying dimensions, and, as a consequence of this, cellulose, as a typical colloid, had no definite reacting unit such as is assigned to a body which takes the crystalline state nor a fixed molecular constitution, such as could be represented by a constitutional formula. It was a body which had reacting dimensions according to the number of ionic exchanges which took place in the particular sphere of reaction under consideration. That is to say, it was not a static unit which could be measured in terms of the ordinary physical measurements, but represented rather a dynamic equilibrium and the reacting unit of cellulose at any particular moment was simply a function of the conditions in which it was placed. He would not go into this at any length now, as they were preparing a brochure on the subject. He was sure that Mr. Dreaper, with whom he had discussed these phenomena before, would agree with him that the use of terms at the moment was perhaps a little unnecessary. They all required to suspend their judgment and to really inquire into the hypothesis which he had endeavoured to formulate in those few words: that the fibre-colloids react in all essential respects as solution aggregates and not as polymerised molecules or fixed units. That would in itself explain many of the phenomena of dyeing, and in his opinion if that view of colloids were prosecuted to the end, and especially taking into account these very typical dyeing phenomena, it would be found to explain very much that at present appeared to be extremely nebulous.

Mr. W. P. DREAPER, in reply, said with regard to Dr. Perkin's remarks, he thought himself that the great evidence against the chemical theory was, that if the silk fibre were regarded as an amido acid, and the necessary steps were taken to "deamidate" the fibre and remove the  $\text{NH}_2$  or  $\text{NH}$  groups, it was found that the silk dyed with acid colours just as well as before. It seemed to him that that fact, which seemed fairly well established, was absolutely fatal to any theory of an amido acid nature. With reference to the experiments with the sulphonic acids mentioned by Mr. Friswell in the presence of sodium car-

bonate, he did not think the idea that they acted against the theory of aggregates was correct. The action of sodium carbonate there was more an action on the silk itself, and was probably a hydrating one, especially if it happened to be wool. This was of importance and overbalanced any action of reduced aggregation on the dye-stuff in the alkaline solution. With regard to the action of dyes on recently-ignited silica, it might be due to surface concentration; if the silica was not actually washed, and some of the solution merely withdrawn in a pipette, this might be mistaken for an attraction of the silica itself. It might only be due to surface concentration on the powdered silica. Otherwise, he thought the surface of the silica in the presence of water was always slightly hydrated, or in a colloid state, and the dye was attracted by that portion of the silica. As regards the osmotic pressure on the indigo, the fact was noticed by Linder himself, and it was undoubtedly a fact that pseudo-solutions, or colloid solutions did actually give rise to osmotic phenomena, the case of arsenious sulphide a pressure equal to, thought, 17 mm. was obtained. He referred to the action of mercerised cotton being similar to that of boiled cotton because he thought it would be generally recognised that in the case of boiled cotton a hydrated product was obtained. The alkali in the case of mercerised cotton was, of course, not essential to the finished product. A similar effect was obtained in both cases. The experiments in that case were some published recently in this Journal in one of Hübner and Pope's papers. As regards Mr. Cross' remarks, he perfectly agreed with him that it was very difficult, in the present state of knowledge, to define too closely theoretical considerations, but at the same time, if they altogether overlooked one side of the subject, they might miss their opportunity. He thought that it was better to consider the two sides together, rather than wait until the experimental data were complete before theoretical considerations were taken into account.

## Newcastle Section.

Meeting held at Armstrong College on Thursday, February 16th, 1905.

DR. J. T. DUNN IN THE CHAIR.

### METHODS FOR SEPARATING AND DETECTING MIXING ZINC IN BLENDES AND OTHER NATURAL AND ARTIFICIAL PRODUCTS.

BY THE LATE H. SALVIN PATTINSON, PH.D., F.I.C., AND GEORGE C. REDPATH.

The separation of zinc from metals associated with it in blendes, flue-dusts, &c., frequently gives trouble, and discrepancies occur when the same sample is analysed by different analysts. These discrepancies are probably due in most instances, to imperfect separation rather than errors in the zinc-determination itself.

We have obtained satisfactory results from the methods of treatment, and, though this record of our work contains nothing new in principle, we think our figures and results may be useful to those who, like ourselves, have very frequently to assay, for zinc, ores and artificial products which contain it.

1. *Von Schulz and Low's Method.*—In this method the ore is dissolved in nitric acid and potassium chloride, evaporated to dryness, the residue heated, cooled, and extracted with ammonium chloride and ammonia. The zinc in the solution so obtained is titrated with ferrocyanide, using uranium acetate as an indicator, and ferrocyanide is standardised by means of a solution of



ing a known amount of zinc, to which has been added out as much ammonium chloride as the actual solutions assay contain. The method is described in this trial, 1892, 846, so that details need not here be given. modifications we have found necessary or desirable accurate work are as follows:—*a.* In dissolving the ore, use hydrochloric acid alone in the first place, and after the time add nitric acid. *b.* We find it necessary, after reacting with ammonium chloride and ammonia, to resolve the residue in hydrochloric acid, evaporate to dryness, and extract a second time. This being so, we for each extraction a smaller amount of ammonium chloride than v. Schulz and Low recommend—1 grm. of ammonium chloride and 3–5 c.c. of ammonia, instead of 1 grm. of ammonium chloride and 15 c.c. of ammonia, each gramme of ore. As the figures in Table I show, usually leave, working thus, a little more zinc for second extraction than if we used the larger amount of ammonium chloride in the first place; but the second action is in all cases necessary, and is in either case complete. *c.* We find it desirable to wash with 5 per cent. of 1 per cent. ammonium chloride solution. *d.* If manganese be present with the zinc, we precipitate it by adding bromine to the ammoniacal solution, filter, redissolve the precipitate in hydrochloric acid, add ammonium acetate, precipitate by hydrogen sulphide any zinc left down with the manganese, dissolve the zinc chloride in hydrochloric acid, and add it to the main solution. We have added to Table I some figures for a known mixture of zinc and iron salts, which show that the ammonium chloride rather than the ammonia is the active agent in the extraction. We have also found that the residue from evaporating to dryness a solution of zinc chloride containing 0.5 grm. of zinc may be heated for an hour to 470° C. without any loss of zinc; if the solution contains, in addition to the zinc, 1 grm. of ammonium chloride, an hour's heating of the residue at 470° C. volatilises 0.006 grm. of zinc, but no zinc is lost after an hour's heating at 200° C.

ore and neutralisation of the solution are carried out exactly as in von Berg's method (either ammonium or sodium carbonate may be used in the neutralisation); then 1 grm. of gallic acid as ammonium salt and 2 grms. of the free acid are added, and the zinc is precipitated as directed by Lewis. The further treatment of the zinc sulphide and the examination for impurities are carried out exactly as described under von Berg's method.

A few typical figures obtained in actual practice are given in Table II. It will be seen that the three methods

TABLE II.

*Comparison of Results Obtained by the Methods Described.*

Nature of Sample.	Von Schulz and Low.	Von Berg.	Lewis.
Blende .....	49.29	49.00	49.01
Slime blende .....	49.29	—	—
Flue dust .....	47.66	47.56	47.56
Flue dust .....	47.66	—	—
Flue dust .....	39.29	—	39.46
Flue dust .....	39.39	—	39.46
Flue dust .....	37.55	37.44	37.40
Flue dust .....	37.55	37.60	37.40
Flue dust .....	36.31	36.40	36.40
Flue dust .....	36.31	36.40	36.40
Flue dust .....	41.60	41.70	—
Flue dust .....	41.60	41.70	—

give very closely agreeing results. On the whole, for rapidity and convenience, we prefer to use von Schulz and Low's method, though the others are also fairly quick and not at all tedious. Of the two sulphide methods, von Berg's is distinctly to be preferred on account of the greater density of the sulphide precipitate, which allows of its being collected on a smaller filter and being more rapidly washed than is the case in Lewis' method; moreover, cobalt, if present, interferes with the accuracy of

TABLE I.

*Showing the Amounts of Zinc Left in the Residue after One Extraction with Ammonium Chloride and Ammonia. (Von Schulz and Low's Method.)*

Nature of Sample.	Amount Taken.	Temperature at which Residue was Heated.	Ammonium Chloride Used.	Ammonia Used.	Water Used.	Zinc left in Residue.
	grms.	° C.	grms.	c.c.	c.c.	mgrms.
dust .....	5	100	5	15	20	45
dust .....	5	150	5	15	20	25
dust .....	5	250	5	15	20	17
dust .....	5	about 200	35	75	125	8
dust .....	5	do.	15	15	20	7
dust .....	5	do.	10	15	20	5
dust .....	5	do.	5	15	20	7
dust .....	5	do.	20	50	100	none
dust .....	5	do.	8	20	40	1
dust .....	5	do.	5	15	20	1
dust .....	5	do.	2	10	15	1
dust .....	7	do.	7	15	20	4
dust .....	—	do.	none	15	20	24
dust .....	—	do.	7	2 drops	20	5

*Von Berg's Method:* see Dittmar, Quantitative Analysis (1887), page 104.—1 grm. of the ore is dissolved in hydrochloric and nitric acids, evaporated to dryness in sulphuric acid, taken up with dilute sulphuric acid, filtered, the residue on the filter being well washed with dilute sulphuric acid. The filtrate is nearly neutralised with ammonia, then ammonium carbonate is added till a permanent precipitate appears. This is just dissolved in sulphuric acid, ammonium chloracetate and chloracetic acid added, and the zinc precipitated with hydrogen sulphide according to Dittmar's directions. The washed sulphide may be treated in a variety of ways; usually dissolve it in hydrochloric acid and bromine, precipitate by sodium carbonate, and weigh the zinc as oxide. Any small amounts of co-precipitated iron, manganese, or copper are determined, and subtracted from the weight of the oxide so obtained.

*Lewis' Method:* Analyst, 28, 93.—The solution of the

Lewis' method, but is completely separated from the zinc by von Berg's method.

Von Schulz and Low's method can be very advantageously used for the separation of zinc in the course of analysis of iron ores, &c., being more rapid than the acetate method. In no case have we found any zinc remaining in the residue after two extractions with ammonium chloride and ammonia.

In the course of our work we also examined a very ingenious method of separating iron from zinc and other metals, devised by Nicolardot (this J., 1901, 1242), depending on the precipitation of the iron as basic sulphate after a molecular change produced in the chloride by long heating to 125° C. Though this frequently gave a very complete precipitation of the iron, however, it did not always do so; and as the other methods we have described proved so satisfactory, we did not investigate the method farther.

## DISCUSSION.

Mr. W. W. PROCTOR said that while the volumetric method was suitable where many estimations of zinc were required in a short time, he preferred to use a gravimetric process where accuracy rather than time was the object. Time and trouble were required to obtain a solution free from interfering metals such as lead, copper, iron and manganese, and having obtained such a solution, if some modification were made in the process usually recommended, the additional time required seemed to be compensated by the greater accuracy of the result obtained by actually weighing the oxide of zinc obtained in the analysis. He would advise bringing the ammoniacal solution, freed from interfering metals, nearly to boiling, precipitating the zinc with a slight excess of ammonium sulphide, and boiling for about 15 minutes, by which means the slimy precipitate of zinc sulphide became granular and subsided more readily, so that it could be washed by decantation; a few drops of ammonium sulphide and chloride were added to each wash water and the mixture again boiled, and allowed to settle. The precipitate did not then require much washing. The filtrate was usually clear, but if turbid it should be again warmed up with a little ammonium sulphide and chloride, if necessary, and passed through a separate Swedish filter. The precipitate should then be dried gently with the filter in a platinum crucible, so as to char the paper, which was then burnt off at a temperature too low to reduce the zinc. Zinc sulphide was not so readily reduced as the oxide. The process might, of course, be assisted by moistening the char with a little ammonium nitrate solution. On now heating the residue more strongly, with free access of air, the sulphide was almost entirely converted into oxide, if the amount of zinc was not much more than 0.5 gm. It was then weighed, but as it usually retained a small amount of sulphuric anhydride, it was dissolved in dilute hydrochloric acid, boiled, and precipitated with barium chloride in the usual way. This need not require more than a quarter of an hour, as the barium sulphate was only in small quantity and easily filtered off. The precipitate of barium sulphate was calculated into  $\text{SO}_3$ , and this, when deducted from the mixed zinc oxide and sulphate, gave the amount of zinc oxide from which the quantity of zinc existing in the ore was easily found.

By acting in this way the tedious operation of converting into carbonate was avoided, as well as the unpleasant action of sodium carbonate, if glass or porcelain vessels were employed, which rendered it necessary to examine the precipitate for silica.

Mr. ERNEST JACKSON said that the method he had used for extracting the zinc previous to titrating with ferrocyanide differed from that employed by the authors. It was carried out in the following manner:—The blende, or flue dust, was dissolved in nitro-hydrochloric acid, evaporated to dryness and the silicious matter, &c., separated. The solution was then carefully neutralised with ammonia, slightly acidified with hydrochloric acid, and any lead, copper, cadmium, &c., precipitated. (In the case of a large percentage of copper being present, the precipitate was re-dissolved and examined for zinc.) After filtration the solution was boiled to expel hydrogen sulphide, oxidised with nitric acid, and, after the addition of bromine, poured into an excess of ammonia. The precipitate of iron, manganese, alumina, was then filtered off, re-dissolved in hydrochloric acid, and re-precipitated in the same way, the filtrate being added to the main solution. If a large quantity of iron, alumina, or manganese were present it was advisable to re-precipitate again and examine the filtrate for zinc by the addition of ammonium sulphide. The solution was boiled to liberate most of the ammonia, carefully neutralised with HCl, 6 c.c. HCl added in excess, heated to above  $75^\circ\text{C}$ ., and titrated with ferrocyanide. The indicator used was a 4 per cent. solution of uranium nitrate, this having been found to be more reliable, in the presence of hydrochloric acid, than the acetate solution.

When the copper and cadmium were present in small quantities, the solution, after separating the silicious residue, might be treated as above for the separation of

iron, &c., and after neutralising with excess of ammonia 6 c.c. HCl added in excess and saturated with hydrogen sulphide. On heating to the same temperature as before the solution was ready for titration. It was most important to regulate the degree of acidity since the interfering metals—cadmium and copper—were to be precipitated, whilst it was inadvisable and unnecessary to precipitate the lead sulphide. The presence of sufficient acid was necessary to prevent the precipitation of the lead, but if the solution be too acid, the cadmium would be thrown down. It was found by experiment that 6 excess of hydrochloric acid in the final bulk of 200 solution gave the most accurate results. Tests carried out by the gallic acid method referred to by the author gave results concordant with those obtained by the method described. This means of separating the elements interfering with the accurate titration of zinc by ferrocyanide, although probably not so rapid as the process described by the authors, left nothing to be desired with regard to the accuracy of the results obtained.

## New York Section.

Meeting held at Chemists' Club, on December 16th, 1905.

DR. RUSSELL W. MOORE IN THE CHAIR.

## IMPROVED METHODS OF APPLYING RADIUM.

BY HUGO LIEBER.

The proportions of the radiations given off by radium and its disintegrated emanations are about 95 per cent. of  $\alpha$ -rays and about 5 per cent. of combined  $\beta$ - and  $\gamma$ -rays. Because of their nearly negative penetrative power the  $\alpha$ -rays, as well as the emanations, are practically unavailable for therapeutic purposes when the radium is used in glass tubes or similar containers. Even the superficial layers of a given radium preparation are relatively impervious to both the emanations and the  $\alpha$ -rays proceeding from the underlying portions of the preparation. Therefore it is essential, in order to obtain the radioactive effects of a given quantity of radium, to have the radium in such a form (1) that the surrounding walls of the container could intercept neither the  $\alpha$ -rays nor the emanations, and (2) that the given quantity of radium should be spread out so thinly that, practically speaking, an upper layer would not exist. These requirements finally led to the production of what the author terms "radium coatings."

Radium coatings are made in the following manner. Radium is dissolved in a suitable solvent and into this solution a suitable material is dipped. This material is then withdrawn, with radium solution adhering to it, the solvent quickly evaporates, leaving the material covered with an exceedingly thin film of radium. The kind of solvent to be used is determined by the nature of the material to be coated. Such solvents are employed which have a tendency to soften and to permeate the material which is to be coated. Thus, if celluloid rods, discs, or similar instruments are to receive a radium coating in order to be used for therapeutic purposes, solvents such as alcohol, amyl acetate, &c., may be employed. These solvents have a tendency to soften celluloid temporarily. When the solvent evaporates, the radium has been uniformly distributed over the celluloid, and has also been incorporated in its surface. In order to prevent accidental removal of the radium in such coatings, the celluloid instruments produced in this way are dipped for a short time in a collodion solution. By this process the whole radium coating is covered with a very thin film of collodion. In the course of a few days this film of collodion becomes so tough that it will strongly resist destruction, thus affording ample protection for the underlying radium. This thin film, however, permits the  $\alpha$ -rays as well as the emanations to penetrate freely.

In the preparation of these coatings both the radium and the collodion solutions are coloured with an aniline



This is done to show the part that has been coated, i.e., if the radium happens to be removed by accident otherwise, as by scraping, &c., the disappearance of the  $\alpha$  rays makes such removal evident.

The great difference between radium used in containers, used even of exceedingly thin aluminium, and  $\alpha$  rays used in the form of the coatings here described, shown by their relative influences on the electroscopes; a fine rod coated at its tip with radium bromide of 0.001 activity and holding, therefore, very little radium, worked very favourably in its effects with 1 grm. of radium bromide of 10,000 activity in a glass tube, or with 1 grm. of radium bromide of 1,000,000 activity in a thin aluminium tube.

The scintillations produced upon a zinc sulphide screen uncovered radium, such as is shown in the spintharion of Crookes, are produced solely by the impact of  $\alpha$  rays upon the zinc sulphide. If what has been said above is correct, that is, that the  $\alpha$  rays can penetrate the collodion coating of the celluloid rods, discs, then the latter should yield evidence of these scintillations when placed upon a zinc sulphide screen. Such scintillations were abundantly demonstrated with various coatings of the coatings.

Radium emanations will always follow an air current. Consequently, if some uncovered radium is placed in an air current, the current will carry with itself the emanations, which emanations will ionise the air and discharge the electroscopes.

The radium coatings make it possible to apply radium to practically any part of the body. The radium applied would be practically equivalent in radioactive effects to the same amount of uncovered radium of the same thin layer. Any instrument could be conveniently coated with radium at a proper place, by the method indicated, and the radiations could be brought into action wherever desired.

A great advantage of these radium coatings is that all instruments, &c., coated by the method described, can be easily sterilised without loss of radium, for the protective coating effectually resists even continued boiling. A strip of celluloid which had been coated with radium and then in collodion, was placed in water in a test tube, and the contents vigorously boiled; both the radium and the collodion solutions used for the preparation of the coatings were coloured with a soluble blue aniline dye. That the collodion protected the radium was shown by the fact that the water, after boiling, was entirely free from colour. The strip also retained its original radioactivity.

Meeting held on Friday, November 25th, 1904.

## USE OF TANNIC ACID IN DETERMINING ALUMINA.

BY ROBT. E. DIVINE.

(This J., Jan. 16th, 1905, 11.)

### NOTE.

The author wishes it to be placed on record that the experimental work for this paper was done in the Research Laboratory of the Larkin Soap Co., and that the paper was read by their permission.

## Yorkshire Section.

Meeting held at Queen's Hotel, Leeds, on Monday, January 23rd, 1905.

PROF. H. R. PROCTER IN THE CHAIR.

## MICROSCOPICAL EXAMINATION OF SUMACH ADULTERANTS.

Communication from the Leather Industries Laboratory of the University of Leeds.)

BY HOWARD PRIESTMAN.

In making microscopical investigation of sumach for adulterants, several difficulties occur which are worthy of

mention before making a comparison of the various cuticles with a view to identification.

In the first place, the thickness of the leaves and the nature of their constitution makes it impossible to see through them until they have been treated with some reagent which will separate the cuticles from the substance of the leaf, so that only the stratum of single cells, which forms the cuticle, will remain. Hot concentrated nitric acid is most generally used for this purpose, although this treatment, if prolonged to boiling, will entirely destroy the tissues of *Rhus Coriaria* and most other leaves.

This fact makes it very difficult to form any idea of the percentage of foreign matter in any mixture, because so much of the leaf substance in *Rhus Coriaria* will be destroyed before the cuticles of stronger leaves are separated. Workers in this branch of research will soon find other minor difficulties which need the greatest care if comparisons made under the microscope alone are to be of any use. The different cuticles vary very greatly in thickness, the lower cuticles of *Rhus Coriaria*, *Cotinus* and *Glabra* being so thin and transparent that it is difficult to see their structure until they are dyed; and the writer found it equally difficult to dye them uniformly and to free them from wrinkles under a cover glass.

In order to get sharp negatives of considerable enlargement, it seems necessary to have the slide coloured to some non-actinic shade, so that the actinic and visual foci may be the same, and the image formed upon an isochromatic plate may be perfectly sharp. For this purpose safranin and acid red seem equally suitable, the former being simpler to use because most of the cuticles take it quickly and retain it uniformly after they have been dehydrated with alcohol and benzene, and mounted in balsam. Even these dyes did not prove as good as could be wished for the three very thin cuticles already mentioned, and no satisfactory photographic results were obtained until dehydrating was given up and glycerine jelly used as a mountant instead of Canada balsam. This, of course, gives much less permanent slides than balsam, but if well ringed with asphalt black, slides mounted in jelly will doubtless last for a considerable time.

In the case of *Colpoony Compressa*, *Rhus Metopium*, *Pistacia Lentiscus*, and the upper cuticle of *Rhus Glabra*, dyeing is really unnecessary, because the cuticles are dense enough and yellow enough to give a very definite image, showing the cell walls quite plainly if they be mounted just as they come from the neutralising bath after being treated with nitric acid.

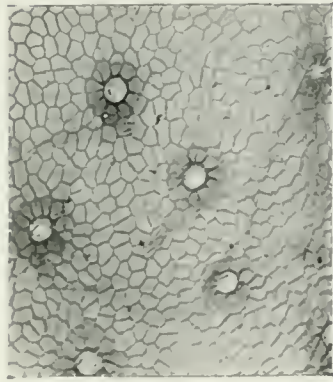
*Genuine sumach*, consisting of the leaves of *Rhus Coriaria*, is very easy to distinguish from all other vegetable products used as adulterants, because both upper and lower cuticles are covered with a dense growth of hairs. Those on the upper surface are about 0.005 inches long, tapering all the way from the root to the point; the root itself being bulbous, so that each hair strongly resembles a badly made hob nail, both in size and shape, when seen under an enlargement of 120 diameters. The upper cuticle is much stronger than the lower one, and when it is entirely separated from the vein structure it shows a well-defined cell structure, so arranged that the base of each hair forms the centre of a symmetrical group of 10 or 11, 4, 5 or 6 sided cells, so that when the hair is absent or quite transparent, the root space appears like a large stomata very clearly defined (figs. 2 and 1).

Stomata proper seldom if ever occur on the upper cuticle. The lower cuticle is very thin and transparent and is so difficult to handle that large portions are seldom obtained, but like the upper cuticle it is thickly covered with hairs, which, in this case, are thinner and longer, varying from 0.015 to 0.03 in length. Owing to its extreme thinness and transparency, the lower cuticle seldom absorbs sufficient dye to affect its colour after it has been treated with alcohol and benzene, whilst the lower hairs have sufficient substance to absorb a great deal of colour, consequently appearing very dense to transmitted light. For this reason they form a very prominent feature in photographs. In spite of the extreme transparency of the cuticle, careful inspection will reveal a large number of stomata between the roots of these longer hairs, and in addition there are always present some very small club-









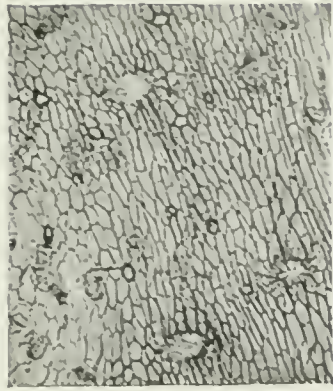
1.—RHUS CORIARIA, UPPER.  $\times 84$ .



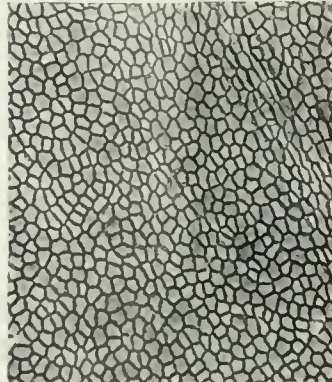
2.—RHUS CORIARIA, UPPER DYED.  $\times 84$ .



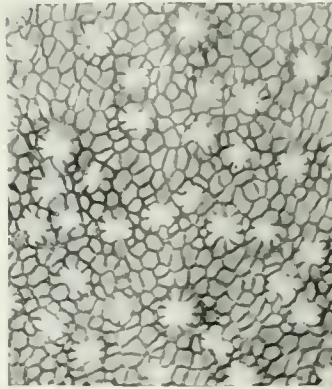
3.—RHUS CORIARIA, LOWER  $\times 84$ .



4.—RHUS CORIARIA STEM CUTICLE.  $\times 84$ .



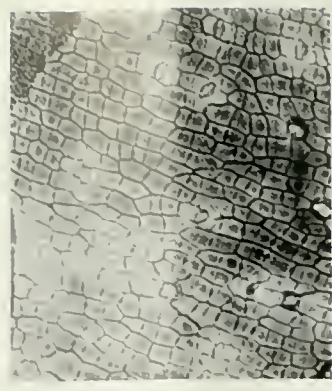
5.—PISTACIA LENTISCUS, UPPER.  $\times 84$ .



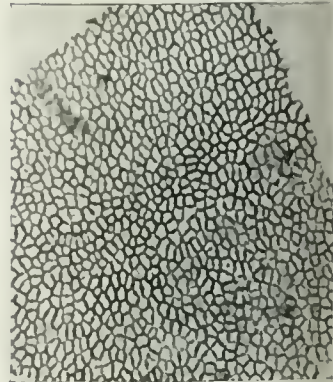
6.—PISTACIA LENTISCUS, LOWER.  $\times 84$ .



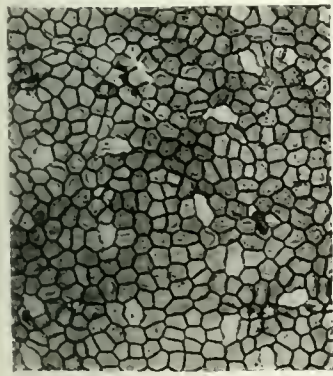
7.—TAMARIX, STEM SUBSTANCE.  $\times 42$ .



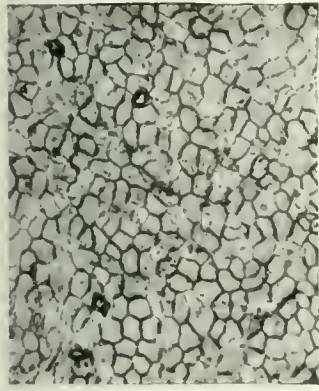
8.—TAMARIX, STEM CUTICLE.  $\times 84$ .



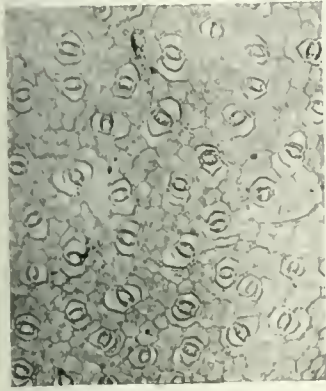




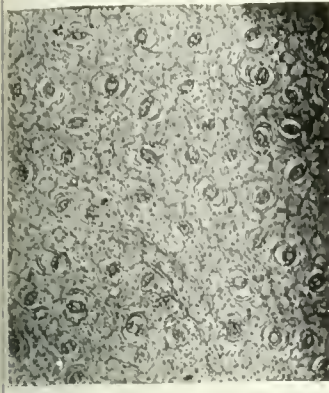
13.—CORIARIA MYRTIFOLIA, UPPER.  $\times 84$ .



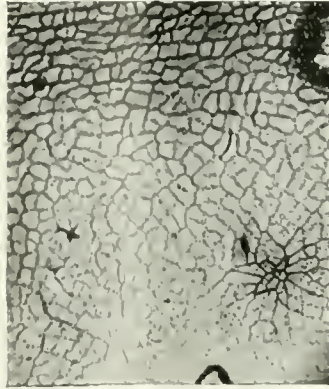
14.—CORIARIA MYRTIFOLIA, LOWER.  $\times 84$ .



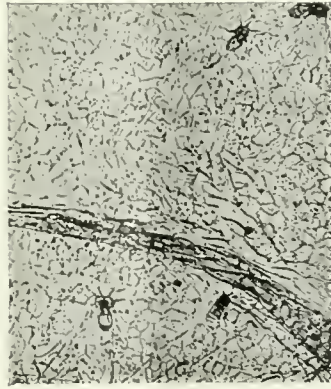
15.—COLPOON COMPRESSA, UPPER.  $\times 84$ .



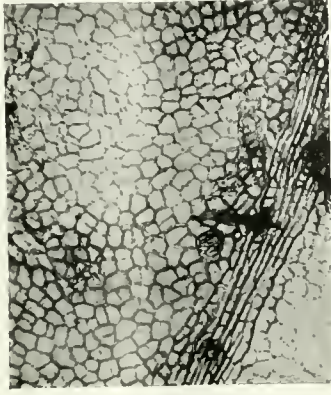
16.—COLPOON COMPRESSA, LOWER.  $\times 84$ .



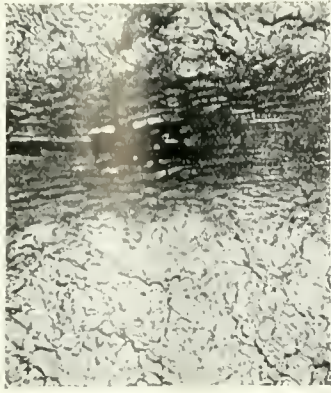
17.—RHUS COTINUS, UPPER.  $\times 84$ .



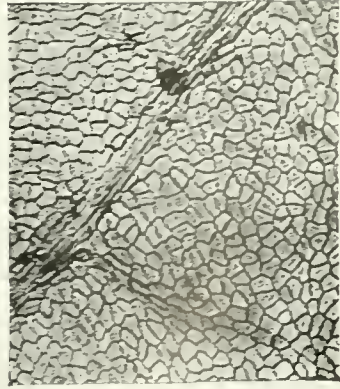
18.—RHUS COTINUS, LOWER.  $\times 84$ .



19.—ALANTHUS GLANDULOSA, UPPER.  $\times 84$ .



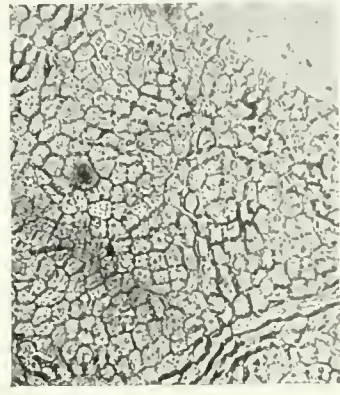
20.—ALANTHUS GLANDULOSA, LOWER.  $\times 84$ .



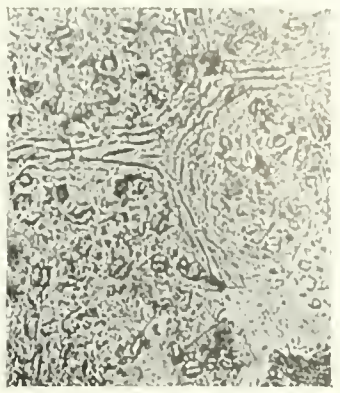
21.—RHUS GLABRA, UPPER.  $\times 84$ .



22.—RHUS GLABRA, LOWER.  $\times 84$ .



23.—VITIS VINIFERA, UPPER.  $\times 84$ .



24.—VITIS VINIFERA, LOWER.  $\times 84$ .





curious waviness in the well-defined walls, which makes it easy to distinguish (fig. 13).

The upper cuticle has no stomata, and the cells covering the veins are elongated and distorted in a marked manner. The lower cuticle also shows very frequent vein markings between them there occur numerous stomata, each near the centre of a group of less defined cells, which are surrounded by others with stronger walls. Stomata do not occur on the vein markings (fig. 14).

*Rhus glabra* is an exception to the general rule that adulterants are quickly soluble in boiling nitric acid. Although the lower cuticle is so thin as to be visible to the naked eye, and very difficult to see under a microscope, the upper one is extremely strong, and shows the effects of boiling nitric acid for quite a long time.

It has a well defined cell structure without stomata with frequent vein marks (fig. 21).

The lower cuticle is very difficult indeed to dye and, on account of its extremely thin and transparent nature, but as it carries small club-shaped hairs and shows minute stomata, it is the most important exception to the general rule and worthy of notice on this account. Extreme transparency makes it very difficult to photograph, and no regular cellular structure is visible. When it has been dehydrated in alcohol and benzene mounted in balsam, it was found quite impossible to get any result whatever with the camera; but it was, as in many other cases of difficulty, that fairly good results could be obtained if the same specimens were mounted on slides in glycerine jelly (fig. 22).

*Spon. compressa* separates easily in nitric acid, the two cuticles being of nearly equal strength and they are easily handled and may be observed and photographed after neutralisation, but without dye.

Neither cuticle carries fibre of any kind, but both have stomata, and they only differ from one another in the nature of the cell walls, which are less defined in the lower than in the upper cuticle, though they are of similar form in both (figs. 15 and 16).

*Rhus glandulosa* like *Rhus glabra* separates easily, and has a very thin lower cuticle, but is not entirely soluble in boiling nitric acid; unlike *Rhus glabra* it has no stomata of any kind upon it, and both cuticles show a distinct cell structure (figs. 19 and 20).

In the upper cuticle the cells have well defined walls approximately the same size as those in other leaves for the same purpose, but there are no stomata, and the cells which cover the veins are elongated and distorted to such an extent that they show very distinctly.

The lower cuticle has similar characteristics but the stomata are frequent, and as is often the case with others, the shape of the cell walls is less definite, the markings being so dark as to be very noticeable.

*Tamarix africana* differs from all the other adulterants at the commercial article is composed entirely of twigs instead of leaves. If, however, it is subjected to the same influences as the leaf adulterants of sumach, it undergoes even more striking disintegration, for although the stems are so much harder than the leaf tissue, they are readily soluble in hot acid, and if a sample in nitric acid is heated slowly in the water bath at about 70°, it will be found that the cuticle begins to separate from the stem at 80°, and at 80°—85° it will be floating loose in the acid.

If it is desired to dissolve the stem fibres entirely, density and size make it necessary to keep the test at this temperature for 5 or 10 minutes, and as the cuticle itself is soluble at a little over 90°, it is well to maintain a temperature not over 75°, for a longer period than to dissolve the core fibres quickly by raising the acid to a point at which the cuticle also will begin to dissolve (figs. 7 and 8).

These facts are equally true of the stems of *Rhus glabra*; the stem cores of that plant dissolving at 75°—80°, whilst the delicate transparent stem cuticle with its growth of hairs and frequent stomata or holes, remains undissolved at 95°.

The cuticle of *Tamarix* has a well defined cell structure; the cell being elongated in the direction of growth, and not infrequent stomata arranged between pairs of triangular cells. For some reason it is never easy to

straighten this cuticle on a slide; it is always apt to double on itself and to lie in creases, which give an incorrect impression, and as already noticed, if it has been raised to a temperature near to the point at which it dissolves, it tends to consolidate into gelatinous lumps, which are naturally of no use for investigation. As it carries no hairs of any kind on its surface it is easy to distinguish from *Coriaria* stem, where fibres are always to be found, and even if this distinction were wanting, there should be no difficulty in deciding between the different cuticles simply from the nature of their cell structure (fig. 8).

*Rhus Cotinus*.—With the exception of vine cuticle, that of *Rhus Cotinus* is the most transparent of the cuticles of this group. Both upper and lower cuticles are so clear that they show little or no cell structure even when dyed, for they absorb so little dye that the transparency is very slightly impaired, but the club-shaped hairs which take a small percentage of the dye are more easily visible on the upper cuticle after dyeing (figs. 17 and 18).

The cuticles are so difficult to handle, or even to see when in the acid, that it is almost impossible after boiling them to say which is upper and which lower. There is no definite indication of stomata in either of them.

*Vitis vinifera* (English vine) requires slower treatment with nitric acid to separate the cuticles. If the temperature of the water bath were raised at such a speed as to boil in 10 minutes, the leaf substance will not dissolve until 80° is reached, and as the cuticles begin to disintegrate at 85°—90°, they are always very soft and difficult to handle if they are separated in this way. On the other hand, if the bath be warmed so slowly that 20 to 25 minutes are required to raise it to 60°, the cuticles will be found to separate easily, with much less tendency to tear. They will also be found stronger if only just sufficient alkali is used to neutralise the acid, so that they are not treated with a superfluity of strong alkali.

The cuticles are both extraordinarily transparent; the upper one only showing indistinct cell structure, with no stomata, or hairs of any kind, whilst there are very large numbers of the stomata on the lower cuticle and something resembling short straight pointed fibres, say 0.005 in. in length, has at times been seen on isolated samples.

The structure of the veins is very curious. On the under side of the leaf they seem to consist of ribs, covered with a kind of fibre, adhering so loosely that it may spread over adjacent portions of the leaf, giving the whole surface the appearance of being covered by a dense growth of fine fibres, although this is not really the case.

A sample of ground Italian vine leaves, such as are actually used for adulteration, give results very similar in every way to English leaves. It is difficult to dissolve all the leaf substance without softening the cuticle because the nitric acid sets up such violent action as to raise the temperature without the aid of a water bath at all.

The rare samples which can be found free from leaf substance are absolutely transparent and difficult to dye. If mounted in balsam or other benzine solution they give no result in the camera, and the best results have been obtained from temporary slides mounted in water. In this condition also the cuticle is transparent, but the difference in thickness between the walls and other portions of the cells causes refraction which is more apparent with wide angle lenses; the photographs being taken by this method with a very small condenser stop and a Zeiss B. objective giving about 120 enlargements (figs. 23 and 24).

*Caroubier*, carob tree or locust bean (*Ceratonia Siliqua*) resembles *Pistacia lentiscus* in many ways. The cells are similar in arrangement and size, but appear to have somewhat thicker walls. Both cuticles are strong, the lower one containing stomata, but specimens appear very seldom after boiling, and it is probable that much of the lower cuticle is without stomata.

Neutralisation with ammonia leaves the cuticle of a definite yellow colour, and there is no need to dye it prior to photographing (fig. 9).

Unless there is some chemical colour test which will differentiate between these leaves and those of *Pistacia lentiscus*, it would be impossible to swear that a given sample contains either one or the other for certain.

*Arbousier*, *Arbutus unedo*, is a plant of the heath tribe,

more nearly resembling *Tamarix africana* than any other specimen hitherto examined. Samples submitted contain a great deal of stem substance soluble only at about 100° in 20 minutes, the cuticle of which is so like tamarix cuticle in the arrangement of the cells and the stomata, that great care must always be necessary when dealing with either of these adulterants, for it is the writer's opinion that the microscope alone can never tell for certain which is which (fig. 12, taken with 1 in. lens).

NOTE.—All the photographs used as illustrations to this paper were taken with a Zeiss B. lens.

#### DISCUSSION.

Prof. H. R. PROCTER mentioned *Rhus cotinus* and *Rhus copallina* as American sumachs, used in the United States for tanning purposes. Tamerisk was collected in Africa and used for adulteration. It was impossible to detect dried exhausted sumach microscopically, but this was of small consequence if sufficient tannin were present. Pistacio had been tried as a sumach substitute, and in some cases was a useful material, but the tannin was different in character from that of the true sumach. Some other adulterants spoiled the colour of leather. *Colpoon compressum* was not an adulterant, but a sumach substitute, and in many respects resembled pistacio. It was used in South Africa, especially in Cape Town.

Mr. F. W. BRANSON asked if nitric acid of slightly lower specific gravity had been used where the stronger acid destroyed the cuticle.

Mr. G. W. SLATTER asked if siliceous matter, absorbed by the plant from the soil was the cause of the resistance of the cuticle to nitric acid, or if this could be attributed to something else. Perhaps the shape of cells, which he thought were different in some of the specimens, might be a useful means of identification.

Dr. SMITH said the cuticle might be chemically a more indefinite substance than starch or dextrin. Resistance must be due to the cellulose wall becoming impregnated and converted into cutine. Cutine remarkable in giving no tests. He asked why many of the substances could not be identified with low powers as in seed testing. If small tests were made, could impurities be thrown out and analysed? With reference to whole *Rhus*, which were covered with hairs, some could be detected by the low powers of the microscope, but others would perhaps require treatment.

Mr. HOWARD PRIESTMAN said *Rhus coriaria* was abundant in hairs. No other plant had hairs at all like this. The cell structure of the cuticle was the only visible when undyed. After practice, the upper cuticle of *coriaria* was easily detected, though several adulterants were difficult to identify with certainty. The apparatus used for taking the micro-photographs consisted of a simple box camera and taper bellows. Light was supplied from an ordinary incandescence burner passed through a bull's eye and sub-stage condenser. The initial difficulty was in getting good definition especially with ordinary plates. If red dye and chromatic plates were used the focus was easily obtained.

Prof. H. R. PROCTER explained that the ordinary nitric acid of sp. gr. 1.42 was used. Siliceous matter was a possible cause of the resistance of the cuticle to nitric acid, but other substances such as waxy matter contained in many plants of the evergreen class, tended to similar results. The shape of stomata and special arrangement of the latter had been noticed in the work. Samples when received in this country usually very finely ground, and this prevented the use of low power objectives for separating the various constituents.

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### I.—PLANT, APPARATUS, MACHINERY.

#### ENGLISH PATENT.

*Condensing and Cooling Apparatus.* H. Austin, Formby, and G. Scott and Son (London), Ltd. Eng. Pat. 7139, March 24, 1904.

THE inventors claim a combination of apparatus in which the vapour from an evaporator is first condensed in a tubular or other form of surface condenser, the condensed liquid being subsequently cooled in a series of counter-current, tubular cooling vessels. These are so arranged that the cooled liquid only leaves the coolers as it is dis-

placed by freshly-condensed liquid from the condenser. By this arrangement the entire surface of the cooling condensing devices is utilised. Claim is also made causing the cooling medium to flow in the opposite direction to that taken by the vapour to be condensed, condensed liquid formed.—W. H. C.

#### UNITED STATES PATENTS.

*Filter.* K. Kiefer, Cincinnati. U.S. Pats. 781,830 and 782,200, Feb. 7, 1905.

SEE Fr. Pat. 344,254 of 1904; this J., 1904, 1080.—T. I.



*Retort.* J. L. Jackson, Assignor to American Sandstone Machine Machinery Co., Saginaw, Mich. U.S. Pat. 2,207, Feb. 7, 1905.

An arched retort is constructed of sections rivetted together, and under each circumferential series of rivets a "rip-trough" curved to conform to the internal contour of the arch is arranged, in order to convey any condensed liquid to the sides of the retort. The trough is supported by "jam-bolts" passing through the side of the retort and the bottom of the trough, and having their ends flush with the convex side of the latter.—W. H. C.

*Retorts with Gases; Apparatus for Treating* —. J. Quarez, Amiens, France. U.S. Pat. 782,622, Feb. 7, 1905.

Liquid and gas are made to pass down a "downflow-column" in which are arranged "deflectors" and "conduit sleeves" forming passages between the deflectors. The bottom of the "downflow-column," which has a lower edge serrated, the gas and liquid pass to a communicating "ascension-column." In the latter there are arranged a number of superposed deflectors, having curved rims, and of varying diameters. The liquid flows from the upper part of the "ascension-column" into a "tank," which is provided with an adjustable vertical partition, forming a filtering medium, to keep back any sand and with an outlet pipe for the liquid.—W. H. C.

## II.—FUEL, GAS, AND LIGHT.

### ENGLISH PATENTS.

*Pressing and similar Humid Materials; Apparatus for Pressing the Moisture from* —. A. H. Higginbottom and A. B. Lennox, Newcastle-on-Tyne. Eng. Pat. 1,5170, March 2, 1904.

Material to be treated is fed on to an endless band, sprocket chain carrying wooden boards, mounted on suitable pulleys. As the material is carried forward by the band or chain, it is pressed against the exterior of a revolving drum, mounted on a spring-bearing, so that it may give somewhat and allow any hard lumps to pass between its surface and the band without damaging the arrangement. After being compressed, the material on the band is carried forward on the surface of the drum to a point where it is taken off by a scraper and fed into a shoot.—W. H. C.

*Furnaces; Impts. in* —. E. Dury and O. Piette, at Gilles, les-Bruxelles, Belgium. Eng. Pat. 27,276, Jan. 14, 1904.

On each lateral wall of a horizontal coke-furnace with vertical flues, a fixed conduit is arranged for the supply of fuel-gas. The conduits are provided with branches "tuyères" with valves, operated from without the furnace, either singly or in groups, by means of rods or by a convenient arrangement. The rods are arranged in a manner that it is easy to determine which valve is operated. Further claim is made for constructing the conduits of such elongated section in the direction of light, that the introduction of cleaning hooks is facilitated.—W. H. C.

*Manufacture of Illuminating* —. B. Dutteneier, Karlsruhe, Germany. Eng. Pat. 2001, Jan. 26, 1904.

Eng. Pat. 340,055 of 1904; this J., 1904, 745.—T. F. B.

*Producers and like Apparatus.* A. L. Forster, Birmingham. Eng. Pat. 6999, Mar. 23, 1904.

To facilitate the poking of the fuel within the producer, a support is provided, consisting of a ball with a through it, a seating for the ball, fixed over the poke-hole and an adjustable guard for retaining the ball in position and forming a sufficiently gas-tight joint between the ball and its seating. The ball has free rotary movement in all directions. The poker is inserted into the producer

through the bore in the ball, and may then be worked about at any desired angle. When the poker is withdrawn, the ball is rotated on its seating to such a point that the bore does not permit communication between the interior and the exterior of the producer.—H. B.

*Gas; Apparatus for Producing* — from Pulverisable Fuel. G. Marconnet, Paris. Eng. Pat. 25,404, Nov. 22, 1904. Under Internat. Conv., Dec. 8, 1903.

SEE FR. Pat. 337,514 of 1903; this J., 1904, 484.—T. F. B.

*Calcium Carbide; Preparation [Agglomeration] of* —. L. Leinss, Paris. Eng. Pat. 4506, Feb. 23, 1904.

SEE FR. Pat. 339,492 of 1904; this J., 1904, 710.—T. F. B.

### UNITED STATES PATENTS.

*Fuel; [Electrical] Process of Preparing Peat for* —. J. W. Vaughan and C. S. Horner, Eaton Rapids, Mich. U.S. Pat. 782,587, Feb. 14, 1905.

THE process claimed consists in first mechanically separating the contained water as completely as possible. The peat is then subjected to the action of an electric current in order to disintegrate it and liberate the water left in it by the mechanical process. The water liberated by the electrical treatment is separated either concurrently or subsequently.—W. H. C.

*Coke Oven; Retort* —. C. S. Mason, Buffalo, N.Y. U.S. Pat. 782,259, Feb. 14, 1905.

A SERIES of horizontal retort-ovens is arranged with combustion-chambers below, and have regenerators communicating with the latter. There are vertical heating flues between adjacent ovens, communicating by their lower ends with the combustion chambers. Three or more horizontal flues, one above the other, are situated between adjacent ovens, above the vertical flues. The lowest horizontal flue communicates with the upper ends of the vertical flues beneath, and extends from the median line of the ovens to the sides. The upper horizontal flue extends right across the series of ovens. The walls between the horizontal flues have openings, in different vertical planes, to equalise the flow of the gases, and are provided with valves or dampers, or with adjustable refractory blocks, moved by rods introduced through suitable openings in the side walls, for altering the size of the openings in the horizontal partitions.—W. H. C.

*[Oil] Gas; Apparatus for Manufacturing* —. L. P. Lowe, San Francisco. U.S. Pat. 781,836, Feb. 7, 1905.

Two vertical generators, communicating at the foot with a common combustion chamber, are filled with chequer work, except at a point midway up each generator, where a mediate chamber is formed in each. Steam and air inlet pipes, and a flue, are provided at the upper end of each generator; an oil inlet pipe enters the combustion chamber; and an oil inlet pipe and gas outlet pipe open into each of the mediate chambers, the two gas outlet pipes entering a common hydraulic seal. All the pipes are controlled by valves.—H. B.

*Gas; Apparatus for Manufacturing* —, and Recovering By-Products. L. P. Lowe, San Francisco. U.S. Pat. 781,837, Feb. 7, 1905.

Two superposed chambers, filled with chequer work, are connected by means of a gas conduit, in which is interposed a condenser. The upper chamber is fed with oil, the lower one with steam. By means of a flue between the chambers, independent of the condenser, products of combustion can be passed successively through the lower chamber, the flue, and the upper chamber. Gas may also be drawn off from the bottom of the lower chamber without passing it through the first chamber.—H. B.

*Gases; Apparatus for Cleaning* —. L. P. Lowe, San Francisco. U.S. Pat. 781,838, Feb. 7, 1905.

WITHIN a vertical cylindrical casing is arranged a vertical series of cylindrical chambers alternating with piles of open chequer work. The gas to be washed is admitted

at the base, along with an obliquely directed current of steam, so that a whirling motion is imparted to the mixture; the latter then ascends through the first pile of chequer-work, on to which water is being sprayed and thus the steam is condensed. In the next cylindrical chamber the gas encounters another obliquely directed steam current, and then rises through another pile of chequer work; and so on till the outlet is reached.—H. B.

*Gas Washer.* B. T. Mullen, Leetonia, Ohio. U.S. Pat. 782,041, Feb. 7, 1905.

THE gas is admitted into a chamber, enclosed in and forming the upper part of a larger vessel. At the foot of this enclosed chamber is a horizontal plate, from which depends a series of short vertical pipes, which divide the gas stream into small jets that impinge upon the surface of water maintained at a constant level, and contained in the lower part of the enclosing vessel. The washed gas passes out at a side opening in the vessel.—H. B.

*Gas Washer.* B. T. Mullen, Leetonia, Ohio. U.S. Pat. 782,042, Feb. 7, 1905.

COMPARE preceding abstract. The gas enters at the side of the apparatus, passes down through an annular series of short pipes, impinging upon the surface of the water, and is led out by a central pipe which hangs down into the apparatus.—H. B.

*Gas; Method of Purifying Illuminating* —. C. S. Lomax, Everett, Mass. U.S. Pat. 782,403, Feb. 14, 1905.

SEE Eng. Pat. 14,445 of 1904; this J., 1904, 977.—T. F. B.

#### FRENCH PATENTS.

*Briquettes of Coal Dust or Peat; Manufacture of* —. G. van der Heyden. Fr. Pat. 346,861, Oct. 7, 1904.

COAL dust or peat is mixed intimately with a small quantity (say, 2 per cent.) of liquid glue; the mixture is moulded into the desired shape; and the briquettes obtained are hardened by leaving them for several hours in a solution of formaldehyde, or by submitting them to the action of formaldehyde vapour.—H. B.

*Coke; Treatment of Coal for the Manufacture of* —. W. J. Patterson. Fr. Pat. 346,775, Aug. 20, 1904.

SEE Eng. Pat. 17,580 of 1901; this J., 1904, 977.—T. F. B.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

#### ENGLISH PATENT.

*Oils; Process for Reducing the Density of Mineral and Vegetable* —. A. Canera di Salasico and C. C. Rovere, Turin, Italy. Eng. Pat. 26,192, Dec. 1, 1904.

MINERAL or vegetable oils are reduced in density, and thereby rendered more suitable for illuminating, heating, and other purposes, by treating them with lime and an acid, such as sulphuric, hydrochloric or oxalic acid. For example, a tar oil of sp. gr. 1.02 may be reduced to a sp. gr. of 0.8 by stirring slowly into it not more than 6 per cent. of its weight of pure sulphuric acid. Not more than 20 per cent. of lime (on the weight of the oil) is then gradually added, with agitation, and the mixture is allowed to stand for some hours.—T. F. B.

#### UNITED STATES PATENT.

*Ammonium Sulphate Saturator.* K. Zimpell, Stettin, Germany. U.S. Pat. 782,637, Feb. 14, 1905.

SEE Eng. Pat. 23,379 of 1904; this J., 1905, 81.—T. F. B.

#### FRENCH PATENT.

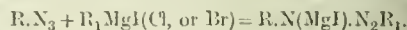
*Hydrocarbons such as Petroleum and Benzine; Solification of* —. G. van der Heyden. Fr. Pat. 346,8 Oct. 7, 1904.

GLUE or gelatin is softened in hot water, and then melted; the petroleum, or other hydrocarbon which is desired to solidify, is then added gradually, with stirring to the molten glue or gelatin, the stirring being continued until emulsion is complete. It is stated that by this method, petroleum can be emulsified with as little as 11 per cent. of its weight of glue. The emulsion is run into moulds, and allowed to set, and the blocks thus formed hardened by treatment with formaldehyde vapour solution, or with tannin.—T. F. B.

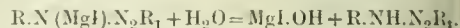
### IV.—COLOURING MATTERS AND DYESTUFFS.

*Diazoamino Compounds; New Synthesis of* —. Dimroth. Ber. 1905, 38, 670—688.

ORGANOMAGNESIUM compounds react with alkyl and derivatives of hydrazoic acid according to the equation

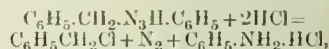


The intermediate compounds thus formed react with water to form diazoamino compounds, according to equation:



Methylphenyltriazine is obtained by acting on methylmagnesium iodide with diazoiminobenzene in ethereal solution and then pouring into an aqueous solution of ammonium ammonium chloride. The product is an almost colourless crystalline solid and can be distilled *in vacuo*, though considerable loss. It can be distilled without decomposition in a current of steam produced from water containing caustic soda and a trace of ammonia.

Precaution is necessary, as it is rapidly decomposed by small quantities of carbon dioxide. Its characteristic behaviour is that of a tautomeric compound. In some reagents it behaves as diazomethane  $CH_3.N_2.NHC_6H_5$ , and with others as diazobenzemethylamide  $CH_3.NH.N_2.C_6H_5$ . It is extremely unstable towards acids, evolving nitrogen and forming quantitatively. Even carbonic acid causes this decomposition in the cold. With diazobenzene chloride it forms bisdiazobenzene-methylamide  $(C_6H_5.N_2)_2N.C_6H_5$ . Ethylphenyltriazine was prepared in an analogous manner and showed similar properties. Benzylphenyltriazine can be obtained either from phenylazide, benzylmagnesium chloride, or from benzylazide, phenylmagnesium bromide. It is decomposed by cold hydrochloric acid according to the equation:—



but in other respects acts as a tautomeric compound, colourless, and is not decomposed by carbonic acid. Methylbenzyltriazine was prepared from benzylazide, methylmagnesium iodide. It was purified by means of the crystallisable silver compound, which re-forms methylbenzyltriazine with sodium sulphide. This triazine is a colourless oil which is more sensitive to acids than carbon dioxide than methylphenyltriazine. It has a fungus-like odour. Methyl- and ethylphenyltriazine have a characteristic odour. Though the parent aliphatic triazines are colourless, their silver and copper compounds are yellow and orange respectively. The silver compound of methylbenzyltriazine is colourless, but its copper compound is faintly yellow.—E. F.

*Aniline Solutions; Electrolysis of Acid* —. L. Gillet. XI A., page 243.

*Nitrogen in Azo-, and Hydrazo Compounds; Determination of* — by Kjeldahl's Method. C. Flamand and B. Prager. XXIII., page 251.



ENGLISH PATENTS.

*Colouring Matters or Dyes [Sulphide Dyestuffs]; manufacture of Blue* — H. C. Cosway and the United Alkali Company, Ltd., Liverpool. Eng. Pat. 140, March 23, 1904.

mol. of *p*-aminophenol hydrochloride and two mols. of *p*-aminophenol are heated together at a temperature of 10°—180° C., till a sample dissolves in alkali with a blue colour. Sulphur is then added in small quantities to the melt (for example, 7½ molecules altogether) at a temperature of 160°—220° C.; the mixture is maintained at this temperature until no more hydrogen sulphide is evolved, and is then heated to 220° C. The mass is allowed to cool, and ground. It can be dissolved for use in alkali hydroxide solution, and dyes cotton from a bath containing sodium sulphide and common salt in rich blue shades. —E. F.

*Colouring Matters or Dyes [Sulphide Dyestuffs]; manufacture of Blue-black to Black* — H. C. Cosway of the United Alkali Co., Ltd., Liverpool. Eng. Pat. 41, March 23, 1904.

BLUE-BLACK to black sulphide dyestuffs are obtained by heating a mixture of sulphanilic acid, *p*-aminophenol, water, evaporating to dryness, raising the temperature, adding sulphur, followed by the addition of a solution of sodium hydroxide, and heating at an elevated temperature. For instance, 180 parts of sulphanilic acid, 110 parts of *p*-aminophenol and 50 parts of water are heated with steam to 100° C., until all the water is driven off. The temperature is then raised to 140° C., and 50 parts of sulphur added in small quantities. The melt is maintained at 140° C., for two hours, and 200 parts of sodium hydroxide solution of 28° B. are then added. The melt is kept at 180° C. for four hours, dried and ground. The product dyes cotton in blue-black to black shades from a bath containing sodium sulphide and common salt. —E. F.

*Colouring Matters or Dyes [Sulphide Dyestuffs]; manufacture of Green* — H. C. Cosway and the United Alkali Co., Ltd., Liverpool. Eng. Pat. 7042, March 23, 1904.

*p*-AMINOPHENOL hydrochloride is heated to 140°—160° C., for two parts of sulphur for about three hours. A solution of sodium hydroxide is then added; for example, 1 part of a solution of 28° B., the temperature is raised about 210° C., and maintained for some time, say, four hours. The crude product may be used directly for dyeing, or may be first purified by solution in water and precipitation with mineral acid. It dyes cotton in green shades from a bath containing sodium sulphide and common salt. —E. F.

FRENCH PATENT.

*Chlorinated Amino Bases and Violet Monoazo Dyestuffs for Wool Derived therefrom; Preparation of* — H. Arb. v. m. Meister, Lucius und Brüning. Fr. Pat. 39,225, Dec. 18, 1903.

2,5-DICHLORO-4-AMINOACIDYLANILIDES are manufactured by nitrating 2,5-dichloroacetylanilides and reducing the resulting nitro-compound. Suitable acetylanilides are obtained by boiling 2,5-dichloroaniline with formic acid and acetic anhydride. Dyestuffs which yield violet-blue shades on wool from an acid bath are obtained either by diazotising a 2,5-dichloro-4-aminoacetylanilide, combining with one molecule of chromotropic acid or chlorochromotropic acid in alkaline solution, and saponifying the resulting dyestuff by boiling with sodium hydroxide solution; or by diazotising 2,5-dichloro-4-nitraniline, combining in alkaline solution with chromotropic or chlorochromotropic acid, and reducing the resulting dyestuff in alkaline medium. The resulting chlorinated aminoazo-dyestuffs are more stable than the corresponding mono-chlorinated dyestuffs previously known. —E. F.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

*Vegetable Fibres; Action of Dilute Nitric Acid on* — J. Jardin. Comptes rend., 1905, 140, 314—315.

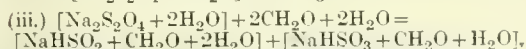
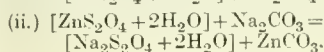
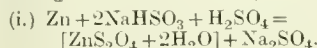
THE author finds that in the bleaching of linen, after the preliminary treatment in an alkaline solution and then in dilute hydrochloric acid, the long exposures on grass can be replaced by immersions of from five to six hours in cold, dilute nitric acid (5 per 1000). Linen is bleached in one-third of the time that is usually required, and the material is equal in appearance to and stronger than linen bleached by exposure on grass. It is stated also that the treatment with dilute nitric acid renders the substance of the fibre much more homogeneous, and increases its affinity for dyestuffs. —A. S.

*Formaldehyde-Hydrosulphite of Sodium*. L. Baumann, G. Thesmar, and J. Frossard. Bull. Soc. Ind. Mulhouse, 1904, 74, 348—360.

FURTHER particulars are given regarding the properties of the formaldehyde-sodium bihydrosulphite recently isolated by the authors (this J., 1904, 1211; See also this J., 1904, 657 and 658).

The compound readily crystallises from water in large, transparent, monoclinic prisms. It is rather less soluble in water than formaldehyde-sodium bisulphite, moderately soluble in dilute alcohol, but insoluble in absolute alcohol, ether, benzene, carbon bisulphide, &c. The compound is a powerful reducing agent, but owing to its stability, it hardly reacts in neutral solution at the ordinary temperature. To render it active, it is necessary to heat the solution, or to add to it either ammonia or sodium bisulphite, which, by reacting with the formaldehyde set the bihydrosulphite free. It is considered probable that by the addition of sodium hydroxide and ammonia in excess, the normal hydrosulphite, Na<sub>2</sub>SO<sub>3</sub>, is formed, but this compound has not yet been isolated.

In preparing the double salt of formaldehyde-sodium bisulphite and formaldehyde-sodium bihydrosulphite, according to the reactions expressed by the equations:—



the first reaction takes place very readily, and the yield is satisfactory. When, however, increased proportions of zinc and sulphuric acid are taken, with a view to increasing the yield of bihydrosulphite, zinc sulphide and sulphur are formed, and the yield is considerably reduced. —E. B.

*Gelatins; Comparison of Sizing Qualities of Different* — C. Beadle and H. P. Stevens. XIX., page 248.

UNITED STATES PATENTS.

*Dyeing; Apparatus for* — L. Dêtré, Rheims, France. U.S. Pat. 782,008, Feb. 7, 1905.

SEE Eng. Pat. 4787 of 1904: this J., 1905, 194.—T. F. B.

*Dyeing Machine*. J. Leisel, Charlotte, N.C. U.S. Pat. 782,147, Feb. 7, 1905.

A NUMBER of nozzles, connected with the liquor-supply pipe, are provided at the bottom of the dye-vat, and are so arranged as to give the liquor a horizontal circular movement in the vat, thus driving the sediment, &c., to the centre of the vat, where it is received in a well, which can be periodically discharged. Perforated plates are provided for supporting and covering the material to be dyed, and a vertical overflow pipe is also provided in the centre of the vat, this latter being connected with the circulating pump which supplies the liquor to the supply pipe. Mechanical details of a device for raising

out of the vat the plate on which the material rests and tilting it to discharge the dyed material, are also claimed.

—T. F. B.

#### FRENCH PATENTS.

*Cellulose: Process of Preparing a Solution of — in Ammoniacal Copper Oxide of Concentration suitable for the Manufacture of Artificial Threads.* R. Linkmeyer. Fr. Pat. 346,722, Oct. 1, 1904.

COTTON is treated in a dilute ammoniacal copper oxide solution to soften it, and cause it to swell: this solution should be so dilute that no cellulose is dissolved (e.g., it may contain about 9 grms. of copper and 90 grms. of ammonia per litre). After some hours' treatment, the cotton is wrung out, and dissolved in a concentrated ammoniacal copper solution (containing, for instance, 16–18 grms. of copper and 250 grms. of ammonia per litre) at a temperature of 10° C. or under. The solution is filtered, and agitated in an evacuated vessel, the ammonia being collected. Threads made from such solutions are stated to solidify very rapidly in the atmosphere.—T. F. B.

*Bleaching Textiles of Vegetable Origin by means of Sodium Peroxide; Process of —.* E. Saint-Hilaire and E. de Grousseau. Fr. Pat. 346,831, Oct. 5, 1904.

VEGETABLE fibres may be simultaneously scoured and bleached by means of a strongly alkaline solution of sodium peroxide and sodium silicate. Such a scouring and bleaching solution may be prepared by dissolving eight parts of caustic soda, one part of sodium silicate, and one part of sodium peroxide in 1000 parts of water.

—T. F. B.

*Dyeings on Cotton; Process for Brightening —.* Manuf. Lyon. de Mat. Col. Fr. Pat. 339,217, Dec. 11, 1903.

BLUE and black shades, produced on cotton fabrics by means of azo dyestuffs, may be effectively brightened by means of Prussian blue. The process may be carried out as follows:—100 kilos. of cotton, dyed with a black dyestuff which can be diazotised, is immersed in a solution of 2 kilos. of sodium nitrite, 6 kilos. of hydrochloric acid, and 3 kilos. of ferric nitrate, and wrung out. It is then treated with a bath containing 400 grms. of toluylene-diamine, 400 grms. of  $\beta$ -naphthol, and 1600 grms. of potassium ferrocyanide. After 15 minutes, 1600 grms. of sulphuric acid are added; the goods are worked about, rinsed and dried.—T. F. B.

### VI.—COLOURING WOOD, PAPER, LEATHER, &c.

*Sulphide Colours; Application of — in the Dyeing of Chrome Leather.* W. Epstein. J. Soc. Dyers and Colourists, 1905, 21, 39–41.

THE author attempted to prepare sulphide dyestuffs by fusing nitro derivatives of benzidine with sodium sulphide and sulphur. Mononitrobenzidine gave a weak black, but the dinitro compound gave a strong black colour. The mono- and dinitro derivatives of diaminodiphenylmethane also yielded sulphide dyestuffs; the products were identical, the second nitro group in the dinitro compound probably being eliminated during the fusion in the form of ammonia. All the dyestuffs prepared were inferior to Immedial Black for dyeing cotton, but were more stable and required less sodium sulphide in the dye-bath. This latter point is important in the dyeing of chrome leather, as the amount of sodium sulphide usually required in dyeing with sulphide dyestuffs, has an injurious action on the leather. The dyestuff prepared from dinitrobenzidine produced on chrome leather a black equal to that obtained with logwood and iron, without the leather being at all injuriously affected. The best results are stated to be obtained by reducing the amount of sodium sulphide in the sulphur melt to a minimum; using only a small quantity of the sulphide dyestuff in the dye-bath; and then "topping" the dyed leather with a basic dyestuff. The shades produced in this way

are extremely fast to washing and to alkalis, and do not "bleed" when the dyed hides are subsequently "fatted and liquored" with an emulsion of alkali, fat and soap.—A.

### VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

*Sulphur Trioxide; Arsenic Pentoxide as Catalyst in Formation of —.* E. Berl. Z. angew. Chem., 1905, 18, 252–254.

THE arsenic pentoxide was contained, in the form either of a melted coating on the walls, or of a filling of porous granulated substance, in a Jena glass tube 10 cm. long and 18 mm. diameter, connected by a system of capillary tubes and stopcocks with: (1) a manometer; (2) a graduated tube with pressure reservoir; (3) a glass globe of 1200 c.c. capacity containing the gaseous mixture to be treated; (4) a mercury pump. By appropriate arrangement of the cocks, the apparatus could be evacuated and then filled with the mixture, either at atmospheric pressure or so as to contain a measured quantity of the mixture. The reaction-tube was heated in a bath to the desired temperature, and the speed of reaction measured by observing the diminution of pressure at constant volume (the complete reaction  $2\text{SO}_2 + \text{O}_2 = 2\text{SO}_3$  is accompanied by a reduction of pressure to two-thirds of its initial value). The results, summarised as follows:—(1) At temperatures of 300–500° C. sulphur trioxide attacks glass. (2) Lunge and Reinhardt's conclusion that arsenic pentoxide is a catalyst of similar order to ferric oxide, vanadium pentoxide, &c., is confirmed. Its activity diminishes in the early stages, and later on reaches a constant value. (3) The substance reacts more efficiently on gases dried by concentrated sulphuric acid than on gases either moistened or more completely dried. (4) The temperature coefficient increases 1.21 fold per 10° C. between 295° and 340° C., 1.19 fold between 340° and 380° C. The case is, therefore, one of diffusion reaction. (5) The reaction speed increased by rise of concentration either of sulphur dioxide or of oxygen, but the increase is greater in the former case than in the latter. The relative speed in the two cases, reckoned as percentage of sulphur trioxide formed, are almost alike. (6) Sulphur trioxide exerts a retarding influence; no doubt because it forms a layer on the surface of the catalyst, and hinders the diffusion of the reacting gases. (7) The view that the action in the case of a diffusion-reaction is confirmed by the fact that carbon dioxide retards the reaction more than nitrogen. Chemically the two gases would act alike as indifferent diluents, but the greater density and slower diffusion of carbon dioxide cause it to act more strongly in retarding the reaction than nitrogen.—J. T. D.

*Nitric Acid; Experiments on the Preparation of Absolute —.* F. W. Küster and S. Münch. Z. anorg. Chem., 1905, 43, 350–355.

THE authors attempted to prepare absolute nitric acid by a process of fractional crystallisation in an apparatus so constructed that moist air could be excluded. It was found, however, that although successive fractions began to crystallise at the same temperature, yet the temperatures fell several degrees during the solidification, and the acid obtained was only of 99.4+0.1 per cent. strength. In an apparatus from which even dry air was, as far as possible, excluded, an acid of 99.79 per cent. strength was prepared, but this, when left in contact with dry air, became weaker until it finally contained only 98.67 per cent.  $\text{HNO}_3$ . The crystallised acid (m.pt.  $-41.3^\circ\text{C}$ .) in an apparatus was pure white, but on melting it acquired a yellowish tinge even at  $-41^\circ\text{C}$ ., and the intensity of the colour increased as the temperature rose to that of the atmosphere. These results appear to show that absolute nitric acid exists only in the crystallised condition below  $-41^\circ\text{C}$ . On melting, it decomposes partially into nitrogen pentoxide and water, which dissolve in the acid. On passing a current of dry air through the solution, the nitrogen pentoxide is removed, until a colourless and



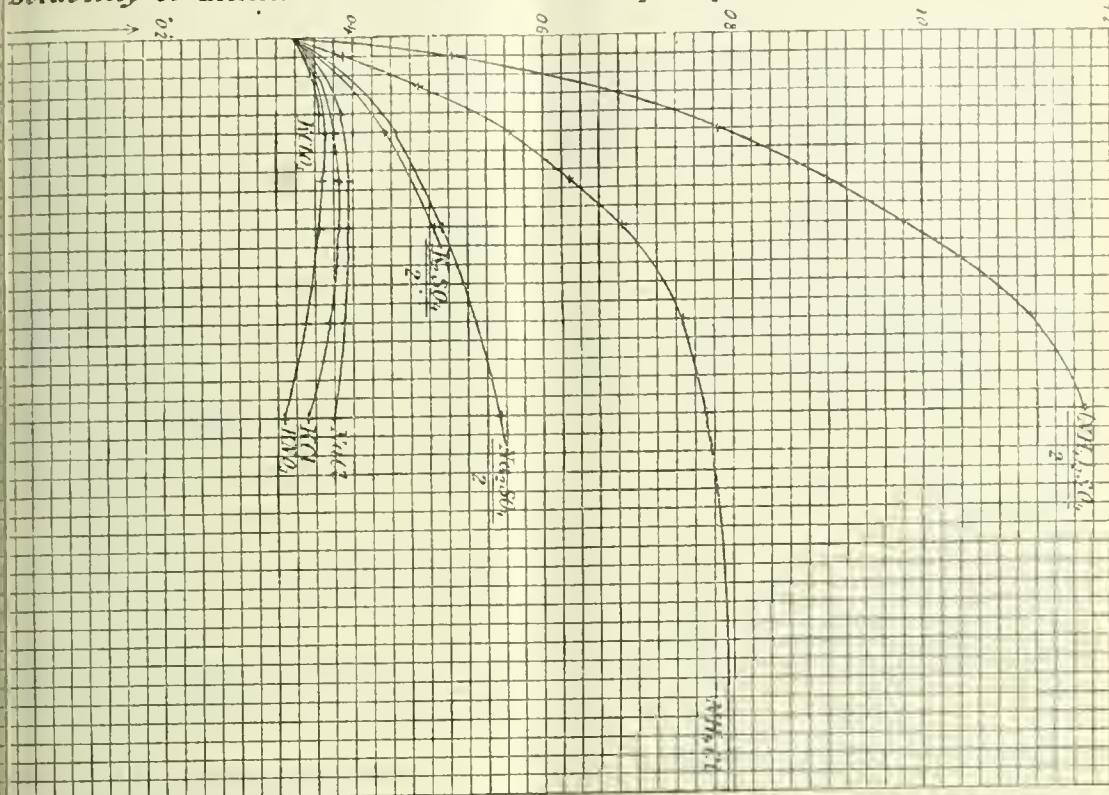
aining 98.67 per cent. of nitric acid is left, which  
utilises unaltered.—A. S.

Liam Carbonate; Solubility of — in Alkali Salt  
olutions. G. Geffcken. Z. anorg. Chem., 1905, 43,  
7—201.

Lium carbonate, which is but slightly soluble in water,

dissolves more freely in solutions of the alkali salts,  
especially of ammonium salts; the sulphates of ammonium,  
sodium and potassium exercising a greater influence than  
the corresponding chlorides (see figure). In separating  
lithium in the form of carbonate, therefore, the presence of  
ammonium salts and salts of dibasic acids is to be avoided  
as far as possible.—H. B.

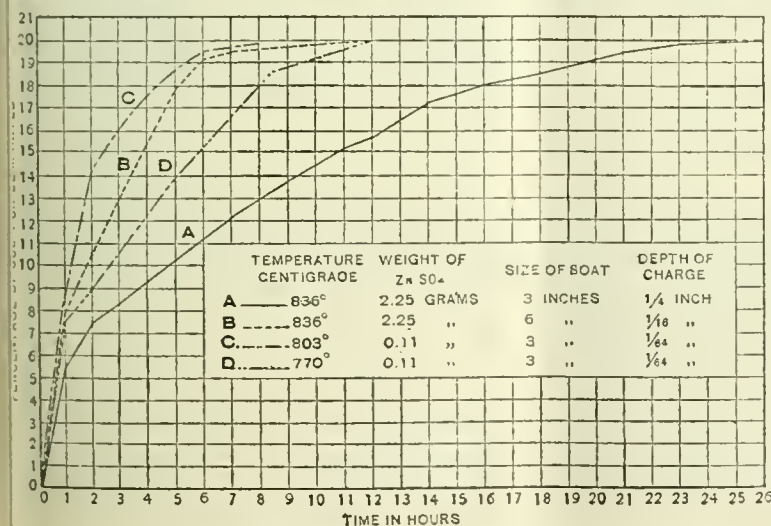
# Solubility of Lithium Carbonate in Grm.-equiv. per Litre.



c Sulphate; Decomposition and Formation of —,  
y Heating and Roasting. N. O. Hofman. Amer.  
nst. Mining Eng. Trans., 1905, Jan. 117—164.

c sulphate was heated in an electric tube furnace to  
erent temperatures, which were ascertained by a

thermo-electric pyrometer. The lowest temperature at  
which dehydration of the crystallised salt could be carried  
to practical completion was 263° C., but after heating to  
constant weight at this temperature (30—40 hours for  
2 grms.), about 0.24 per



RAPIDITY OF DECOMPOSITION OF ZINC SULPHATE.

cent. of water still remained,  
which was not driven off till  
the temperature of incipient  
decomposition of the sulphate  
was reached. This temperature  
was found to be 528° C. The  
lowest temperature at which  
complete decomposition could  
be effected was 739° C., but a  
very long time is necessary at  
this temperature. The diagram  
shows the effects of tempera-  
ture and of depth of layer on  
the progress of the decomposi-  
tion (a loss of 19.8 of sulphur  
represents complete decom-  
position). These experiments,  
as well as another series in  
which the rate of rise of tem-  
perature with uniform applica-  
tion of heat was plotted, give  
no indication of the formation  
of stable basic sulphates as  
stages in the decomposition of  
the normal salt. Some basic  
sulphate is, however, always  
formed during the decomposi-  
tion, the amount of sulphur

in this form being, in the early stages of the process, from one-fourth to one-fifth of the amount eliminated.

In another series of experiments, zinc sulphate was heated with carbon. Carbon begins to have some action at 400° C., and the action increases gradually up to 528° C.; but at this temperature the effect of carbon in eliminating the sulphur begins to be opposed by its tendency to reduce the sulphate directly to sulphide. In the most favourable experiments with carbon the 19.86 per cent. of sulphur in the sulphate was reduced to 3.47 per cent., of which 1.41 per cent. was present as sulphide, and the rest as unaltered sulphate.

A number of experiments were also carried out on roasting blendes, to see whether it was possible by regulating the temperature to convert the blende largely or completely into soluble sulphate; it was found, however that the quantity so produced was in all cases very small, 9 per cent. of the total zinc being the largest amount obtained in this form from a raw blende, and 16 per cent. from a dead-roasted blende mixed with pyrites. The reasons are two—the temperature of roasting is above the decomposition point of zinc sulphate, and at the beginning of a roast the product of oxidation is chiefly sulphur dioxide, and to a very small extent sulphur trioxide. Along with the normal sulphate a certain amount of basic sulphate is also formed, the ratio of basic to normal sulphate increasing with the temperature. Ferruginous blende is more difficult to roast than that containing less iron, but it gives under similar conditions of treatment a higher yield of normal sulphate.—J. T. D.

*Ferrous Sulphide; Action of Dilute Acids on* — A. Lipschitz and R. v. Hasslinger. *Monatsh. f. Chem.*, 1905, 26, 217–225.

THE authors proved both by electrical and by chemical methods that pure ferrous sulphide is insoluble in dilute acids in the cold. Ordinary ferrous sulphide which develops hydrogen sulphide when treated with cold, dilute acid was found to contain metallic iron. This free iron is primarily dissolved by the acid; the hydrogen liberated reduces the ferrous sulphide with evolution of hydrogen sulphide and formation of metallic iron, which latter is again attacked by the acid, and thus acts as a catalyst.—A. S.

*Sulphurous Acid; Iodometric Determination of* — in *Alkaline Solution*. O. Ruff and W. Jeroch. *XXIII.*, page 250.

*Molybdenum Compounds; Reduction of* — by *Magnesium, in Sulphuric Acid Solution*. B. Glassmann. *XXIII.*, page 251.

*Molybdenum Trioxide and Vanadium Pentoxide; Determination of* — in *presence of each other*. B. Glassmann. *XXIII.*, page 250.

#### ENGLISH PATENT.

*Carbonic Acid Gas; Impts. in and Apparatus for the Manufacture of* — J. Leslie, Belfast. Eng. Pat. 8377, April 12, 1904.

THIS invention is a development of Eng. Pat. 9142, of 1903 (this J., 1903, 1130). Coke or charcoal is burnt in a furnace, and the gases are forced through a series of purifiers and absorbers, each of which is provided with a finely perforated diaphragm near its bottom, for passage of the gases. The first two purifiers are charged with water, and the third with an alkaline permanganate solution. The absorbing cylinders are charged with an alkali carbonate solution, and each has an immersed steam coil (brought into use as required) with means for cutting any one cylinder out of the series in turn, whereby the work may be rendered continuous. When the solution in any absorber has become bicarbonated, it is at first gently heated, to expel air, and is then sufficiently heated (by the steam coil) to drive off the absorbed carbon dioxide, which gas is led into a neighbouring gasometer.

—E. S.

#### UNITED STATES PATENTS.

*Nitric Acid; Process of Making* — H. W. Henry, Walthamstow, Essex. U.S. Pat. 781,826, Feb. 7, 1905.

SEE Eng. Pat. 8759 of 1902; this J., 1903, 561.—T. F. I.

*Platinum Contact Substances [Sulphuric Acid Manufacture]; Process of Revivifying* — R. Kniel and M. Scharff, Assignors to Badische Anilin und S. Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 782,782, Feb. 14, 1905.

SEE Fr. Pat. 324,751 of 1902; this J., 1903, 628.—T. F.

*Bisulphite; Apparatus for Making* — G. A. Stebbins, Watertown, N.J. U.S. Pat. 781,689, Feb. 7, 1905.

THE apparatus has a series of communicating compartments, alternately arranged as mixing and as cooling chambers. In the mixing chambers, a basic solution agitated by stirrers operating adjacent to baffle-plates whilst cooled sulphurous gas is discharged upwards a stream of minute bubbles, from a submerged partition with a straight bottom edge. In each cooling chamber the hot sulphurous gas is passed through a series of pipes surrounded by a "cooling liquid," and is discharged into the lower part of the adjacent mixing compartment, in the manner described.—E. S.

*Gypsum; Manufacture of Crystalline* — applicable for *Filling Purposes*. W. Brothers, Prestwich. U.S. Pat. 782,321, Feb. 14, 1905.

SEE Fr. Pat. 340,952 of 1904; this J., 1904, 880.—T. F. I.

*Oxygen; Process of Obtaining* — G. F. Jaubert, Paris. U.S. Pat. 782,609, Feb. 14, 1905.

SEE Addition of July 3, 1903, to Fr. Pat. 325,627 of 1903; this J., 1903, 1348.—T. F. B.

#### FRENCH PATENT.

*Ores containing Sulphur; Utilisation of Sulphurous Gas obtained from* — I. Sanfilippo. Fr. Pat. 346,000, Oct. 5, 1904. *N.*, page 243.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

#### ENGLISH PATENTS.

*Stone, Artificial; Composition of Matter for* — C. Brunson, Hamilton, Ohio. Eng. Pat. 18,804, Aug. 1, 1904.

THIRTY-FIVE lb. of cinders or slag, preferably vitrified, other similar insoluble material, ground to  $\frac{1}{4}$  in. size, 5 lb. of fine sand,  $\frac{1}{2}$  lb. of barium sulphate, 2 lb. of cement and sufficient water to form a thick "slush" are mixed together in a pug-mill, moulded, and allowed to harden.—A. G.

*Bricks; Manufacture of* — from *Magnesite*. J. Gerster, F. Freund, S. Freund, and T. Imre, Budapest, Hungary. Eng. Pat. 27,857, Dec. 20, 1904.

THE magnesite is calcined until the whole of the carbon dioxide is expelled, and then ground so as to pass through a sieve with meshes of  $\frac{1}{4}$  to  $\frac{3}{8}$  mm. diameter. The powder obtained is moulded under pressure as usual, and bricks further burnt.—A. G. L.

#### UNITED STATES PATENTS.

*Plaster; Method of and Apparatus for Calcining* — F. A. Simonds, Assignor to Adolph Leitelt Iron Works, Grand Rapids, Mich. U.S. Pat. 781,747, Feb. 7, 1905.

A CONTINUOUS stream of plaster is passed through a series of steam-jacketed and inclined rotating cylinders, the temperature of which is determined by regulating the pressure of the steam, the last vessel being kept at a temperature near the calcining-point of the plaster.



each double-walled cylinder is provided with perforated closing the hollow space, and with hollow hubs attached to heads comprising hollow arms placed opposite perforations. Means are provided for supplying steam to the hub, and for conveying water away from the other. The head is surrounded by a receiving-case carrying buckets and having inwardly-curved ends rotating in the case. The other head is surrounded by a discharge with spout. Means for regulating the steam-pressure are also provided.—A. G. L.

*Roofing or Sheathing* — J. R. Kelly, Quincy, Ill. U.S. Pat. 782,507, Feb. 14, 1905.

Cement is made by mixing 25 per cent. of dehydrated lime, 60 per cent. of dehydrated aluminium silicate, 15 per cent. of subcarbonate of iron, and sufficient fixed oil to insure a proper consistency.—A. G. L.

#### FRENCH PATENTS.

*Slime contained in a mixture of Sand and Lime; Apparatus for Slaking* — with Steam. E. Kreft. Pat. 345,914, Aug. 29, 1904.

Sand and lime are mixed, at the same time that the lime is slaked, in a long horizontal mixing cylinder, rotated by a rotating shaft carrying blades fixed at angles. Barely sufficient steam for the slaking is introduced at one end, the other end being kept cold to insure thorough slaking. The sides of the cylinder are at a higher temperature than the interior by means of steam-jacketing, in order to prevent the mixture from cooling to them. The product obtained is ready for slaking.—A. G. L.

*Apparatus for Impregnating and Staining* — G. Kron. Fr. Pat. 346,723, Oct. 1, 1904.

A part of the wood at a time is enclosed by a box, in which is placed an annular vessel of some elastic material such as india-rubber. The box is filled with liquid with which the wood is to be impregnated; and air is forced into the elastic vessel, which expands, and forces the impregnating liquid into the pores of the wood. The elastic vessel may be strengthened by supports of a non-elastic material.—A. G. L.

### X.—METALLURGY.

*Copper-Zinc Alloys*. E. S. Shepherd. J. of Phys. Chem., 1904, 8, 421—435. Chem. Centr., 1905, 1, 428.

HERTS-AUSTEN (Fourth Report of the Alloys Research Committee; this J., 1898, 249) concluded from melting-point determinations that five different solid phases exist in the series of copper-zinc alloys, but the author has been aided by microscopic examination in recognising six different solid phases. These six different crystalline forms have the following composition:— $\alpha$ , 71—100 per cent. of copper;  $\beta$ , 45—64 per cent.;  $\gamma$ , 31—40 per cent.;  $\delta$ , 30 per cent.;  $\epsilon$ , 13—19 per cent.; and  $\eta$ , 0—2.5 per cent. of copper. The crystals vary in colour from bluish to red; they appear to be solid solutions, not chemical compounds.—A. S.

*Brushes [Copper-Tin Alloys]; Chilling of* — L. Guillet. Comptes rend., 1905, 140, 307—310.

The author determined the effect of chilling bronzes containing from 5 to 21 per cent. of tin from temperatures varying between 300° and 800° C. The results show that in the case of the alloys containing more than 92 per cent. of copper, the breaking stress and elongation are slightly increased by chilling from temperatures between 400° and 600° C. The breaking stress and elongation of the alloys containing less than 92 per cent. of copper showed a sharp rise when the temperature from which the alloys were chilled exceeded 500° C.; this is in agreement with results obtained by Heycock and Neville (see this J., 1896, 8, 1901, 814). The maximum breaking stress was shown by alloys which had been chilled from about 600° C., irrespective of their composition. The maximum

elongation on the other hand was attained by chilling at temperatures which differed according to the composition of the alloy. For example, with the bronze containing 91 per cent. of copper and 9 per cent. of tin, the maximum elongation was attained by chilling from 800° C., whilst for the alloy containing 79 per cent. of copper and 21 per cent. of tin, the corresponding temperature was 600° C. The difference between the breaking stress of the alloy as cast and that of the alloy chilled from the most suitable temperature was greater the smaller the percentage of copper. It is clear that the chilling of bronzes from temperatures between 600° and 800° C. improves considerably their tensile strength, but the influence of this treatment on the resistance of the alloys to friction must also be investigated, more especially as and according to Heycock and Neville, chilling causes the disappearance of the compound  $\epsilon$  ( $\text{Cu}_3\text{Sn}$ ), a very hard substance, which may play an important part in this respect.—A. S.

*Aluminium; Use of* — for Beer Filters. F. Schönfeld. XVII., page 246.

#### ENGLISH PATENTS.

*Ferruginous Ore; Apparatus for Treating* — for the Manufacture of Iron and Steel therefrom. M. Moore, Melbourne, and T. J. Heskett, Brunswick, Victoria. Eng. Pat. 5041, March 1, 1904.

SEE Fr. Pat. 341,169 of 1904; this J., 1904, 827.—T. F. B.

*Steel; Manufacture of* — A. E. Vandeveld, Brussels. Eng. Pat. 27,894, Dec. 20, 1904.

The charge for the open-hearth process is previously melted and refined in one or more cupolas; these are provided with receivers and herein the composition of the products of the melting apparatus is determined. Thence in accordance with the composition of the contents of each receiver, determined quantities of the products are conveyed into a mixing collector, or mixing collectors, whence they are introduced finally into the hearth furnace, in a uniform charge. It is thus possible to use inferior materials without injurious results.—J. H. C.

*Metals; Separation of* — from their Ores. J. D. Wolf, London. Eng. Pat. 4793, Feb. 26, 1904. Under Internat. Conv., May 22, 1903.

The ore-pulp is agitated with mineral oil mixed with a viscous animal or vegetable oil, the mixed oils having been previously treated with sulphur chloride, and the whole is passed through warm water, whereby suspended particles of gangue are removed. The oil is recovered by forcing the mixture through a filter-press, and currents of air with or without steam may be employed to facilitate these operations at various stages.—J. H. C.

*Metallic Particles from Ore; Process for Extracting* —, and Apparatus for Performing same. A. Schwarz, New York. Eng. Pat. 23,906, Nov. 4, 1904.

SEE U.S. Pat. 771,277 of 1904; this J., 1904, 1032.—T. F. B.

*Magnetic Separating Apparatus*. C. Scholl, Goeppingen (Wurtemberg), Germany. Eng. Pat. 26,262, Dec. 2, 1904.

Ax inclined, slowly rotating flat disc is provided with a number of rows of magnets lying radially, having their upper ends standing flush with the disc. A rotary scraper with arms provided with adjustable brushes is made to pass over a portion of the disc, so as to scrape off the attracted particles upwards, while the non-attracted particles fall automatically down the inclined side of the disc.—J. H. C.

*Copper Ore; Treatment of* — G. H. Blenkinsop, Swansea. Eng. Pat. 24,585, Nov. 12, 1904.

The ore is crushed and passed over a Wilfley table or other suitable machine, so as to separate a high-grade concentrate. The residue is calcined with or without a mixture of ferrie or ferrous sulphate, whereby much of the copper is converted into sulphate, which can be easily extracted

by washing, whilst cupric oxide or other compounds not soluble in water can be dissolved out by acid. The copper is extracted by known methods from the solutions thus obtained; the mother liquors may be used for saturating the table residues before calcination.—J. H. C.

*Aluminium and other Metals; Process of Reducing [Compounds of] —.* H. J. Blackmore, Mount Vernon, U.S.A. Eng. Pat. 27,865, Dec. 20, 1904.

SEE U.S. Pat. 778,100 of 1904; this J., 1905, 94.—T.F.B.

#### UNITED STATES PATENTS.

*Zinc-Sulphide Ores containing Iron; Process of Treating —.* C. E. Dewey, Assignor to the American Zinc and Chemical Co., Denver, Colo. U.S. Pat. 781,133, Jan. 31, 1905.

THE ore is roasted, placed in water, and heated for a suitable period with sulphur dioxide, air, and steam.

—J. H. C.

*Agitating Device.* W. B. Devereux, Glenwood Springs, Col. U.S. Pat. 781,406, Jan. 31, 1905.

CLAIM is made for the combination in a metallurgical apparatus of a closed tank divided into communicating compartments, and provided with an agitator in the form of a screw propeller mounted on a vertical shaft, the upper end of which passes through a stuffing-box. A flexible pipe with valved outlet is provided for discharging the liquid contents when desired.—J. H. C.

*Ores; Method of Treating —.* Hascal A. Hogel and Herbert A. Hogel, New York, Assignors to Hascal A. Hogel and D. Wallace, New York. U.S. Pat. 781,520, Jan. 31, 1905.

THE ore is pulverised and agitated by mechanical means in a solution containing suitable chemicals, which is atomised by heat, currents of air, and steam.—J. H. C.

*Ores; Apparatus for Treating —.* Hascal A. Hogel and Herbert A. Hogel, New York, the latter Assignor to the said Hascal A. Hogel. U.S. Pat. 781,521, Jan. 31, 1905.

THE apparatus is a combination of a solution tank, a mixing tank, means for delivering a chemical solution to the mixing tank, means for agitating the mixture of ore and solution, and atomising it under the influence of heat, steam, air or oxygen, a filter tank, and a deposition tank, all with suitable connections.—J. H. C.

*Precious-Metal-bearing Ores; Process of Treating —.* A. H. Brown, Boulder, Colo. U.S. Pat. 781,711, Feb. 7, 1905.

THE ore is ground in presence of cyanide solution; subjected to hydraulic classification by introducing cyanide solution at the bottom of an overflow-tank to produce an ascending current; and then leached with cyanide solution, the dissolved metals being recovered in any suitable manner. The residual ore is subjected to concentration. Claim is also made for a process of treating sulphide ores, which consists first in subjecting the raw ore to the action of a cyanide solution, whereby the precious metals from the more finely divided ore are dissolved, and secondly, subjecting the ore or tailings to concentration, whereby the metals from the coarser ore are recovered.—A. S.

*Copper-bearing Rock; Process of Smelting Native —.* F. R. Carpenter, Denver, Colo. U.S. Pat. 781,807, Feb. 7, 1905.

THE copper-bearing mineral is mixed with a basic flux such as lime, and with sulphur, or a sulphide material such as iron pyrites, and smelted, whereby a matte is produced of greater sp. gr. than the slag, and containing the copper, and also any gold and silver present.—A. S.

*Vanadium; Process of Reducing —.* F. R. Carpenter, Denver, Colo. U.S. Pat. 781,808, Feb. 7, 1905.

VANADIUM is extracted from its silicious ores by mixing them with a compound of a metal with which vanadium

will form an alloy, e.g., iron oxide, and a basic flux such as dolomite and fuel, and subjecting the mixture, in furnace, to the action of an air-blast, in such a manner that a high temperature and a reducing atmosphere are maintained. The vanadium and the iron are reduced and form an alloy, whilst the basic flux and the silica unite to form a slag.—A. S.

*Furnace; Rotary Ore-Roasting —.* F. Heberle, London, and W. Hommel, Lee, England. U.S. Pat. 781,824, Feb. 7, 1905.

THE muffle-furnace claimed, comprises a circular or chamber, the floor of which rotates, a heating-chamber immediately beneath, rotating with the floor of the ore-chamber, and a stationary heating-chamber immediately above the ore-chamber. The lower heating-chamber divided into three compartments, which successively arrive opposite and communicate with the fireplace-furnace furnishing the heating gases. Each of the compartments is provided with partitions so disposed that the furnace-gases are caused to travel radially inward to the centre of the heating-chamber, and then radially outward to flues communicating with the upper heating-chamber.—A. S.

*Furnace; Metallurgical —.* R. L. Lloyd and P. Thibault, Greatfalls, Mont. U.S. Pat. 781,834, Feb. 7, 1905.

THE furnace comprises a stationary hearth arranged about a vertical shaft, and forming a continuous helical path for the ore. The shaft carries feeder-arms, which are disposed in the spaces between the turns of the helix. A rotary reciprocating motion is imparted to the shaft and guides are provided so that the movement of the feeder-arms follows the pitch of the helix. The shaft also alternately raised and lowered, in such manner that the feeder-arms are kept out of contact with the ore during their backward stroke. The feeding mechanism is supported by a hydraulic cylinder and piston, and means are provided for counterbalancing the thrust on the piston.—A. S.

*Furnace or Kiln for Roasting Ores.* G. O. Petersen, Dalsbruk, Russia. U.S. Pat. 781,904, Feb. 7, 1905.

SEE Eng. Pat. 22,162 of 1903; this J., 1904, 22.—T. F.

*Furnace; Rotary Puddling or Bushelling —.* Stubblebine, Bethlehem, Pa. U.S. Pat. 782,080, Feb. 7, 1905.

THE treating-vessel of the furnace rotates about longitudinal axis, which axis is inclined to the horizon. There is a gas inlet at the higher end of the vessel, and a gas outlet of smaller area than the inlet, at the other end. The vessel is also provided, "on opposite sides of centre of its longitudinal axis," with "suspending means whereby it can be raised and lowered and tilted." "Suspending means" are independent of the mechanism for rotating the vessel.—A. S.

*Matte or Pyritic Smelting; Method of —.* O. S. Garretson, Buffalo, N.Y., Assignor to Garretson Furnace Co., Pittsburg, Pa. U.S. Pat. 782,123, Feb. 7, 1905.

THE matte is bessemerised or converted by means of a blast underneath a column of material containing a flux. The slag produced, flows on to a reverberatory furnace, where it is mixed with sulphur-bearing material and subjected, in a shallow layer, to heat from above, whereby a low-grade matte is produced, which is then taken up by the metal or matte contained in the slag. This low-grade matte is led continuously back to the converter.—A. S.

*Matte; Method of Converting —.* O. S. Garretson, Buffalo, N.Y., Assignor to Garretson Furnace Co., Pittsburg, Pa. U.S. Pat. 782,124, Feb. 7, 1905.

THE slag produced when matte is converted by means of a blast underneath a column of material containing a flux or silicious substances, is freed from accompanying matte by settling, and is then heated by means of a flame playing over its surface, sulphur-bearing material being added at the same time added intermittently, whereby a low-



gic matte is produced, which combines with any values  
ained in the slag. Claim is also made for a method  
ultaneously smelting and converting matte, which  
ists in regulating the height of the layer of matte  
re the blast in accordance with the desired degree of  
ersion, injecting an oxidising blast in excess of that  
h is consumed in converting, heating the excess blast  
ausing it to pass through the molten matte, and utilis-  
t, above the layer of matte, in smelting.—A. S.

Apparatus for the Removal and Utilisation of —  
C. King, Marion, Ala., Assignor to J. W. McClure,  
ttsburg, Pa. U.S. Pat. 781,887, Feb. 7, 1905.

molten slag is supplied to a slag-pit constructed with  
or more adjacent chambers having walls which slope  
rdly near and toward the basal portion. Means are  
ided to control the slag inlets, to supply water to the  
as it enters the pit, and to carry off the overflow of  
water. A slag-discharging conveyor is placed so as  
ave its inlet end in the basal portion of the pit. A  
tle shaft operates the several conveyors in the series,  
clutch mechanism is provided to throw them severally  
of action, as well as means to govern the inlet to the  
eyor, and to receive and discharge the granulated  
—A. G. L.

Metall. — L. H. E. Lacroix, Pont de Chéruy,  
ssignor to J. L. Routin and L. M. E. Mourraile, Lyons,  
rance. U.S. Pat. 782,401, Feb. 14, 1905.

Fr. Pat. 332,605 of 1903; this J., 1903, 1247.—T. F. B.

als; Method of Coating — H. Rodman, Clevel-  
land, Ohio. U.S. Pat. 781,230, Jan. 31, 1905.

metal is cleaned by the action of an alkali metal,  
h is electro-deposited on it, and thereafter plunged  
in molten bath containing an alkali metal in suitable  
portion.—J. H. C.

#### FRENCH PATENTS.

containing Sulphur; Utilisation of Sulphurous Acid  
ained from — I. Sanfilippo. Fr. Pat. 346,834,  
ct. 5, 1904.

sulphurous acid which is given off when ores con-  
taining native sulphur are treated in furnaces is made  
to pass through valved pipes into chambers where it  
may be utilised in any known manner, and especially in  
the manufacture of sulphuric acid.—J. H. C.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A.)—ELECTRO-CHEMISTRY.

aline Solutions; Electrolysis of Acid — L. Gil-  
rist, J. of Phys. Chem., 1904, 8, 539—547. Chem.  
entr., 1905, 1, 440.

electrolysing a solution of aniline in hydrochloric acid,  
line Black was formed at the anode, and not chloro-  
line. A similar reaction took place in sulphuric acid  
solution. The decomposition-potential of aniline in hy-  
drochloric acid and in sulphuric acid solution was found  
to be the same—0.95 volt, that is 0.3 volt below that of  
hydrochloric acid and 0.7 volt below that of sul-  
phuric acid. Aniline thus acts as a depolariser and forms  
the same oxidation-product when dissolved in either acid.  
The decomposition-potential of hydrobromic acid is 0.75  
volts, and therefore less than that of aniline, and as was to  
be expected, a bromine derivative of aniline (*s*-tribromoani-  
line) was formed by the electrolysis of aniline in hydro-  
bromic acid solution. The decomposition-potential of  
nitraniline in sulphuric acid solution is 1.43 volts, and  
the compound is oxidised less readily than aniline.—A. S.

### ENGLISH PATENTS.

Accumulator Plates; Preliminary Treatment of — H.  
Leitner, Woking, Surrey. Eng. Pat. 6792, March 21,  
1904.

LEAD plates are subjected as anodes to the action of a  
high-density current in a dilute solution of a suitable  
sulphate to which traces of substances capable of forming  
soluble lead compounds are added. (As example, a  
solution containing 2 per cent. of sodium sulphate and  
2 per cent. of chlorides is mentioned.) After cleansing,  
the plates are reduced, by being used as cathodes in a  
suitable electrolyte, whilst finally the layer of finely  
divided lead is oxidised by exposure to warm air.

—R. S. H.

Electrical Resistance Bodies; Process for the Production  
of — from Amorphous or Crystalline Carbide  
Silicon or Boron, or of Silicon or other like suitable  
Materials. W. P. Thompson, London. From Chem.  
Elekt. Fabrik "Promethens," G. m. b. H., Bockenheim,  
Germany. Eng. Pat. 12,707, June 4, 1904.

SEE Fr. Pat. 343,731 of 1904; this J., 1904, 1034.—T. F. B.

### UNITED STATES PATENTS.

Electrolytic Apparatus. A. Wright, Brighton, England.  
U.S. Pat. 782,308, Feb. 14, 1905.

THE apparatus described is a mercury electrolytic meter  
which consists of a chamber divided into two parts by  
a sieve-like mercury receptacle made of a material which  
is not wetted by mercury and which has openings so  
small that the liquid metal cannot flow through them,  
whilst allowing of the free passage of the electrolyte.  
This receptacle is corrugated so as to receive mercury  
in its depressions only, and is formed with a channel or  
channels which permit of the electrolytically-deposited  
metal being returned to the receptacle.—A. G. L.

Fuel; [Electrical] Process of Preparing Peat for —  
J. W. Vaughan and C. S. Horner. U.S. Pat. 782,587,  
Feb. 14, 1905. 11., page 235.

### FRENCH PATENT.

Accumulator Plates; Regeneration of Negative —  
of reduced Capacity; or Prevention of diminution of  
Capacity of new Plates. R. Kieseritzky. Fr. Pat.  
346,760, Oct. 3, 1904.

For the purpose described in the above title, the author  
proposes to use pieces of wood between the positive and  
negative plates of an accumulator. Probably owing to  
some slight solubility in the electrolyte, they prevent the  
agglomeration and consequent loss of activity of the  
finely-divided spongy lead. The wood should be pre-  
viously freed from injurious organic acids and resin by  
treatment with alkaline solutions.—R. S. H.

### (B.)—ELECTRO-METALLURGY.

Mercury Distilling Apparatus. J. Pollak. Ann. der  
Physik, 1904, 15, 1049—1050. Chem. Centr., 1905,  
1, 417—418.

THE apparatus consists of a barometer tube which is con-  
siderably enlarged at its upper part, and which opens into  
a T-tube. One branch of the T-tube is connected to an  
air-pump, and the other, which is bent upwards, to the  
receiver for the purified mercury. The barometer tube  
is heated electrically by means of a spiral encased in  
asbestos. The first portion of the mercury which distils,  
collects in a T-tube interposed between the barometer  
tube and the pump thus cutting off the latter. The  
apparatus needs little attention and yields about 4 kilos.  
of purified mercury in 24 hours with a consumption of  
10 volts and 20 ampères.—A. S.

### ENGLISH PATENTS.

Steel; Manufacture of — La Soc. Electro-Metallurg.  
Française, Froges (Isère), France. Eng. Pat. 25,948,  
Nov., 29, 1904. Under Internat. Conv., July 8, 1904.

WASTE iron or steel of any kind is submitted to a preliminary super-oxidation in an oxidising furnace; the over-oxidised metal is then deoxidised in an electric furnace. (See Eng. Pat. 7027 of 1903; this J., 1904, 118; also this J., 1904, 25.)—J. H. C.

[Copper] *Electro-depositing Apparatus*. Leeds Copper Works, Ltd., London, and J. C. Jobling, Leeds. Eng. Pat. 7061, March 23, 1904.

THE anodes are arranged parallel with each other and each surrounds a cathode, generally in the form of a mandrel, the anode and cathode surfaces being approximately equidistant at all points. The anode arrangement takes the form of a series of plates supported vertically on bases of the same material, the angles between the three sides of the anode thus built up may be filled with strips or scraps of the same metal, with a view to making the anode and cathode surfaces more completely equidistant.—R. S. H.

*Aluminium and other Metals*: [Electrolytic] *Process of Reducing* —, and *making Alloys thereof*. H. S. Blackmore, Mount Vernon, U.S.A. Eng. Pat. 24,781, Nov. 15, 1904.

SEE U.S. Pat. 775,060 of 1904; this J., 1904, 1225.—T. F. B.

#### UNITED STATES PATENTS.

*Copper*: [Electrolytic] *Process of Producing Pure* —, L. M. Lafontaine, Paris. U.S. Pat. 782,145, Feb. 7, 1905.

COPPER-PRODUCING substances or ores, without any previous treatment, are formed into suitable plates by agglomerating with lime, and these are connected together and used as anodes in an electrolytic bath with suitable cathode plates also connected together. The electrolyte is prepared by saturating water with copper sulphate, adding a quantity of sulphuric acid, and then adding "calcined soot" to the filtered liquid. By passing a current of electricity through the liquid, the copper is dissolved at the anodes, and deposited as chemically pure or refined copper at the cathodes.—B. N.

*Nickel-Plating; Apparatus for* —, J. W. Aylsworth, East Orange, N.J., Assignor to Edison Storage Battery Co., Orange, N.J. U.S. Pat. 781,867, Feb. 7, 1905.

THIS invention relates to an apparatus for electroplating a continuous strip-like iron or steel article, or a connected series of separate articles, and subsequently welding the nickel film on to the metal. The article or articles pass continuously through a chamber in which they are heated electrically in the presence of a reducing atmosphere so as to deoxidise them. The articles then pass continuously through an electrolytic bath, in which they are coated with a metal during transit. After passing through a washing tank they pass continuously through a second heating chamber in which they are electrically heated to a welding temperature in the presence of a non-oxidising gas, and finally through an extension of the heating chamber so that they are cooled below the oxidising point while still surrounded by the gas. A series of pulleys in the plating and washing baths support and guide the strip during transit, and the heating chambers are also provided with pulleys over which the strip passes.—B. N.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*Cacao Butter; Specific Gravity of* —, M. Rakusin. Chem.-Zeit., 1905, 29, 139.

THE specific gravity of cacao butter was given by Hager as 0.945–0.946 at 15° C., and by Dieterich as 0.976 at 15° C. The author has found this value to be 0.9702 at 20° C. and thus confirms Dieterich's results. He points out that cacao butter sinks in castor oil, and must therefore have a greater density than 0.9604 at 20° C. (the value for that oil on Regnault's hydrometer).—C. A. M.

#### ENGLISH PATENTS.

*Oils; Process for Reducing the Density of Mineral Vegetable* —, A. Canera di Salasco and C. C. Roy. Eng. Pat. 26,192, Dec. 1, 1904. III., page 236.

*Soap; Process for Producing* —, F. A. V. Klop. Dresden-Leubnitz, Saxony. Eng. Pat. 10,350, Mar. 1904.

SEE Fr. Pat. 342,691 of 1904; this J., 1904, 942.—T. F.

## XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

### (A.)—PIGMENTS, PAINTS.

#### ENGLISH PATENT.

*Lakes [from Azo Dye-stuffs]; Manufacture of New Co* —, H. E. Newton, London. From Farbennorm. F. Bayer und Co., Elberfeld, Germany. Eng. 7953, April 6, 1904.

SEE Fr. Pat. 341,867 of 1904; this J., 1904, 906.—T. F.

### (B.)—RESINS, VARNISHES.

#### UNITED STATES PATENT.

*Turpentine, Spirits of; Process of Obtaining* —, H. J. C. Mallonee, Charlotte, N.C. U.S. 781,733, Feb. 7, 1905.

THE "defibrated" wood is subjected in a closed vessel to the action of steam at a temperature somewhat at 100° C., and is agitated mechanically during the treatment "throughout its entire body in such a manner its tendency will be to raise, with certainty, portion the mass below toward the top, plunging top portion or toward the bottom." The resinous matter is removed, and the pulp is treated with a dilute solution of caustic soda, and finally heated under a pressure of 100 lb. per sq. in.—T. F. B.

### (C.)—INDIA-RUBBER, &c.

#### UNITED STATES PATENT.

*Rubber; Filler for* —, J. R. Hunter, Assignor to W. H. Smith. U.S. Pat. 781,881, Feb. 7, 1905. XIV., page 245.

## XIV.—TANNING, LEATHER, GLUE, SIZE

*Sheep Leather with Chamois-like Finish*. R. Bun Der Gerber, 1905, 31, 49–50.

SHEEPSKINS that are damaged on the grain can be finished upon the flesh side. When a highly-glazed leather is required, the skins may be brushed over on the flesh side with a solution of dyestuff, to each litre of which has been added 200 grms. of flour. After drying, they are glazed by machine.

The goods to be dressed for imitation chamois or fancy leathers, are placed for 5 minutes in a solution of 2 grms. of potassium bichromate dissolved in 6 litres of cold water, washed, slicked out, and dyed in the usual way using basic dyestuffs. The drum and paddle methods of dyeing are not to be recommended in the case of these skins. The dyed goods are washed, slicked out, oiled over, and quickly dried. When dry, they are rubbed over with powdered pumice on the flesh side in order to raise the "nap," and are brush-stained on the flesh side with a colour supplementary to that used in dyeing the grain side, e.g., red with yellow, orange with blue, purple with violet. The final finish is produced by rubbing over the flesh side with fine pumice stone.—M. C. L.

'Candle Filter Method' [for Tannin Extracts]; Report of Commission Appointed to Investigate the — as a Substitute for Filter Paper. XXIII., page 251.



*Aluminoids; Oxidation of — by Calcium Permanganate.* II. *Oxidation of Glue.* F. Kutscher and M. Benk. XXIV., page 252.

# UNITED STATES PATENTS.

*Leathering Composition.* J. Campbell and W. A. Rushforth, Chicago, Ill., Assignors to Schoellkopf, Hartford, and Hanna Co., Buffalo, N.Y. U.S. Pat. 781,714, Feb. 7, 1905.

It is made for a composition for use in the depilation of faces or skins, consisting of a mixture of calcium sulphide with an excess of barium hydrate, or one calcium hydrate and sodium sulphide in presence of calcium of barium hydrate. The mixture is employed in form of an aqueous solution.—M. C. L.

*Leathering Machine; Automatic —.* C. J. Glasel, New York. U.S. Pat. 782,193, Feb. 7, 1905.

Eng. Pat. 17,817 of 1903; this J., 1903, 1140.—T. F. B.

*Filler for [from Bone] —.* J. R. Hunter, Assignor to W. H. Smith, both of Philadelphia, Pa. U.S. Pat. 781,881, Feb. 7, 1905.

It is finely-divided shreds of bone that have been freed from liquid and mineral matter, or delimed animal tissue, intended for use as a filling material for rubber. (See abstract following.)—M. C. L.

*Products and Compressed Product from —; and Also Process of Treating —.* J. R. Hunter, Assignor to W. H. Smith, both of Philadelphia, Pa. U.S. Pats. 781,880; 781,882 and 781,883, all of Feb. 7, 1905.

The products claimed (781, 880) include fibres from bone treated along general lines of natural cleavage and freed from mineral matter; also the shredded cartilaginous matter from bone.

It is also made (781,882) for a process of treating or shredding bone, to remove mineral matter, finely dividing the product and "recombining" the particles by means of pressure; the claim also includes the compressed product (see also preceding abstract). The process claimed (781,883) consists of treating pieces of bone after washing, with acid to approximately a blood red color in order to remove mineral matter, and, after neutralizing the excess of acid, finely dividing the product into shreds. (See preceding abstract).—M. C. L.

*Product from —.* J. R. Hunter, Assignor to W. H. Smith, both of Philadelphia, Pa. U.S. Pat. 781,884, Feb. 7, 1905.

It is freed from mineral matter and the residuum is pressed transversely to the length of the cells of the natural bone. (See the two preceding abstracts).—M. C. L.

# XV.—MANURES, Etc.

*Humic Compounds; Agricultural Value of —.* J. Dumont. Comptes rend., 1905, 140, 256—259.

He found that certain crops are improved more when they are treated with a dressing of humic compounds than with a manure of purely mineral origin, and that phosphoric compounds, humates and humophosphates have a relatively higher manurial value than ordinary superphosphates or slag phosphates. The humo-phosphates are considered to be the most valuable compounds in this respect.—J. O. B.

# XVI.—SUGAR, STARCH, GUM, Etc.

*Arabinose and Xylose; Diphenylhydrazones of —.* J. Tollens and A. D. Maurenbrecher. XXIV., page 252.

# ENGLISH PATENT.

*Sugar; Treatment or Preparation of —, and Apparatus for use therein.* E. Shaw, London. Eng. Pat. 4112, Feb. 18, 1904. (Compare this J., 1905, 144.)

CLAIMS are made, in apparatus for use in the preparation of "acrated" or "basket" sugar, for an enclosed chamber or trough wherein hot syrup is caused to crystallise evenly throughout, without being allowed to cool unduly; for the combination of this chamber with a pipe heated externally by steam, and means for forcing syrup through it, and also means for separating "the steam from the syrup as it leaves the heated pipe"; for another chamber or trough through which the crystallised mass from the crystallising chamber is passed and wherein it is stirred and broken up, steam being thus allowed to escape, but loss of heat from other causes being retarded, the syrupy mass during its passage through this chamber or trough gradually changing into more or less dry, acrated sugar; for the production of sugar by adjusting precisely the proportion of invert sugar present in the syrup, rapidly boiling the solution by forcing it at a suitable speed through a pipe heated externally by steam, and then converting the boiled syrup into saleable sugar by passing it through apparatus as described above.—T. H. P.

# FRENCH PATENTS.

*Inulin; Manufacture of — from Artichoke Roots.* J. B. Gailhat. Fr. Pat. 346,837, Oct. 6, 1904.

ARTICHOKE tubers are harvested a short time before they reach maturity, and are treated in the same manner as potatoes in the manufacture of starch, or else they are dried at 100°—110° C. in special evaporators in order to preserve them until required. The dried slices may be boiled and pulped, or ground to flour before extracting the inulin, which is done in the way usual in the case of potato starch.—J. F. B.

*"Saccharo-Gum."* J. Pernod. Fr. Pat. 339,228, Dec. 21, 1903.

"SACCHARO-GUM" is produced by the viscous fermentation of saccharine liquids, which is set up by the addition of nitrogenous organic matters, such as blood, sewage, &c. The infected liquid is maintained at a temperature of 10°—20° C. with frequent agitation for 15 or 20 days, until sufficient viscosity is obtained. The viscous solution may be utilised direct or after concentration as a substitute for ordinary gum. The gummy matter may be separated in the pure state by dialysis, or by precipitation with alcohol.—J. F. B.

# XVII.—BREWING, WINES, SPIRITS, Etc.

*Yeast; Production of Sulphuretted Hydrogen by —.* H. Will. Z. ges. Brauw., 1905, 28, 108—109.

THE liberation of sulphuretted hydrogen by fermenting wort has been traced by the author and his assistants to the action of yeast on peptones. Likewise Osterwalder has found that a liberation of this gas takes place when yeast acts upon pear- and wine-musts entirely free from sulphur, and analogous results have been obtained by Schander with a number of yeasts and other wine organisms. The latter worker concludes that this property of forming sulphuretted hydrogen is inherent in yeasts, and is manifested more especially when free sulphur is present, but less so when the sulphur is in combination. With one exception, sulphates are more readily acted on by yeast in this direction than organic sulphur compounds. A considerable influence is exercised by the composition of the nutrient medium, the temperature, and the race of yeast. Yeasts with the greatest fermentative activity produce the most gas. In certain circumstances the formation of sulphuretted hydrogen in wine is so extensive as to spoil the flavour, the addition of gypsum to the wine, and growing grapes on soils rich in sulphates, probably favouring the reaction. Some organic sulphur compounds, probably mercaptans, were also detected. Sulphates and especially free sulphur stimulate the

fermentative activity of yeast, which utilises them as food; and the formation of sulphuretted hydrogen is not a simple process of reduction, but one of metabolism. The sulphuretted hydrogen is not produced by the decomposition of albuminoids, but probably from altered sulphur compounds at a stage anterior to their utilisation in the synthesis of albumin. Other micro-organisms are able to form sulphuretted hydrogen, *apiculatus* yeasts, *mycodermæ* and a few fission fungi having this power in presence of sulphur, but only the two first-named in presence of sulphates.—C. S.

*Zymase and Alcoholic Fermentation.* A. Harden. J. Inst. Brewing, 1905, 11, 2—13.

THE author has continued his investigations on the effects produced by the addition of substances of a proteid nature to yeast cell-juice upon the relative activities of the proteolytic and the fermentative enzymes. In addition to the effects already recorded in the case of blood-serum (see this J., 1903, 432), it has been found that when boiled yeast cell-juice is filtered and added to fresh juice, a very considerable increase in the fermentative power is produced, which increase is greater the greater the proportion of boiled extract added. The boiled extract also has a somewhat irregular retarding effect upon the proteolytic enzyme, but apparently this effect is independent of that on the fermentative enzyme. The addition of varying volumes of boiled juice affects the two enzymes in totally different manners; in the case of the zymase the maximum result is reached slowly, in that of the proteolytic enzyme the maximum effect is very quickly reached, and then remains constant. The nature of the substance which stimulates the alcoholic fermentation is not known, but it is precipitated by alcohol, and is unaffected by boiling but is not produced thereby, it is present equally in fresh and old juice, it is destroyed by incineration, and it will pass through a dialyser. Experiments on the dialysis of fresh yeast cell-juice appear to indicate that the zymase by itself is incapable of effecting alcoholic fermentation, and that the presence of this stimulating substance is necessary before the activity of the zymase is manifested. Membranes of gelatin were prepared in the pores of a Chamberland filter, and the fresh yeast juice was forced through this under a pressure of 50 atmospheres. It was then found that neither the filtrate nor the residue on the filter was capable of setting up any sensible fermentation in sugar solutions, but that when the residue and filtrate were mixed together a fermentation was produced comparable in magnitude with that set up by the original juice.—J. F. B.

*Alcoholic Fermentation; Chemical Mechanism of* —. II. E. Buchner and J. Meisenheimer. Ber., 1905, 38, 620—630.

THE present investigations confirm the conclusions previously drawn by the authors (see this J., 1904, 262) that the alcoholic fermentation of sugar by yeast cell-juice takes place in two stages, with the formation of lactic acid as an intermediate product. It is proposed to confine the name of "zymase" to the enzyme which splits up the sugar into lactic acid, and to call the complementary enzyme which splits up the lactic acid into carbon dioxide and alcohol, "lactacidase." The conditions under which the equilibrium between the two enzymes, as they occur in yeast juice, can be disturbed so that lactic acid is either formed, or destroyed, are still obscure. But it would appear that the addition of much sugar, as also of lactic acid would favour the destruction of the latter. Cell juices prepared in the summer and those with low fermentative power also appear to favour the destruction of lactic acid, whilst those prepared in the winter and those with high fermentative power generally show an increase in the quantity of lactic acid after fermentation. The lactic acid produced during fermentation was, in all cases, the inactive modification. The assumed initial production of a dihydroxy- $\gamma$ -ketonic acid (*loc. cit.*) is not confirmed; it is more probable that the primary product of the decomposition of dextrose may be methylglyoxal.

Acetic acid appears to be a characteristic product of the cell-free fermentation of sugar, quantities ranging from 0.01 to 0.33 per cent. of free acetic acid having been observed in the fermented liquids.

Lactic acid is produced by the action of caustic potash solution upon dextrose, both in daylight and in the dark, e.g., when 10 grms. of dextrose, 10 grms. of caustic potash and 200 c.c. of water are kept for 11 months.

By digestion of invert sugar with concentrated caustic soda for four days, small quantities of ethyl alcohol were produced.

Lastly, when calcium lactate was subjected to distillation with slaked lime, considerable quantities of ethyl alcohol were obtained, together with iso-propyl alcohol, the latter resulting probably from the reduction of acetone.—J. F. B.

*Mash Tun; Internal Rakes in the* —. A. H. Lev. J. Inst. Brewing, 1904, 10, 533—535.

THE provision of internal rakes in the mash tun is necessary, in the old method of mashing, for mixing grist with the water, but even with more modern mash appliances, rakes are desirable for levelling the goods discharged from the mashing machine, and to prevent the solid portion heaping up under the delivery where the liquid runs to the opposite side. No mashing plate is perfect without an underlet, by which the temperature may be raised at any moment by forcing hot liquid through six or eight tap-holes in the bottom. In the method of raising the temperature the action of the underlet will be only local, unless the goods are stirred during underlet, and some portions of the mash will remain at the relatively low initial temperature for a dangerous long time. In addition, the uniform distribution of heat will increase the yield of extract by rupturing starch granules, which would otherwise escape. Finally the judicious use of the rakes and underlet will cure the tendency for the mash to "set dead" on the bottom, the lifting of the goods off the plates will enable the water to run off more freely. The existing form of rakes capable of some improvement: the best arrangement would be the usual arm with teeth on one side of shaft, and on the other side, in a line with it, a spoon-shaped or perforated blade, which would lift the warm mash from the bottom.—J. F. B.

*Fusel Oil; Production of* —. H. H. Pringsheim. Ber., 1905, 38, 486—487.

THE author confirms the observation of Emmerling (J., 1904, 1107) as to the existence of a bacillus on potatoes which forms fusel oil. When pieces of American potatoes were digested under water at a temperature of 35° for some days, three classes of organism were isolated from the slimy mass, *viz.*, a round coccus, an organism apparently identical with *B. mesentericus vulg.*, and fusel oil potato bacillus. This last is a motile rod-shaped bacillus which converts potatoes into slime with copious evolution of carbon dioxide and hydrogen, and production of amyl alcohol. When spores are produced, the rods swell up into club-shaped cells, each containing generally two spores. The spores survive the process of heating at 80° C. for 10 minutes, by which treatment a preliminary purification of the cultures may be effected. The colonies grow only slowly on agar plates, and have a silvery lustre with indefinite edges. The bacillus is not an obligate anaerobe; it liquefies gelatin rapidly. No growth or fermentation takes place in potato media when 10 per cent. of alcohol is added; it would, therefore, appear unlikely that this bacillus is responsible for the production of fusel oil in distillery washes.—J. F. B.

*Aluminium; Use of* — for Beer-Filters. F. Schönd. Woch. für Brau., 1905, 22, 79—80.

THE author finds that when beer is left for some time in a filter made of cast aluminium contained in a copper casing, electrolytic action takes place, and the beer becomes turbid. There is a considerable proportion of a minoxid matter in the deposit, which contains also phosphoric acid, a large amount of alumina, traces of iron and tin oxide (from the solder). If the copper casing is replaced by one of glass, the aluminium is only slightly attacked, and the beer shows only a very slight turbidity or none at all.—T. H. P.



*Effects of Various "Fining" Agents on the Composition of —.* K. Windisch and T. Roettgen. *Nachr. u. Genussmittel*, 1905, 9, 129—133.

Others have tested the effects of isinglass, gelatin, albumin and "Spanish earth" (a species of China clay) on the composition of wine when they are added for effects of clarification. The total acidity, dry extract, tannin and nitrogen were determined before and after in the case of both red and white wines. The results showed that the total acidity, extract and ash were not affected by the clearing agents, with the exception of albumin slightly increased the extract and ash of red wine. The tannin in the case of the red wine and of the white wines was distinctly lowered both by nitrogenous fining agents and by the Spanish earth. In the case of one of the white wines, however, the proportion of tannin was slightly increased, without any reason. In the case of wines prepared from grapes the removal of tannin by finings may be very considerable. Bad samples of Spanish earth, containing carbonate, may reduce the acidity of the wine. The proportion of nitrogen was in all cases practically unchanged by the fining agents.—J. F. B.

*Musts; Preparation of Practically Sterile —.* Perrier. *Comptes rend.*, 1905, 140, 324—325.

Apples are washed with water, immersed for 5—10 minutes in a dilute aqueous solution of formaldehyde (8 per 1000), again washed with water, and allowed to dry. The must is prepared from the fruit in the usual manner, except that the presses, &c., are first washed with a 4 per 1000 solution of formaldehyde. The must obtained in this way are sterile with respect to bacteria, and are similar in taste and composition to those obtained in the usual manner; some specimens have been obtained from Rennes to Buenos Ayres and back without undergoing fermentation. When they are sown with yeast, fermentation proceeds in a uniform manner, and of equal quality is produced. Among the advantages claimed for this treatment are that musts can be kept from one year to another in view of a possible scarcity of apples; and that of uniform quality can be freshly prepared at any period of the year. (See also this J., 1904, 73; 1905, 11—A. S.)

*Brandy.* O. Hehner. *Analyst*, 1905, 30, 36—43.

The author protests against the tendency to generalise the conclusions formulated in the report of the "Lancet" Commission on Brandy (see this J., 1903, 433). That report is solely with the production of Cognac brandy, produced in the Charentes district in a more or less primitive manner by pot-still distillation without much purification. Liquors equally entitled to the name of "brandy" are, however, produced in other districts and in other countries, from other varieties of grapes, by other types of fermentation, and are distilled by other and frequently more perfect methods of distillation. Since the character and flavour of all spirits depend solely on the nature and quantity of the impurities left in them by the method of distillation employed, it is impossible to apply to these various brandies the same analytical criteria applicable in a very limited degree to brandies produced in the Cognac district. These criteria consist in the establishment of certain limits for the "coefficient of impurities" and for the ratio of higher alcohols to esters. But it has been conclusively proved from published analyses that the proposed limits (*viz.*, 300 for the "coefficient of impurities" and 80 for "ethers" per 100,000) cannot be rigorously maintained even for genuine Cognac brandies, as they depend entirely upon more or less accidental conditions. These coefficients are capable of useful application under proper restrictions for products made in the same way from approximately constant raw materials, but they are absolutely misleading as a test for spirits "distilled from the grape" in a general sense, as cannot possibly form the basis of an official standard of authenticity. The question of determining whether a spirit is genuine brandy is beyond the power of chemical analysis; grape spirit differs from other spirits only in its flavour of its residual impurities, and the matter must be left to the opinion of the expert taster.—J. F. B.

# FRENCH PATENTS.

*Cell-Contents [Yeast]: Extraction and Preparation of Organic —.* H. C. Empis. *Fr. Pat.* 346,862, Oct. 7, 1904.

THE cells are mixed with water, to which reagents may be added if desired, and the fluid or semi-fluid mass is projected with considerable velocity through capillary tubes against an obstacle, whereby the cell-walls are ruptured and the juices are liberated. The liquid is then subjected to successive freezings and thawings in order to fractionate the products, which may also be concentrated by evaporation under vacuum, or dried.—J. F. B.

*Musts; Preservation and Sterilisation of — before Fermentation.* E. J. B. J. Dequen. *Fr. Pat.* 346,867, Oct. 7, 1904.

THE musts are rapidly evaporated to dryness before fermentation, by spreading them in thin layers over a surface heated to a temperature a few degrees above 100° C, and scraping off the film of solid matter.—J. F. B.

## XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

### (A).—FOODS.

*Polenski's New Butter-Value [Detection of Coconut Oil in Butter].* A. Hesse. *XXIII.*, page 251.

### ENGLISH PATENT.

*Milk and Milk Preparations; Production of Desiccated —.* G. Döllner, Gross Lichterfelde, Germany. *Eng. Pat.* 23,100, Oct. 26, 1904. Under Internat. Conv., Nov. 12, 1903.

MILK or cream, is first rendered homogeneous and then evaporated to dryness under reduced pressure. In the case of milk, the cream may be separated by centrifugal action, and then both cream and skimmed milk made homogeneous, after which they may be re-mixed, either during the evaporation or when dry. The skimmed milk may also be separately evaporated, then mixed with the homogeneous cream, and the desiccation continued.

—W. P. S.

### FRENCH PATENT.

*Casein Preparation.*—J. T. Gateau. *Fr. Pat.* 346,838, Oct. 6, 1904.

CASEIN, obtained from milk by precipitation with an acid, is subjected in the wet or dry state, to the action of ammonia vapour. The resulting product is soluble in water.—W. P. S.

### (B).—SANITATION; WATER PURIFICATION.

*Ammonia in Drinking Water; New Method of Determining —.* Trillat and Turchet. *XXIII.*, page 251.

### UNITED STATES PATENT.

*Water; Process of Sterilising —, by means of Ozonised Air.* H. Friberg, Charlottenburg, Germany, Assignor to Siemens and Halske Akt.-Ges. Berlin. *U.S. Pat.* 782,021, Feb. 7, 1905.

THE water to be sterilised is first aerated by subjecting it in "finely divided streams" to the action of oxygen or pure air, and thereafter the water thus treated is further subjected to the action of ozone under pressure.—E. S.

### (C).—DISINFECTANTS.

### UNITED STATES PATENT.

*Allyl-formaldehyde-isosulphocyanate [Disinfectant] and Process of Making same.* S. Fabaron, Assignor to P. L. Piot, Paris. *U.S. Pat.* 782,016, Feb. 7, 1905.

SEE *Fr. Pat.* 330,988 of 1903; this J., 1903, 1100.—T. F. B.

## XIX.—PAPER, PASTEBOARD, Etc.

*Gelatins; Comparison of Sizing Qualities of Different* — C. Beadle and H. P. Stevens. *Paper and Pulp*, 1905, 10, 69—77 and 105.

THE authors give the results of the examination of several samples of commercial gelatins, classifying them according to their reputed origin, relative prices, colour and transparency of sheets, ash, and increase in weight by soaking in water. Jellies were also made containing 5 per cent. of air-dry gelatin, and these were classified according to their colour, transparency and stiffness.

A series of sizing tests was then carried out to determine the increase in strength imparted to one and the same waterleaf paper by equal quantities of the various gelatins under similar conditions. The waterleaf selected was composed of two-thirds cotton and one-third linen; it was exceptionally constant in its tensile strength in both directions. Sheets of known weight were carefully sized in 5 per cent. solutions of the gelatins heated to 131° F., every effort being made to ensure equal absorption. This was, however, impossible, so the results of subsequent mechanical tests had to be corrected by calculation in proportion as the percentage of gelatin in the paper differed from 5 per cent. By this method the gelatins were classified according to their relative strength-giving qualities; these qualities were in no way proportional to the relative prices of the gelatins, neither was the stiffness of the jelly any indication of the strength-giving power. The stiffness of the jelly does, however, indicate to a large extent the sizing qualities, i.e., the ink-resisting qualities, of the gelatin. It was found as a rule that the closer the gelatin approached to the "glue" class, the greater was its strength-giving quality, whilst the higher its ink-resisting power, the lower, apparently, was its strength-giving quality.—J. F. B.

## ENGLISH PATENTS.

*Paper; Manufacture of Many Coloured, Marbled, or Unequally Mixed* —, and *Apparatus therefor*. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst on the Maine, Germany. Eng. Pat. 6849, March 21, 1904.

PULP dyed with the colour of the desired marbling is allowed to run, with much water, down an inclined plane, on to a sheet of wet paper, dyed another colour, as it comes from the paper machine. The pulp is prevented from penetrating the sheet of paper by the usual vacuum boxes, which operate on the paper shortly after the pulp has come into contact with it. Suitable apparatus for carrying out this operation consists of a vessel into which the pulp and water flow, supported above the wire cloth over which the paper passes. This vessel is provided with a stirrer and baffle plates, to give the pulp a circuitous flow; the pulp then passes down an inclined plane on to the sheet of dyed paper, producing a marbled effect. The effect may be varied by altering the inclination of the plane down which the pulp runs.—T. F. B.

*Pyroxylin, Collodion Cotton, Celluloid, and the like; Manufacture of Coherent and Opaque Films, Sheets, or Masses of* —. C. D. Abel, London. From Act.-Ges. f. Anilinfabrikation, Berlin. Eng. Pat. 9962, April 30, 1904.

COHERENT, opaque white films or masses are obtained by allowing a solution of pyroxylin, collodion cotton, or celluloid in suitable solvents to evaporate. By varying the concentration of the solutions, it is possible to produce either a brilliant or a dull mass. Coloured opaque masses may also be produced by adding a dyestuff to the solution. For example, by allowing a solution of 20 parts of celluloid in 100 parts of ethyl acetate and 120 parts of methyl alcohol to evaporate at the ordinary temperature, a brilliant, white layer, resembling enamel, is produced. A dull white layer, of very fine grain, is obtained by diluting the above solution with 130 parts of methyl alcohol, and allowing it to evaporate. Films or sheets thus produced are suitable for covering glass, wood, leather, or paper.

—T. F. B.

## FRENCH PATENT.

*Cellulose; Process of Preparing a Solution of — Ammoniacal Copper Oxide of Concentration suitable for the Manufacture of Artificial Threads*. R. Linka. Fr. Pat. 346,722, Oct. 1, 1904. V., page 238.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

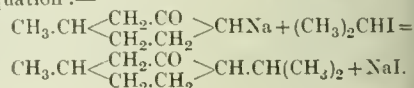
*Rare Earths; Bibliography of the* —. R. J. Me. Z. anorg. Chem., 1905, 43, 416—480.

THE bibliography relates to the cerite and yttria and to thorium, but does not include references to art on radio-activity and on the discovery, properties, analysis of minerals containing rare earths. It covers the period between the year 1751 and the beginning of the present year.—A. S.

*Mercury Distilling Apparatus*. J. Pollak. XI. 1, page 243.

*Menthone and Menthol; Synthesis of* —. A. H. and C. Martine. *Comptes rend.*, 1905, 140, 130—

THE authors have succeeded in preparing menthone the methyleyclohexanone derived from pulegone. Menthone is a cyclohexanone, in which one atom of hydrogen has been replaced by sodium by heating it with sodium amid a suitable solvent such as ether, is treated with isopropyl iodide and the mixture heated. When the reaction is complete, water is added, and the ethereal layer separated and fractionated. In this way menthone is obtained, and from it, by reduction with sodium in alcoholic solution, menthol is produced. The formation of menthone from sodium-methyleyclohexanone takes place according to the equation:—



—A.

*Thymomenthol and its Derivatives*. L. Brunel. *Comptes rend.*, 1905, 140, 252—253.

THYMENTHOL is readily obtained by hydrogenating thymol by the Sabatier-Senderens reaction, the results being obtained at 160° C.

Pure thymomenthol is a colourless syrupy liquid, with a strong odour of peppermint; it has the sp. gr. 0.823 at 0° C., and crystallises at low temperatures to a white solid which melts between —5° and 0° C.; it boils at 215° C. and when exposed to the air, it readily volatilises at no temperatures without forming crystals. When heated with phosphoric anhydride or potassium hydrogen sulphate it is dehydrated, yielding a tetrahydrocymene, thymene, sp. gr. 0.823 at 0° C.; b. pt. 167°—168° C., similar in character to menthone. Thymomenthol forms esters with acids; in consequence of transformation at the time of esterification these esters are those of a stereoisomeride of thymomenthol; the alcohol formed by hydrogenation is, therefore, designated  $\alpha$ -thymomenthol, that liberated from the esters,  $\beta$ -thymomenthol.

The acid succinate and phthalate of  $\beta$ -thymomenthol have been prepared. The former,  $\text{COOH}\cdot\text{CH}_2\cdot\text{CH}(\text{COO}\cdot\text{C}_{10}\text{H}_{15})$ , crystallises from light petroleum spirit in fine colourless and odourless needles; m. pt. 80° C.; they are soluble in alcohol, and in hot light petroleum spirit—from the latter being almost completely precipitated on cooling. It is soluble in dilute alkaline solutions, forming salts. The acid  $\beta$ -thymomenthyl phthalate forms large colourless, odourless prisms; m. pt. 128° C., and is very soluble in alcohol, chloroform and dilute alkaline solutions.

$\beta$ -thymomenthol crystallises in long needles having the appearance and odour of menthol. It melts at 17° C. and boils at 217° C. It dissolves in most organic solvents and volatilises less rapidly in the air than  $\alpha$ -thymomenthol, so that by exposing a mixture of the two alcohols to the air the  $\alpha$ -thymomenthol is entirely volatilised in a few hours.



ing  $\beta$ -thymomenthol as a crystalline residue.  $\beta$ -thymomenthol gives esters with acids which are identical with those given by the  $\alpha$ -alcohol, showing that the esterification is effected solely on the alcohol function.  $\alpha$ - and  $\beta$ -thymomenthol give the same ketone, thymoketone,  $C_{10}H_{18}O$ . They are probably racemic forms, possessing three asymmetric carbon groups.—J. O. B.

*Santonin; The Oxonium Nature of* —. E. Wedekind and A. Koch. Ber., 1905, 38, 421–428.

The authors discuss the chemical character of santonin, and conclude that it forms oxonium salts. It is pointed out that santonin contains the grouping  $(CH_2.CO)$ , and ketones have a particular tendency to salt formation. Desmotropo-santonin, the enolic isomeride of santonin, on the other hand, shows not the slightest tendency to salt formation. It is interesting to note that the toxic action (thread worms) of santonin appears to have some connection with the basic nature of the  $CH_2.CO$  group. It contains, since the enolic form, (desmotropo-santonin) which the corresponding group is  $CH_2.CH(OH)$  has no such properties, and is also non-toxic. Santonin may be regarded as an alkaloid which contains no nitrogen. Also this J., 1898, 867; 1903, 509.)—A. S.

*Strychnine Salts; Optical Behaviour of Solutions of* —. Minquinn. Comptes rend., 1905, 140, 243–245.

On the action of solutions of strychnine salts on polarised light, observed with solutions of the base in a solvent consisting of one part of absolute alcohol and two parts of ethyl alcohol in the presence of, first, a molecular equivalent of various acids; and second, excess of these acids, it was found that the reading in many instances differed materially from that required theoretically by the amount of acid present. It would appear that a kind of distortion of the strychnine salts takes place, which is more pronounced with weaker acids than with stronger. It was found that in a homologous series of salts, the permanent rotation was practically constant for a given molecular concentration; in the case of strychnine trihydroxybenzoate, the permanent rotation was notably greater than in the corresponding meta- or para- salts. Also, as has been previously shown, the double refraction exercised a marked influence on the rotation of salts in which it occurred, as was seen by comparing the permanent optical rotation of strychnine succinate, maleate and fumarate and of butyrate and crotonate. —J. O. B.

*Hydrazine; New Reaction of* —, and *Isomerism of their Oxides*. A. Conduché. XXIII., page 251.

*Iodoform; Source of Error in the Determination of* — by the Iodoform Method. W. Vaubel and O. Scheuer. XIII., page 252.

*Planted Plants; Consumption of Odoriferous Substances* —. E. Charabot and A. Hébert. XXIV., page 252.

#### ENGLISH PATENT.

*Camphor from Isoborneol; Manufacture of* —. J. Y. Johnson, London. From G. F. Boehringer und Soehne, Mannheim, Germany. Eng. Pat. 28,035, Dec. 21, 1904.

ISOBORNEOL can be easily and rapidly oxidised to camphor by means of chlorine. Excess of chlorine is to be avoided. Oxidation may be effected either by mixing solutions of chlorine and isoborneol, or by passing chlorine gas, previously diluted with some inert gas, into a cooled solution of isoborneol, or by the action of chlorine gas on solid isoborneol. The yields are said to be nearly quantitative. —T. F. B.

#### UNITED STATES PATENTS.

*Theophylline [and 8-Chloro-caffeine]; Preparation of* —. C. Massie, Washington, Administrator to F. Ach, assignor to C. F. Boehringer und Soehne, Mannheim, Germany. U.S. Pat. 782,154, Feb. 7, 1905. Eng. Pat. 5901 of 1903; this J., 1903, 648.—T. F. B.

*c.c.-Diethylbarbituric Acid and Process of Making same*. E. Fischer, Berlin, Assignor to E. Merck, Darmstadt. U.S. Pat. 782,739, Feb. 14, 1905.

SEE Eng. Pat. 1664 of 1903; this J., 1903, 923.—T. F. B.

*Dipropylbarbituric Acid, Analogous Derivatives, and Process of Making them*. E. Fischer, Berlin, Assignor to E. Merck, Darmstadt. U.S. Pat. 782,740, Feb. 14, 1905.

SEE Eng. Pat. 1664 of 1903; this J., 1903, 923.—T. F. B.

*Barbituric Acid; Disubstituted* —, and *Process of Making same*. E. Fischer, Berlin, Assignor to E. Merck, Darmstadt. U.S. Pat. 782,741, Feb. 14, 1905.

SEE Eng. Pat. 1664 of 1903; this J., 1903, 923.—T. F. B.

*Barbituric Acids; Trisubstituted* —, and *Process of Making them*. E. Fischer, Berlin, Assignor to E. Merck, Darmstadt. U.S. Pat. 782,742, Feb. 14, 1905.

SEE Eng. Pat. 2054 of 1903; this J., 1903, 923.—T. F. B.

### XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*Orthochromatic Plates and Sensitisers*. A. J. Newton and A. J. Bull. Phot. J., 1905, 45, 15–20.

PHOTOGRAPHS of a spectrum, produced by a "prism-grating," were obtained on a number of brands of orthochromatic and panchromatic plates, and also on collodion plates which had been bathed with the various "sensitising dyestuffs" on the market. Reproductions of the photographs are given, and also tables showing the sensitiveness of the plates to the different colours of the spectrum. In general, it was found that more even colour sensitiveness was obtained with the bathed collodion plates than with the commercial panchromatic varieties. —T. F. B.

#### ENGLISH PATENTS.

*Films for Photography*. M. Bry, Courbevoie, France. Eng. Pat. 24,774, Nov. 15, 1904.

SEE Fr. Pat. 345,535 of 1904; this J., 1904, 1238.—T. F. B.

*Light for Photographic and other Purposes; Flash-light Cartridges for Producing Artificial* —. H. Lüttke, P. Arndt and E. L. Löwengard, Wandsbek, Germany. Eng. Pat. 27,466, Dec. 16, 1904.

FLASH-LIGHT powders, consisting of aluminium or magnesium with substances capable of evolving oxygen (see Eng. Pat. 27,465 of 1904, this J., 1905, 210) are encased in a tube of aluminium, or of aluminium coated with copper, about 0.1 to 0.3 mm. thick, instead of in paper, as is the usual practice.—T. F. B.

#### FRENCH PATENT.

*Photography in Colour; Process of* —. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses Fils. Fr. Pat. 339,233, Dec. 17, 1904.

SEE Eng. Pat. 22,988 of 1904; this J., 1905, 104.—T. F. B.

### XXII.—EXPLOSIVES, MATCHES, Etc.

*Explosion; Circumstances attending an* —, which occurred in an Ironmonger's Shop at Newcastle Emlyn, in the County of Carmarthen, on the 25th Nov., 1904. By Capt. J. H. Thomson, H.M. Chief Inspector of Explosives.

THE explosion took place in a fire-proof safe containing some 20 lb. of gunpowder. The door of the safe was not locked and it is probable that it was not completely closed. The most probable cause of the explosion was the fall of some iron or steel article displaced from one of the upper shelves. Any such article falling on the concrete floor would be very likely to ignite the powder grains which undoubtedly must have been spilt on the floor in front of the safe, seeing that it was the custom

to sell blasting powder out of a 25 lb. bag, from which it was served by means of a scoop. This was a contravention of the Order in Council requiring "that no package containing more than 1 lb. of explosive shall be opened on registered premises." It is suggested that the space around or in front of fireproof safes containing explosives should be covered with lead or linoleum.—G. W. McD.

#### ENGLISH PATENTS.

*Explosives.* J. C. Mitchell, Reynolds, Ind., U.S.A. Eng. Pat. 23,973, Nov. 5, 1904.

It is claimed that the constituents of sandal-wood soluble in alcohol have the property of preserving explosives composed of oxygen-yielding materials and carbonaceous materials from damage by moisture, and that such explosives have an increased propulsive effect and a higher degree of safety. Cane sugar (30 parts) and milk sugar (10 parts) are mixed and heated to 100° C. To this is added an extract made by digesting sandal-wood (4 parts) with alcohol (6 parts). After standing for ten minutes potassium chlorate (50 parts) is added, and the whole thoroughly incorporated, dried and granulated.—G. W. McD.

*Explosive Compounds and Method of Manufacturing same.* C. A. Allison, London. From A. Muller-Jacobs, Armand Heights, U.S.A. Eng. Pat. 27,162, Dec. 13, 1904.

SEE U.S. Pat. 777,125 of 1904; this J., 1905, 44.—T. F. B.

*Explosives; Manufacture of* —. L. Lheure, Paris. Eng. Pat. 27,166, Dec. 13, 1904.

POWDERED potassium chlorate (88–90 parts) is stirred up with molten paraffin (10–12 parts) until it acquires the appearance of mortar. By pressing the mass through sieves it can be obtained in the form of granules or powder. The explosive is said to be non-sensitive to shock and friction, but is exploded by a 1.5 grain fulminate detonator. Claim is made for the use of paraffin with chlorates without the employment of any other combustible body.—G. W. McD.

*Detonating Tubes; Manufacture of* —, for use in Blasting Operations. L. Lheure, Paris. Eng. Pat. 27,167, Dec. 13, 1904.

A TUBE of lead or tin, of suitable internal diameter, is filled with melted trinitrotoluene or trinitrobenzene. When the nitro compounds have solidified, the tube may be reduced to any required diameter by successive drawing operations in a draw-plate. These tubes are not sensitive to shock or friction but may be exploded by a detonator of 1.5 grains of mercury fulminate.—G. W. McD.

*Explosive or Blasting Compounds.* G. Dittmar, Washington, U.S.A. Eng. Pat. 29,056, Dec. 30, 1904.

PARAFFIN or stearin (50 parts) and rosin (25 parts) are mixed together, heated, and the liquid brought to a temperature of 110°–150° C. Nitroglycerin (25 parts to 100 parts), previously heated to 50°–60° C., is then run in and the whole stirred continuously until solidification begins, otherwise the nitroglycerin, being suspended in the state of an emulsion in the liquefied carrier, would separate out. If desired, the ingredients of ordinary black powder can be incorporated in the fused blasting compound. The finished explosive is said to be unaffected by frost, and can be used in the winter without thawing.—G. W. McD.

#### UNITED STATES PATENT.

*Powder; Smokeless — and Method of Making same.* H. W. Wiley, Washington, Assignor to International Smokeless Powder and Dynamite Co., Philadelphia. U.S. Pat. 781,926, Feb. 7, 1905.

SEE Eng. Pat. 13,457 of 1903; this J., 1903, 963.—T. F. B.

#### FRENCH PATENTS.

*Explosives [containing Cyanamide]; Process for obtaining* —. Cyanid-Ges. m. b. H. Fr. Pat. 339,233, 23, 1903.

SEE Eng. Pat. 27,515 of 1903; this J., 1905, 44.—T. F. B.  
*Explosives [Nitrocellulose].* F. E. W. Bowen. Fr. 346,812, Oct. 5, 1904. Under Internat. Conv. 6, 1903.

SEE Eng. Pat. 21,482 of 1903; this J., 1904, 1238.—T. F. B.

*Explosives [Perchlorate].* F. E. W. Bowen. Fr. 346,813, Oct. 5, 1904. Under Internat. Conv. 6, 1903.

SEE Eng. Pat. 21,481 of 1903; this J., 1904, 1238.—T. F. B.

### XXIII.—ANALYTICAL CHEMISTRY.

#### INORGANIC QUANTITATIVE.

*Sulphurous Acid in Alkaline Solution; Iodometric determination of* —. O. Ruff and W. Jeroch. Ber., 38, 409–419.

Two methods have been hitherto proposed for the titration of sulphurous acid in presence of sodium bicarbonate: namely: (1) direct titration with iodine solution; a second method, in which an addition of iodine solution in excess, the excess being titrated with sodium thiosulphate solution. The first method is inaccurate as the sulphurous acid is largely oxidised by the oxygen of the air in presence of the iodine ions which act catalytically. The second method only gives correct results if by chance the error mentioned is compensated for by the fact that the sulphate solution is oxidised by iodine in alkaline solution with partial formation of sulphuric acid. It is, therefore, quite unreliable. Reliable results are obtained by titration with iodine solution in an atmosphere of carbon dioxide in presence of mannitol (10 to 20 per cent.). It is not to be titrated directly, but if excess of iodine be added it may be titrated back with arsenious acid and not with sulphate.—E. F.

*Silver; Separation of* —, from Lead. H. Liebermann. Ber., 1905, 38, 566–568.

THE substance having been dissolved, with addition of tartaric acid if necessary, the filtered solution is neutralised, and ammonium acetate added. Any basic lead which may precipitate, is dissolved by means of acetic acid, and the liquid heated to boiling. A few drops of solution of quinol (hydroquinone) (2 c.c. of a 4 per cent. solution to 0.1 gm. of silver) are added, when the silver is precipitated in the metallic state. After subsiding the liquid is filtered, the precipitate on the filter washed with water containing 5 per cent. of ammonium nitrate, dried, ignited, and weighed. Cadmium does not affect the process, but copper and bismuth are partly either reduced or precipitated as phenolates. If these latter metals are present, the ignited precipitate is placed in a beaker, the portion adhering to the crucible being dissolved in acetic acid, and the solution washed into the beaker, the residue is dissolved in nitric acid, and the silver precipitated as chloride, any co-precipitated bismuth being removed by nitric acid according to Fresenius' directions.—J. T.

*Molybdenum Trioxide and Vanadium Pentoxide; Determination of* —, in presence of each other. B. Mann. Ber., 1905, 38, 600–603.

VANADIUM pentoxide is reduced by zinc to dioxides of vanadium; but molybdenum trioxide is either case reduced to sesquioxide. If then, equal quantities of the solution containing the mixed oxides be reduced in flasks fitted with Bunsen valves, by means of hydrochloric acid and zinc, and magnesium respectively, and the solutions titrated with permanganate, the difference between the amounts of permanganate used represents that necessary to convert the vanadium present from  $V_2O_5$  to  $V_2O_3$  ( $2KMnO_4 = 5V_2O_3$ ). The amount of vanadium present being thus ascertained, the amount of molybdenum may be calculated from either of the experimental results.



$\text{MnO}_4$  converts  $5\text{V}_2\text{O}_3$  into  $5\text{V}_2\text{O}_5$ ;  $6\text{KMnO}_4$  converts  $\text{O}_2$  into  $5\text{V}_2\text{O}_5$ ;  $6\text{KMnO}_4$  converts  $5\text{Mo}_2\text{O}_3$  into  $10\text{O}_3$ . With about 0.25–0.5 grm. of substance 45 c.c. of hydrochloric acid of sp. gr. 1.19 are used; solution is heated with zinc or magnesium for 1 to 4 hours, poured into a 500 c.c. porcelain basin, containing c.c. of boiling water in which has been dissolved grms. of manganous sulphate, and titrated with N/20 manganate, stirring continually.—J. T. D.

**Molybdenum Compounds; Reduction of** — by Magnesium in Sulphuric Acid Solution. B. Glasmann. *Chem. Ztg.*, 1905, 38, 604–605.

While the possibility of determining molybdenum by reducing the trioxide with zinc in sulphuric acid solution, titration with permanganate, is disputed, the author states that it can be done quite well by substituting magnesium for zinc. The substance is gently heated for  $\frac{1}{2}$ – $\frac{3}{4}$  hr. in a flask provided with a Bunsen valve, with mesium and a sufficient quantity of sulphuric acid (5), poured into a capacious porcelain basin, diluted with about 300 c.c. of water at  $30^\circ$ – $40^\circ$  C. containing little sulphuric acid and titrated with N/20 permanganate.—J. T. D.

**Ammonia in Drinking Water; New Method of Determining** —. Trillat and Turchet. *Comptes rend.*, 1905, 140, 374–377.

The method proposed, is based on the formation of nitrogen when an ammoniacal solution is treated with potassium iodide and an alkali hypochlorite. The nitrogen imparts an intense black coloration to the solution, the depth of colour depending on the amount of ammonia present. To determine the amount of the latter in water, 20 to 30 c.c. of the water (or distillate) are placed in an ordinary Nessler cylinder and three drops of a 10 per cent. solution of potassium iodide and two drops of a concentrated alkali hypochlorite solution are added. The authors use commercial *eau de Javel*. The coloration obtained, is compared with that produced by known amounts of ammonia, as in Nessler's process. In cases where the black coloration is very faint, and may be obscured by the colour of the liberated iodine, a slight excess of the hypochlorite solution can be added to dissolve the iodine. This excess must be very small, or the nitrogen iodide will also dissolve. No black coloration is obtained with solutions containing amino compounds, the fatty and aromatic series, ureides, pyridine bases, nitrates or nitrites. All ammonium salts, however, give coloration. As the latter is not affected by the presence of albuminoid matter or sulphides, the saline ammonia can be directly determined in drinking water without previous distillation. The results obtained by the above method, agree closely with those furnished by Schloesing's process.—W. P. S.

### ORGANIC—QUALITATIVE.

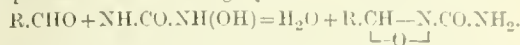
**Polenske's New Butter-Value** [Detection of Coconut Oil in Butter] —. A. Hesse. *Milchwirtschaftl. Centralbl.*, 1905, 1, 13–20. *Chem. Centr.*, 1905, 1, 66–567.

The author finds that besides using an apparatus of the prescribed dimensions in carrying out Polenske's method (S. J., 1904, 387), it is of still greater importance to use pumice of uniform size for the prevention of bumping. Pumice powder is recommended. If pieces of pumice of uniform size be employed, acids distil over which would otherwise remain in the distilling flask, and the results are thus considerably affected. The author's results indicate that the upper limit for the new butter-value of pure butter should be about 0.8 higher than that given by Polenske. Tests with butter procured from one and the same dairy during a period in which a change of feed was made, showed that in certain cases the new butter-value varies considerably, whilst the Reichert-Meissl value is only affected to a much smaller degree.—A. S.

**Aldehydes; New Reaction of** —, and Isomerism of their Oximes. A. Conduché. *Comptes rend.*, 1905, 140, 434–436.

ALDEHYDE when treated with a dilute aqueous

solution containing hydroxylamine hydrochloride and potassium cyanate in equimolecular proportions, yields a crystalline substance of m. pt. 125° C. Similar substances have been obtained from other aromatic aldehydes, from furfural, and from cinnanthol, but none from ketones. The author attributes to these products the constitution expressed in the following equation:—



Of the two isomeric forms of hydroxyurea yielded by a mixture of hydroxylamine salt and potassium cyanate, Francesconi and Parrozzani's form is alone operative in this reaction.

Aluminium amalgam reduces these substances, giving the corresponding substituted urea (benzylurea in the case of the benzaldehyde derivative). Weak acids do not affect these compounds, but strong acids (aqueous hydrochloric acid) decompose them, regenerating the original aldehydes. Alcoholic hydrochloric acid yields (from the benzaldehyde derivative) benzamide, ammonium chloride, and carbon dioxide. Dilute aqueous or alcoholic potassium hydroxide yields  $\beta$ -benzaldoxime and potassium cyanate. This reaction is reversible, but  $\alpha$ -benzaldoxime is without action on potassium cyanate, and the two oximes can thus be distinguished. This difference is made clear in favour of the view that the isomerism of these oximes is structural, not stereomeric.—J. T. D.

### ORGANIC—QUANTITATIVE

**Nitrogen in Azo-, Azoxy-, and Hydrazo- Compounds; Determination of** — by Kjeldahl's Method. C. Flamand and B. Prager. *Ber.*, 1904, 38, 559–560.

The following modification of Kjeldahl's method is given for determining the nitrogen in these classes of substances. From 0.15 to 0.2 grm. of the substance is dissolved in 10 c.c. of alcohol in a long-necked flask of 500 c.c. capacity. After adding 0.5–1.0 grm. of zinc dust and 2–5 c.c. of concentrated hydrochloric acid, the contents of the flask are heated until colourless. This usually takes but a few minutes. Ten c.c. of concentrated sulphuric acid and 0.5 grm. of crystallised copper sulphate are now added, and the heating continued until white fumes are given off. About 6 grms. of potassium sulphate are then added, and the whole heated until a clear green solution is obtained. This is distilled as usual. By the use of this method the authors obtained the correct amount of nitrogen in *p*-oxyazobenzene, *p*-dimethylamino-azobenzene, azobenzene-acetoacetic ester, *p*-bromo-azobenzene-*p*-ethoxyazobenzene-oxalacetic ester, *p*-bromo-azobenzene-oxalacetic ester, dimethyl hydrazobenzene, azoxybenzene, and azobenzene. Unsatisfactory results were given by phenylhydrazine, benzalphenylhydrazine and formazyl compounds. In the case of *m*-ethoxy-azobenzene and *p*-bromo-azobenzene-oxalacetic ester the amounts of nitrogen found were 0.15 and 0.13 per cent. respectively too low.—W. P. S.

**[Tannin Extracts] Candle Filter Method; Report of the Commission appointed to Investigate the** —, as a Substitute for Filter Paper. *Collegium*, 1905, 46–49.

The members of the International Association of Leather Trades Chemists, at their seventh conference appointed a commission, consisting of 12 members, to investigate and report upon the method proposed by J. G. Parker and E. E. M. Payne (*Collegium*, 1904, 249), of filtration of solutions for tannin analysis through a specially prepared filter candle [modified Berkefeld filter-candle].

Determinations were made upon six different tanning extracts by each member of the commission. The solutions, prepared for analysis according to the standard method of the Association, were filtered through: (1) No. 605 Schleicher and Schull filter paper; (2) the candle filter; and the filtrates evaporated to determine the percentage of total soluble matter.

The results of the various determinations made by the members of the commission are given in the report; these are in close agreement with each other. The filter candle absorbs little or no colouring matter from the liquor, and, therefore, no correction for absorption is necessary;

the filtration is most rapid, and though the initial cost of the filter is greater, the method is cheaper than when paper is employed, owing to the large number of determinations that can be performed without replenishing the filter candle.

The commission recommended that the size of the filter candle be much larger than at present, and that the exact dimensions be specified.

The Executive Committee of the Association have decided that the filter candle method be adopted as the official method for the filtration of all tannin solutions previous to analysis and that it be compulsory for use in official work from March, 1905.—M. C. L.

*Acetone; Source of Error in the Determination of — by the Iodoform Method.* W. Vaubel and O. Scheuer. *Z. angew. Chem.*, 1905, **18**, 214—215.

IN Messinger's method (this J., 1889, 138) for determining acetone, the quantity of thio-sulphate used in titrating back is always too low. The authors recommend titrating the unused iodine by arsenious acid after adding bicarbonate to the acidified solution, this course being found to yield correct results. The facts are discussed in the light of the ionic hypothesis and the demands of mass-action.—F. SDX.

#### XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Phosphorus; Phosphorescence of —.* E. Jungfleisch. *Comptes rend.*, 1905, **140**, 444—447.

WHEN an inert gas, carefully deprived of oxygen, is passed over phosphorus at the ordinary temperature, there is no sign of phosphorescence, although the gas, charged with the vapour of phosphorus, becomes just perceptibly luminous when allowed to stream into the air in a dark room. The admission of even a minute quantity of oxygen with the inert gas, however, causes the phosphorus to glow, and enormously increases the luminosity of the gas issuing into the air. Analysis shows that the issuing gas under these circumstances contains much more phosphorus than corresponds with the vapour pressure of phosphorus at the temperature of the experiment. Passage through a vessel cooled to 10° C. removes the phosphorescent substance almost completely; and an inert gas, afterwards passed through this vessel at room temperature, becomes phosphorescent. An oxide of phosphorus, then, is the active substance in phosphorescence.—J. T. D.

*Radiotellurium.* W. Marekwald. *Ber.*, 1905, **38**, 591—594. (See this J., 1903, 49, 1146).

WORKING on a large quantity of crude tellurium, obtained from about 15 tons of Joachimsthal pitchblende, the author succeeding in preparing about 3 mgrms. of radiotellurium, many times more active than the product prepared by him previously (*loc. cit.*). His further experiments confirm the view that radiotellurium is an individual radio-active substance, not identical with Curie's polonium. Doubtless the latter product, like Geisel's polonium, contains radiotellurium, but it is a mixture, not an individual substance.—A. S.

*Aurous Oxide; Supposed Solubility of — in Water.* L. Vanino. *Ber.*, 1905, **38**, 462—463.

THE author finds that the blue liquid obtained on mixing freshly-precipitated aurous oxide with water is not a solution, but a colloidal suspension. The suspended matter can be separated by shaking the liquid with barium sulphate or kieselsol, and allowing to settle; or by passing through a Pukall's earthenware filter.—A. S.

*Gold Hydrosols.* L. Vanino. *Ber.*, 1905, **38**, 463—466.

COLLOIDAL solutions of gold can be prepared from solutions of gold trichloride by the use of methyl or ethyl alcohol as a reducing agent, without the addition of alkali. The colour of the colloidal solution obtained, varies with the proportions of the gold salt and of alcohol employed. It was also found that by leading a current of hydrogen through a dilute aqueous solution of gold chloride (1.5 c.c. of a solution containing 0.43% per cent. of gold in the form

of chloride, diluted to 150 c.c.) and allowing the liquid to stand for a long time in a well-corked flask, a permanent coloration appeared.—A. S.

*Albuminoids; Oxidation of — by Calcium Permanganate. II. Oxidation of Gluc.* F. Kutseher and A. Schenk. *Ber.*, 1905, **38**, 455—459.

By preparing larger quantities of the oxidation product of glue (gelatin), and by modifying the method previously given (this J., 1904, 992), the authors have been enabled to separate the various substances formed and to identify them. After oxidising as before, the solution was filtered, the filtrate concentrated as much as possible on the water bath, and allowed to stand in a cold place for 24 hours. The crystals so obtained were filtered off and washed. These crystals were then dissolved in water, the calcium removed by precipitation with ammonium carbonate, and the solution again concentrated. From this insoluble residue was obtained which was found to consist of oxamide. The mother-liquor from the latter contained ammonium oxamate.

The filtrate from the above-mentioned crystals was next evaporated to a thin syrup and precipitated with hot saturated solution of picric acid. The granular crystalline precipitate was separated by filtration after a lapse of 24 hours, washed with alcohol, dried and weighed. From 250 grms. of gelatin, 20.3 grms. of picric precipitate was obtained, and was found to consist solely of guanipicric acid. The filtrate from the latter yielded no organic bases.—W. P. S.

*l-Arabinose and Xylose; Diphenylhydrazones of —.* B. Tollens and A. D. Maurenbrecher. *Ber.*, 1905, **38**, 500—501.

NEUBERG has stated that the diphenylhydrazone of arabinose melts at 216°—218° C., and that the melting point given by Muther and Tollens, viz., 204°—205° C., is incorrect owing to the use of impure diphenylhydrazones. The authors have again prepared the hydrazones, special precautions having been taken in the purification of materials, with the result that the lower melting point is re-affirmed. Diphenylhydrazine has been employed for the identification of arabinose in the product of hydrolysis of cacao beans.

*Xylose-diphenylhydrazone.*—The authors give the melting point of this substance as 107°—108° C., whereas Neuberg has stated it to be 103°—104° C.

The authors add that they determine the melting points of hydrazones and osazones by the method described by Muther and Tollens (*Ber.*, 1904, **37**, 314).—J. F. B.

*Odoriferous Substances; Consumption of — in Etiolated Plants.* E. Charabot and A. Hébert. *Comptes rend.*, 1905, **140**, 455—457.

COMPARISONS were made upon basil plants during the period of flowering, from early July to late August. One set of plants being kept in the dark, the other under natural conditions. The total essential oil, and amounts of estragol and of terpenic compounds in it, determined at the beginning and end of the period, results being, for the average plant:—

	July 4		August 26.	
			Natural.	Etiolated.
Estragol .....	mgrms.	10.0	mgrms.	mgrms.
Terpenic Compounds .....		9.5		
Total Essential Oil ....		19.5		12.0

Thus the plant kept in the dark consumes the essential oil, and especially its terpenic constituents, and odoriferous substances in the plant, then, are not entirely excretory substances which cannot be utilised; they contribute, under certain circumstances, to the formation of tissue, or to the supply of energy not furnished by light.

—J. T. D.



## New Books.

REPORT OF THE DEPARTMENTAL COMMITTEE APPOINTED BY THE BOARD OF AGRICULTURE AND FISHERIES TO INQUIRE INTO AND REPORT UPON THE WORKING IN GREAT BRITAIN OF THE FERTILISERS AND FEEDING STUFFS ACT, 1893, WITH COPY OF MINUTES APPOINTING THE COMMITTEE. Wyman and Sons, Ltd., Fetter Lane, London, E.C. : and 32, Abingdon Street, Westminster, S.W. Oliver and Boyd, Edinburgh, or E. Ponsonby, 11, Grafton Street, Dublin. 1905. Price 4½d.

CONTAINS 38 pages of subject matter, 19 of which are devoted to the Report of the Committee to the President of the Board of Agriculture and Fisheries, and 19 to the basis of the Evidence, this again being classified in three parts as follows:—(i) Administration of the Act. (ii) Inefficiency of Act. (iii) Deficiencies in Safeguards to Purchaser. (iv) Deficiencies in Safeguards to

## Trade Report.

### I.—GENERAL.

#### BRITISH INDIA: VALUATION TARIFF OF —.

Issues of the *Board of Trade Journal* for January and February 23 inclusive, contain the revised valuation fixed for various classes of goods imported into India. The revised tariff came into effect on January 1, 1905. Copies of the *Journals* referred to are available from the Commercial Branch of the Board of Trade, 73, Basinghall Street, London, E.C., price 1d. each.

#### II.—TAR PRODUCTS, PETROLEUM, Etc.

##### PETROLEUM INDUSTRY IN BURMA.

*Bd. of Trade J., Feb. 16, 1905.*

The chief centres of production are Yenangyaung in the Mandalay and Yenangyat in the Pakokku district, but the Burma Oil Company have also lately developed a new field at Singu in Myingyan, while the Akyab and Kyaukpadaung are producing a small quantity of oil. The great expansion of the industry at the chief centres may be deduced from the fact that at Yenangyaung the Government royalty in 1903-04 amounted to Rs. 7,37,134 as against Rs. 5,68,429 in the year preceding; the output of the field increases steadily and there is no sign of exhaustion of the supply. Yenangyat is a newer field, consisting of 50 blocks of about a square mile or so each, and is worked by the Burma, Rangoon, and Minbu Oil Companies. Five are paying royalty at present. The output of this field has risen to 22,356,904 gallons, and the revenue to Government from Rs. 2,22,837 to Rs. 2,93,022. At the actual working at the Yenangyat field, the Burma Oil Company are working eight blocks, and have tested others without finding oil. Royalty is being paid for each block by the Rangoon Oil Company, who are also obtaining a small amount of oil on several others. The Burma Oil Company are working one block and are working on two more. The Burma Oil Company's new field at Singu yielded the Government a royalty of Rs. 1,63,222. The Company also prospected for oil in Pegu without success.

##### PETROLEUM PRODUCTION OF BAKU.

*Bd. of Trade J., Feb. 16, 1905.*

The petroleum production of Baku during the last few years, as given in the *Moniteur des Intérêts Matériels* (No. 1), is as follows:—1901, 671,200,000 pounds; 1902, 686,500,000 pounds; 1903, 595,800,000 pounds; 1904, 614,700,000 pounds. The output from springs showed a decrease during 1904, whilst the amount obtained by pumping reached an unprecedented figure of 593,200,000 pounds.

Of 147 firms engaged in the petroleum industry at Baku, the eight principal ones obtained 314,000,000 pounds in 1904.

Poud = 36 lb. avoirdupois.

### VII.—ACIDS, ALKALIS, Etc.,

#### SPANISH CHEMICAL TRADE.

*Eng. and Mining J., Feb. 9, 1905.*

Domestic production is inadequate to meet the increasing consumption of chemicals in Spain, and as a result imports are made from the United States, Great Britain, France, Germany and other near by countries. The imports in 1903 included 513 metric tons of hydrochloric, nitric and sulphuric acids, 6,505 tons sulphur, 17,545 tons caustic soda, 16,990 tons alkali carbonates, soda and ammonium salts (except sulphate and caustic soda) 3,771 tons chlorides (not including sodium chloride), 2,687 tons copper sulphate and 186,360 tons raw materials for manufacturing artificial fertilisers. Two years ago there were operating in Spain 23 sulphuric acid plants, 11 for distilling ammoniacal liquors, 20 for distilling coal tar products, 15 of carbon bisulphide, and 54 laboratories of chemical and pharmaceutical products. Since then there has been an increase in almost all manufacturing plants.

### X.—METALLURGY.

#### MINERAL OUTPUT OF THE UNITED KINGDOM.

*Bd. of Trade J., Feb. 23, 1905.*

The following tables, showing the output of coal and other minerals in the United Kingdom at mines worked under the Coal and Metalliferous Mines Regulations Acts during the year 1904, with comparative figures for the preceding year, are taken from an advance proof (subject to correction) of the Mines and Quarries General Report and Statistics for 1904:—

#### I.—Output of Minerals under the Coal Mines Regulations Acts.

	1903.	1904.
	Tons.	Tons.
Barytes .....		4,459
Coal .....	230,324,295	232,411,784
Clay and shale other than fire-clay .....		
and oil shale .....	219,018	272,349
Fire-clay .....	3,060,835	3,043,045
Igneous rock .....	2,646	804
Iron pyrites .....	6,900	7,511
Ironstone .....	7,473,236	7,557,733
Limestone .....	38,514	37,569
Oil shale .....	2,009,602	2,333,062
Sandstone (including "Ganister") .....	102,540	106,999*
Total .....	243,243,586	245,775,315

\*The quantity of ganister obtained was 94,868 tons.

#### II.—Output of Minerals under Metalliferous Mines Regulation Act.

	1903.	1904.
	Tons.	Tons.
Barytes .....	23,671	21,130
Clay and shale .....	112,843	115,892
Gold ore .....	28,600	23,203
Gypsum .....	176,980	195,665
Igneous rocks .....	90,236	94,255
Iron ore .....	1,605,148	1,603,855
Lead ore .....	26,355	26,371
Limestone .....	573,011	510,828
Rock salt .....	167,769	187,828
Sandstone .....	183,520	192,284†
Slate .....	164,278	168,278
Zinc ore .....	24,888	27,655
Other minerals .....	66,329	79,092
Total .....	3,243,633	3,246,336

† Including 2,663 tons of ganister.

The above figures do not in all cases represent the total production of minerals during the year. Large quantities of several important minerals such as iron ore, limestone, sandstone, slate, clay, &c., are obtained from quarries under the Quarries Act, and from other open workings, the returns from which are not yet available. The totals for coal and the ores of copper, lead, and zinc may, however, be regarded as substantially complete.

#### THERMIT: U.S. CUSTOMS DECISION.

Jan. 18, 1905.

The decision of the Board of General Appraisers of October 26, 1904, holding that thermit, a mixture of powdered metallic aluminium and iron oxide was dutiable at 45 per cent. *ad valorem*, under paragraph 193 of the present tariff, as an "article composed wholly or in part of aluminium," was sustained by the United States Circuit Court.—R. W. M.

#### XII.—FATS, FATTY OILS, Etc.

##### SESAME PULP: U.S. CUSTOMS DECISION.

Feb. 2, 1905.

Ground sesame pulp, containing the oil natural to the seed, is not free of duty as "sesame oil," under paragraph 626 of the Tariff Act. The Board held it to be dutiable at 20 per cent. *ad valorem* as a "manufactured article unenumerated," under Section 6.—R. W. M.

#### XV.—MANURES, Etc.

##### PHOSPHATE DEPOSITS IN TUNIS.

*Bd. of Trade J.*, Feb. 23, 1905.

The following particulars are given of the three deposits in Tunis acquired by the Sfax-Gafsa Phosphate Co., on Jan. 5 last:—

*Redief*.—The deposits are said to be rich, the "extracts" containing 63–64 per cent. of tribasic phosphates. The cost of export (including royalty and export duty) is 3s. 11d. per ton.

*Ain-Moulars*.—The "extracts" are reported to contain 65–70 per cent. of tribasic phosphate; total cost of export is estimated at 8s. 10d., the railway rates to Soussa (the port of outlet) being heavy.

*Mellaoui*.—The extracts from this deposit contain 60 per cent. of tribasic phosphate; the cost of export is about 3s. 7d. per ton. About 400,000 tons of phosphate were extracted from this deposit in 1904, and shipped to Europe, chiefly to the United Kingdom, France and Italy.

#### XVI.—SUGAR, STARCH, Etc.

##### DEXTRIN; WHITE —. U.S. CUSTOMS DECISION.

Goods invoiced as soluble starch or soluble potato starch were assessed for duty at 2 cents per lb. as "dextrin," under paragraph 285 of the present tariff, on the ground that they were known to commerce as white dextrine. The importers claimed them to be dutiable at 1½ cents per lb., under paragraph 285, as "starch," on the ground that they were physiologically, chemically and microscopically starches slightly modified.

The analyses of the two samples submitted were as follows:—Moisture, 9.70 and 9.78 per cent.; soluble starch 52.22 and 51.84 per cent.; dextrin, 29.27 and 28.83 per cent.; dextrose, 5.56 and 5.56 per cent.; ash, 0.45 and 0.40 per cent.

The Board held that the commercial designation was controlling, and that the evidence showed that the goods were generally known to trade as white dextrine, and affirmed the assessment of duty.—R. W. M.

#### XVII.—BREWING, WINES, SPIRITS, Etc.

##### METHYL ALCOHOL; TAXATION OF — IN FRANCE.

*J. Officiel de la République Franç.*, through *Chem. Ind.*, 1905, 28, 89.

In accordance with Article 5, Section I. of the Law

of Dec. 16, 1897, with regard to the taxation of denat spirit, the President of the French Republic, in an Order dated Jan. 4, 1905, has given his assent to a resolution passed on March 14, 1900, by the "Comité Consultatif des Arts et Manufactures," according to which methyl alcohol is to be regarded as unfit for consumption, and therefore free from the costs of denaturing and of taxation, if it contain at least 5 per cent. of acetone and 1 per cent. of dry distillation residue, which impart to it an unpleasant, empyreumatic odour.—A. S.

#### ALCOHOL: EXPORT OF —, FROM THE GERMAN CUSTOMS AREA IN 1904.

*M. Student. Z. Spiritusind.*, 1905, 27, 52.

The exports of spirits in cask was only 30,136 (Dz.=Doppeltzentner, or 100 kilos.), as compared with 232,797 dz. in 1903, and 313,502 dz. in 1902; of quantity 15,883 dz. consisted of re-exported imported spirits, so that the net export of German spirits was 14,253 dz. In the other years mentioned the re-exports were insignificant (1 dz. and 54 dz. respectively). With exception of Portugal which took 5424 dz., against 228 dz. in 1903, the export trade with all the principal countries shows a great falling off, Great Britain having taken 5587 dz. in place of 55,786 dz., Switzerland 2980 instead of 51,012 dz., Hamburg 2867 against 11,284, the Netherlands 261 dz. instead of 22,412 dz., 26 dz. in place of 15,134 dz., and Austria-Hungary against 14,323 dz. in 1903. The exports of bottled and bottled spirits also showed a considerable decrease, being only 5307 dz., against 22,973 in 1903, and 2 dz. in 1902. On the other hand the imports increased largely, being 38,700 dz. (though 38,600 dz. were destroyed for re-export as improved spirits), in comparison with 8095 dz. in 1903, and 3415 dz. in 1902. The bulk of these imports (30,843 dz.) came from Russia, and 331 dz. from Belgium.—C. S.

#### ALCOHOL TAX; FRENCH CUSTOMS DECISION.

*Bd. of Trade J.*, Feb. 16, 1905.

*Manufacturing tax on alcohol*.—In accordance with the Decree of February 18, 1904, the manufacturing tax on products with a base of "industrial alcohol" (see *J.*, 1902, 202) has been increased from the 1st Jan. 1905, from 80 cts. to 1 fr. 37 cts. per hectol. or pure alcohol.

#### XIX.—PAPER, PASTEBOARD, Etc.

##### PULP, PULP WOOD, AND PAPER; CANADIAN EXPORTS OF —.

*U.S. Cons. Rep. No. 2179*, Feb. 9, 1905.

Wood pulp is being shipped at the rate of 1000 cords a day from points along the Canadian Atlantic Railway and the Great Northern Railway, a connecting line running through Quebec Province. All this is being forwarded to mills in the United States. It is affirmed that over 50,000 tons of wood pulp have been contracted for in Canada by American paper manufacturers. This pulp is sent forward from eastern Ontario, New Brunswick and Quebec. In some instances it will represent the output of the mills up to March 1 next. The mills in the St. John district, Quebec, are foremost on the list of those that are shipping wood pulp to American mills.

The statistics for the fiscal year 1904 show that the export of wood pulp from Canada decreased, the value of the raw material (pulp wood), all of which goes to the United States, increased. The value of the export of pulp wood in 1904 was 1,758,049 dols., an increase over 1903 of 229,489 dols. or 4½ per cent. The export of pulp decreased 23 per cent., the value 2,409,074 dols., against 3,150,943 dols. in the previous year. The falling off was chiefly in the export to Great Britain, namely, from 1,129,173 dols. in 1903 to 548,720 in 1904. The value of exports to other countries from 226,002 dols. to 52,912 dols. The value of Canadian total exports of paper, however, rose from 849,519 to 1,097,212 dols., an increase of 247,693 dols. or 29 per cent. This paper went to the following countries: Great Britain, 447,072 dols.; the United States, 160 dols.; other countries, 486,531 dols.



XX.—FINE CHEMICALS, Etc.

DIAMETHYLENETETRAMINE; U.S. CUSTOMS DECISION.

Jan. 31, 1905.

Diamethylenetetramine is dutiable at 55 cents per lb. medicinal preparation in the preparation of which it is used," under paragraph 67 of the present tariff. Evidence did not show that no alcohol had been used in preparation.—R. W. M.

OPHINE MECONATE; U.S. CUSTOMS DECISION.

Feb. 10, 1905.

Opium meconate is dutiable at 1 dol. per oz., under paragraph 43 of the present tariff, as a "salt of opium," in the hands of the importers that it was dutiable at 25 per cent. *ad valorem*, either as a "chemical salt," or as a medicinal preparation," were overruled.—R. W. M.

QUININE PREPARATIONS AND SALTS; U.S. CUSTOMS DECISION. Feb. 10, 1905.

The following salts of quinine were held to be free of duty under paragraph 647 of the present tariff act as "salts of cinchona bark," and not at 25 per cent. *ad valorem*, under paragraphs 67 or 68 as "medicinal preparations":—

Quinine glycerinophosphate, quinine borate, quinine hydrochloride, quinine dihydrochloride, quinine hydrochloride carbanide, quinine tannate, quinine salicylate, quinine hydroferrocyanide, quinine salicylate, quinine carbolate.—R. W. M.

QUININE AND ARISTOCHININE; U.S. CUSTOMS DECISION.

Feb. 10, 1905.

Quinine is dutiable at 25 per cent. *ad valorem*, under paragraph 67 of the tariff act as a "medicinal preparation." The claims of the importer that it was free of duty as an alcohol or salt of cinchona bark," under paragraph 647 at 1 dol. per lb., as an "ether, not specially prepared for," under paragraph 21, were overruled. The decision was rendered in the case of aristochinine, a carbonic ester of quinine.—R. W. M.

ALDEHYDE; U.S. CUSTOMS DECISION.

Feb. 8, 1905.

The Board of General Appraisers overruled the assessment of duty on merchandise invoiced as "Aldehyde concentrated Ethylic," as an "alcoholic compound," under paragraph 2 of the present tariff, holding it to be a chemical compound" and not a "medicinal preparation," and that it is dutiable at 25 per cent. *ad valorem*, under paragraph 3.—R. W. M.

Patent List.

1.—In these lists, [A.] means "Application for Patent," and [C.S.] means "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to opposition at the Patent Office immediately, and to opposition within two months of the said dates.

—PLANT, APPARATUS, AND MACHINERY.

- [A.] 3015. Suzuki. Furnaces.\* Feb. 14.
- 3105. Ray. Vacuum evaporating apparatus. Feb. 15.
- 3121. Adams. See under XVIII B.

- [A.] 3175. Nicholas. Rotary filtering apparatus for the separation of liquids or solutions from tailings, slimes, sewage and the like. Feb. 15.
- " 3517. Boulton (Gebler). See under VIII.
- " 3582. Appleton. Filter. Feb. 21.
- " 3602. James (Roth). See under XII.
- " 3805. Massey (Massey-Harris Co., Ltd.). Centrifugal liquid separators.\* Feb. 23.
- " 3972. Schütze. See under XVI.
- " 3991. Dental Manufacturing Co., Ltd., and Le Crom. Pyrometers or devices for indicating the attainment of high temperatures. Feb. 25.
- [C.S.] 3807 (1901). Aktiebolaget Separator. Centrifugal separating apparatus. Feb. 22.
- " 4687 (1904). Perrier. Distilling apparatus. Feb. 22.
- " 8978 (1904). Don. Rotary kilns. March 1.
- " 12,145 (1904). Lennox. Evaporators for evaporating the liquid in brewer's wash, sewage, waste or spent dyes, &c., and concentrating the solids in the same. Feb. 22.
- " 24,686 (1904). Lillie. Evaporating apparatus. Feb. 22.
- " 26,255 (1904). Neumann and Stade. Vacuum apparatus for concentrating and evaporating liquids. Feb. 22.
- " 28,470 (1904). Vial. Filtering apparatus. Feb. 22.
- " 28,867 (1904). Loeber. Furnaces. Feb. 22.
- " 29,039 (1904). Müller. Draw-off cock for viscous liquids. March 1.
- " 92 (1905). Giclis. Furnaces with horizontal re-torts. March 1.

II.—FUEL, GAS, AND LIGHT.

- [A.] 2900. Tattersall and Yates. See under V.
- " 3089. Schlatter and Deutsch. See under XXIII.
- " 3154. Woltmann. Artificial fuel.\* Feb. 15.
- " 3174. Vedy and Bilbie. Gas producing apparatus and method of working same.\* Feb. 15.
- " 3244. Moeller and Valeriola. Manufacture of incandescent mantles or illuminant bodies. Feb. 16.
- " 3245. Schmidt and Desgraz. Producer gas furnaces.\* Feb. 16.
- " 3298. Sutcliffe. Incandescent gas mantles. Feb. 17.
- " 3408. Eveno. Gas maker for heavy oils. Feb. 18.
- " 3509. Griffin and Cox. Production of gas. Feb. 20.
- [C.S.] 700 (1904). Roman. Fuel. Feb. 22.
- " 5479 (1904). Cutler, Cutler and Cutler. Gas purifiers. Feb. 22.
- " 6308 (1904). Kennedy. Treatment of peat and apparatus therefor. Feb. 22.
- " 6860 (1904). Cutler, Cutler and Cutler. Gas purifiers. Feb. 22.
- " 7767 (1904). Hamilton. Gas producers. Feb. 22.
- " 8827 (1904). Tonkin and Puppelt. Manufacture of producer gas and apparatus used therein. Feb. 22.
- " 11,268 (1904). Schweich. Gas producers. March 1.
- " 17,497 (1904). Bessey. Manufacture of peat fuel. Feb. 22.
- " 21,317 (1904). Payens. Plants for making water gas. March 1.
- " 21,488 (1904). Lake (Jackson). Liquid fuel burners for heating purposes. March 1.
- " 22,342 (1904). Körting und Mathiesen Act.-Ges. Arc lamp electrodes. March 1.
- " 26,770 (1904). Fleischer. Manufacture of power gas. Feb. 22.

- [C.S.] 28,126 (1904). Bromhead (Cie. des Charbons et Briquettes de Blanzv et de l'Ouest). Smokeless fuel. Feb. 22.
- „ 28,966 (1904). Von Kerpely. Gas generators. March 1.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [C.S.] 26,198 (1904). Wynne. Process for purifying petroleum oils. Feb. 22.

### IV.—COLOURING MATTERS AND DYESTUFFS.

- [A.] 3083. Johnson (Badische Anilin und Soda Fabrik). Manufacture of sulphur colouring matters. Feb. 14.
- „ 3160. Newton (Bayer und Co.). Manufacture of anthraquinone derivatives. Feb. 15.
- „ 3182. Imray (Meister, Lucius und Brüning). Manufacture of chlorinated indigo dyestuffs. Feb. 15.
- „ 3497. Imray (Dye Works formerly Durand, Huguenin and Co.). Manufacture of new dyestuffs derived from dyestuffs of the oxazine class.\* Feb. 20.
- „ 3692. Imray (Meister, Lucius und Brüning). Manufacture of sulphurised dyestuffs and intermediate products. Feb. 22.
- „ 3819. Johnson (Badische Anilin und Soda Fabrik). Manufacture of new compounds of the anthracene series and of colouring matters therefrom. Feb. 23.
- [C.S.] 9456 (1904). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new cyanine dyestuffs. March 1.
- „ 12,145 (1904). Lennox. *See under I.*
- „ 29,141 (1904). Davey. *See under XIII A.*

### V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 2900. Tattersall and Yates. Burners for use in machines for gassing yarns or threads. Feb. 13.
- „ 2974. Haddan (Ripert). Felt substance for industrial purposes and method of manufacturing same. Feb. 13.
- „ 2993. Mather, Hübner and Pope. Mercerising and apparatus therefor. Feb. 14.
- „ 3638. Bradford Dyers' Assocn., Ltd., and Singer. Process for treating cotton and other vegetable fibres preparatory to dyeing and printing. Feb. 21.
- „ 3718. Holmes. Preparation and dyeing of wool, yarns, tops or other textile fabrics. Feb. 23.
- „ 3730. Hanitzsch. *See under VI.*
- „ 3737. Frankenburg and Sons, Ltd., and Frankenburg. Apparatus for proofing yarns. Feb. 23.
- „ 3797. Sumner and Pickering. Process for obtaining the fibre from fibre yielding plants. Feb. 23.
- „ 3864. Lee and Lee. Apparatus for printing upon velvet and other fabrics. Feb. 24.
- [C.S.] 3824 (1904). Kenworthy. Machines for finishing textile fabrics. Feb. 22.
- „ 5790 (1904). Leatham. Process of bleaching and sterilising and apparatus therefor. March 1.
- „ 8545 (1904). Cross. Treatment of cottonseed hulls to obtain useful products therefrom. Feb. 22.
- „ 10,767 (1904). Anderson and Inverarity. Manufacture or treatment of printed yarns and apparatus therefor. March 1.

- [C.S.] 20,637 (1904). Valette. Manufacture of artificial silk. March 1.
- „ 25,208 (1904). Dêtré. Apparatus for subjecting textiles or other material to the action of liquid under pressure for the purpose of dyeing, danting, bleaching, washing, exhausting, extracting or performing other operations thereon. March 1.
- „ 29,514 (1904). Adamson. Scouring and milling, fulling of woollen cloths and other woollen goods and scouring wool, cotton and linen and woollen yarns and cotton, woollen, and linen articles. March 1.

### VI.—COLOURING WOOD, PAPER, LEATHER,

- [A.] 3730. Hanitzsch. Production of effects or designs on the surface of paper, textile fabrics or the like. Feb. 23.
- „ 3799. Imray (Franz). Process for the manufacture of marbled paper. Feb. 23.
- [C.S.] 26,532 (1904). Hennessen and Spix. Machinery for figuring continuous paper and other material on the web. March 1.

### VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 3346. Lake (Helbig). *See under XI.*
- „ 3450. Moore. Method for filtering and removing waste and spent acid and acid solution. Feb. 23.
- „ 3820. Johnson (Badische Anilin und Soda Fabrik). Preparation of alkali peroxides for use in the obtaining of oxygen gas. Feb. 23.
- [C.S.] 3776 (1904). Boulton (Soc. Romana Solfat). Simultaneous preparation and purification of hydrochloric acid from alumina. Feb. 22.
- „ 4462 (1904). Gutensohn. Recovery of metallic bases or compounds from their solutions. Feb. 22.
- „ 6921 (1904). Roux and Gonin. *See under X.*
- „ 7534 (1904). Hamel. *See under XX.*
- „ 9265 (1904). Paul. Preparation of lime milk and milk of lime. March 1.

### VIII.—GLASS, POTTERY, AND ENAMELS.

- [A.] 3139. Sharp. Kiln for simultaneously drying, burning earthenware, malt, and the like. Feb. 15.
- „ 3382. Jacques. Kilns or stoves for burning, enamelling metal, &c. Feb. 18.
- „ 3517. Boulton (Gebler). Manufacture of enamelled vessels or the like.\* Feb. 20.
- „ 3906. Johnson (Heraeus). Manufacture of glass.\* Feb. 24.

### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 2932. Martin. Manufacture of a new material for building and general purposes. Feb. 13.
- „ 3619. Colloseus. Manufacture of cement from furnace slag. [Ger. Appl., Nov. 3, 1904.] Feb. 21.
- „ 3669. Henke. Process of producing an insulating and heat retaining medium.\* Feb. 22.
- „ 3686. Mau (Mau). Manufacture of blocks, tiles, or material for paving, flooring, and similar purposes. Feb. 22.
- [C.S.] 24,712 (1904). Kwiatkowski. Process of making bricks, artificial stone, and similar products. Feb. 22.
- „ 27,890 (1904). Whitcomb and Hasley. Process of making cement. Feb. 22.



X.—METALLURGY.

3179. Soc. La Neo-Metallurgie. Metallic alloys. [Fr. Appl., March 18, 1904.]\* Feb. 15.  
 3185. Baggaley and Allen. Process for producing copper or copper matte. [U.S. Appl., March 17, 1904.]\* Feb. 16.  
 3191. Savelsberg. Smelting ores. Feb. 16.  
 3194. Baggaley and Allen. Smelting sulphide ores. [U.S. Appl., March 19, 1904.]\* Feb. 15.  
 3403. Sulmar and Picard. Treatment of complex sulphide ores. Feb. 18.  
 3405. Movio. Art metal. Feb. 18.  
 3589. King and The Advertising Mirrors Co., Ltd. Flux whereby ordinary solder can be used to solder aluminium.\* Feb. 21.  
 3739. Bedford. Manufacture and treatment of compound armour plates.\* Feb. 23.  
 3798. Goodson. Process of galvanising, tinning, or otherwise plating wire or other metallic bodies. [U.S. Appl., June 9, 1904.]\* Feb. 23.  
 10,902 (1904). Imray (Soc. Anon. pour l'Industrie de l'Aluminium). Process for the deoxidation of ingot iron, ingot steel, and the like. Feb. 22.  
 19,251 (1904). Thompson (Pollak and Rothschild). Alloy and process for manufacturing the same. Feb. 22.  
 20,542 (1904). Thompson (Wickels Metallpapier-Werke). Substitute for tin foil and process of making same. March 1.  
 28,490 (1904). Langridge. Amalgamators. March 1.  
 29,093 (1904). Jabulowsky. Method of producing a layer of black oxide on the surface of steel. March 1.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

3029. Andrews. Electrical insulating material. Feb. 14.  
 3346. Lake (Helbig). Method of and apparatus for electrically oxidising atmospheric nitrogen. Feb. 17.  
 3525. Birkeland. Apparatus for producing electric reactions in gases by aid of electric arcs. [Appl. in Norway, Feb. 20, 1904.]\* Feb. 20.  
 3560. Morrison and Bulkley. Secondary battery.\* Feb. 21.  
 3894. Gratze. Accumulator plate.\* Feb. 24.  
 3826 (1904). Pontite, Ltd., and de Pont. Manufacture of insulating materials for electrical purposes. Feb. 22.  
 8686 (1904). Delafon. Primary galvanic battery. March 1.  
 8984 (1904). Delafon. Manufacture of positive electrodes for galvanic batteries. March 1.

II.—FATTY OILS, FATS, WAXES, AND SOAP.

2930. Starling and Yarnold. Treatment of coconut and palm-nut oils. Feb. 13.  
 3438. Haase. Manufacture of candles and the like. Feb. 18.  
 3602. James (Roth). Apparatus for the rapid cooling of fluid soaps. Feb. 21.  
 6028 (1904). De Rijk. Absorbent for lubricants and method of lubricating with the aid thereof. Feb. 22.  
 6554 (1904). McClelland and Risk. Oil purifiers. March 1.

- [C.S.] 8304 (1904). Nicloux. Method of separating from castor oil seeds, &c., a material for saponifying fats and oils. Feb. 22.  
 „ 25,683 (1904). Harrison, Wild and Robb. Means for and process of extracting oil from cod livers and the like. March 1.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

- [A.] 3430. Gordon. Means for making paint adherent to rusty metal. Feb. 18.  
 [C.S.] 29,141 (1904). Davey. Manufacture of vegetable black. Feb. 22.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

- [C.S.] 8368 (1904). Russell. Adhesive compound or cement. Feb. 22.

XV.—MANURES, Etc.

- [C.S.] 6920 (1904). Roux and Gonin. Process and apparatus for the production of a new chemical fertiliser. March 1.  
 „ 6921 (1904). Roux and Gonin. Process of and apparatus for recovering ammonia from gases during the manufacture of fertilisers. March 1.  
 „ 6922 (1904). Roux and Gonin. Process for the treatment of humus for fertilising purposes. March 1.

XVI.—SUGAR, STARCH, GUM, Etc.

- [A.] 3827. Robin-Langlois. Machines for the manufacture of sugar. [Fr. Appl., March 11, 1904.]\* Feb. 23.  
 „ 3972. Schütze. Process of and apparatus for the production of crystals from sugar solutions and the like.\* Feb. 25.  
 [C.S.] 8544 (1904). Cross. Manufacture of a crystalline sugar from a form of cellulose. March 1.

XVII.—BREWING, WINES, SPIRITS, Etc.

- [A.] 3139. Sharp. *See under VIII.*  
 [C.S.] 3688 (1904). Boulton (Re). Method of and apparatus for coating seed with germinating substances, and products thus obtained. Feb. 22.  
 „ 12,145 (1904). Lennox. *See under I.*

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(A.)—FOODS.

- [A.] 3284. White. Preparation of coffee essence. Feb. 16.  
 „ 3645. Lehmann. Preserving meat and other food-stuffs. Feb. 22.  
 „ 3705. Wilson. Preservation of organic substances. Feb. 22.  
 [C.S.] 4589 (1904). Biuder. Process of making milk extract similar to meat extract. Feb. 22.  
 „ 6819 (1904). Thorp. Sterilisation of food. March 1.

(B.)—SANITATION; WATER PURIFICATION.

- [A.] 28,403A (1904). Lines. Treatment of sewage and other liquids for the purification thereof. Feb. 15.  
 „ 3121. Adams. Filtering apparatus for sewage and other liquids. Feb. 15.  
 „ 3175. Nicholas. *See under I.*

- [C.S.] 5790 (1904). Leetham. *See under V.*  
 „ 12,145 (1904). Lennox. *See under I.*  
 „ 18,083 (1904). Serpin and Bertrand. Methods and apparatus for purifying and sterilising water. March 1.  
 „ 20,984 (1904). Pearson. Apparatus for producing perfectly pure water by distillation, automatic and continuous in operation. Feb. 22.

#### NIX.—PAPER, PASTEBOARD, Etc.

- [C.S.] 8544 (1904). Cross. *See under XVI.*  
 „ 22,179 (1904). Perkins. Manufacture of paper for decorative purposes. Feb. 22.

#### XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 2957. Passmore. Pharmaceutical preparations. Feb. 13.  
 „ 3247. Goldsmith and The British Xylonite Co., Ltd. Treatment of turpentine oils and production therefrom of camphor and other intermediate hydro-aromatic bodies. Feb. 16.  
 [C.S.] 7534 (1904). Hamel. Manufacture of concentrated formic acid from formates. Feb. 22.  
 „ 7954 (1904). Newton (Bayer und Co.). Manufacture of a new pharmaceutical product. March 1.  
 „ 8302 (1904). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of derivatives of barbituric acid. Feb. 22.  
 „ 8543 (1904). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of derivatives of barbituric acid. March 1.

#### XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 3164. Kelly. Development of photographic plates, films, and the like.\* Feb. 15.  
 [C.S.] 6018 (1904). Fulton and Gillard. Photographic plates. Feb. 22.  
 „ 25,897 (1904). Gillard and Molyneux. Coating and preparation of paper or other material for photographic purposes. Feb. 22.

#### XXII.—EXPLOSIVES, MATCHES, Etc.

- [A.] 2945. Barthélemy. Method of manufacturing explosives.\* Feb. 13.  
 „ 3426. Dickson. Manufacture of explosive compositions. Feb. 18.  
 „ 3725. Musker. Manufacture of pressed or solidified gun-cotton blocks from the loose or static. Feb. 23.  
 „ 3789. Imperiali. Explosive. Feb. 23.  
 [C.S.] 8041 (1904). Mikolajczak. Process of manufacturing dinitroglycerin and dinitroglycerin explosives and powders. March 1.

#### XXIII.—GENERAL ANALYTICAL CHEMISTRY.

- [A.] 3089. Schlatter and Deutsch. Apparatus for indicating the amount of carbonic acid contained in combustion gases. Feb. 14.



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Session 1904-5—Monday, April 3rd—Messrs. Napier Hake and R. J. Lewis, "The Formation of Sulphuric Esters in the Nitration of Cellulose and their influence on stability"; Dr. H. W. Brownson, "The proof of Percussion Caps." Monday, May 1st—Prof. Otsuki, "The action of Hydrogen Peroxide on a Photographic Plate in the dark."

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### ANNUAL GENERAL MEETING, 1905.

Annual General Meeting will be held in London next, and the proceedings will commence on July 10th. Full particulars will appear later.

### INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

Meeting of the Organising Committee of the Sixth International Congress of Applied Chemistry, held in March 2 last. Prof. E. Paternò in the chair, decided to divide the Congress into the same number of sections as was the case at Berlin in 1903. Suggestion of the Presidents of foreign Committees, and of meeting was fixed for April, 1906, during week.

Communications with respect to the Congress are addressed to the President, Prof. E. Paternò, Casaperna 89, Rome.

## List of Members Elected.

March 23rd, 1905.

Prof. W. B., 42, Morris Avenue, Athens, Ohio, U.S.A., Prof. of Chemistry (Ohio University).  
 Lyman M., Revere Rubber Co., Chelsea, Mass., U.S.A., Chemist.  
 George A., 503, Walnut Street, Newtonville, Mass., U.S.A., Chemist.  
 Gerald F., Hunter's Hill, Sydney, N.S.W., Australia, Paint Manufacturer.  
 Roscoe E., 17, South 13th Street, Newark, U.S.A., Chemist.  
 Dr. K. N., The Indian Pharmacy, Girgaum, Bombay, India, Manager.  
 Harold W., 153, West 121st Street, New York U.S.A., Chemist.  
 Thomas J., c/o General Chemical Co., Hegeworth, Ill., U.S.A., Chemist.  
 Eric, 5, Oak Terrace, Beech Street, Liverpool, England, Chemist.  
 John Michael, 39, Queen Street, Melbourne, Victoria, Australia, Metallurgist and Chemical Engineer.  
 Percival G. W., c/o Mr. S. Trott, 6 G., Morgan Mansions, Highbury, N., Metallurgical Chemist.  
 W. Ellis, 80, Arundel Avenue, Liverpool, Sugar Refiner.  
 Arthur D., 93, Broad Street, Boston, Mass., U.S.A., Consulting Chemist.  
 G. D., Perranuthnoe, Marazion, Cornwall, Vine Owner.  
 Ernest, "Yerong," Glossop Street, Balmain, Sydney, N.S.W., Australia, Paint Works Manager.

Moignot, René, 54, Westbourne Grove, Bayswater, London, W., Chemical Engineer.  
 Moody, Dr. Gerald T., Lorne House, North Dulwich, S.E., Lecturer on Chemistry.  
 Neff, Robert W., 22, India Square, Boston, Mass., U.S.A., Chemical Manufacturer.  
 Nichols, E. Remington, 25, Broad Street, New York City, U.S.A., Treasurer (Nichols Chemical Co.).  
 Oakes, Francis J., 2, West 72nd Street, New York City, U.S.A., Dye and Chemical Manufacturer.  
 Ogden, Alfred W., Room 1007, 641, Washington Street, New York City, U.S.A., Chemist.  
 Ormandy, W. R., Bewsey Cottage, Warrington, Chemist.  
 Osborne, Frank W., Herold's Institute, Drummond Road, Bermondsey, S.E., Chemist.  
 Otsuki, Prof. Chiri, Am Kleinen Felde 321, Hanover, Germany; and Imperial University of Kyoto, Japan, Prof. of Applied Chemistry.  
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 Sewell, B. F. Brooke, Eden Terrace, Catonsville, Baltimore, Md., U.S.A., Chemical Engineer.  
 Shainwald, Ralph L., jun., 667, Madison Avenue, New York City, U.S.A., Chemical Student.  
 Speight, W. E., Sewage Works, Deighton, Huddersfield, Chemist.  
 Temperley, Joseph, 22, Down Street, Piccadilly, London, W., Shipowner.  
 Tichenor, Henry D., 18, Exchange Place, New York City, U.S.A., Custom House Broker.  
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- Kittredge, H. G., 1/o Linden Avenue; 217, North Ludlow Street, Dayton, Ohio, U.S.A.
- Lange, Dr. M.; Journals to Malapani, bei Oppeln a. Schl., Germany (temp.)
- Loomis, H. M., 1/o Norristown; Box 301, West Chester, Pa., U.S.A.
- McCrae, Dr. Jno.; P.O. Box 434, Pretoria, Transvaal, and Journals as before, Chemist, Dept. of Agriculture.
- McLellan, J. Y., 1/o Goole; Elmet Avenue, Roundhay, Leeds.
- Mears, Jas., 1/o Handsworth; Frodingham Iron and Steel Works, nr. Doncaster.
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- Neumann, Dr. Edgar, 1/o Chancery Lane; 7 and 8, Idol Lane, London, E.C.
- Ormerod, Ernest; Journals to Chemisches Laboratorium, Eidg. Polytechnikum, Zurich.
- Paton, W. Grant, 1/o Bertram Road; Airlie, Huyton, near Liverpool.
- Perkins, T. S., 1/o Easton; Spring Garden Place, Brooklyn, N.Y., U.S.A.
- Pettit, Alf., 1/o Flatbush; 3421, Glenwood Road, Brooklyn, N.Y., U.S.A.
- Platts, J. C., 1/o Heaton Moor Lodge; 13, Howard Avenue North, Heaton Chapel.
- Proctor, W. W., 1/o The Side; 184, Portland Road, Newcastle-on-Tyne.
- Rawson, C.; Journals (temp.) to c/o Badische Anilin und Soda Fabrik, Ludwigshafen a/Rhein, Germany.
- Schoder, Dr. R., 1/o Berlin; 6, Brandreth Road, Balham, S.W.
- Scott, Walter, 1/o Manchester; c/o The Powell Dufryn Steam Coal Co., Ltd., Aberaman Offices, near Aberdare.
- Thomson, Allen B., 1/o Silvertown; Furzedown, Abbey Wood, Kent.
- Thorburn, Jas., 1/o Stevenston; c/o The British Explosives Syndicate, Pitsea, Essex, Manager.
- Thurlow, N., 1/o Union Place; 78, Warburton Avenue, Yonkers, N.Y., U.S.A.
- Timmans, W. G.; Journals to c/o The Basford Chemical Co., Basford, Nottingham.
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- O.M. Ballard, Edw. G., 7, Godstall Chambers, Chester, Alkali Works Inspector.
1891. Fraser, L. McG., 98, Commercial Road East, London, E., Chemical Engineer.
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1901. Sawyer, Harris E., 163, C Street, South Boston, Mass., U.S.A., Chemist.
1892. Witthaus, Dr. R. A., Cornell Medical College, First Avenue and 28th Street, New York City, U.S.A., Professor of Chemistry.

### Deaths.

- Foster, Jas., 42, Herriet Street, Pollokshields, Glasgow. Merch 10th.
- Prescott, Dr. Albert B., Ann Arbor, Mich., U.S.A. February 24th.

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- Gray, G. O., 1/o Iron Gate, Va., U.S.A.
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- Spicer, A. J.; 1/o 543, Gifford Street, Syracuse, N.Y., U.S.A.

### London Section.

*Meeting held at Burlington House, on Monday, February 6th, 1905.*

MR. A. GORDON SALAMON IN THE CHAIR.

### ON THE FADING OF INKS AND PIGMENTS

BY JOSEPH W. LOVIBOND.

Workers in colour have long felt the want of a method of recording the colour changes which take place in their wares under different physical conditions. The object of this paper is an attempt to fill this want by establishing a system of measuring and recording colour changes as they occur.

No attempt will be made in this preliminary paper to co-relate the colour changes with the chemical composition of the substances in which they occur, or to deal with the chemical changes of the substances whose colour is altered, nor to trace any effect of the absorbed rays may have on the substances whose colour is unaltered.

The method of measuring a colour has already been submitted to this Society, and, therefore, need not be detailed: it will be sufficient to recall the fact that the most complex colour can be quantitatively determined by means of two colour terms and one light term, the terms themselves are associated with their mutual intensities.

The examples chosen for illustration are selected being types used for specific purposes; they were purchased in the open market, and are indicated by numbers.

In all twenty-six samples (some of which are recorded in this paper), comprising water colours, trichromatic printing inks, writing inks and dyes, submitted to three conditions of exposure—a day, daylight, a South daylight, and a North daylight in a damp atmosphere.

The samples were placed near windows and the atmosphere was obtained by means of a wet sponge over a bell glass; no attention was paid to temperature variations in these experiments, but it is an active factor in change in some instances, and should not be neglected in a systematic estimation.

Measurements were made at stated intervals, the results tabulated, the details of the tables furnish data for making comparisons and for charting the curves.

In the charts for plotting the fading curves, the curves were divided according to the unit values of the scales, and the abscissæ represent the time intervals in which the measurements were made. The change factor is represented by a separate curve.

The nature of the colour changes varies in different pigments, each having its own characteristics: in some there is an increase of colour for a time after exposure, in others both colour factors fade, but at different rates, or one may fade and the other increase.

The transparencies are built up with glass slides corresponding in value to those used in making the measurements, and when viewed in a North daylight against a standard white background, they correspond to the pigments themselves.



already stated the nature of the colour changes vary different pigments, each having its own characteristics, no being exactly alike, but they are sufficiently diverse to merit of classification into the five following divisions; examples in each division have a wide range of detail changes with certain properties in common:—

*Classification of Colour Changes by Exposure.*

Colours which are stable.

Colours which increase in density for a time after exposure.

Colours in which one factor increases and the other

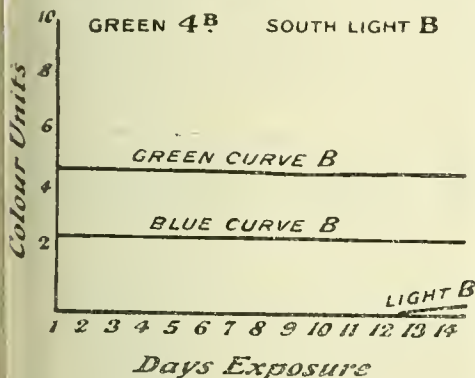
Colours in which all the factors fade.

Colours in which temporary changes occur with a return to their normal condition of stability or rate of change.

The object of this paper is not so much a comparison of examples as the formulation of a system for measuring or changes no useful purpose would be gained by going in detail with the mass of tables and curves which fitted this classification; it will be sufficient for my purpose to illustrate each class by means of one example.

EXAMPLE OF CLASS 1.

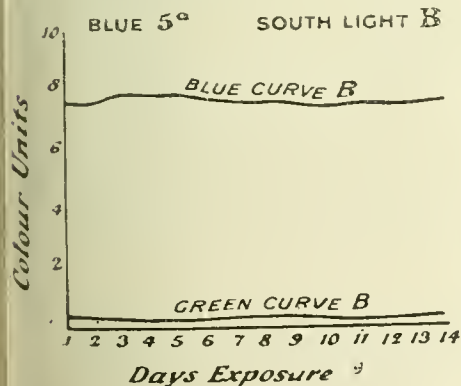
*Green Water Colour pigment exposed to a South Light.*



As green is associated with a considerable proportion of blue, both colour factors are stable for fourteen days under the conditions named, but become brighter on the thirteenth day.

EXAMPLE OF CLASS 2.

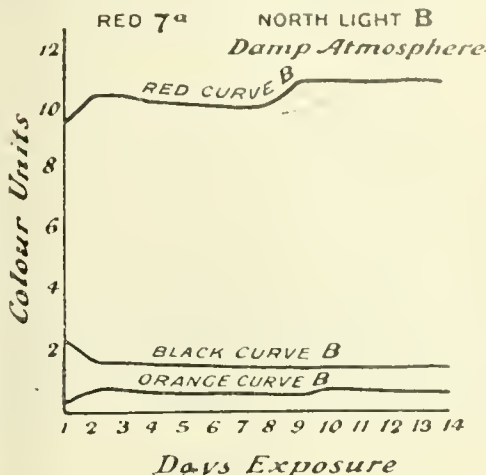
*A Blue Water Colour 5a in a South Light.*



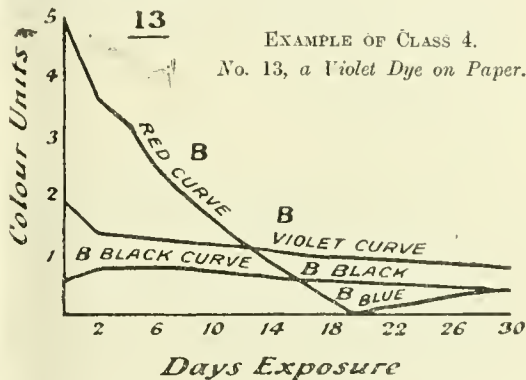
As blue is associated with a small proportion of green, the blue factor increases in intensity up to the fifth day, after which a slight decrease takes place; the green factor increases slightly up to the ninth day, after which it remains constant to the end of the period.

EXAMPLE OF CLASS 3.

*A Red Water Colour 7a in a Damp Atmosphere and North Light.*



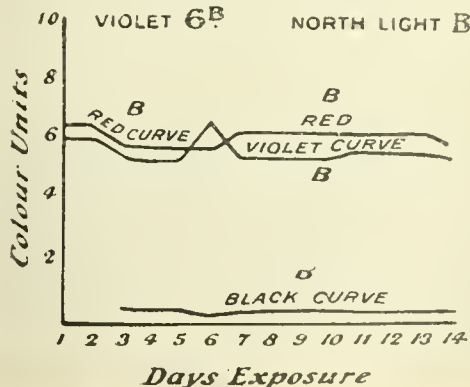
This red is associated with a small proportion of orange. The red factor shows a rapid fading, whilst the orange increases at a lesser rate. The fluctuations in their rates may be influenced by variations of intensity in the impinging light from day to day.



This colour, when fresh, is a slightly saddened red violet with red preponderating, which, however, fades rapidly up to the eighteenth day of exposure, when it disappears, being replaced by blue, which increases up to the thirtieth day, when what little colour is left becomes almost indistinguishable by the increased proportion of the black factor.

EXAMPLE OF CLASS 5.

*A Violet Water Colour 6b in a North Light.*



This colour is a red violet, red slightly preponderating, and a small proportion of the black factor. The temporary intermittent change took place on the eighth day as indicated by the break in the curves. The increase in one colour factor is frequently associated with a decrease in the other. The interruption seldom occurs on two successive days, and in the above example only once in the fourteen days of exposure, and after the disturbance the stability, or rate of change returns to its normal condition. More frequent measurements, at intervals of one hour for example, would modify the abruptness of the curve and give some information as to the time of the day in which the disturbing energy was most active, also if the chemical composition of the pigments was known, it might be possible to identify the constituents which are sensitive to this energy, and which cause the colour fluctuations in some pigments, but not in others.

The term fading seldom expresses the full nature of the changes which take place by time and exposure; in most cases there is also a change of colour which is quantitatively defined by the unit values in the tables of measurements, when fading is unaccompanied by a change of colour, the colour lines of the charted values are parallel to each other.

#### DISCUSSION.

Mr. J. SPILLER said he would call the author's attention to the Government Report of Dr. Russell and Sir William Abney, in conjunction with the Presidents of the Royal Academy and of the Royal Institute of Painters, and others, who worked in much the same way as Mr. Lovibond had described: with this difference, however, that these gentlemen had been washing colours on paper of the kind here specified and exposing them, watching the changes not only from day to month but also from year to year. These experiments extended over two years.

The CHAIRMAN asked by what instrument those changes were recorded.

Mr. SPILLER said they were judged by the eye, by the curves which were plotted, and by the degrees of tint. There were other interesting statements in the report; for instance, in the case of Prussian blue, the fact that this pigment, after being bleached by light, might on putting by in the dark recover to some extent its original tint. This report showed for the 39 colours experimented upon, the relative degrees of permanence and the variation of tints by exposure: the curves indicating the changes undergone as compared with the solar spectrum which was of course an exact method of comparison.

The CHAIRMAN asked if Mr. Spiller could say whether the methods indicated in the report had been and were now employed in industry, as was suggested would be the case with this method which Mr. Lovibond had explained. He took it that that was the whole gist of Mr. Lovibond's communication, that he described a method which could be applied in industry, and pointed out that the instrument with which he worked could be applied with great advantage in connection with these particular industries, which had not probably employed the methods described in the report.

Mr. SPILLER said he supposed they could be so applied, for the tintometer was only a variation of comparison with the solar spectrum which was used by Dr. Russell and his colleagues.

Mr. E. GRANT HOOPER congratulated Mr. Lovibond on bringing forward another of his most useful applications of the tintometer. As the Chairman had already suggested, the essential point of this paper was the application of an instrument capable of the exact measurement of colour in connection with the question of fading tints. Without it one could only measure the degree of fading by standard colour solutions of different strength, but with Mr. Lovibond's colour scale this was more rapidly done and was capable of being recorded as a numerical expression.

Mr. CLAYTON BEADLE said he had consulted Mr. Lovibond with the object of ascertaining if the tintometer

could not be used for recording the various tints of class note papers, and he was much struck by the accuracy and precision with which the colours could be recorded. He was interested in what Mr. Spiller had to say in reference to the work of Dr. Russell, Sir William Abney and others with regard to the effect of light on pigments and so forth. He had read these reports they were very different from the work of Mr. Lovibond who had placed in their hands an instrument by which they could carefully and accurately record extraordinary small changes in colours, such as was not possible at the time when Dr. Russell and his colleagues were under their researches; otherwise he thought they would have had a far more useful and scientific report from gentlemen. With regard to the subject of inks, the United States had made great progress both with regard to standard required in inks and papers; many of the records had become obliterated, and it was very necessary that they should have some means by which they could record very minute changes in the fading of inks. They knew was this, that after 10, 20, or 30 years, inks had changed and had become more or less obliterated, but, by the aid of Mr. Lovibond's instrument, they have a means of recording these changes in a very short time of exposure. It seemed to him that the results would have been more valuable if the samples had been exposed to a perfectly constant light, because the condition of the atmosphere, temperature, humidity had a great deal to do with the fading of water colours apart from the actual actinic rays. The ever-changing rays of the sun made these results much more complicated than they would have been if the various pigments had been exposed under uniform conditions for a given time.

Mr. A. S. D. ARUNDEL asked Mr. Lovibond whether trichromatic inks were laid on approximately in the way which they would be used in the trade on the printing machine, or whether they were laid on with the brush.

Mr. LOVIBOND said they were immersed in one colour and laid on with the brush in the other.

Mr. ARUNDEL said, when they were trying to reproduce objects in their true colours by three colours, it was important that the colours should not fade, or, if they faded, that they should all fade in the same ratio. Probably what Sir William Abney used was the colour apparatus or else Maxwell's colour box. They were indebted to Mr. Lovibond for a practical eye instrument.

The CHAIRMAN said the last speaker had very briefly described the purport of Mr. Lovibond's paper, and understood it; it was with a view to provide information to chemists and those concerned with the industries of pigments with an instrument whereby they could rapidly register these changes and so make their observations continuously in connection with their work, understood also, and it was only fair to state it, that Mr. Lovibond only gave this paper by way of a preliminary contribution with a view to encourage observation in this instrument in the direction indicated.

Mr. J. W. LOVIBOND, in reply, said when he commenced his work he went to the spectrum for the standard, and a very short investigation showed him that there was a sufficiently constant in the spectrum for the purpose to begin with, the idea that certain of the colour rays of the prismatic spectrum were pure was not borne out by his own work, which satisfied him that they were continuous and overlapping, so that the colour of a given line from part of the spectrum, except possibly the extreme violet, was a complex beam to which colour-character was given by one or two of the preponderating rays. The theory which adopted red, green, and violet as the only simple colour, and excluded yellow because it could be produced by a mixture of red and green appeared to be inconclusive. The method of demonstration appeared to be this. A slit was taken from the spectrum, slit from the red, and the mixture produced was yellow. He never himself saw a pure yellow so pure as what he saw was a dingy colour which approximated to yellow. As far as he could judge by watching the exper-



obtained by opening the slit of the green towards the w and by opening the red towards the yellow, so that no time the mixture was obtained the overlapping w of the two became the predominating ray of the are. So far as that experiment was concerned, he d upon it as fatal as a proof. Also when it is remem- that the opening of this slit also lets in a number of rays, the beam which was supposed to be made up o pure colours was too complex for him to deal with. her difficulty he found was this. However much spectrum was elongated, he could not obtain a workable which was monochromatic over the whole surface e smallest gradation gave no definite point for the a to rest on—thus making comparison impossible. ound that the only way to measure a colour was to perceptible differences, however small, between the lards. By means of the regular set of standards a he used he was able to differentiate out of a beam of ght of 20 units intensity—the average diffused day—60 million colours. How was it possible to identify f those 60 million colours in a spectrum? He was not eating the work done with the spectrum, but he only ed how it was impossible for anyone who had to deal colour quantitatively to take the spectrum as a ard. So that he was obliged to abandon it and ulty fall back on glass standards which had been co- ed to physical colour constants. The colour con- s he had relied upon up to now for co-relation to the lards had been 4 ft. of distilled water, containing mimate of potash, permanganate of potash, sulphate upper, and similarly simple chemical compounds in ion. With reference to the shortness of time, he t say that these experiments had been all done n five weeks, but shortness of time did not detract as s he could see from the value of the records; they e be extended as long as was considered desirable, ds having a colour constant to fall back upon for eging the unit. The remark about the ink experi- s in the United States applied to all the experiments w had preceded, either for inks or for pigments; it mply a measure—simply the validity of the measure- e that he was bringing forward. The Chairman, in his rks, gave the paper its true position. Concerning onstant light it had yet to be found. There were two tions in the light which were absolutely necessary; t be sufficiently luminous to distinguish the colours, e found anything below 16 units of light of no value ver for systematic colour work, and anything above hich was a bright summer day, was also useless. In case there was insufficient light to distinguish the rs, and in the other the colours were more or less ed by excessive light. That had been one of the ulties in dealing with the arc lights and all such se lights, they simply masked the colour they were osed to develop.

r. GRANT HOOPER said he would like to ask a question reference to the provision of some standard light by h these colours were viewed. He had himself expe- ried the difficulty to which Mr. Lovibond had icially referred of having to make comparisons with a light under which circumstances no such fine dis- tion of colour was possible, as was readily observed r more favourable conditions. He should like to v if Mr. Lovibond had evolved any method by which e could work with light of the same colour and degree, f he was in the habit of using any lamp or other ing arrangement by which they could get a satis- fory illumination under all conditions. With this e- nience of the tintometer in use would be much ased.

r. LOVIBOND said the desired light had yet to be ined. He was at work on a light, but was not very ful about it at present, but he thought there was a ice of it. This uniformity of light was very important, ac had only to look at the curves to see. He had no ot that the fluctuations in the curves were dependent o the nature of the light, and, if so, there were some ors or forces in the daylight which influenced certain rs in a hitherto unsuspected manner. In this pre- ary paper he had not attempted to associate these

fluctuations with any given property. He even thought it possible that it might have as much to do with the medium as with the colours themselves

*Meeting held at Burlington House, on Monday,  
March 6th, 1905.*

M<sup>R</sup>. A. GORDON SALAMON IN THE CHAIR.

# ESTIMATION OF ARSENIC IN FUELS—A SHORTENED METHOD.

BY GEORGE MCGOWAN, PH.D., F.I.C., AND R. B. FLORIS, A.I.C.

In the final report of the Royal Commission on Arsenical Poisoning, published in 1903 (Vol. II., p. 227, Appendix 23), full details are given of the method which we adopted in estimating the arsenic present in anthracite, &c., used for malting purposes. This method gave very concordant results, but because of the necessity for eliminating iron from the arsenical solution before the latter could be "marshed," it was rather long and troublesome.

Briefly, the method consisted in igniting the finely powdered fuel in a platinum basin, according to the method of Newlands and Ling (*J. Fed. Institutes of Brewing*, 1901, 7, 314). (a) with lime, for the total arsenic, and (b) alone, for the non-volatile arsenic, the difference between the two results representing the volatile arsenic. The ignited residue was in each case dissolved in dilute hydrochloric acid, the solution filtered, the filtrate reduced with aqueous sulphurous acid, saturated with sulphuretted hydrogen and allowed to stand in a small conical flask (which was filled nearly full and closed with a cork wrapped round with filter paper) for some days. The sulphide precipitate was then filtered off and extracted with a warm solution of dilute aqueous ammonia, the extract evaporated to dryness, and the residue oxidised by nitric acid and again evaporated. This last residue was dissolved in a solution of ammonium carbonate, the ammonia evaporated off, and the solution then reduced by a little aqueous sulphurous acid, any excess of the latter being expelled by gentle warming before the solution was made up to a given volume for "marshing."

Some time ago it occurred to us that the method of F. Platten (this J., 1894, p. 324) might be applicable, and that by making use of it the above process might be materially shortened and simplified. According to Platten, when a precipitate of arsenious sulphide is boiled with pure water, the sulphide is converted quantitatively into oxide, which remains in solution. We therefore applied this in the following way:—

## (1) *Testing the method with a pure dilute solution of Arsenious Acid.*

Two separate quantities of a solution of arsenious acid, each containing 0.05413 mgrm.  $As_2O_3$ , were acidified with 10 c.c. of arsenic-free hydrochloric acid (containing 20 per cent. HCl), diluted to 100 c.c., and precipitated with sulphuretted hydrogen, the liquids being re-saturated with the gas as required. The two precipitates, a and b, were then filtered through arsenic-free asbestos in separate Gooch crucibles.

Precipitate a was treated according to our old method and one-fifth of the final solution was "marshed." This gave a mirror equal to 0.0108 mgrm.  $As_2O_3$ , which was used as the standard.

Precipitate b, together with the asbestos, was transferred to a flask of Jena glass and boiled for three hours with 150 to 200 c.c. of glass-distilled water, the latter being renewed from time to time as it evaporated. The additions of fresh water were so arranged that at the end of the three hours only about 30 c.c. of liquid remained in the flask, when it was again filtered through asbestos in a Gooch crucible. As it was not improbable that some of the arsenic might have become oxidised to the higher oxide in the course of the boiling, a few c.c. of aqueous sulphurous acid were added to the filtrate, and the excess of

sulphur dioxide expelled by gentle warming. One-fifth of the solution was then "marshed" and gave a mirror equal to 0.0110 mgrm.  $\text{As}_4\text{O}_6$ , taking the mirror from a  $\text{As}_4\text{O}_6$ —0.0108 grm.  $\text{As}_4\text{O}_6$ . The arsenic from the above pure dilute solution was therefore all recovered in solution by Platten's method. The second filtration through the Gooch crucible would of course have removed any unoxidised sulphide.

It was, however, necessary to ascertain whether an equally satisfactory result would be obtained when dealing with the sulphide precipitates from solutions of the residues from the ignition of (1) coal, and (2) coal and lime, by the method of Newlands and Ling. To test this, 2.8 grms. of an impure anthracite were ignited in a platinum basin with 3 grms. of arsenic-free lime for three to four hours, i.e., until all the carbon was burnt off; the resulting ash was then treated with 2 or 3 c.c. of pure dilute nitric acid (1 in 10), to decompose any sulphides, dried, and again ignited for a short time. The residue was now dissolved in 25 c.c. of arsenic-free hydrochloric acid diluted to about 70 c.c., the solution filtered and reduced with aqueous sulphurous acid, and the excess of the latter expelled by warming. Three equal portions of the solution (each consisting of three-tenths of the whole = 0.84 grm. of the original coal) were then transferred to three conical Jena flasks of about 100 c.c. capacity, acidified further in each case with 10 c.c. hydrochloric acid, and saturated with sulphuretted hydrogen (the total volume of liquid in each flask was about 70 c.c.); the solutions were subsequently re-saturated. After standing in the corked flasks for three or four days, the mixtures were filtered through separate Gooch crucibles.

*Precipitate (a)* was treated by our old method and two portions, each consisting of one-fourth of the final solution (= 0.21 grm. coal), were "marshed." These gave mirrors equal to 0.012 and 0.011 mgrm.  $\text{As}_4\text{O}_6$ .

*Precipitate (b)*, including its asbestos, was boiled for three hours with excess of water, the extract filtered and reduced with sulphurous acid, the excess of the latter being then driven off. One-fourth of the final extract (= 0.21 grm. coal) gave a mirror equal to 0.011 mgrm.  $\text{As}_4\text{O}_6$ .

*Precipitate (c)* was treated in the same way as (b), excepting that the reduction with sulphurous acid was omitted. The mirror from one-fourth of this final extract (= 0.21 grm. coal) was equal to 0.011 mgrm.  $\text{As}_4\text{O}_6$ .

These results may be shortly summarised:—

		Mirror equal to:—
Sulphide precipitates a, b and c, each from 0.21 grm. coal.	(a) Treated by old method ( <i>loc. cit.</i> )	0.011 mgrm. $\text{As}_4\text{O}_6$
	(b) Boiled with water and reduced by $\text{SO}_2\text{Aq.}$ . . . . .	0.012 " "
	(c) Boiled with water and reduced by $\text{SO}_2\text{Aq.}$ . . . . .	0.011 " "

A preliminary set of three estimations had already been done on the same lines as the above, but in this case the second precipitate was extracted with warm dilute ammonia previous to the reduction of the solution by sulphurous acid. The object of this was to get rid of the asbestos, which caused bumping when the flask was boiled over a small Bunsen flame. It was afterwards found, however, that with a rose burner no bumping took place; hence extraction with ammonia is unnecessary. The third precipitate was boiled up with water and the solution then reduced.

This first series of experiments did not give quite such concordant results as those which have just been quoted, but possibly this may have been due to the fact that different lots of zinc had to be used for "marshing" the first two solutions and the third one.

The results may, however, be given:—

		Mirror equal to:—
Sulphide precipitates (1), (2) and (3), each from 0.24 grm. coal.	(1) Treated by old method ( <i>loc. cit.</i> )	0.012 mgrm. $\text{As}_4\text{O}_6$
	(2) Extracted with ammonia and the solution reduced by $\text{SO}_2\text{Aq.}$ . . . . .	0.013 " "
	(3) Boiled with water and reduced by $\text{SO}_2\text{Aq.}$ . . . . .	0.010 " "

We should have liked to have tested this short method further upon various other samples of fuel, but time has not so far allowed of our doing so. We think, however, that the results quoted above show that the method is reliable, and we shall be glad if any one is interested in the subject cares to put it to further proof, e.g., in the direction of seeing whether the presence of much copper sulphide interferes.

In conclusion, this process for the estimation of arsenic in anthracites and other fuels may be shortly summarised as follows:—

1. Sampling and grinding of the fuel.
2. Ignition (a) with and (b) without lime, according to the method of Newlands and Ling.
3. Solution of the ash in dilute hydrochloric acid and reduction with sulphurous acid.
4. Precipitation of the arsenic as trisulphide.
5. Filtration of the precipitate through a Gooch crucible lined with asbestos, and subsequent boiling-out with water.
6. "Marshing" of the aqueous extract so obtained.

## New York Section.

Meeting held at the Chemists' Club, on Friday, January 20th, 1905.

DR. RUSSELL W. MOORE IN THE CHAIR.

### CHEMICAL COMBINATION OF OXYGEN AND HYDROGEN UNDER ACTION OF RADIUM RAYS.

BY BERGEN DAVIS AND C. W. EDWARDS.

This paper is a preliminary account of some experiments on the synthetic action of radium radiations, and the dissociative action of radium upon certain substances has been previously observed. When radium is dissolved in water, for example, hydrogen is continuously liberated.

The authors have obtained the reverse effect, i.e., the association of oxygen and hydrogen into water, and those gases are exposed to the radiations of radium.

The apparatus consisted of two small bulbs of equal volume, which were connected together by a capillary tube. A drop of mercury was placed in this capillary as an indicator of the rate of the action. One of the bulbs was furnished with two electrodes for the purpose of measuring the amount of ionisation produced by radium. About 4 mgrms. of pure radium bromide was placed on a piece of platinum foil in the bulb containing the electrodes.

The two bulbs were then filled with a mixture of oxygen and hydrogen, and phosphorus pentoxide was placed in both bulbs for the purpose of absorbing water. The radium in the one bulb caused a combination of the gases into water. The decrease of pressure in the bulb was registered by the motion of the drop of mercury in the capillary tube toward the bulb containing radium. The rate of motion of the drop of mercury indicated a disappearance of  $36 \times 10^{-7}$  c.c. of gas per second.

The amount of ionisation produced in the gas by radium was measured by an electrometer. Care was taken to have a saturation current. The presence of an electromotive force on the electrodes did not alter the rate of the chemical action. All the ions formed were driven out by this electromotive force. This indicates that the chemical combination results from the action of ionisation, and not from ionic recombination.

The rate of leak of the electrometer showed that 2 electrostatic units of electricity were set free in the air per second by the radium. If Q is the total set free



ad, and  $N$  is the number of ions produced per second,  $e$  is the charge on one ion, then

$$Q = Ne.$$

aking the charge on one ion as  $3 \times 10^{-10}$  E. S., we have  $Q = 7.3 \times 10^9$  free ions produced in the gas per second.

ie number of molecules of gas disappearing can be d from the change in volume, which was  $36 \times 10^{-7}$  c.c. second. Taking the number of molecules of gas per as  $4 \times 10^{19}$ , we have the number of molecules of gas appearing per second as  $n = 144 \times 10^{12}$ .

et  $M$  equal the number of molecules of water formed second.

$= 96 \times 10^{12}$ . The ratio of  $M$  to  $N$  is  $\frac{M}{N} = 13100$ . That

r each physical ion produced in the gas by the radium were 13100 molecules of water formed.

is ratio is surprisingly large. One of us (C. W. ards) has since found that temperature has an effect is ratio. The ratio increases with increase of tem- ure. The experiments will be continued for the nment of more accurate results. The rate of chemical ination of other gases will also be studied in the way.

e experiments were conducted at the Physical ratory of Columbia University, and at Trinity ge, North Carolina. The authors also wish to express thanks to Mr. H. Lieber, who has kindly furnished adium for this research.

## Nottingham Section.

ing held at Nottingham on Saturday, Feb. 25th, 1905.

MR. J. T. WOOD IN THE CHAIR.

### DAMAGE CAUSED BY MAGNESIA SOAPS IN BLEACHING.

BY S. R. TROTMAN.

mong the difficulties with which bleachers of lace have ontend is that of the appearance of a yellowish or n coloration in goods which leave the works in a et condition and apparently free from damage. The n discolorations may be due to several causes, among h are:—(1) Iron. (2) Over-bleaching. (3) Mildew. rease stains. (5) The use of unsuitable soaps and r.

ie present note is generally concerned with the last of causes, which, in the experience of the author, is of a more common occurrence than is supposed. It is ry common thing to put down all discolorations to r over-bleaching, but in my experience the facts do often support this assumption. Over-bleaching and equent discoloration by production of oxycellulose is comparatively rare. I have tested a large number of doured samples, and have rarely found more oxy- lose than can be detected in a normal piece of the e goods. The method which is adopted in testing for ellulose is to remove all starch and soluble matters hushing with water and subsequent fermentation with t. The goods are then distilled with hydrochloric and the distillate treated with phenylhydrazine, the resulting precipitate dried and weighed. The test care is, of course, required to remove all soluble tances from the surface of the material, since a great y bodies other than oxycellulose produce furfural stillation with acid. A number of experiments have b made with a view to determining the amount of fural which is likely to be obtained from a normally shed curtain, the results of which tend to show that, e, when proper proportions are taken to prevent over-

bleaching, the quantity found is rarely less than 0.2 per cent. On the other hand, in distinctly over-bleached samples it sometimes rises as high as 1 per cent. In certain text books much stress is laid upon the behaviour of oxycellulose towards certain basic dyes as a qualitative test for oxycellulose. That is, however, in my experience totally misleading. Perhaps the best test for oxycellulose is a careful measurement of the breaking strength of the fabric, for anything more than a trace of this body causes its equivalent of destruction of cellulose and marked tendering. These tests are, of course, made with a machine specially designed for the purpose.

The class of damage to which this note refers generally appears some considerable time after the goods have left the warehouse, and often at the end of a longish voyage to a hot country, and in several cases it has been conclusively traced to the presence of a resinate of lime or magnesia. A great many of the waters which are used in bleaching operations contain notable quantities of lime and magnesia, and are not softened, or, if so, are often softened by means of soap. Now a large quantity of the soaps used in the scouring operations contain notable quantities of resin. This resin is, of course, not to be regarded as an adulterant, for its presence is well known to both buyer and seller, and for certain scouring operations it is probable that a resin soap is preferable to one containing only fatty acids; but if it is necessary or desirable to use a soap containing resin, it is of the greatest importance that no water containing more than traces of lime and magnesia should be used with them. Both lime and magnesia resinates are insoluble in water, and, when dried, gradually become distinctly brown in colour, partly owing to dehydration and partly to dissociation. The magnesia soap is distinctly darker in colour than the corresponding lime soap. When lace goods are scoured with these resin soaps and subsequently washed with hard water, considerable quantities of calcium and magnesium resinates often become precipitated in the fibres, and, although these may not be visible at first, the characteristic brown coloration is gradually produced, this being especially the case in lightly-dressed goods. It is often possible to extract weighable quantities of fatty matter from these damaged goods and to qualitatively prove that it contains resin acid. The same remarks apply to any soap which is made from a dark oil, although not to so marked an extent, and it seems advisable that the nature of a soap used for certain scouring operations should be largely determined by the quality of the available water. The following examples will illustrate these points:—A piece of lace net was boiled with a solution of a resin soap, a portion was then scoured in soft water and was seen to be perfectly white. Further portions were scoured in water containing about 50 parts per 100,000 of magnesia and lime respectively, and subsequently dried; the discoloration was here quite apparent, being also more marked in the case of the magnesia than the lime. Another set of tests was made in the same way with a soap from a dark oil, and illustrated the same points. The suitability of a soap may readily be judged by the colour of its fatty acids, and this can be quantitatively determined by means of a Lovibond's tintometer.

Although the discolorations caused by a combination of unsuitable soaps and water is chiefly seen in cotton goods, yet the same thing is by no means infrequently met with in hosiery, where it makes its appearance chiefly in uneven dyeing. A common cause of this is the composition of the lather which is used in making up hosiery, which often contains notable quantities of magnesia and lime soaps which are extremely difficult to scour out, and almost invariably cause patchiness in subsequent dyeing operations.

### DISCUSSION.

Mr. S. J. PENTECOST said the bleachers in his district found trouble with hard water. In the earlier stages of boiling with caustic soda, softened water was unnecessary; but after scouring lace goods with soap, the lime and magnesia soaps formed by hard water doubtless caused inferior whites, and, in the case of goods to be afterwards

dyed, uneven colours. The old method of softening by boiling the water with a little soap was most unsatisfactory, as, after skimming off the lime soap which rises to the surface, there remained a very large proportion disseminated in small particles throughout the liquor. He had come across very few of the stains caused by magnesium resinate in his own experience, as he avoided resin soap for economical reasons. Mineral oil and black-lead stains more frequently troubled the lace bleacher. The former because, when apparently cleared, it frequently developed a light yellow stain after three or four weeks; while the latter could only be removed by persistent dollying or rubbing, which often caused damage. A cheap chemical process for removing blacklead (which was used to lubricate the lace machine) would be of great assistance to the lace bleacher.

Mr. T. A. GERARD said it was an accepted rule to make scouring soaps with an excess of alkali, and this was due to the fact that few people took the trouble to soften the water. Would the soda in the soap soften the water before the hardness of the water had time to combine with the soap? Many bleachers apparently used any kind of soap, and did not get stained goods. A soap was made from locomotive grease, to which was added a quantity of resin, which was very highly coloured, and he knew of

some bleachers who claimed to obtain good results from its use; this, however, he somewhat doubted.

Mr. S. R. TROTMAN, in reply, said that an important point to be remembered was, that while sodium resin was soluble in hot water they were only very sparingly so in cold, and hence in the case of goods scoured with resin soap even in the absence of hardness, if the wash was not completed with hot water, there was always some resin soap left in the fibre, which would afterwards be transformed into calcium and magnesium resinates. Addition of extra alkali to the soap was really of very little use, for firstly, unless a soap were made with particular reference to each water, there would be no guarantee that the alkali would be in sufficient excess to soften; secondly, the free alkali in soap was always present as carbonates in which state it was of little use in removing hardness due to magnesia, and the magnesium resinates, as already shown, were more objectionable than the corresponding calcium compounds. The effect with hosiery goods was not so marked as in the case of cotton, since they retain much more water, and hence dehydration was not so rapid. The stains produced by resinates were, of course, at once distinguished from those produced by acids, as they caused no tendering, which both acid and alkali bleaching invariably did.

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### I.—PLANT, APPARATUS, MACHINERY.

*Copper; Use of—*in Pipes and Fittings for Superheated Steam. Mech. Eng., 1904, 14, 865-866. Science Abstracts, 1905, 8, B, 119.

A BOARD OF TRADE report dealing with the failure of a copper steam-pipe at the Edinburgh Tramway Co.'s power station is discussed, and it is pointed out that the softening of copper above 400° F. (204.5° C.), and, to some extent also of copper alloys, renders these materials unsuitable for pipes and fittings for superheated steam. The results of compression tests on two pieces of gun-metal cut from the same bar, one being tested at about 400° F. (204.5° C.), and the other in the cold state, are described, showing that the metal when heated is much less resistant to pressure than when in the cold state. Pipes for superheated steam should be of wrought iron or mild steel, and the valves should be made of special alloys, preferably those containing nickel.—A. S.

### ENGLISH PATENTS.

*Separating Apparatus; Centrifugal*—Aktiebolaget Separator, Stockholm. Eng. Pat. 3807, Feb. 1904. Under Internat. Conv., Feb. 17, 1903.

SEE Fr. Pat. 342,115 of 1904; this J., 1904, 895.—T

*Filters; Impts. in*—C. Sellenscheidt, Berlin. Pat. 11,979, May 26, 1904.

THE filtering material is contained between filter-forms of grids with conical perforations, the apertures of the perforations being adjacent to the filtering medium, so that when the grids are pressed together the filtering medium enters into the perforations and into recessed portions of the frame. The object is to obtain a large filtering surface combined with a strong grid to withstand the pressure and to prevent leakage round the edges of the frame. The grids are held in position in the frame by means of adjustable wedges in order to allow the layers of filtering medium to be



of different thickness so that a uniform density of the  
um can be easily obtained.—W. H. C.

*Evaporating Apparatus.* S. M. Lillie, Philadelphia.  
Eng. Pat. 24,686, Nov. 14, 1904.

U.S. Pat. 777,114 of 1904; this J., 1905, 78.—T. F. B.

#### FRENCH PATENTS.

*Temperature; Process and Apparatus for Automatically  
indicating Changes in—.* C. Cyon. Fr. Pat.  
7,042, Aug. 6, 1904.

The space, of which the change in temperature is to be  
ated, is connected by a tube with another space at a  
r temperature. The current of air which is produced  
he tube will vary in speed with the variation in  
difference of temperature in the two spaces. The  
ent of air acts on a balanced damper or on a wheel  
anes or wings. The movement produced is trans-  
ed electrically or otherwise to some form of indicator  
eorder.—W. H. C.

*Evaporating or Drying; Apparatus for —.* H.  
Tournour. Fr. Pat. 347,074, Oct. 13, 1904.

The vessels, one the evaporator and the other the  
lenser, are connected by means of pipes and valves  
hough two cylinders provided with pistons working  
ointly and acting as pumps. The pistons are  
ated, either by the pressure produced in the evapora-  
y heating the liquid in it by a steam coil, or by some  
of external power acting mechanically on the piston.

One of the pumps withdraws air or gas laden with  
ur, from the evaporator, which is at a high pressure,  
delivers it into the condenser which is at a lower  
sure. The air expands and is consequently cooled  
deposits the vapour. The cooled air is aspirated  
the condenser by the other pump and is compressed  
consequently heated, and is injected under the  
ace of the liquid in the evaporator. As it is hot  
dry it can take up more vapour, which is thus con-  
ally carried by the air or other inert gas from  
evaporator to the condenser.—W. H. C.

## II.—FUEL, GAS, LIGHT.

*Peat [in Coal]; Determination of —, by Eschka's  
Method.* C. Bender. XXIII., page 293.

#### ENGLISH PATENTS.

*Peat and Analogous Substances; Carbonisation and  
Drying of —.* X. M. Roux, Paris, and B. W. Gonin,  
London. Eng. Pat. 2578, Feb. 2, 1904.

The invention relates to a special form of drying apparatus  
peat in combination with an auto-carbonising oven.  
Peat is carbonised "by the heat of fire supplied by  
itself." Air is dried by passing it through a chamber con-  
taining lime or other material capable of absorbing moisture,  
then it passes through a heating chamber into the drying  
chamber, through which waggons laden with raw peat  
travel in a direction opposed to the current of hot and dry

Subsequently some of this dried peat is carbonised  
the "auto-carbonising" oven, where it burns, and the  
gases evolved are collected, purified, and afterwards used  
providing heat for further heating already dried  
peat. The gases evolved in carbonising are also used to  
drive a motor which moves the peat waggons.—L. F. G.

*Peat; Process of Consolidating —.* J. O. Green,  
Whitewater, Wisconsin, U.S.A., and H. T. Martin,  
Beloit, Wisconsin, U.S.A. Eng. Pat. 6314, Mar. 15,  
1904.

Peat is ground to a fine powder till the fibre is  
destroyed, and is then pounded in a tube or die by a  
suitable hammering machine with sufficient rapidity, so  
that the heat generated in the hammering process  
releases peat-tar, which acts as a binder, so that a solid  
mass is forced out of the die.—L. F. G.

*Gas Producers.* I. W. Whitworth, Chorlton-cum-Hardy.  
Eng. Pat. 7079, Mar. 24, 1904.

For the purpose of preventing the excessive generation  
of steam in a suction gas-producer, the steam generator  
is arranged at one side, and projects for a short distance  
over the top of the fire-brick lining. A horizontal outlet  
channel for the hot producer-gas passes through the water  
in the generator, the latter being provided with an air  
passage above the water line, and a pipe for leading the  
the mixture of air and steam generated down to the fire-  
grate, which is situated within an enclosed ashpit. The  
grate is hinged at one side, and supported at the other by  
a cam or eccentric, by means of which it can be tilted so  
as to facilitate the removal of clinker.—H. B.

*Gas Producers.* H. Gerdes, Berlin. Eng. Pat. 10,344,  
May 5, 1904. Under Internat. Conv., May 6, 1903.

A suction gas-producer, into which the mixture of steam  
and air is introduced by means of an injector beneath  
the fire-grate, is provided with an outlet, likewise beneath  
the grate, whereby any superfluous steam and air, and  
also any superfluous gas, may escape harmlessly, in the  
event of the suction periods becoming irregular or ceasing  
altogether.—H. B.

*Gas Producers.* L. Wilson, Glasgow. Eng. Pat. 20,845,  
Sept. 28, 1904.

The gas-producer is constructed of a number of units  
grouped together, each unit comprising a combustion  
chamber the walls of which are formed of plain or water-  
tube boilers, for the purpose of generating steam and so  
far moderating the temperature in the fuel chambers, as to  
prevent the adhesion of clinker and minimise the  
destruction of the ammonia yielded by the fuel. The  
boilers may be traversed by vertical fire-tube outlet  
passages for the hot gases or may be enclosed in a series  
of fire-tubes or plain flues, the latter in turn being  
surrounded by a series of water-tubes for superheating  
the steam generated. The steam from all the boilers  
is collected in a common steam drum above the apparatus.  
The boilers are constructed of corrugated metal to allow  
of expansion and contraction.—H. B.

*Gas; Apparatus for the Manufacture of Producer—.*  
G. Viarmé, Paris. Eng. Pat. 27,519, Dec. 16, 1904.  
Under Internat. Conv., Dec. 19, 1903.

SEE Fr. Pat. 337,974 of 1903; this J., 1904, 540.—T. F. B.

*Incandescence Mantles for Gas and like Illuminants and  
Process of Manufacturing same.* H. Wien and R. Mintz,  
Vienna. Eng. Pat. 7668, Mar. 31, 1904.

FUSED quartz is drawn into filaments from which a woven  
mantle is then constructed. The mantle is immersed for  
a long time in a strong solution of thorium and cerium  
salts, in order that the latter may adhere to or crystallise  
upon the quartz fabric, or the luminous earths may be  
cemented to the fabric by means of dextrin or a readily  
fusible salt such as an alkali carbonate. The mantle  
may also be woven from a mixture of quartz filaments and  
vegetable fibres, the whole being impregnated and burned  
off as usual.—H. B.

*Electrodes for Arc Lamps.* J. T. H. Dempster, Schenec-  
tady, U.S.A. Eng. Pat. 26,915, Dec. 9, 1904. Under  
Internat. Conv., Dec. 10, 1903.

THE electrodes are composed principally of oxides of iron  
and titanium, the oxide of iron being preferably reduced  
more or less to the metallic state. For example, a powdered  
mixture of magnetic oxide of iron, 160 parts; red oxide  
of iron, 40 parts; rutile, 15 parts; and boric acid, 1 part,  
is mixed with a 5 per cent. solution of glycerin, ground  
up, dried to the consistency of hard putty, moulded into  
the desired shape, dried at 200° C. and baked at 1100°—  
1200° C. Part of the oxide of iron may be reduced to  
metallic iron, either by packing the electrodes in carbon  
during the baking operation, or by adding graphite to  
the mixture from which the electrodes are made.—H. B.

*Electrodes; Arc Lamp*—C. P. Steinmetz, Schenectady, U.S.A. Eng. Pat. 26,916, Dec. 9, 1904. Under Internat. Conv., Dec. 10, 1903.

A small quantity (say 2 or 3 per cent.) of titanium, either in the pure state, or as a compound such as the carbide or oxide, is introduced into an ordinary carbon electrode, which is employed in conjunction with a similar electrode or with one to which no titanium has been added. The titanium volatilised into the arc imparts luminosity and a white colour to it.—H. B.

*Arc Lamps and Electrodes therefor*. J. Hårdén, Schenectady, U.S.A. Eng. Pat. 26,918, Dec. 9, 1904. Under Internat. Conv., Dec. 10, 1903.

In alternating current arc-lamps, employing moderate voltages and current strengths, there are used, for the production of a flaming arc, two electrodes, one of which is composed principally of a titanium compound, and the other principally of carbon. For example, the one electrode is prepared from a mixture of titanium carbide, 90 parts, and carbon, 10 parts, which is mixed with a suitable binder such as tar, moulded to the desired shape, and then heated first at 900° C. and finally at 1800° C. The other electrode may consist of a shell of carbon, having a core composed of a mixture of carbon and titanium carbide, to which a suitable binder, such as water-glass, has been added.—H. B.

*Electrodes; Arc Light*—J. Hårdén, Schenectady. Eng. Pat. 26,919, Dec. 9, 1904. Under Internat. Conv., Dec. 10, 1903.

The electrodes are composed either partially or wholly of ferromanganese, containing preferably 30 to 40 parts of manganese to 70–60 parts of iron. For example, a powdered mixture of titanium carbide, 40 parts; ferromanganese, 40 parts; and carbon, 20 parts, is moistened with water and oil, moulded into pencils or the like, baked at 200°–300° C., and then fired at 1200–1300° C.—H. B.

#### UNITED STATES PATENTS.

*Gas; Retort for the Manufacture of*—G. Horn, Braunschweig, Germany. U.S. Pat. 783,435, Feb. 28, 1905.

SEE Eng. Pat. 12,182 of 1903; this J., 1903, 943.—T. F. B.

*"Smelting Refractory Ores" [Calcium Carbide]*. E. F. Price, Assignor to Union Carbide Co. U.S. Pat. 782,922, Feb. 21, 1905. XI A., page 281.

#### FRENCH PATENTS.

*Briquettes; Manufacture of Combustible*—F. Chailluy, Second Addition, dated Aug. 2, 1904, to Fr. Pat. 312,276 of June 29, 1901.

The claim is for mixing the combustibles, such as coal, peat, wood shavings, vegetable matters, &c., with any kind of silicate or silicic acid, or with calcined compounds of silicic acid and bases. A certain proportion of blacklead or lampblack and sodium peroxide may also be added.

—L. F. G.

*Briquettes; New [Agglomerant and] Process for Manufacturing*—L. Marton. Fr. Pat. 347,092, Oct. 14, 1904.

A suitable agglomerant for briquetting coal, charcoal, coke, or mineral dust, is made by heating starch or starch residues with water in a closed vessel, till solution results. The liquid is then drawn off into another vessel and mixed with some crude petroleum if desired; it is then incorporated with the briquette material, pressed into moulds, and dried. Suitable materials for the agglomerant are: maize, potatoes, rye-grass, vetch, cheap flour, and starch waste.—L. F. G.

*Peat; Process for Converting Crude — into a Solid Combustible*. C. Schlickeysen. Fr. Pat. 347,106, Oct. 14, 1904.

SEE Eng. Pat. 4995 of 1904; this J., 1904, 1204.—T. F. B.

*Burner for Heavy Oil; Vaporising*—F. Dumontie, Mme. C. Chartier née Paysant, L. H. Ninin and Mm. M. Vénitien née Leroy. Addition dated Sept. 14, 1904 to Fr. Pat. 3725 of Mar. 31, 1904. (See Eng. Pat. 8596 of 1904; this J., 1904, 815.)

THE joints of the apparatus described in the main patent are rendered tight, in the case of the annular apparatus by arranging the joints of the exterior and interior cylinder in the same plane; and in the case of the elongated apparatus by confining the movable cover to that part which is farthest removed from the furnace. The closing of the closed parts of the apparatus is effected through openings which are usually closed by screw plugs.

—W. H. C.

*"Gas; Bituminous Mineral"—[Carburetted Air]*. Perrier. First Addition, dated Aug. 23, 1904, to Fr. Pat. 327,461, Dec. 22, 1902.

MODIFICATIONS are described in the construction details of an apparatus in which, by means of a hot-air engine, warm air is passed over petrol for the production of carburetted air. The hot-air engine, the burner which is fed by the gas produced, drives the bellows which supply the air current, and actuates the pump which feeds the saturators with petrol. Air from the bellows first enters a small gas-holder, passes thence under pressure through a coiled pipe surrounding the burner, the engine, flows next through the saturators, and finally enters a small gas-holder from which it is led to the place of consumption.—H. B.

*Light, Heat, and Power from Heavy Benzols; Process and Apparatus for the Production of*—P. Léota and H. Digne. Fr. Pat. 347,080, Oct. 13, 1904.

THE process consists of carburetting air with heavy benzol of sp. gr. of about 0.910. The air is drawn from the atmosphere through a valved pipe into a gasholder, which is lifted by a piston worked by water under pressure. When full, the supply of water is cut off automatically and the holder descends by its own weight, driving the air in a second gasholder which serves as a pressure equaliser.

From this second gasholder the air is forced by the weight of the holder into the carburettors. The latter are in duplicate and worked alternately, in order that when one apparatus works badly, owing to the low temperature produced by the evaporation of the benzol, can be cut out and the other used. The carburettor is a vessel the lower part of which serves to hold the benzol whilst over the surface of the latter is a horizontal perforated partition. Tubes filled with broken pumice, with wick are fixed in these holes to dry the gaseous mixture. The air is introduced by a bell-mouthed pipe with the opening covered by gauze, under the surface of the benzol. It bubbles up, and after passing through the drying tubes it is further dried by broken pumice and "calcium" contained in the upper compartment of the carburettor. A screw-shaped fan or propeller is situated in the pipe conveying the gas from the carburettor to the pressure regulator and distributing main. It rotates the current of gas, and serves to complete the mixing of air and benzol vapour.—W. H. C.

*Gas free from Tar; Producer for Weak*—L. Boutillier et Cie. Fr. Pat. 347,044, Sept. 1, 1904.

BITUMINOUS fuel is fed upwards, by means of a screw conveyor, on to an inclined grate, the inner end of which rests upon a transverse wall which extends right across the fuel chamber, the top of the wall being inclined as to form a prolongation of the slope of the grate. The fuel, pushed up beneath the superincumbent layer of incandescent coal, partly falls back upon itself and partly pushed over the transverse wall into a chamber formed by the transverse wall, the back wall of the producer, and the horizontal fire-grate. Air and steam are admitted beneath the inclined grate, and the gases produced are drawn off beneath the horizontal grate. The tarry vapours disengaged from the fresh fuel are decomposed partly on rising through the covering layer of incandescent fuel, and partly on passing down through the reducing column collected behind the transverse wall.

—H. B.



*s Purifier. Cie. pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.* Fr. Pat. 347,190, Oct. 18, 1904.

Eng. Pat. 22,815 of 1904; this J., 1905, 22.—T. F. B.

*rbides; Manufacture of Metallic — by means of the combined Heating Effects of the Arc and Resistance.* E. Lanhoff and Comp. Continent. d'Electricité. Appl. Fr. Pat. 347,090, Oct. 14, 1904 X1 A., page 281.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

*nzols; Sulphur Content of Pure—.* C. Schwalbe. Z. Farben- u. Textil-Ind., 1905, 4, 113—119.

The author has examined a number of specimens of benzol ended for the manufacture of aniline, and also one o. 6 in table) marked "purissimum krist. thiophen-i pro analysi." The results are shown in the following table:—

	Total sulphur.	Sulphur as carbon bisulphide.	Thiophen by Dimro's method.	Thiophen by difference between total sulphur and sulphur of carbon bisulphide.
	Per cent.	Per cent.	Per cent.	Per cent.
o. 1	0.036	0.022	0.038	0.039
2	0.027	0.001	0.061	0.069
3	0.030	0.021	0.073	0.047
4	0.021	0.019	0.019	0.005
5	0.060	0.011	0.171	0.127
6	0.010	0.010	—	—

has been admitted recently by Liebermann and Fieus at the nitroso reaction will only detect thiophen with rainty within 20 minutes when at least 0.12 per cent. is esent. As the average proportion of thiophen is 0.26 r cent. in commercial benzols, and 0.04 per cent. in pure nzols, it is preferable to use the isatin reaction for e detection of thiophen in the latter. A method for e determination of thiophen which is perfectly trust- orthy, simple, and rapid has not yet been devised.

—A. S.

*odium Acetate; Manufacture of—*from Pyrolygneous Acid. E. Bauer. VII., page 275.

#### ENGLISH PATENT.

*reosole; Process of Treating—and Product of same [for Medicinal Purposes].* A. G. Meyer. Eng. Pat. 28,997, Dec. 30, 1904. XX., page 290.

#### UNITED STATES PATENTS.

*Food or the like; Apparatus for the Distillation of —.* T. A. Dungan, Kipling, Ala. U.S. Pat. 782,953, Feb. 21, 1905.

A NUMBER of cars or trucks holding the wood, &c. to e distilled, are run on a track through a retort, open at ither end, the sides of which are provided with troughs ituated approximately on a level with the floors of the rucks. The floors of the trucks are "turned down at heir edges to engage with the troughs." The open ends f the retort may be closed by gates. Suitable means are rovided for removing the products of distillation from he troughs.—T. F. B.

*Püch; Process of Manufacturing—.* G. von Wirkner, Schalke, Germany. U.S. Pat. 783,916, Feb. 28, 1905.

SEE Fr. Pat. 333,011 of 1903; this J., 1903, 1289.—T.F.B.

#### FRENCH PATENT.

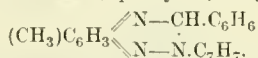
*Tar, Tar Oils, and Mineral Oils; Process of Distilling—.* Rütgerswerke-Aet.-Ges. First Addition, dated Sept. 24, 1904, to Fr. Pat. 329,574, Feb. 20, 1903. Under Internat. Conv., Jan. 21, 1904. (See this J., 1903, 1041.)

IN tar and mineral oils heavier than water, the greater part of the contained water floats on the top of the liquid, the remainder being either mixed with the tar, or dissolved in it. In drying these oils to avoid frothing during distillation, it is proposed to heat the upper portion of the liquid first, to remove the supernatant water, and then to continue the heating downwards; in this way it is stated that the whole of the water can be conveniently removed from the tar. This process may be carried out by having two retorts in the same setting, one for drying and the other for distilling; the furnace is situated beneath the latter, and the flues are so arranged that a part of the furnace gases pass first to an annular space round the upper part of the drying retort, and thence round the lower part of it, and are finally carried up a chimney; the other portion of the furnace gases heats the distilling retort directly, and passes into the same chimney.—T. F. B.

### IV.—COLOURING MATTERS AND DYESTUFFS.

*o-Aminoazo Dyestuffs; Study of the—.* M. Busch and E. Bergmann. Z. Farben- u. Textil-Ind., 1905, 4, 105—113.

o-AMINOAZO dyestuffs differ from the corresponding para-compounds, in that almost invariably they behave as hydrazones of quinone-imines,  $\text{NH:C}_6\text{H}_4\text{:N.NHR}$ , rather than as normal aminoazo compounds. (See Goldschmidt and Rosell, this J., 1890, 494.) The authors find that on benzylating aminoazotoluene with benzyl chloride and sodium carbonate in alcoholic solution, benzylaminoazotoluene is formed, but this is readily transformed in presence of glacial acetic acid into the quinonoid derivative, phenyltolylidihydrotriazine



Goldschmidt and Rosell obtained this latter compound directly by treating o-aminoazotoluene with excess of benzaldehyde, but this was probably owing to the presence in the benzaldehyde of benzoic acid, which favours the transformation of benzylaminoazotoluene into the triazine. o-aminoazotoluene also behaves as a primary amine when treated with benzene sulphochloride in pyridine solution, the corresponding benzene sulphamide being formed. The authors conclude that o-aminoazo dyestuffs have a normal constitution, but are very readily transformed into quinone-imine derivatives. There is a marked difference between the normal aminoazo compounds and the tautomeric heterocyclic derivatives of o-quinone-imino-hydrazones; the former are real dyestuffs, whereas the latter although sometimes coloured, are more or less completely devoid of dyeing properties.—A. S.

*Benzylethylaniline and Benzylidine-aniline; Determination of—.* W. Vaubel and O. Scheuer. XXIII., page 293.

#### ENGLISH PATENT.

*Anthraquinone Derivatives [Anthracene Dyestuffs]; Manufacture of New—.* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 8282, April 11, 1904.

SEE Fr. Pat. 342,195 of 1904; this J., 1904, 898.—T.F.B.

#### UNITED STATES PATENT.

*Sulphur Dye [Sulphide Dyestuff]; Orange—, and Process of Making Same.* R. Gley, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 782,905, Feb. 21, 1905.

SEE Fr. Pat. 341,798 of 1904; this J., 1904, 898.—T.F.B.

## V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

*Cotton Yarn [Embroidery Yarn]: Bleaching of —.*  
E. Harter. *Färber-Zeit.*, 1903, 16, 49—50.

AFTER boiling out, the yarn is well washed and entered at about 30° C. into the bleaching bath (2.5—3.0 kilos. of bleaching powder for 50 kilos. of yarn). The yarn is left in this solution for one hour, with occasional turning, taken out, and, after draining, passed through a cold acid-bath (2—2.5 litres of sulphuric acid at 168° T. for 800—1000 litres of water), and then well washed. It is then treated for some time in a boiling soap bath, washed, and again passed through the old bleaching and acid baths. After a final washing, the yarn is ready for dyeing.—A. B. S.

*Mercerised Cotton: Increased Affinity of — for Dye-stuffs and Mordants.* W. Schaposchnikoff and W. Minajeff. *Z. Farb.-u. Textil.-Ind.*, 1903, 4, 81—84. (See also this J., 1903, 903, and 1904, 604).

PIECES of mercerised and unmercerised calico were mordanted with an alkaline solution of alum, and the amount of alumina absorbed determined. As in the case of the chrome mordant, the results were not consistent.

$\beta$ -Naphthol was absorbed almost equally by both fabrics, but the dyeings of Paranitriline Red were considerably more intense and fuller on the mercerised than on the unmercerised material. In the case of Immedial Blue C, a sulphur determination showed that the mercerised fabric had absorbed about 40 per cent. more dyestuff than the unmercerised; this agrees with the result previously found in direct dyeing with dyes such as

perature. The mordants used were basic ferrous sulphate, basic chromium chloride, and aluminium acetate:—

Mordant.	Strength ° B.	Ratio of fibre to metal oxide after treatment to that of fibre to metal oxide after treatment number—							
		1	2	3	4	5	6	7	8 9
Iron ...	30	100	51	49	49	41	60*	40	38 30
Chrome	20	100	29	26	25	24	18	14	15 14
Alumina	7.5	100	Average 2.3						

\* After the fifth mordanting with iron, the silk was heated in a soap bath.

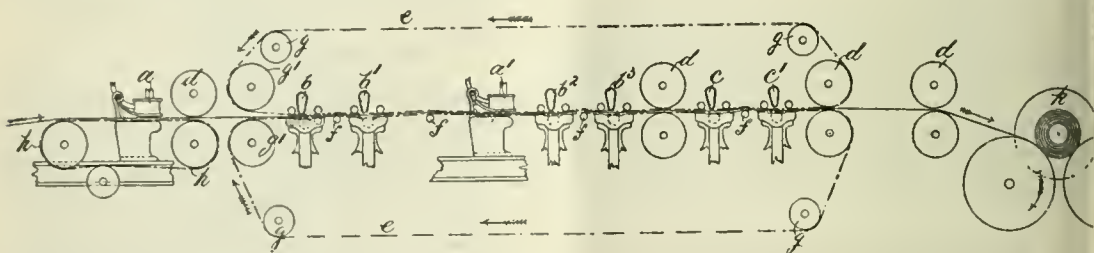
Each treatment in the iron mordant occupied one hour in the chrome and alumina mordants, 24 hours.—T. F. B.

*Wool Oil: Preparation of Sulphonated —.*  
P. Pollatschek. *XII.*, page 282.

*Bleaching and Cleansing of Vegetable Fibres.*—L. J. and F. Erban, Nachod, Bohemia. Eng. Pat. 31, Feb. 12, 1904.

VEGETABLE textiles are said to be thoroughly cleaned and bleached by immersion, at ordinary temperature in a bath containing an alkali hypochlorite and a "clarifying body." For example, for 100 kilos. of dry cotton, the bath may consist of 500 litres of sodium hypochlorite solution (containing 0.3 per cent. of available chlorine) to which has been added 10 litres of Turpentine oil or castor oil soap (containing 75—80 per cent. fatty acid). The treatment is complete in two or three hours.—T. F. B.

*Mercerising, and Apparatus therefor.* W. Mather,



Indigo White and Diamine Blue 3B. With Aniline Black the unmercerised material absorbs a little more than the mercerised. If the cotton be mercerised after dyeing, it becomes darker in shade; this may be partly due to the contraction.—A. B. S.

*Dyeing Processes [Mordanting]: Contribution to the Knowledge of —.* VIII. Repeated Mordanting with Iron, Chrome, and Alumina. P. Heermann. *Färber-Zeit.*, 1905, 16, 66—70.

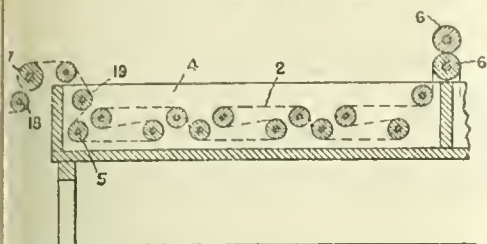
THE effect of repeatedly mordanting silk with tin has already been described by the author (this J., 1903, 1344). As the result of repeated passages of silk through iron and chrome mordants, fixing and washing between each treatment, it was found that the amount of mordant (calculated as oxide) taken up by the fibre, decreased with successive passages, the decrease in the case of the chrome mordant being much more rapid than when an iron mordant was employed. With alumina mordants, the increase in the ratio of alumina to fibre was very slight and irregular with successive treatments; in fact, for practical purposes it may be neglected. The following results were obtained, using boiled-off silk, and mordants of "normal" basicity, working at the ordinary tem-

Hübner and W. J. Pope, Manchester. Eng. Pat. 67, March 16, 1904.

IN the mercerisation of delicate fabrics unable to withstand tension, such as muslins, laces, as well as yarns of unspun cotton, the material is held in a compressed condition between sheets of wire gauze during the operations of wetting out, treating with caustic soda lye, and washing. The pressure of the wire gauze suffices to prevent or minimise contraction of the cotton fibres during mercerisation. The invention is applied in two ways. In the one the material is rolled up with wire gauze, the whole then wetted out with steam or water, impregnated with caustic soda lye and subsequently washed; the operations may be carried out in a centrifugal machine. In the other method, which is a continuous one, the material is fed between two endless bands, *e* of wire gauze which travel horizontally, holding the material between them, under pipes from which steam, caustic soda lye and washing water are forced through the gauze and material at *a*, *b* and *c*. A preliminary wetting out with steam is performed at *a*. Squeezing rollers, *d*, are provided where needed, and suction boxes are fitted underneath the supply pipes for steam, caustic soda and washing water in order to remove the excess of liquor retained by the material.—A. B. S.



*Dyeing Warps for Weaving, and otherwise Treating them with Liquids; Apparatus for —.* R. W. Goddard, Bedford. Eng. Pat. 5247, March 3, 1904.



der to maintain a uniform sheet of yarn during the treatment, the "yarn 2" is passed over a roller 17 and rollers 18 and 19 before it enters the liquid; the roller 19 is on the same level as the surface of the liquid. (See Eng. Pat. 15,038 of 1901; this J., 1132.)—T. F. B.

*Production of Blue to Blue-black Shades on —.* Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. g. Pat. 8288, April 11, 1904.

Fr. Pat. 342,026 of 1904; this J., 1904, 899.—T. F. B.

*Dyeing Raw Cotton, Loose Wool or Silk, Rags, Mungo, Straws, Slubbings and the like; Apparatus for —.* W. Kemp, Blackpool. Partly from J. F. Morley, S. Hamilton, Canada. Eng. Pat. 13,895, June 20, 1904.

A TATABLE cage, composed of two perforated cylinders, one inside the other, around a central horizontal shaft, and provided with radial divisions, extending throughout the length of the cage, and with perforated doors and a movable cover, is mounted within a dye-vessel in such a manner as to be partially immersed in the dye-liquor contained in this. The materials to be dyed, if in the loose state, are packed in this condition in compartments formed by the radial divisions; if in form of yarns, they are spread in hawk-form upon the divisions, which are constructed so as to fit into the compartments, and are thus placed in the latter.—E. B.

*Dyeing [Dyeing, &c.] Yarn; Machines for —.* J. W. Hies, Winston-Salem, N. Carolina, U.S.A. Eng. Pat. 10,084, Nov. 30, 1904.

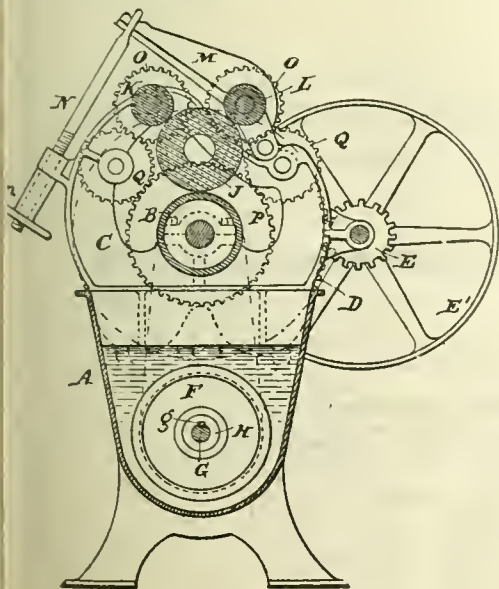


FIG. 1

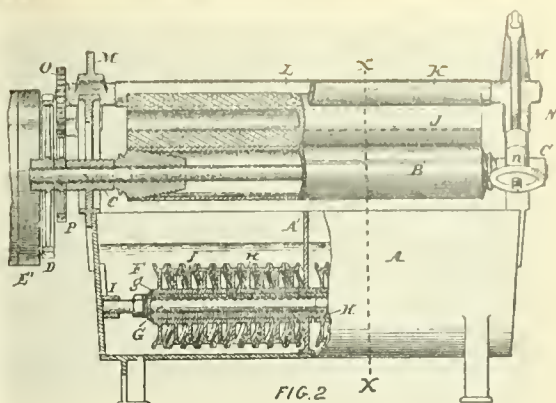


FIG. 2

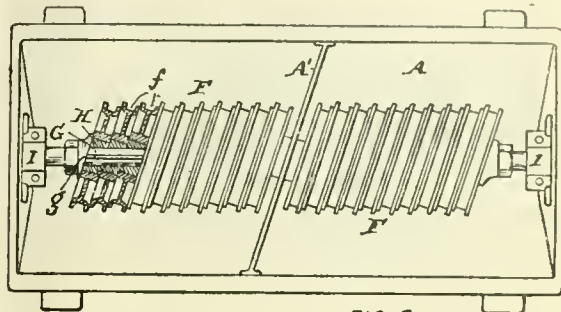


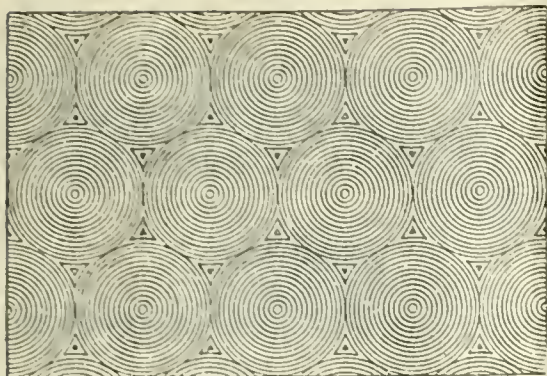
FIG. 3

A STATIONARY shaft G (see figures), fixed in bearings I within a dye-vessel A, carries upon it a number of wheels H, with oblique centres, upon which a series of larger wheels F with grooved rims is journaled. A metal roller B, suitably driven, is mounted above the vessel. Upon this rests a hollow, tubular, indiarubber roller J, internally unsupported, externally supported by the roller B and by two other rollers, one K of which is carried in fixed, the other L in movable bearings, to the end that the degree of squeezing-pressure to which the yarns are subjected by the rollers B and J may be adjusted as desired. The obliquity at which the wheels F are set, causes the yarns which pass alternately partly around them and partly around the roller B gradually to travel from one end of the apparatus to the other, the revolution of the wheels F being effected by the tension exerted upon them by the yarns.

The apparatus which, it is stated, is especially useful in dyeing yarns with Indigo, enables long lengths of these, while being repeatedly immersed in dye-liquors and squeezed, to be passed in the form of "webs," and in a continuous manner through it. If desired, one of the wheels F may be omitted from the shaft G, and its place taken by a division plate A<sup>1</sup>, for the purpose of treating the yarns with two different dye-liquors during their passage through the machine.—E. B.

*Silky Finish on Textile Fabrics or Paper; Engraved Bowls or Rollers for Producing an Improved —.* W. J. Pope and J. Hübner, Manchester. Eng. Pat. 4907, Feb. 29, 1904.

THE ordinary engraved or "Schreinerised" finish on textiles is obtained by impressing the fabric with a metal cylinder engraved with some hundreds of straight lines to the inch; the full lustre of the finish thus obtained is only seen when the light falls on the fabric in a particular direction, and the finish is therefore termed non-homogeneous. The inventors obtain a homogeneous finish and a new technical effect by engraving the metal cylinder with sets of concentric circles (see figure) or similar closed figures arranged concentrically, each set of figures being so small as not to be distinguishable by the naked eye.



The finish obtained by impressing the fabric with such a cylinder presents the same appearance in whichever direction it is examined, and the lustre of the finish is further enhanced by the fact that the sets of concentric figures "shimmer," or appear to move. The lines on the engraved cylinder are from 1/100 in. to 1/500 in. apart.—A. B. S.

#### UNITED STATES PATENTS.

*Mercerising Apparatus.* P. Edlich, Triebes, Germany.  
U.S. Pat. 783,569, Feb. 28, 1905.

SEE Eng. Pat. 894 of 1903; this J., 1903, 416.—T. F. B.

*Designs upon Flexible Fabrics; Machine for Printing* — G. A. Herzog, San Francisco. U.S. Pat. 783,580, Feb. 28, 1905.

THE machine consists of a framework supporting design and transfer rollers; the former rotates in a bearing, and the latter presses by means of gravity against the former, the transfer roller being mounted on roller bearings. The colour is applied to the transfer roller by a suitable device situated beneath it. The web of fabric is fed over the design roller, and is then returned itself by means of a curved shield; its freshly coloured surface is then brushed with a rotating "blending" roller operated by a band from the design roller.—T. F. B.

#### FRENCH PATENT.

*Dyeing with Oxidation [aged] Black on Animal or Vegetable Fibres and Fabrics therefrom; Process of* — F. Könitzer. Fr. Pat. 347,067, Oct. 8, 1904.

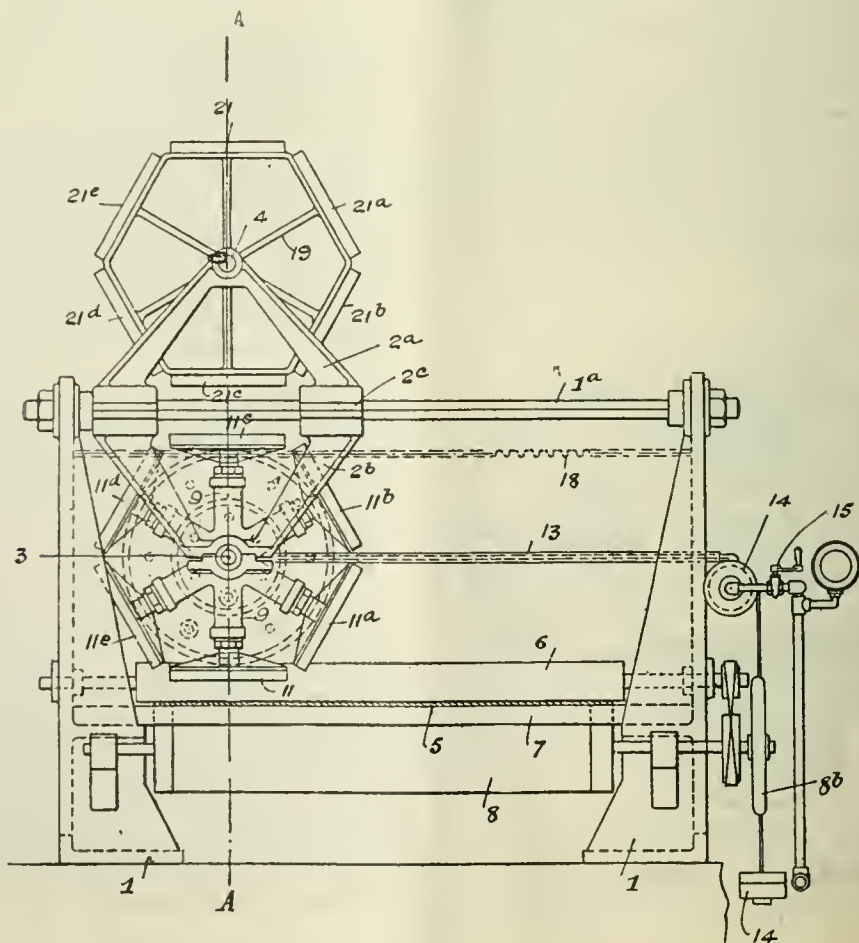
SEE Eng. Pat. 21,634 of 1904; this J., 1905, 85.—T. F. B.

### VI.—COLOURING WOOD, PAPER, LEATHER, &c.

#### ENGLISH PATENT.

*Linoleum, Oilcloth, and the like Materials; Machine for Printing the Pattern on* — H. C. Shavels. Eng. Pat. 7256, March 26, 1904.

THIS invention relates to machinery for printing the pattern on linoleum or other material to which is to be applied





the pigment. The colours are applied by means of shaved flat square plates, 11, 11a, &c., mounted on axes which work in cylinders 9 which radiate from a central axis 3 thus forming a rotating plate-carrier, which is supported on a travelling frame 1a above the bed, over which the web of material (5) passes. Above the frame is situated an inking frame, consisting of a set of inking plates 21, 21a, &c., mounted on a shaft 4, which is connected by gearing to the shaft of the printing carrier, so that each printing plate may be brought into contact with the corresponding inking plate. When a coloured fluid is introduced through the flexible tube 11 the pistons 9 are driven forward, thus causing the plates (11) to press upon the material, and the next one (11c) to meet the corresponding inking plate. When the whole pattern is printed upon a square piece of material, the printing plate carrier is moved along the shaft (1a) to the desired position, and the operations are repeated, and so on until the whole width of material is printed. At this stage the material is advanced the required distance upon the bed by means of a roller 8 provided with teeth, and the process repeated.—T. F. B.

## VII.—ACIDS, ALKALIS, AND SALTS.

*Potassium Chloride, Bromide, and Iodide; Solubility in Water.* A. Meusser. Z. anorg. Chem., 1905, 44, 79-80.

The author determined the solubility of potassium chloride, bromide and iodide in water at temperatures above and below 0° C. The results are shown in the following table:—

Potassium chloride.		Potassium bromide.		Potassium iodide.	
Temperature in °C.	Grms. of salt per 100 grms. of water.	Temperature in °C.	Grms. of salt per 100 grms. of water.	Temperature in °C.	Grms. of salt per 100 grms. of water.
+ 18.5	33.3	10.5	62.1	— 1.0	122.2
11.5	31.2	10.0	60.7	— 5.0	119.8
10.0	30.8	9.5	59.5	— 4.0	117.4
7.5	29.8	0.0	52.6	— 10.0	115.1
2.5	28.4	— 5.0	50.1	— 14.0	75.8
0.0	27.5	— 8.0	47.5	— 11.5	64.7
— 1.0	27.2	— 11.5	45.3	— 9.5	51.5
— 4.5	25.9	— 11.0	44.9	— 7.0	42.6
— 9.0	23.9	— 10.5	41.8	— 6.0	34.4
— 8.5	21.5	— 10.0	39.7	— 5.0	25.7
— 8.0	20.0	— 8.5	35.7	..	..
— 7.0	17.5	— 8.0	31.2	..	..
— 6.0	15.7	— 6.5	25.0	..	..
— 5.5	14.3	..	..	..	..

—A. S.

*Carbonate; Action of Alkali Chlorides on* —. Passanik. Schweiz. Ver. anal. Chem., Jan. 17, 1905; em. Zeit. 1905, 29, 199.

Zinc carbonate is heated with solutions of alkali chloride, partial formation of alkali carbonate and zinc chloride occurs, as in the reaction of alkaline earth carbonates upon ammonium chloride.—J. T. D.

*Sodium Acetate; Manufacture of* — from *Pyrolytic acid*. C. Bauer. Chem.-Zeit., 1905, 29, 181.

Addition of 20 kilos. of caustic soda to 2000 kilos. of sodium acetate liquor of 27 B° light yellow crystals are obtained, which after recrystallisation give a white product of good commercial value, the yield being 90 per cent.—R. L.

*Potassium Permanganate and Hydrochloric Acid; Reaction between* —, in presence of Ferric Chloride. J. Brown. anorg. Chem., 1905, 44, 144-153.

The author has repeated Wagner's experiments (this J., 1899, 527), heating N/10-potassium permanganate solution to 50° C., for some time with N/1-hydrochloric acid with and without the addition of N/10-ferric chloride solution, then adding oxalic acid equivalent to the permanganate originally taken, and titrating with permanganate. The results showed that in all cases per-

permanganate had been reduced during the digestion; but though on the average the amount reduced was greater when ferric chloride was present, as Wagner maintained, yet the results were widely divergent, and the amounts reduced greatly in excess of those found by Wagner. Further experiments showed that when the chlorine formed during the digestion was removed by bubbling carbon dioxide or air through the liquid during digestion, the amounts reduced were practically constant, were much greater than in the former set of experiments, and were alike whether ferric chloride was used or not. Moreover, the amount reduced was greatly increased, even up to 30 times the amount obtained by Wagner, by increasing the amount of original permanganate, keeping other factors unchanged. Wagner's results, then, do not prove the existence of any catalytic action of ferric chloride on the reaction between permanganate and hydrochloric acid, nor do they justify the assumption that a chloroformic acid (akin to chloroplatinic acid), is formed. If they indicate any action of ferric chloride at all, it is that it has possibly some effect on the oxidation of oxalic acid by free chlorine.—J. T. D.

*Perborates.* J. Bruhat and H. Dubois. Comptes rend., 1905, 140, 506-509.

The solutions of the perborates have an alkaline reaction and may be regarded as equivalent to mixtures of borates with hydrogen peroxide; the active oxygen is liberated by acidifying the solution, by heat, and by a large excess of water.

A solution of perborate in presence of excess of the salt, contains only the active oxygen corresponding to the dissolved portion. Manganese dioxide, however,

decomposes the whole of the perborate present, whether dissolved or not. The same total decomposition is also brought about by catalytic organic ferments, reductases or oxydases. The solution of hydrogen peroxide produced by the action of strong sulphuric acid on the perborates decomposes spontaneously with evolution of ozone. The alkalinity of solutions of perborates does not prevent them from liberating iodine from potassium iodide; the colour of the iodine soon disappears and oxygen is evolved. Perborates convert chromic acid and molybdic acid into perchromic acid and yellow permolybdates; they yield colour reactions with titanous and vanadous acids. They readily oxidise protoxides and their salts into higher oxides, but do not always form perborates with them. Ferrous, mercurous, manganous, and lead salts yield higher oxides without formation of perborates; the salts of other metals yield perborates of an indefinite or basic composition; uranyl perborate UBO<sub>4</sub> is, however, a yellow compound of great stability. Perborates of the alkali metals may be obtained by precipitation of mixtures of alkali borates in presence of hydrogen peroxide. The authors describe potassium biperborate, KP<sub>2</sub>O<sub>5</sub>.2H<sub>2</sub>O, ammonium perborate NH<sub>4</sub>BO<sub>3</sub>.H<sub>2</sub>O and sodium perborate NaBO<sub>3</sub>.4H<sub>2</sub>O. The latter when carefully dried, gradually loses water, forming the tri-, di- and monohydrated salts. The last is very stable and definite, containing 16 per cent. of

active oxygen; its solubility is increased in presence of feeble acids, and it is readily soluble in glycerin.—J. E. B.

*Boron Peroxides; Alkali Salts of — and their Reactions.*  
O. Christensen. Oversigt over Videnskabelnes Selskabs Forhandling, 1904, 6, 397. Chem.-Zeit. 1905, 29, Rep., 43.

To prepare sodium perborate, 60 grms. of boric acid are added to a solution of 40 grms. of caustic soda in 200 c.c. of water, and when completely dissolved, 120 c.c. of 30 per cent. hydrogen peroxide are carefully introduced. When, after some time, a crystalline deposit has formed, 400 c.c. of water are added and the mixture allowed to stand for 2 days; 100 grms. of the crystallised salt are thereby obtained. Sodium perborate is a strong oxidising agent and readily oxidises chromic acid to the characteristic blue perchromic acid soluble in ether. With the exception of sodium and rubidium perborates, the salts of the alkali metals in general are fairly stable, but in solution there is always partial decomposition. The decomposed compounds can, however, be regenerated by addition of hydrogen peroxide, but the salts of the potassium group usually take up more than the theoretical quantity of oxygen. This fact, the author believes, points to the existence of higher unstable perborates of the type  $R.BO_4$ .—B. J. S.

*Centrifugal Purification [Salts]; Efficiency of —.*  
T. W. Richards. J. Amer. Chem. Soc., 1905, 27, 104–111.

A NUMBER of experiments are described, showing the extent of purification obtained by filtration and recrystallisation on the one hand, and centrifugal separation on the other hand. The experiments were all carried out on sodium nitrate which had been crystallised from a solution containing about 2 per cent. of nitric acid. By filtration only, crystals containing about 0.5 per cent. of nitric acid were obtained. A short treatment in a centrifugal separator reduced the amount to under 0.2 per cent., whilst by a further washing with water (1 c.c. to each 10 grms. of salt) the amount of nitric acid was reduced to 0.05 per cent. By recrystallising the product and repeating the treatment, sodium nitrate containing only 0.0001 per cent. of nitric acid was obtained; it required nine recrystallisations to produce so pure a product without using centrifugal separation. The most effective and rapid method of procedure was found to be to stop the centrifugal several times, and stir the crystals with a small quantity of the washing fluid; thus, after three such treatments with water (1 c.c. to 5 grms. of salt), sodium nitrate containing only very slight traces of nitric acid was obtained. Suitable apparatus is described for applying centrifugal methods to the purification of small quantities of substances.—T. F. B.

*Phosphorus; Preparation of —.* M. Neumann. Z. angew. Chem., 1905, 18, 289–292.

HEMPEL (this J., 1905, 195) was unable to obtain reduction of phosphorus from metaphosphoric acid. His yield of 92.5 per cent. gives no true criterion as to the efficiency of the method described, as the phosphorus obtained was impure. The reduction of monocalcium phosphate,  $H_4Ca(PO_4)_2$  by means of carbon, can never yield a really good result, since part of the phosphorus must always remain in the residue, combined with the calcium. The author, however, in experiments without the use of electric heat, has obtained yields of 80 per cent. of pure yellow phosphorus by the reduction with carbon of metaphosphoric acid from crude Belgian calcium phosphate, at a price of 1.50 to 1.60 mark per kilo. for the finished product. The temperature of reduction ( $650^\circ$ – $850^\circ$  C.) is much lower than that required for the reduction of calcium monophosphate ( $1000^\circ$ – $1200^\circ$  C.), and the cost of heat in the latter case is thus much greater. To obtain thus practically all the phosphorus from metaphosphoric acid, it is essential that the acid employed shall be dry, for if it contain moisture much of the phosphorus will be converted into hydrogen phosphide. In the author's opinion the yields obtained by the electric method of heating do not justify the increased cost; and it is pointed out that

Hempel does not give the yields of pure phosphorus obtained. An advantage claimed by Neumann in his metaphosphoric acid method, is that cheap mineral phosphates can be used instead of the comparatively dear ash, but the extraction of the phosphoric acid should be carried out so that there is but little iron or alumina since these bases retain phosphoric acid in the residue just as lime does. Notwithstanding this, the phosphoric acid extracted from a poor Belgian phosphate containing 50 per cent. of  $Ca_3(PO_4)_2$  and 6 or 7 per cent. of  $FeAl_2O_4$  yielded as much as 80 per cent. of pure phosphorus. In addition, 6 to 8 per cent. of amorphous phosphorus could be recovered from the condensed water, and 3 per cent. or 4 per cent. were present as phosphoric acid. About 5 per cent. remained in the residue as silico-phosphate, leaving a final deficiency of 5 per cent. lost as phosphoretted hydrogen, &c. Little diffusible phosphorus seemed to occur through the walls of the retort but any such loss was minimised by working under a vacuum.—C. A. M.

*Nitric Acid; Gravimetric Determination of —.*  
Busch. XXIII., page 291.

*Ammonia; Electrolytic Oxidation of — to N<sub>2</sub>.*  
E. Müller and F. Spitzer. XI A., page 279.

*Ammonia; Electrolytic Oxidation of —.* W. T. b. XI A., page 280.

*Bismuth Ammonium Molybdate; Application of — to Gravimetric Analysis [Determination of Bismuth].*  
E. H. Miller and F. V. D. Cruser. XXIII., page 291.

#### ENGLISH PATENTS.

*Nitric Oxide and Nitric Acid; Production of — from Air or other Mixture of Oxygen and Nitrogen.*  
H. Pauling, Bismarck, Germany. Eng. Pat. 40,000, March 7, 1904.

THE essential feature of the invention consists in heating air to a very high temperature to induce the formation of nitric oxide, and then suddenly cooling the heated air to prevent loss of the nitric oxide by reversal of the reaction. In one apparatus for carrying out the reaction, air is forced through a highly-heated chamber, and leaving the latter through a small outlet meets a cold atomised water. Or, air heated over an electric resistance is suddenly cooled at the place of maximum heating by water-cooled tubes; or by a water-spray.—E. S.

*Nitrate, Nitrite, or Sulpho-Nitrate or Nitrite of Soda, or Potash; Processes for Manufacturing —.*  
J. Price, London. Eng. Pat. 24,297, Nov. 9, 1905.

OXYGEN and nitrogen, obtained as described in Eng. Pat. 14,213, 1903 (this J., 1904, 787), or by fractional distillation of liquid air, are stored in separate gasometers and are discharged thence under pressure, in the proportions, into the lower part of a series of communicating vessels, charged with solutions of basic substances, or with such substances in a dry or deliquescent condition, through or over which the gases pass. "Carrying" or "converting" apparatus, among which gypsum, carbon, spongy platinum, sodium sulphate and sodium bicarbonate, are specified, are used to or suspended in the solution; or, in the case of the use of carbon or the like, may form a diaphragm packing through which the gases pass upwards. The chemical combinations may be assisted by the introduction of ozone. The solutions when saturated, are drawn off and concentrated for crystallisation, or are dried, to give the different products. The nitrates obtained, particularly calcium nitrate, may be compounded with gypsum or sodium sulphate for manurial application.—E. S.

*Hydrate of Aluminium; Simultaneous Preparation and Purification of —.* A. J. Boulton, London. Proc. Società Romana Solfat, Rome. Eng. Pat. 3776, Feb. 1904.

ALUMINOUS minerals containing potassium, such as



te, are attacked by sulphuric acid, and the alum obtained in crystalline form. From the hot solution the alum, aluminium hydroxide is precipitated by sodium carbonate, in a condition stated to be easily filtered, and free from iron and silica, which remain in solution. From the resulting solution of potassium and sodium sulphates, the two salts may be separated by successive crystallisations. The ammonium sulphate may be decomposed by lime, for instance, to recover the ammonia for continued use. (See also Fr. Pat. 330,280, March 16, 1903; this J., 1903, 1086.)—E. S.

*Allic Bases or Compounds; Means for the Recovery — from their Acid Solutions.* A. Gutensohn, unthd. Eng. Pat. 4462, Feb. 23, 1904.

Fr. Pat. 344,630 of 1904; this J., 1904, 1222.—T. F. B.

*on; Process of and Apparatus for Separating — in Pulverised Carbonaceous Materials.* J. D. Darling, Philadelphia. Eng. Pat. 6863, March 21, 1904.

U.S. Pat. 763,859 of 1904; this J., 1904, 780.—T. F. B.

# UNITED STATES PATENTS.

*Acids; Apparatus for the Recovery of — from Solutions.* E. R. Hewitt, Garden City, N.Y. U.S. Pat. 3,783, Feb. 28, 1905.

apparatus is intended for the recovery of volatile from solutions containing soluble salts. Live steam is introduced into the receptacle containing the solution, through a pipe entering the side near the bottom. The open end of the pipe is surrounded by a curved condensing chamber, whereby condensation of the steam is induced, and a cooling motion is imparted to the solution. Fresh steam is introduced through an opening in the top of the receptacle rising from the upper portion of the receptacle. A spray-plate is arranged immediately below the solution, and a side tube is provided, below the spray-plate, for the exit of the volatile products.—A. S.

*Process of Treating —.* C. Ellis, Boston, and B. Chalmers, Dedham, Mass. U.S. Pat. 783,750, May 28, 1905.

ly, completely hydrated lime, containing an insoluble iron oxychloride, is produced by completely hydrating lime with a dilute solution of a metallic salt capable of forming an insoluble oxychloride with the lime.—T. F. B.

*corides; Electrolytic Production of — in Alkaline Solutions.* H. Rodman, Assignor to Electric Storage Battery Co. U.S. Pat. 782,989, Feb. 21, 1905. XI A., 1905, 281.

*Separating Process.* J. E. Johnson, jun., Longdale, Va. U.S. Pat. 783,045, Feb. 21, 1905.

py of liquid air is heated to the boiling point of oxygen, and the evaporated nitrogen is withdrawn, simultaneously with rotation of the body of liquid, whereby centrifugally removing from the source of heat residual liquid rich in oxygen, cooling another portion, and rotating the cooled air in proximity to the inner body of liquid air, thereby compressing, cooling, and liquefying it.—E. S.

# FRENCH PATENT.

*uric Anhydride; Apparatus for the Manufacture — [by the Contact Process].* Soc. de la Fabr. de ac. Chim. de Tentelewa. First Addition, dated Oct. 4, 1904, to Fr. Pat. 321,275, of May 20, 1902. (See this J., 1903, 212.)

chamber containing the vertical contact tubes is surrounded by a chamber of greater diameter, from which is isolated by a perforated cast-iron plate, on which is placed the greater part of the contact material, immediately above which is placed a thermometer, from the readings of which the temperature is controlled. The lower part of the larger chamber is provided with a perforated plate which serves to scatter and distribute the gases which arrive, in part from an adjoining reheater,

and in part from an external source. The apparatus, which is surrounded by a non-conducting material, is heated initially by passing through it heated air, after which the required temperature is maintained by regulation of the admission of gas and air. The sulphuric anhydride formed flows down from the contact tubes in the lower cylinder, below which it is collected.—E. S.

# VIII.—GLASS, POTTERY, AND ENAMELS.

## UNITED STATES PATENT.

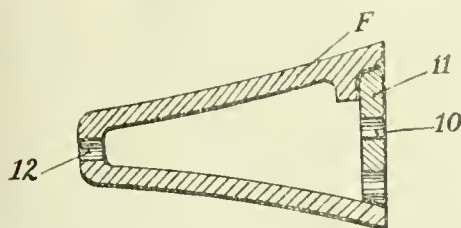
*Glass [Sheet]; Process of Making —.* W. E. Neal, Marion, Ind. U.S. Pat. 782,394, Feb. 14, 1905.

MOLTEN glass is drawn through an endless elongated slot so as to form a vertical tube having flat faces united by convex faces. To resist the inward pressure of these convex faces during the cooling, endless cords disposed longitudinally are advanced against the tube, being protected by a ribbon of non-combustible material. The tube is then cut into lengths, which are annealed, after which the convex faces are severed from the flat faces so as to leave flat sheets.—A. G. L.

## FRENCH PATENTS.

*Crucible for Glass for Continuous Working.* F. Lang. First Addition, of Oct. 5, 1904, to Fr. Pat. 343,309, of May 19, 1904 (this J., 1904, 1090).

To the crucible previously described is added a so-called



“boot,” a cone-shaped vessel (see figure) in which the necks of the bottles made are annealed in the main furnace itself. The “boot” is supported by projections on a platform beside the vessel in which the ladle is worked. The necks of the bottles are thrust through the holes (10), (11), of the lid, whilst hot gases enter through the opening (12) at the rear.—A. G. L.

*Glass in Sheets; Manufacture of — and Apparatus therefor.* Window Glass Machine Co. Fr. Pat. 347,079, Oct. 13, 1904.

SEE Eng. Pat. 22,065, of 1904; this J., 1905, 29.—T. F. B.

*Glass-Furnace for Gaseous Firing for the Continuous Working of Uncovered Pots and the simultaneous production of Different Kinds of Glass.* A. A. Marchand. Fr. Pat. 347,122, Oct. 15, 1904.

THE invention consists essentially in combining with each furnace one or several groups of gas-producers, each group consisting of two producers worked at different rates, the pots being strongly fired during the fusion of the raw materials, and gently heated during the succeeding period of working the glass. In the furnace the pots also are divided into two groups, each of which can be connected with each producer, the heating of each being independent of that of the other. Suitable regenerators are also provided.—A. G. L.

# IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

*Portland Cement; Materials which retard the Setting of —.* R. C. Carpenter. Eng. Record, 1904, 50, 769—770. Science Abstracts, 1905, 8, B, 132.

KNISKERN and Glass have recently investigated the

retarding action of gypsum and calcium chloride on the setting of Portland cement. In the case of gypsum the maximum retarding effect was produced by an addition of 1.5 per cent. The retarding effect disappeared when the mixture of cement and gypsum was exposed to the air, but was restored by the addition of 2-4 per cent. of slaked lime on gauging. Small additions of gypsum for the purpose of retarding setting did not diminish the ultimate strength of the cement, except when the latter was exposed to sea water. The maximum retarding effect of calcium chloride was produced by an addition of about 0.5 per cent. (rather less than 2 lb. per barrel of cement); this addition had no injurious action on the ultimate strength of the cement. It is preferable to add the calcium chloride in the form of a solution when gauging, rather than to add the dry salt during the grinding of the cement clinker. (See also Candlot, this J., 1889, 543; 1890, 736; 1891, 140.)—A. S.

*Powdered Substances, especially Sand; Evolution of Heat on Moistening — with Water, and Experiments on the Behaviour of Water below 4° C. in this respect.* G. Schwalbe, Ann. der Physik., 1905, 16, 32-45. Chem. Centr., 1905, 1, 580-581.

THE fact that absorption of heat takes place when porous stones are moistened with water below 4° C., has been observed by many investigators, but the statements on the subject are conflicting. The cause of the alteration of temperature is the compression of the water at the surface of the solid body. At 4° C. the effect of change of temperature on the volume of water is reversed, therefore the converse should also hold good, i.e., the change of temperature due to alteration of pressure should also be reversed. Experiments were tried with silicic acid, with various kinds of sand, and with glass powder. With the last-named, no alteration of temperature was observed on moistening. In the case of silicic acid and sand, in accordance with theory, absorption of heat was observed with water below 4° C., evolution of heat with water above 4° C., and no change at all with water at 4° C. As the temperature of the water rose, the evolution of heat increased. The amount of water, which with a given quantity of a solid substance causes a maximum evolution of heat, is different for each substance. The numbers found by experiment appear to bear some relation to the fineness of grain of the material. The very fine-grained silicic acid needed the greatest quantity of water, and gave the greatest evolution of heat; the smallest numbers were obtained with sea-sand.—A. S.

#### ENGLISH PATENTS.

*Stone; Manufacture of Artificial —.* W. Glossop, Halifax, Yorks. Eng. Pat. 8504, April 13, 1904.

To give disinfecting or hygienic properties to artificial stone, concrete, cement, mortar, or other manufactured building or paving materials, a suitable disinfectant or antiseptic substance is incorporated with the ingredients at any convenient stage of the manufacture.—W. C. H.

*Wood; Apparatus for Impregnating or Dyeing —.* G. Kron, Copenhagen. Eng. Pat. 9175, April 21, 1904.

SEE Fr. Pat. 346,723 of 1904; this J., 1905, 241.

—W. C. H.

*Wood; Process of and Means for the Impregnation of — with Antiseptic and like Substances or Liquids.* G. Conti-Vecchi, Rome. Eng. Pat. 14,183, June 23, 1904.

SEE Fr. Pat. 344,204 of 1904; this J., 1904, 1091.—T. F. B.

*Bricks, Artificial Stone, and Similar Products; Process of Making —.* L. F. Kwiatkowski, New York. Eng. Pat. 24,712, Nov. 15, 1904.

SEE U.S. Pat. 775,222 of 1904; this J., 1904, 1217.—T. F. B.

#### UNITED STATES PATENT.

*Bricks, Tiles, &c.; Composition for —.* W. Maguire, Toronto, Canada. U.S. Pat. 782,916, Feb. 21, 1905.

THE material consists of a mixture of 25 to 40 per cent.

of magnesian chloride, 10 to 25 per cent. of calcined magnesite, about 25 per cent. each of glass and of sand. The ingredients are mixed together in a liquid paste state, and are allowed to harden.—R. S. H.

#### FRENCH PATENT.

[Wood, Stone, &c.]; *Method of Impregnating.* Hüls and Co. First Addition, of Sept. 27, 1904, to Fr. Pat. 319,758, of March 19, 1902.

WOOD or other material is treated with the impregnating liquid in a closed chamber under a pressure of several atmospheres. The excess of the liquid is then drawn and the chamber exhausted, when the expansion of air in the pores of the material drives most of the liquid out of the interior, so as to leave only the pores nearest the surface filled with the liquid. The preliminary treatment of the material with compressed air or gas, as described in the main patent, is omitted. (See Eng. Pat. of 1902; this J., 1902, 1028).—A. G. L.

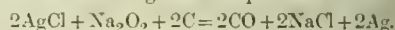
#### X.—METALLURGY.

*Fine Ore, Flue-Dust, Downcomer-Dust, and Store-Residue; Utilisation of — in the Blast Furnace.* J. C. J. Amer. Chem. Soc., 1905, 27, 142-144.

IT is proposed to agglomerate the fine ore, &c., which accumulates at metallurgical works, by coking bituminous coal. The process may be conveniently carried out in a "bee-hive" oven, and the product said to be well suited for reduction, containing more than sufficient carbon for the purpose. Agglomerates from fine ore containing 51 per cent. of iron, and times its weight of coal were found to contain iron, 60 per cent.; lime, 2.35 per cent.; magnesia, 0.36 per cent.; alumina, 2.00 per cent.; fixed carbon, 61.6 per cent.; volatile matter, 10.56 per cent.—T. F. B.

*Metallic Silver; Preparation of — in Small Quantities.* J. Thallwitz. Z. physik. u. chem. Unterr., 1905, 224. Chem.-Zeit., 1905, 29, Rep., 45.

A MIXTURE of silver chloride, charcoal, and sodium peroxide spontaneously decomposes with formation of metallic silver according to the equation:—



IN practice the theoretical quantities of charcoal, sodium peroxide are thoroughly mixed and placed in a small crucible. Finely-powdered silver chloride is sprinkled on the surface and carefully stirred in. After a few minutes, the mixture inflames, and the metallic silver is left in shining globules.—B. J. S.

*Barium; Preparation of —.* M. Guntz. Ann. Chem. Phys., 1905, 8, 5. Chem.-Zeit., 1905, 29, Rep., 45.

THE author has succeeded in obtaining pure metallic barium. A quantity of barium amalgam (3 per cent. of mercury) is heated electrically in an atmosphere of hydrogen at 40 cm. pressure, till it contains 10 per cent. of barium. The resulting product is placed in an iron vessel and gradually heated to 950° C. in *vacuo* over a mercury pump. A residue is thereby obtained containing 98 per cent. of barium, and 2 per cent. of iron and mercury. Great care must be exercised in manipulating the temperature, constant observation of the pyrometer being essential.

Metallic barium has a greyish colour somewhat that of lead; it melts at 850° C. and boils at 1150° C. In the molten state it dissolves most metals easily, being one of the most refractory. It is readily attacked by water and alcohol. At 600° C. it combines with hydrogen, forming a stable hydride  $\text{BaH}_2$ , which reacts with nitrogen to form a nitride  $\text{Ba}_3\text{N}_2$ .

On adding barium to barium chloride a monochloride  $\text{BaCl}$  is obtained, the formation of which probably explains the difficulty of electrolyzing this salt. It acts in a similar manner, except that a double chloride  $\text{NaCl.BaCl}$  is formed. The corresponding iodine compound  $\text{NaI.BaI}$  yields barium amalgam when treated with mercury.—B. J. S.



*inium-Bronze; Special Constituent obtained on quenching* —. P. Breuil. Comptes rend., 1905, 1, 587—590.

author has examined a copper-aluminium alloy "Fortior," which melts at about  $1010^{\circ}\text{C}$ .— $1030^{\circ}\text{C}$ . as a transformation point between  $690^{\circ}\text{C}$ . and  $730^{\circ}\text{C}$ . metal was examined as cast, and also after quenching in water from temperatures of  $550^{\circ}\text{C}$ .,  $650^{\circ}\text{C}$ .,  $750^{\circ}\text{C}$ ., and  $950^{\circ}\text{C}$ . The metal as cast showed large white in a black eutectic; when chilled from  $550^{\circ}\text{C}$ . it was nearly homogeneous and granular, and the blackie had almost disappeared. On chilling from  $750^{\circ}\text{C}$ . a new constituent appeared in the form of elated needles resembling martensite in character; as the temperature from which quenching took place further raised, this martensitic constituent became predominant and ultimately the sole constituent. Its increase the elastic limit, the tensile and compressive strength increased, and the elongation diminished; phenomena are closely analogous to those in the treatment of steel. The martensitic constituent was noticed by Campbell (this J., 1904, 937), who, however, has not described its cause nor its effect on the mechanical properties of the metal. It is produced by the quenching; bars of the same alloy heated then allowed to cool in air showed no sign of it. In the case of steels, many authors have shown that there is an analogy between the effects of quenching and of hammering; and in all probability this may be the case with these aluminium-copper alloys. No doubt the slow cooling prevents the change from the martensitic constituent (formed at the high temperature) at the transformation temperature, as Osmond thinks is the case with steels.—J. T. D.

*esium-Lead Alloys.* G. Gruhe. Z. anorg. Chem., 1905, 44, 117—130.

esium and lead in various proportions were melted in a stream of hydrogen. They were found to be completely miscible in all proportions, but the melted metal had to be continuously stirred to prevent segregation. Study of the cooling curves of these melted alloys indicated the existence of only one compound of the two metals,  $\text{PbMg}_2$ . An alloy of the two metals in these proportions (80.9 per cent. of lead) crystallises as a whole. An alloy containing less lead deposits crystals of the compound or of magnesium, according as it contains more or less than 67 per cent. of lead, and ultimately as the latter composition, when it solidifies as a metallic mixture ( $2\text{Mg} + \text{PbMg}_2$  nearly). An alloy containing more than 80.9 per cent. of lead deposits the compound or lead as it contains less or more than 97 per cent. of lead, at which composition it solidifies as a eutectic mixture ( $\text{Pb} + 7\text{Pb}$  nearly). The formation of the compound occurs with slight evolution of heat. The compound is brittle, with a bright steel-blue crystalline fracture; a polished surface is of a glistening grey colour. Stable in dry air, but in moist air rapidly oxidises and decomposes to a black powder. It decomposes water in the cold. The product of its reaction on moist air is a hydroxide of the formula  $\text{PbO} \cdot 2\text{MgO} \cdot 3\text{H}_2\text{O}$ . —J. T. D.

*thorus [in Iron and Steel]: Colorimetric Determination of* —. T. E. Hewitt. XXIII., page 292.

*Iron [in Tungsten Steel]: New Method of Determining* —. G. v. Knorre. XXIII., page 292.

*er; Use of* — in Pipes and Fittings for Superheated Steam. I., page 268.

*Assay of* —. E. Victor. XXIII., page 293.

#### ENGLISH PATENTS.

*cles; Manufacture of* —, and of Caps for Use with. R. A. Hadfield, Sheffield. Eng. Pat. 7882, ril 5, 1904. XXII., page 291.

*ls [of Rare Earths] in a Pure State; Process for obtaining* —, and Apparatus for Executing same.

H. J. Haddan, London. From Electrodon-Ges. m. b. H., Berlin. Eng. Pat. 9384, April 23, 1904.

SEE Fr. Pat. 342,581 of 1904; this J., 1904, 942.—T.F.B.

#### UNITED STATES PATENTS.

*Ores; Process of Smelting* —, in Blast Furnaces. J. E. Johnson, jun., Longdale, Va. U.S. Pat. 783,044, Feb. 21, 1905.

The fuel is fed into the top of the furnace, and falls by gravity, in the form of a solid column having fluted portions extending laterally into a surrounding body of ore, supplied from a separate channel, intimate contact between the ore and fuel being effected, so that the gases distilled from the fuel traverse the ore and assist in its reduction. A blast, containing an excess of oxygen, and approximately free from water, is supplied to the charge in regulated proportion. The heat of the furnace is utilised by passing the escaping gases through the body of the incoming ore, and maintaining them out of contact with the incoming fuel, the waste gases having a high proportion of carbon dioxide relatively to the carbon monoxide and nitrogen. The surface of the column of fuel is cooled to prevent its adhesion to the walls of the conduit.—E. S.

*Aluminium; Process of Soldering* —. M. Tomellini, Genoa, Italy. U.S. Pat. 783,332, Feb. 21, 1905.

SEE Eng. Pat. 15,849 of 1903; this J., 1904, 664.—T.F.B.

#### FRENCH PATENTS.

*Metalliferous Materials; Vibrating Trough for Concentrating Finely Divided* —. E. J. Swyny and S. G. Plucknett. Fr. Pat. 347,048, Sept. 12, 1904.

SEE Eng. Pat. 19,141 of 1904; this J., 1905, 200.—T. F. B.

*Slimes, Tailings, and Similar Metalliferous Substances; Process for the Extraction of Buoyant Mineral Particles from* —. E. J. Swyny and S. G. Plucknett. Fr. Pat. 347,054, Sept. 17, 1904.

SEE Eng. Pat. 19,142 of 1904; this J., 1905, 200.—T.F.B.

*Furnace for Roasting Minerals and for other Purposes; Rotary* —. F. Heberlein and W. Hommel. Fr. Pat. 346,990, Oct. 8, 1904.

SEE U.S. Pat. 781,824 of 1905; this J., 1905, 242.—T.F.B.

*Armour Plates and Projectiles; Manufacture of* —. F. C. Fairholme and J. E. Fletcher. Addition, dated Oct. 8, 1904, to Fr. Pat. 342,614, April 25, 1904.

SEE Eng. Pat. 1850 of 1903; this J., 1904, 609.—T. F. B.

*Cadmium; Alloy of* —. G. Chaudoir, jun. First Addition, dated Oct. 4, 1904, to Fr. Pat. 335,838, of Oct. 9, 1903. (This J., 1904, 325.)

CORRECTION is made of two misprints in the main patent. E. S.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (I.)—ELECTRO-CHEMISTRY.

*Ammonia; Electrolytic Oxidation of* —, to Nitrite. E. Müller and F. Spitzer. Ber., 1905, 38, 778—782.

In the course of work on the electrolytic reduction of nitrates to nitrites in presence of copper, the authors found themselves obliged to repeat the experiments of Traube and Biltz (this J., 1904, 987), and have obtained results differing from those recorded by the latter authors. They consider that the apparent cessation of the reaction,  $\text{NH}_3 \rightarrow \text{NO}_2$ , and substitution for it of the reaction  $\text{NO}_2 \rightarrow \text{NO}_3$ , described by Traube and Biltz, arises from the diminution of fixed alkali round the anode, for direct experiment shows that the amount of nitrate formed decreases, other things being alike, as the concentration of fixed alkali at the anode increases, and also that the

yield of nitrite under given conditions is practically independent of the concentration of the nitrite already present in the solution. The impossibility of reaching a higher nitrite-concentration than 9 per cent., and the diminution, on further electrolysis, of the nitrite, and increase of the nitrate-concentration, mentioned by Traube and Biltz, are to be ascribed solely to the change in reaction resulting from diminution of the anodic fixed alkali; by keeping up the amount of the latter, higher yields of nitrite are obtainable. Under any circumstances, however, the cost of nitrite thus prepared will probably be too great to allow of the process being used industrially.

In the authors' experiments the gases evolved during the electrolysis consisted almost entirely of nitrogen, with a little oxygen when the nitrate-concentration was high; no nitrogen oxides were observed. In neutral or very slightly alkaline solutions a certain amount of nitrogen was evolved as the result of non-electrolytic decomposition of ammonium nitrite.—J. T. D.

*Ammonia; Electrolytic Oxidation of* — W. Traube. Ber., 1905, 38, 828-831.

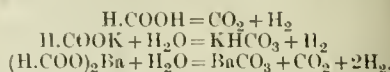
MÜLLER and SPITZER (see preceding abstract) have overlooked the fact that the paper of Biltz and the author (this J., 1904, 987) was a preliminary notice, and that the authors expressly stated that by appropriate alteration of the composition of the anode liquid at the beginning of the operation, or by addition of ammonia or fixed alkali during the process, it was to be expected that nitrite solutions would be obtainable, of higher concentration than those obtained under the conditions of the experiments described. Experiments by Schönwald under the author's direction (still in progress) have already shown that (a) an ammoniacal copper solution containing fixed alkali absorbs atmospheric oxygen much more rapidly than one without it; (b) by increasing the initial concentrations of fixed alkali and of ammonia, more concentrated solutions of nitrite can be obtained before the formation of nitrate from the nitrite begins to occur. By the electrolysis of a solution of ammonia and fixed alkali in presence of copper, containing to start with 11 per cent. of sodium nitrite, the nitrite concentration has been increased to 17 per cent.—J. T. D.

*Organic Acids; Electrolysis of* —, by means of Alternating Currents. A. Brochet and J. Petit. Comptes rend., 1905, 140, 442-444.

THE authors have electrolysed some organic acids and their salts, using alternating currents at densities up to 1 ampère per sq. cm. (At the high densities the cell was cooled by immersion in flowing water.)

*Formic Acid*.—Solutions of the acid, 250 grms. and 10 c.c. of sulphuric acid per litre, of potassium formate 336 grms. per litre, and of barium formate, saturated,

were used. The principal reactions were the same as in the continuous current:—



The percentage yields, calculated from the hydrogen evolved, were as follows:—

Current-Density (amp. p. sq. cm.).	Temperature °C.	Formic Acid.	Potassium Formate.	Barium Formate.
1.0	70-80	46	80-90	
0.5	50-60	10-12	30-40	
0.25	15-20	5	10-15	

With formic acid, a certain quantity of oxygen is formed by simultaneous decomposition of the water present. After some time the electrodes are dulled and the yield diminishes. With potassium formate, the electrodes become covered with a deposit of loosely-adhering carbonate which rapidly lessens the current. With barium formate a similar deposit forms, mixed, however, with barium carbonate. With the formates there is only an insignificant amount of oxygen evolved; and in no case any carbon monoxide observed.

*Oxalic Acid*.—250 grms. and 10 c.c. of sulphuric acid per litre. The reaction  $\text{H}_2\text{C}_2\text{O}_4 = \text{H}_2 + 2\text{CO}_2$  occurs. The yield was about 80 per cent. of the theoretical.

*Acetic Acid*.—A 40 per cent. solution containing 10 per cent. of sulphuric acid. Only a slight evolution of oxygen occurred, for the most part oxy-hydrogen mixture, the electrodes rapidly dulled, and the gas evolution ceased.—J. T.

*Aldehydes; Electrolytic Oxidation of Aliphatic*

H. D. Law. Chem. Soc. Trans., 1905, 87, 198-202.

THE author studied the electrolytic oxidation of formic aldehyde, acetaldehyde, propaldehyde and *iso*-butaldehyde in sulphuric acid solution with platinum electrodes. The chief products were the corresponding acids, together with smaller quantities of carbon dioxide and carbon monoxide; in the cases of acetaldehyde and propaldehyde, small amounts of the corresponding saturated hydrocarbons (methane and ethane) were also produced. The different products are probably formed according to the following equations:—

- (1)  $\text{R.CHO} + 2\text{-OH} = \text{R.COOH} + \text{H}_2\text{O}$ ;
- (2)  $\text{R.COOH} + 2\text{-OH} = \text{R.OH} + \text{CO}_2 + \text{H}_2\text{O}$ ;
- (3)  $\text{R.CHO} + \text{O} = \text{R.H} + \text{CO}_2$ ;
- (4)  $\text{R.CHO} + 2\text{O} = \text{R.OH} + \text{CO}_2$ ;
- (5)  $\text{R.CHO} + \text{O} = \text{R.OH} + \text{CO}$ .

The yields of acid obtained in some of the experiments are shown in the following table:—

Electrolyte.	Current in ampères.	E.M.F. in volts.	Ampère- hours.	Acid calculated in c.c. of oxygen.	Total oxygen liberated, in
370 c.c. containing 30 grms. of formaldehyde and 37 grms. of sulphuric acid .....	2.0	3-4	10	1579	2085
370 c.c. containing 30 grms. of acetaldehyde and 37 grms. of sulphuric acid .....	5.0	7.0	12.9	2368	2690
350 c.c. containing 14 grms. of propaldehyde and 35 grms. of sulphuric acid .....	2.0	3.5	10	1540	2085
370 c.c. of a 2 per cent. solution of <i>iso</i> -butaldehyde, containing 37 grms. of sulphuric acid .....	2.0	2.5	10	177	2085

#### ENGLISH PATENTS.

*Batteries; Storage* — B. J. B. Mills, London. From T. A. Edison, Llewellyn Park, Orange, N.J. Eng. Pat. 25,948, Dec. 10, 1904.

THE receptacle, of nickel-plated steel, is made with welded seams, and is "practically homogeneous," and there is no possibility of leakage taking place at the joints. Within this receptacle are mounted the electrodes. The positive electrodes consist of nickel hydroxide mixed with 6 to 9 per cent. of bismuth hydroxide and the negative electrodes of finely-divided iron, or an oxygen compound

of iron. The electrodes are formed of pockets of same capacity, but the nickel electrodes are arranged in pairs so that the mass of the nickel will be approximately twice that of the iron. Diamond-shaped pieces from a layer of insulating material, separate the adjacent positive and negative electrodes which are placed in an alkaline electrolyte. A hollow glass valve is provided for separating mechanically entrained globules from escaping gases, and the valve floats and remains closed as long as any liquid remains in the valve casing; cover on the valve casing prevents the entrance of air and dirt, but opens to permit of the escape of gases.



side. Several batteries are supported in a crate or insulated plugs on the crate engaging with integral formed on the sides of the batteries. It is advanced to pass a discharging current through the battery, electrodes being used as cathodes with the nickel receptacle as anode. Heat is developed, and the hydrogen gas, generated within the active masses of the plates, drives out the soluble impurities [referred to as "insoluble"] into the solution (electrolyte) may then be poured off, and fresh solution introduced.—B. N.

*ing or Non-Conducting Materials for Electrical Purposes; Impts. in and in the Manufacture of* —. J. H. Little, Ltd., Manchester, and S. de Pont, Levenshulme, Lancs. Eng. Pat. 3826, Feb. 16, 1904.

A mixture is prepared of cellulose, horn or bone (10 per cent.), calcium sulphate or like material (4 per cent.), copal, sandarac or similar substances (20 per cent.) dissolved in spirit, together with mica, slate, marble or other inorganic material (17 per cent.), aniline (1 per cent.), castor oil (6 per cent.), and cellulose or collodion-cotton (20 per cent.) dissolved in a suitable solvent such as ether alcohol. The mixture is dried at 100°–120° F., powdered, heated to a temperature (240°–250° F.) sufficient to melt the lac or agglutinant material, and subjected while being heated to a pressure of 4–5 tons per cubic inch in a die mould.—A. S.

*or other Liquid; Extraction of* —, from Mineral Substances. O. Imray, London. Eng. Pat. 3795, Feb. 15, 1904.

An electro-osmotic process for the extraction of water or liquid from substances, described in Eng. Pat. of 1900 (this J., 1901, 726), is improved by allowing electric current to act at temperatures above the boiling point of the liquid. Claim is made for:—Heating the substance to be treated; heating one or both the electrodes in which the substance is placed; arranging either electrode as one side of a space through which the liquid medium is passed; and arranging two like or unlike electrodes as sides of the space through which the heating current is passed.—W. H. C.

*Apparatus for the Purification of* —, and the Generation of Ozone. J. Harris, London. Eng. Pat. 44, Aug. 22, 1904.

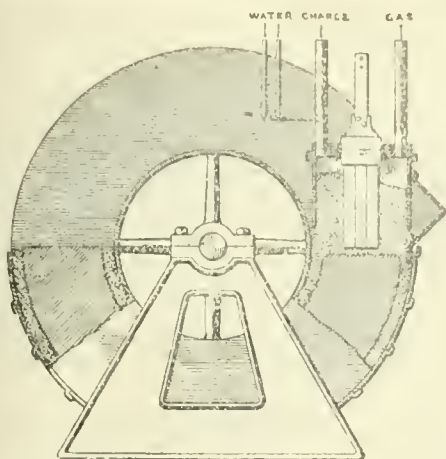
An apparatus for the generation of ozone consists of a set of ozonising elements formed of plates arranged in series. One plate of each pair is made of material such as asbestos, &c., of high insulating properties, and is perforated with tufts or small coils of metal gauze or the like inserted in the perforations and connected together in a series. The other plate may be an enamelled metal sheet and act as a dielectric and pole, or may be a glass plate when it acts as a dielectric only. The apparatus is arranged in one compartment of a portable casing, the latter is provided with a fan, and with a filtering chamber, through which the air is forced either before or after being ozonised.—E. S.

*[Electrically] Refining and Purifying* —. N. J. H. Itzmann. Eng. Pat. 26,905, Dec. 9, 1904. Ill. A., page 288.

#### UNITED STATES PATENTS.

*Aluminum Carbide* —. J. M. Morehead, Chicago. Assignor to Union Carbide Co., Niagara Falls, U.S. Pat. 782,917, Dec. 21, 1905.

The upper part of the furnace, which in the example is of the drum form, is practically closed by a hood which dips into the material forming the charge. The electrodes pass through the top of the hood which is water-



cooled and provided with shafts for the exit of the gases and for introducing the charge into the furnace chamber.

—R. S. H.

*Furnace; Electric* —. G. O. Seward, Holcombs Rock, Va., Assignor to Willson Aluminium Co., New York. U.S. Pat. 783,736, Feb. 28, 1905.

In combination with the cover of an electric furnace, having an aperture through which an electrode passes, claim is made for a separate lid fitting within the aperture and having a flange which rests on the cover, this lid forming a complete ring around the electrode and holding it in position. The lid may be provided with a passage for the circulation of cooling water.—A. S.

*"Ores; Smelting Refractory"* —. [Calcium Carbide]. E. F. Price, Niagara Falls, Assignor to Union Carbide Co., Niagara Falls. U.S. Pat. 782,922, Feb. 21, 1905.

A charge of carbon with some calcium compound is interposed as a "resistance-conductor" between superposed electrodes. The lower electrode, forming the hearth of the furnace and near which is the zone of maximum temperature, is constructed of iron. Water cooling is adopted to cool the lower electrode and retain part in the solid form, despite the intense heat near to it. Means are provided for tapping the carbide and introducing fresh raw material.—R. S. H.

*Superoxides; Electrolytic Production of* — in Alkaline Solutions. H. Rodman, Assignor to Electric Storage Battery Co., Philadelphia. U.S. Pat. 782,989, Feb. 21, 1905.

"SUPEROXIDES" are produced direct from metals by utilising the metal, of which the oxide is required, as anode, in an electrolytic apparatus; the metal is enclosed in a "diaphragm." The electrolyte consists of a "dilute alkaline solution containing an acid radical." The production of a superoxide of nickel by this method is especially claimed.—T. F. B.

*Separating Oily Impurities from Water; [Electrical] Apparatus for* —. H. T. Davis and E. Perrett, London. U.S. Pat. 783,107, Feb. 21, 1905.

An automatic arrangement is described for opening and closing the valves for supplying the oily water and a conducting fluid, to the treatment tanks. The valves are opened by electric means when the current is turned on to the tanks.—R. S. H.

#### FRENCH PATENTS.

*Carbides; Manufacture of Metallic* —, by means of the Combined Heating Effect of the Arc and Resistance. E. Lanhoffer, and Comp. Continentale d'Electricité Appliquée. Fr. Pat. 347,090, Oct. 14, 1904.

Two furnaces are used and the electrodes are connected in series, an electric arc being produced in one furnace,

and the upper electrode is slowly raised as the crucible becomes filled with the sticky mass of carbide. When filled, the upper electrode is slowly lowered so that its lower surface is beneath, and constantly in intimate contact with the carbide, and the heat produced by the resistance of the carbide melts the latter, which flows out through a suitable opening near the base of the crucible. The two furnaces are engaged simultaneously, one being employed in the production of carbide by means of the arc whilst the second is melting the product previously formed. Alternative methods are described for fusing the material by a current produced from a second source; for fusing the material by the combined effect of the two sources of current; and for simultaneously producing and partially melting the carbide.—B. N.

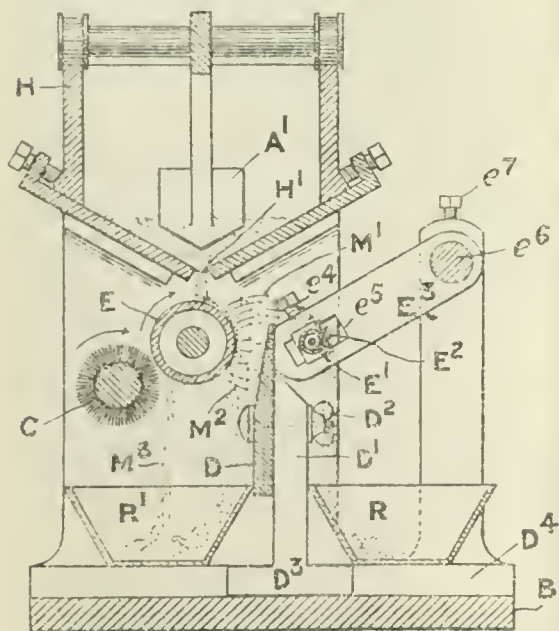
*Ozone: Apparatus for the Industrial Manufacture of — by means of Liquid Air.* P. M. Oudin. Fr. Pat. 347,148, Oct. 17, 1904.

A closed cylinder (of glass or the like) narrowed to a neck above, is surmounted by a vessel containing liquid air, the bottom opening of which is plugged with, for instance, asbestos fibres, which fibres descend some distance centrally into the cylinder, and envelope the upper portion of a vertical metal rod, descending to near the bottom of the cylinder. A helix of metal wire encircles the vertical rod, the outermost portions of the turns of the helix being only a short distance from the walls of the cylinder. The wire is connected to one pole of a condenser communicating preferably with an electrical machine, giving alternating currents of high frequency. The other pole is connected to the central rod. The liquid air flows slowly down the asbestos fibres, and volatilises into the body of the cylinder, where it is acted on by the electric discharge induced within the apparatus. The cylinder is provided near its bottom with an outlet for the ozonised air produced.—E. S.

### (B).—ELECTRO-METALLURGY.

#### ENGLISH PATENTS.

*Electrostatic Separation [Ores]; Method and Apparatus for —.* W. Fairweather, London. From C. H. Huff, Boston, Mass. Eng. Pat. 27,449, Dec. 16, 1904.



This invention relates to the method of separating or concentrating heterogeneous mixtures, such as metal-bearing ores, by the action of rapidly varied static charges

between two terminal electrodes. The material is fed from a hopper H, with the assistance of an agitator through an adjustable slit H<sup>1</sup> on to a rotary electrode E having a conducting surface, the latter being cleaned by a rotary brush C. E<sup>1</sup> is an oppositely charged electrode, relatively smaller than the repelling electrode E, surrounded by an insulating envelope E<sup>2</sup>, and mounted on blocks which are adjustable in slots E<sup>3</sup> formed in an adjustable arm E<sup>3</sup>. A divider D of insulating material, adjustable vertically and horizontally, is placed between E and E<sup>1</sup> so as to act as an obstruction in the trajectory of the less susceptible particles, but so that the highly susceptible particles pass in their trajectory over the divider. Rapid variations in potential are obtained by connecting E and E<sup>1</sup> with the terminals of the secondary of a transformer, the latter "stepping up" the potential from a high-potential alternating dynamo. Several pulsations are thus given during the time required for a particle of the material to pass through the field. An alternative method is described for subjecting the material to rapid "potential variations," so as to produce shocks or electrical impacts, "between relatively long time intervals intervene." In the alternative method, the secondary of the transformer and the electrodes E and E<sup>1</sup> are placed in series with a resistance to damp oscillatory currents, a rectifier if the shocks are to be of positive or negative polarity only and a spark gap. In parallel with the electrostatic condenser and a non-inductive resistant shunt. When the potential rises, the condenser is charged until the spark gap breaks, when the electrodes E and E<sup>1</sup> are energised, and a field potential equal to the breakdown potential of the spark gap is created. The non-inductive resistance shunts the electrodes, and the potential of the electrodes is rapidly reduced to zero. This device extracts from the separator electrodes all potential created, except a selected portion which is represented by an included fraction of the area of the normal curve.—B. N.

#### UNITED STATES PATENTS.

*Alkali Metal Amalgam; Method of Treating — recover the Alkali Metal.* C. E. Baker and W. Burwell, Cleveland, Ohio. U.S. Pat. 782,893, Feb. 21, 1905.

THE alkali metal amalgam is heated in presence of mercury, to form an alkali metal hydride; the mercury is then distilled off, and the temperature raised sufficiently to decompose the hydride. Further claims cover application of this process to the electrolytic production of alkali metal, by electrolysis of an alkali salt with a mercury cathode, and treating the amalgam as described.—T. F.

*Metallic Sulphides; Electrolytic Process of Reducing —.* C. E. Baker and A. W. Burwell, Cleveland, Ohio. U.S. Pat. 782,894, Feb. 21, 1905.

THE metallic sulphide is supported in contact with an anode in a suitable electrolytic apparatus; the sulphide is immersed in the electrolyte, which consists of an alkali chloride. The chlorine produced by the electrolysis converts the sulphide into chloride. The resulting chloride may then be melted and electrolysed in the same apparatus.—T. F.

#### FRENCH PATENT.

*Tantalum; Process for Purifying Metallic —.* Société Anonyme d'Alais Akt.-Ges. Fr. Pat. 347,024, Oct. 12, 1904. Under Internat. Conv., Oct. 15, 1903.

SEE Eng. Pat. 21,766 of 1904; this J., 1904, 1225.—T. F.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*Wool Oil. Preparation of Sulphonated —.* P. J. Latschek. Chem. Rev. Fett- u. Harz-Ind., 1903, 1, 48—49.

ONE of the earliest substitutes for oleic acid as a lubri-



was Turkey red oil, and eventually, as this was so dear by itself, it was used in admixture with lils. In order to increase the emulsifying power of these oils, these oils are now also sulphonated, usually addition of a definite proportion of sulphuric acid, of which is subsequently neutralised. According to the author's experiments, however, it is essential to use the necessary amount of sulphuric acid in each case, since otherwise the sulphonated products render the wool sticky. Thus assuming that castor oil, for example, required 20 per cent. of sulphuric acid, that should be added in separate portions and the mixture tested with water after each addition. As soon as an emulsion is produced, no further addition should be made, but the oil shaken and allowed to stand for 24 hours when it is again tested. If an emulsion is not still the sulphonation is repeated with an additional amount of acid. Finally, the product is washed with a solution of sodium chloride, and a final test is made of its emulsifying power. In this way it was found that different samples of castor oil required from 15 to 20 per cent. of sulphuric acid, whilst with cotton-seed oil the amount was smaller, and with other oils such as olive oil, the amount was greater. The production of stickiness in the wool was due to be greatest with those sulphonated products derived from distilled olein, and this the author attributed to unsaponifiable matter.—C. A. M.

*Bromine Absorption Value of ——. [New Method for its Determination.]* F. Telle. XXIII., 294.

*Direct Method of Determining ——. A. A. Hoff and P. J. Schestakoff. XXIII., page 294.*

#### ENGLISH PATENTS.

*Oil Seeds or the like; Method of Separating from a Material for Saponifying Fats or Oils.* M. A. Paris. Eng. Pat. 8301, April 11, 1904.

*Division of April 11, 1904, to Fr. Pat. 335,902 of 1903; this J., 1904, 942.—T. F. B.*

*Oleic Acid; Process of Manufacturing ——. Oleic Acid.* A. J. Boulton, London. From W. M. A. n, Chicago, U.S.A. Eng. Pat. 20,474, Sept. 22,

Pat. 772,129 of 1904; this J., 1904, 1102.—T. F. B.

*Preparation for use in Preventing Poisoning by Wounds of Lead, Copper, Arsenic, Quicksilver, other Metals; Process for the Manufacture of a ——. A. J. Boulton, London. From Chem. Werke Ges. m. b. H., Dr. C. Zerbe, Freiburg, Germany. Eng. Pat. April 27, 1904.*

Pat. 341,159 of 1904; this J., 1904, 829.—T. F. B.

#### UNITED STATES PATENT.

*Apparatus for Heating and Purifying ——. J. F. Bluffton, Ind. U.S. Pat. 783,880, Feb. 28,*

*Apparatus consists of a tank provided with a number of steam pipes round its circumference, extending to the bottom of the tank; the ends of the steam pipes are so arranged as to impart a rotary motion to the tank and to carry the solid impurities towards the walls of the tank. A suction pipe, to remove the oil, extends vertically down the centre of the tank, and is bent at a right angle at a point close to the bottom of the tank; the lower portion is perforated, and extends almost to the bottom of the tank.—T. F. B.*

#### FRENCH PATENTS.

*Manufacture of a Soft Sodium —— of Creamy Consistency.* Soc. Kjöbenhavn's Sæbefabrik Louis Holger Hansen. Fr. Pat., 346,993, Oct. 10, 1904.

*Process of the sodium soap in water is heated and is incorporated with a suitable fat such as cocoa butter, which is added little by little so as to obtain*

proper admixture. The mass is stirred well while cooling and the resulting cream-like product can be put up in collapsible metal tubes.—C. A. M.

*Soap; Cheap Mixed —— of Uniform Colour.* E. Baillet. Fr. Pat., 347,085, Oct. 13, 1904.

The soap consists of an intimate mixture of a "salted out" soap prepared from palm oil, tallow, and caustic soda lye, with a soft soap prepared from palm-kernel oil, coconut oil, arachis or cotton-seed oil, and rosin with sodium carbonate and caustic potash or potassium carbonate. A separate claim is made for the soft soap.—C. A. M.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

#### (A.)—PIGMENTS, PAINTS.

##### ENGLISH PATENT.

*"Vegetable Black"; Manufacture of ——. C. H. Davey, Woodford, Essex. Eng. Pat., 29,141, Dec. 30, 1904.*

CREOSOTE or other oil is burned in an ignition chamber furnished with a water-jacket, and the fumes are passed into a settling chamber, formed of a number of superposed floors communicating with each other at one end, each floor being divided by a partition into two lateral compartments which communicate at the end away from that at which the different floors are connected. The water-jacket serves to regulate the temperature of the ignition chamber, and to prevent "overburning"; the steam produced can be utilised for driving machinery.—A. S.

##### FRENCH PATENT.

*Fireproof Paint or Coating; Composition for use as a ——. A. B. Nettleton. Fr. Pat. 347,186, Oct. 18, 1904.*

See Eng. Pat. 22,423 of 1904; this J., 1905, 92.—T. F. B.

#### (B.)—RESINS; VARNISHES.

##### ENGLISH PATENT.

*Linoleum, Oilcloth, and like Materials; Machinery for Printing the Pattern on ——. H. C. Shaw. Eng. Pat. 7256, March 26, 1904. VI., page 274.*

##### UNITED STATES PATENTS.

*Rosin; Producing —— [from Pine Wood].* G. P. Craighill, Assignor to C. E. Heald and E. Williams, Lynchburg, Va. U.S. Pat. 783,367, Feb. 21, 1905.

PINE wood is immersed in hot or cold alcohol, and the solution is distilled to remove the alcohol and turpentine. The residue is stated to consist of "commercially pure rosin."—T. F. B.

*Varnish; Process of Making ——. G. Tüschel, Odessa, Russia. U.S. Pat. 783,393, Feb. 21, 1905.*

"RED acroide resin" is boiled with water, and the residue melted with gum mastic, sandarac, Manila copal, and Venice turpentine; the product is dissolved in methylated spirit and mixed with a small quantity of ether.—T. F. B.

#### (C.)—INDIA-RUBBER, &c.

*Caoutchouc; Chemistry of ——. R. Ditmar. Chem.-Zeit., 1905, 29, 175.*

SOME time ago (see this J., 1904, 794) the author drew attention to the red coloration produced by the action of concentrated sulphuric acid upon caoutchouc and the different fractions obtained by the destructive distillation of caoutchouc. He has since applied Ribban's terpine reaction with an antimony trichloride bead (Ann. chim. phys., 1875, 6, 38) to caoutchouc and caoutchouc distillates. Isoprene, the fraction distilling between 70° C. and 150° C., and the dipentene, heptene, diterpene and poly-

terpene fractions give instantaneously the typical red coloration. With a solution of polyprene in chloroform the bead remains colourless until it is heated, when it also turns red. The author explains this by a transformation into terpenes, and concludes that caoutchouc is an intermediate product between aliphatic and aromatic terpenes.

The author tried also to settle the dispute regarding the solubility of caoutchouc in ether (this J., 1904, 1103). He extracted finely divided Para rubber in consecutive operations with acetone, ethyl acetate, and ether. From the last extract he was able to isolate some pure caoutchouc which he identified as such by analysis, by the formation of Harries' "nitrosite" (this J., 1902, 1404, and 1903, 875), and of the dinitro acid (this J., 1904, 794), and by the reactions with antimony trichloride and sulphuric acid. Besides, rubber is precipitated from the ethyl acetate solution by alcohol, but not by ether. Caoutchouc is thus, at least, partially soluble in ether. The insolubility of caoutchouc in ether cannot be taken as a proof for the pre-existence of caoutchouc in latex, and it is not permissible to assume similar chemical composition in different latices.—R. L.

*Rubber Waste; Process for Regenerating Vulcanised* —. A. Kittel, Vienna. Eng. Pat. 15,436, July 11, 1904.

SEE Fr. Pat. 344,734 of 1904; this J., 1904, 1126.—T. F. B.

#### XIV.—TANNING, LEATHER, GLUE, SIZE.

*Tanning by means of Hydrodynamic Pressure; Possibility of* —. E. Nihoul. Chem. Zeit., 1905, 29, 219.

REFERENCE is made to a recent article by de Marneffe, in which a method of tanning by the aid of hydraulic pressure is compared with the usual process (compare Fr. Pat. 339,428 of 1904, next column). The author has examined specimens of leather tanned by the pressure process. A strip taken from the back portion of an ox-hide, which had been tanned in 60 hours with a very weak oak extract ("1° on the barkometer," sp. gr. 1.001), showed a tensile breaking stress of 500 kilos. per sq. cm. Two strips from the same specimen of leather gave the following results when subjected to chemical analysis (see this J., 1898, 164; 1901, 1223):—

	Shoulder Piece.	Back Piece.
	Per Cent.	Per Cent.
Water .....	12.50	—
Ash .....	0.93	—
Fatty matter .....	0.09	—
Total soluble matter .....	9.68	—
Leather substance .....	78.20	78.21
Nitrogen .....	9.09	9.19
Hide substance .....	51.08	51.64
Combined tannin .....	27.89	26.59
Yield of leather .....	195.7	193.7
Index of tannage .....	53.05	51.5
Sp. gr. ....	0.841	—
Absorbed water (percentage on normal leather) .....	49.54	—

Tests upon specimens of leather prepared by the pressure process in a primitive laboratory apparatus, and in a tannery with oak, pine, quebracho, valonia and myrabolans extracts, also gave satisfactory results, and the author concludes that so far as the quality of the leather produced is concerned, the pressure process is worthy of consideration.—A. S.

*Tanning Materials; Analysis of* —, by means of "Spongy" Alumina. II. Wislicenus. XXIII., page 294.

#### ENGLISH PATENT.

*Depilatory Composition*. H. H. Lake, London. From the Schoelkopf, Hartford and Hanna Co., Buffalo, U.S.A. Eng. Pat. 363, Jan. 7, 1905.

SEE U.S. Pat. 781,714 of 1905; this J., 1905, 245.—T. F. B.

#### UNITED STATES PATENT.

*Glue: Method of Treating Bones for the Production of* —. E. R. Hewitt, Garden City, N.Y. U.S. Pat. 783,784, Feb. 28, 1905.

THE bones are treated with successive quantities of combined sulphurous acid and water, from which the combination has previously been dissipated," the same being removed after each treatment, before the bone dissolved therein precipitate, and before the temperature rises above 74° F.—A. S.

#### FRENCH PATENTS.

*Tannage of Skins; Process and Apparatus for Rapid* —. H. de Marneffe. Fr. Pat. 344,734, Jan. 8, 1904. Under Internat. Conv., Nov. 2, 1903 (see first abstract under XIV.).

THE skins are stretched on frames so as to form box-like vessels, which are disposed inside a closed chamber containing the tanning or other liquor. The liquor is then forced by pressure or by aspiration through the stretched skins, whereby a rapid tannage is effected. In the apparatus shown, the interior of the box-like vessels formed by the skins, are in communication with the outer air, whilst the tanning liquor closed chamber is maintained under any desired pressure.—A. S.

*Vegetable Tanning; Process of Rapid* —. M. B. First Addition, dated Sept. 10, 1904, to Fr. Pat. 344,734, April 25, 1904. (See this J., 1904, 943.)

THE common salt recommended in the main patent is replaced by potassium nitrate (20 kilos.) and the inorganic acid by a volatile organic acid, formic or chloroacetic acid (2 kilos.) in 100 litres water.—M. C. L.

*Hides and Skins; Process of Tanning* —. C. Aubert and J. Aubert. Fr. Pat. 347,097, Oct. 14, 1904.

THE prepared pelts are submitted to a three to four hours immersion in a solution of rosin soap, containing 5 to 10 per cent. of rosin with 1 to 3 per cent. of "soda"; the are afterwards placed in a 6 to 12 per cent. solution of chromium, iron, copper, zinc, or aluminium (preferably aluminium sulphate) for three to four hours.—M. C.

#### XV.—MANURES, Etc.

*Copper Solutions; Absorption of Dilute* — by C. Yokote. Bied. Centr., 1905, 34, 103–106; Arch. Hyg., 50, 193.

WHEN copper solutions are filtered through soil, the solution is more or less completely absorbed, unless the soil is acid. Absorption also takes place in pure quartz being slight at first, but increasing as the surface of sand grains becomes covered with copper oxide. Absorption in quartz sand amounted to "39.8 kil. copper per cubic meter" without the full limit of absorption power being reached. The presence of small amounts of alkaline earthy carbonates renders the absorptive power of sand and soil very complete.

The results show that there is no danger of wells contaminated with copper when the latter is present in the water of a river in the neighbourhood. On the other hand, irrigation of fields and gardens with water containing copper is to be avoided.—N. H. J. M.

*Superphosphates; Technical Method for the Determination of Free Phosphoric Acid in* —. Gerhard. X. page 293.

#### ENGLISH PATENT.

*Nitrate, Nitrite or Sulpho-nitrite or Nitrate of Soda or Potash; Process for Manufacturing* —. J. Price. Eng. Pat. 24,297, Nov. 9, 1903. page 276.



## VI.—SUGAR, STARCH, GUM, Etc.

*Transformation of Amylocellulose into* ——. E. Boux. *Comptes rend.*, 1905, 140, 440—442.

Transformation of amylocellulose from starch-paste is a reversible reaction between 0° C. and 150° C. At lower temperature, in presence of excess of water, amylocellulose liquefies, then undergoes a degradation, successive steps of which result in a more simple form, coloured blue by iodine. The various products of the reaction, provided it has not gone too far, are obtained by a reversal of the process, of reproducing amylocellulose. The ultimate products, not capable of further action, are amyloextrin, amorphous dextrin, and binary dextrose.

Complete degradation of amylocellulose the author has effected artificial starches, showing, under the microscope, cellular structures similar to those of natural starch, giving a blue colour with iodine, but not gelling with hot water, and dissolving without residue in water. These artificial starches must themselves be regarded as complex mixtures, still containing amylocellulose. They are identical with the starches obtained from binary cereals under similar conditions of temperature; and all of them, natural and artificial, as well as amylocellulose, differ chemically only by being more or less dense forms of the same fundamental nucleus. (See J., 1904, 124, 197, 261.)—J. T. D.

*Works; Purification of Waste Waters of* ——. A. J. Eld. *Z. Ver. Deutsch. Zucker Ind.* 1905, 55, 173.

Recognised that the Proskowetz system of purification of the waste waters from sugar works, except in so far as it depends on mere earth filtration, owes its efficacy to the decomposition of organic matters in fermentation whereby they are rendered precipitable by lime. Laboratory experiments were carried out by Hermann and Ahlers on waters artificially prepared by addition of beetroot press juice to water which was then subjected to fermentation with yeast at 27° C., to fermentation at 32° C., and to butyric fermentation at 40° C., with or without the addition of chalk. Purification with lime the purification effected was measured by the estimation of the oxygen absorption and the amount of nitrogen. The results encourage a continuance of the process; the conditions to be observed are that the temperature should be maintained as long as possible at a temperature sufficiently high to favour fermentation should not be allowed to proceed in an acid solution, the presence of an excess of calcium carbonate in the form of powdered chalk or "separation lime."

—L. J. DE W.

*Water of Condensation; Test for* ——. H. and L. Pellet. XXIII., page 293.

*Dextrose and Levulose; Simultaneous Determination of* ——. L. Lindet. XXIII., page 295.

*Starch; Tollens' Phloroglucinol-Hydrochloric Acid Reaction for* ——. E. Pinoff. XXIII., page 294.

## ENGLISH PATENTS.

*Apple Juices; Process of and Apparatus for the Production and Extraction of* ——. L. Naudet, Paris. Pat. 2928, Feb. 5, 1904. Under Internat. Conv., 6, 1903.

S. Pat. 746,734 of 1903; this J., 1904, 72.—T. F. B.

*Seed Hulls; Treatment of — to obtain Useful Products therefrom [Cellulose, Sugar and Furfural]*. ——. Cross. Eng. Pat. 8545, April 13, 1904. XIX., 288.

## UNITED STATES PATENT.

*Cleansing Composition and Process of Making* ——. C. A. Spreekels and C. A. Kern, New York,

Assignors to Federal Sugar Refining Co., Jersey City. U.S. Pat. 783,150, Feb. 21, 1905.

SACCHARINE solutions are cleansed and refined by treatment with a mixture of kerosene oil with a sulphonated derivative of a fatty body. The latter is obtained by the action of concentrated sulphuric acid upon cotton-seed oil at a low temperature. (See also this J., 1902, 715 and 781.)—J. F. B.

## FRENCH PATENT.

*Massécuite; Continuous Apparatus for Filtering and Washing* ——. H. Roy. First Addition, dated Oct. 12, 1904, to Fr. Pat. 343,194, May 16, 1904.

THE apparatus described in the original patent (this J., 1904, 1037) can be adapted for re-melting the washed sugar contained in each of the separate compartments by admitting hot water or clarifying syrup to the top one and maintaining the temperature by means of steam coils; syrups will thus be obtained from each of the other compartments in a decreasing order of purity.—J. F. B.

## XVII.—BREWING, WINES, SPIRITS, Etc.

*Barley; Causes of Improvement of Germinative Capacity of — by Drying or Storing*. W. Windisch. *Wöch. f. Bran.* 1905, 22, 89—92.

THE author has sought for an explanation of the fact that freshly harvested barley, especially if ripened and harvested in wet weather, is much inferior in germinative capacity to the same barley after kiln-drying or storage for a few weeks. Hotter has attributed the improvement which is effected by drying or storing the barley to the formation of diastatic enzymes, which he regards as essential to germination and which he thought were deficient in the fresh grain. But the author, although he has observed a distinct increase in the diastatic and proteolytic powers of the barley during after-maturation or drying, has also found that in most cases there is quite a distinct quantity of enzymes in the freshly harvested barley. Experiments are described, which were carried out upon a barley which showed a germinative energy of 33 per cent. in the fresh state and 95 per cent. after kiln-drying. In these experiments the embryos together with the scutella were separated from the endosperms and were tested as to germinative power upon artificial media composed of starch-gelatin. From determinations made with fresh and dried embryos and by re-combining fresh embryos with dried endosperms and *vice-versa*, the author concludes that the improvement effected by drying the barley is mainly or exclusively due to modifications effected, not in the endosperm, but in the embryo or the adjacent scutellum and perhaps the epithelial layer. The primary condition for germination, in the author's view, is that the cell membranes and protoplasmic layers surrounding the embryo be in such a state that the pre-formed sugars can readily penetrate by osmosis. In freshly harvested barley the membranes are either not at all or only partially permeable; they are possibly not in the state of true celluloses or are still clogged with colloidal gelatinous albumin. Drying would then condense and dehydrate the celluloses and albumins and make the walls permeable to the nutrients of the grain.—J. F. B.

*Maize Malt*. W. Christek. *Z. Spiritusind.* 1905, 28, 80.

MALTED maize, though very rarely used in distillery practice, is still employed to some extent in pressed yeast factories. The maize is steeped in water at 22° C. for three days, with daily changes and aeration. It remains 7—8 days on the floor at a temperature between 22° C. and 30° C. with moderate sprinkling. The rootlets are grown to 5—8 times the diameter of the corn, the acrospires to three-quarters the diameter. The fresh green malt has a bad odour, due probably to the decomposition of the maize oil. The malt kilns very easily, it requires 12 hours' withering and 10 hours' kilning

at 56°–62° C. The dressing is preferably effected immediately after kilning and the total loss of weight in the malting process is 15–18 per cent.; the malt loses the unpleasant odour on kilning and acquires a sweet smell. Unlike other malts, maize malt need not be stored for more than two or three weeks after kilning before it is fit for use.

The author employed mashies prepared from barley malt (20 per cent.), maize malt (20 per cent.), wheat (30 per cent.), and maize (30 per cent.). The effect of the maize malt was to increase the quantity of froth and to intensify the "working" of the yeast, giving a strong after-fermentation, the attenuation being increased by 0.5° Bg. The yield from such a mash was 14.5 kilos. of pressed yeast and "30.3 litres per cent." of alcohol per 100 kilos. of grain. The quality of the yeast produced was very satisfactory, but copious washing was necessary to eliminate the sweetish aroma of the malted maize.—J. F. B.

*Malt; Red Uncured* — H. Will. *Z. ges. Brauw.*, 1905, 28, 128–131.

A SAMPLE of uncured malt, from Bohemian barley, was found to be spotted with reddish patches on the husk and rootlets, the contents of the corns being soft and milky. The cause was traced to an infection by budding fungi of the red yeast type derived from the brewery reservoir, accompanied by a cessation of the germinating process the bacterial flora of the yeast and water having prepared the way for the action of the red yeast. The cured malt exhibited numerous instances of burst and peeled husk, causing the sprouts to drop off; this was also traced to the action of bacteria softening the contents of the corns and enabling them to retain an unusual amount of moisture which, converted into steam on the kiln, caused the bursting of the husks. The cured malt was very aromatic and tender, but poor in active diastase.—C. Š.

*Malt; Absolute Yield of Extract and Fine Grist Analysis of* — C. Bleisch and P. Regensburger. *Z. ges. Brauw.*, 1905, 28, 124–126.

TO DETERMINE the percentage of extract left behind in the grains by the ordinary laboratory method of mashing fine grist, the grains were carefully washed until the washing ceased to give any reaction with Fehling solution, and were then dried and ground, 10 grms. of the fine meal being taken for analysis. This quantity was mashed with 100 c.c. of water, boiled for 15 minutes, cooled to 45° C., and treated with 25 grms. of a freshly prepared green malt extract (about "4 per cent. Ball."), this being found more active than commercial diastase. The further treatment was of the usual kind. The results obtained from 15 samples of malt by this method showed a fluctuation of 0.54–1.16 per cent. of unrecovered extract, the loss being apparently independent of the fineness of the original grist, which contained 81.0–92.1 per cent. of fine meal. This seems to be confirmed by the circumstance that in one case observed in practice, the proportion of unrecovered extract in the grains was less with a grist containing only 40 per cent. of fine meal, than with a laboratory grist containing about 85 per cent., the more efficient extraction in the former case being possibly due to the influence of the time factor and the sparging heat.

TWO of the extreme samples were tested for their pentosan content, in order to ascertain whether the unrecovered extract in the husks was capable of unfavourably affecting the flavour of the beer. Weight for weight of extract, that from the husks contains about six times as much pentosan as that from the malt; but in practice this excess is distributed through a large volume of wort, and therefore corresponds to only a small percentage. With regard to the recovery of extract from the grains, it was found in one brewery that no improvement in this respect could be effected by increasing the proportion of fine meal in the grist from 35 to 75 per cent. Possibly, better results could be obtained by separating the hard tips of the malt corns from the husks and treating them apart.—C. Š.

*Malts; Albumin and Extract Percentages of this* — O. Neumann. *Woch. f. Brau.*, 1905, 2

AT THE beginning of the malting season 1904, stated that the new malts yielded on an average 0.5 to 1 per cent. less extract than those of the season, in spite of the fact that the 1904 barleys distinctly better quality than those of the previous year, being extremely pale in colour, and having very germinative power, low moisture, and on the lower percentage of albumin. Later results have confirmed the impression as to the inferiority of the new and the averages of over 100 analyses to date show according to the percentages of albumin, the 1904 extract are fully up to the values for the previous year. The earlier inferiority is attributable to the different weather experienced in the summers of 1903 and 1904. The malting of 1904 barley was begun with grain containing 3–5 per cent. less moisture than the previous crop, the time of steeping was thus prolonged, and this, combined with a much higher temperature, led to oversteeping. The grain thus remained wet on the couches before raking over, got hot and continued to germinate. The consequent early appearance of the green mould also caused the premature removal of the grain from the floor in many cases. When these faults were recognized, however, the malts subsequently prepared have been extremely good.—J. F. B.

*Top-fermentation Beer Worts [German]; Boiled under Pressure*. Mumme. *Woch. f. Brau.*, 1905, 22, 98–99. (Compare this J., 1905, 145.)

BEERS from worts boiled under pressure differ in flavour and aroma from those brewed in the ordinary manner; the pressure-boil appears to eliminate the "top-fermentation" aroma, and provided the beer is too sparingly hopped, it is comparable with a full dark lager beer. The procedure adopted by the author for top-fermentation worts brewed from cool-grown malt, cured at 87.5° C., is as follows: The main wort is brewed under pressure for one hour, reckoning from the time when a pressure of 15 lb. per sq. in. is reached; the pressure is allowed to rise up to 30 lb. per sq. in. at which it is maintained for 10 minutes and is then lowered to 22 lb. per sq. in. at which it is maintained constant. For the remainder of the two hours' total time of boiling, the copper is kept open, without pressure. The after-runnings and washings are boiled for two hours in an open copper, but the results would probably follow from boiling under pressure. The lower the curing temperature of the malt, the higher the pressure which can be used; higher pressures are allowed for soft brewing water for hard waters. The author prefers to boil the worts under pressure from the beginning, rather than to boil the open first and subsequently under pressure (cf. Gribat. *loc. cit.*); the coagulated albumin is thus separated at an early stage and is mostly thrown up against the walls on which it collects as a coherent layer. When the wort is opened for the latter part of the boiling process, it is found to be almost perfectly clear and without "head." For mild ales it is better to add the hops after the pressure-boil, since the pressure increases the extraction of the bitter; for bitter ales, on the other hand, and where the hops are scarce, this increased extraction, obtainable by the decoction under pressure, may be advantageously used and if the colour will not admit of the wort being under pressure, a portion of the hops may be thus extracted with water.—J. F. B.

*Wine Brandies; Composition of* — X. R. Comptes rend., 1905, 140, 511–512.

THE author has studied the relative proportions of various volatile matters existing in the wines of the Charentes district and in the brandies prepared there. It was found that the brandies contained only a very small proportion of the acids of the wines, the greater part of the aldehydes, a very large proportion of the alcohols, and nearly the whole of the higher alcohols, furfural, of which only traces are present in the wines, produced to a greater or less extent according to the manner of heating during distillation. The ethyl and higher alcohols are the most important constituents.



both as regards quantity and effect on the  
The relative proportions of these bodies in  
end on the conditions under which fermentation  
carried out. The author has noticed that when-  
s or brandies are poor in ethers, they are corres-  
y richer in higher alcohols.

Following table shows the range of results obtained  
analysis of 22 samples of brandies distilled from  
ise wines of the 1901 vintage, expressed in grms.  
of absolute alcohol:—

	Maximal.	Minimal.	Mean.
.....	37.7	10.0	18.6
.....	33.5	3.8	14.6
.....	213.0	65.9	121.0
.....	292.4	115.0	211.4
.....	4.4	0.2	2.4
of total impurities	475.6	280.1	367.5
higher alcohols and	429.0	235.2	333.9
her alcohols .....	4.4	0.7	1.9
ethers			

w of the fact that the proportions of higher  
and ethers vary very largely and in an inverse  
the author suggests that a more valuable  
of purity might be found in the sum of the two,  
ows less tendency to variation than the ratio.

—J. F. B.

rom Pears ("Brantwein"): *Manufacture of*  
K. Windisch. Z. Spiritusind. 1905, 28, 87—88.

de only the small, unripe pears, unsuitable for  
perry, are converted into spirit, but it is more  
e to use sound, ripe pears. The pears must be  
to a pulp, and the thick mash requires to be  
with water before it can be worked properly.  
great mistake to ferment the must at too low a  
ture; the diluting water should be warmed to a  
ture not exceeding 40° C., and the fermentation  
uld stand in a warmed room. A wild yeast,  
lotus, which has a low fermentative power and  
tendency to produce acetic acid, is very prevalent  
t. It is therefore advisable to pitch the pear-  
th a prepared yeast, at a temperature of at least  
or preferably at 20° C. Beer yeast is generally  
d, but it is not very suitable and is apt to injure  
in of the spirit. It is far better to use wine yeast,  
ay be cultivated in the pure state or else obtained  
sediments in the fermentation casks after racking  
wine. The best way of pitching the pear-musts  
l 2—3 per cent. of grape must in active fermenta-  
f cask-deposits be employed, the yeast should  
revivified. The ferment should be well mixed  
diluted pear-pulp immediately after grinding.  
musts show an exceptional tendency to acetifi-  
because the mares rise and form a crust on the  
he liquid, in which the aerobic bacteria develop.  
ause the must is deficient in natural acid. Fer-  
on should, therefore, be conducted in closed casks  
pped bung-holes, or else the mares should be kept  
ged by a perforated plate. Fermentation is complete  
weeks, but acetified musts do not attenuate  
ely. Full attenuation is reached with 0.2—0.25  
of residual sugar. The liquid should be distilled  
as fermentation is finished, otherwise acetification  
be avoided. Distillation is generally carried out  
tills; with direct firing the danger of scorching  
great, owing to the tendency of the mares to settle  
bottom; this may be obviated to some extent by  
ical stirrers, or by placing blocks of wood at the  
of the still. Small pears, poor in sugar, yield only  
res of absolute alcohol per 100 kilos. of fruit, fully  
rs yield 3—3.5 litres; under very good conditions  
s of pear-pulp yield 6 litres of alcohol. The spirit  
led at an alcoholic strength of 45—50 per cent. by  
—J. F. B.

; *Denaturing of —: Criticisms on Lindet's*  
rt to the French Government. R. Duchemin.

Bull. Assoc. Chim. Suer. Dist., 1905, 22, 668—682.  
(See this J., 1905, 146).

The author enumerates several reasons for the rejection  
of the denaturing agent proposed by Lindet and shows  
that the only security lies in the maintenance of the high  
proportion of wood spirit at present employed by the  
French Excise.

Wood spirit is the only practicable denaturing agent  
which cannot be eliminated from the alcohol, and the  
proposed reduction in its proportion would make fraudu-  
lent blending (after redistillation) five times more pro-  
fitable than it is at present. The other denaturing agents  
proposed are both objectionable and capable of elimination.  
The author contends that it is quite possible to convert  
formaldehyde into formic acid by the action of peroxides,  
and even if traces were still present, as stated by Lindet,  
the quantities detected by the latter are so minute that no  
legal action could be taken, in view of the fact that  
formaldehyde occurs in nature. Moreover, the irritant  
action of formaldehyde would prevent the use of the spirit  
in closed rooms and the production of formic acid under  
the influence of heat and oxygen would render it unfit for  
motor purposes. Pyridine is unsuitable because of its dis-  
gusting odour, its limited supply, and rising price. The  
recognition of the occurrence of methyl alcohol and for-  
maldehyde in natural products has led to the conclusion  
that Trillat's test is too delicate for Excise purposes, and  
that some less sensitive reaction should be employed; this  
again, is an additional reason for maintaining the high  
proportion of methyl alcohol added for the purpose of  
identifying denatured alcohol in blended spirits.—J. F. B.

*Potatoes; Determination of Moisture in Desiccated —*,  
by Hoffmann's Method. E. Parow and G. Ellrodt.  
XXIII., page 295.

*Alcohol in Aqueous Solutions; Determination of —*, by  
means of the Freezing Point. R. Gaunt. XXIII.,  
page 295.

#### ENGLISH PATENTS.

*Wines, Wash or Beer; Fermentation of —, and Making*  
*of Yeast for Distillers.* E. Vignier, London. Eng.  
Pat. 3196, Feb. 9, 1904.

THE must or wort is fed from a containing vessel auto-  
matically at regular intervals in fractional portions into  
the fermentation tun, in which "about a foot of yeast" in  
active fermentation is first introduced. The fermentation  
tun is preferably closed and provided with means for  
supplying hot and cold air to the interior, and for with-  
drawing the air and fermentation gases through filtering  
and washing vessels, so as to retain the alcohol and ether  
vapours. The fermentation of successive fractions of  
the must separately enables a product of higher alcoholic  
strength to be obtained than in the ordinary manner.

—J. F. B.

*Distilling Apparatus [for Alcohol].* O. Perrier, Paris.  
Eng. Pat. 4687, Feb. 25, 1904. Under Internat. Conv.,  
Feb. 25, 1903.

SEE Fr. Pat. 340,700 of 1904; this J., 1904, 815.—T. F. B.

*Distillery Refuse and other Liquids; Drying Apparatus*  
*for —.* E. W. Gaskell and C. Day, Glasgow. Eng.  
Pat. 20,031, Sept. 17, 1904.

THE liquid to be dried is fed into metal trays supported  
on an endless chain, which carries them through a drying  
chamber heated by a furnace. The movement of the trays  
is so regulated that a dry tray is taken out at one end,  
when a fresh tray is put in at the other. A bye-pass regu-  
lated by dampers is provided by which the heat may be  
diverted to the chimney, when the chamber is opened for  
changing the trays.—J. F. B.

### XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

#### (A).—FOODS.

*Ammonia in Milk; Determination of —.* W. N. Berg  
and H. C. Sherman. XXIII., page 293.

## ENGLISH PATENTS.

*Milk Extract, similar to Meat Extract; Process of Making* —, X. Binder, Paris. Eng. Pat. 4589, Feb. 24, 1904. Under Internat. Conv., Feb. 25, 1903.

SEE Fr. Pat. 329,706 of 1903; this J., 1903, 1062.—T.F.B.

*Centrifugal Cream and other Liquid Separators.* J. Mèlotte, Liège, Belgium. Eng. Pat. 26,623, Dec. 7, 1904.

The separate parts of the bowl or turbine of the suspended type are connected together by a central bolt and nut which also serves to suspend the apparatus. The milk is introduced into a distributing chamber formed by an addition to the cover of the bowl and provided with a central annular inlet around the suspension bolt, and radial discharge openings into the separator bowl.

—W. H. C.

*Coffee; Refining and Purifying* —, N. J. H. Weitzmann, Malmö Sweden. Eng. Pat. 26,905, Dec. 9, 1904. Under Internat. Conv., Sept. 27, 1904.

RAW coffee, which is usually stored for several years, can be matured to an equal extent by exposing the packages in which it is contained to the action of a powerful magnetic field, obtained by two adjustable electro-magnets. The effect of maturation can be obtained in one half to two hours according to the quality of the material and the strength of the current. If desired, permanent magnets may be used, or the coffee or the magnets may be rotated during treatment.—J. F. B.

## FRENCH PATENTS.

*Foodstuffs, Vegetable; Process for Preparing the Assimilable Phospho-Organic Matter contained in most* —, S. Posternak. Second Addition, dated Sept. 30, 1904. to Fr. Pat. 318,311, Feb. 3, 1902.

SEE Eng. Pat. 22,030 of 1904; this J., 1905, 39.—T. F. B.

*Albuminoids of Milk [Casein] with Silicic Acid; Preparation of a Compound of the* —, A. Bernstein. Fr. Pat. 347,135, Oct. 15, 1904.

A COMPOUND of casein with silicic acid, which is intended for a substitute for egg albumin, is prepared as follows:—35 c.c. of ammonia solution (sp. gr. 0.98) are added to 100 grms. of casein and 650 c.c. of water; 35–45 c.c. of "commercial" sodium silicate are then added, and then acetic or phosphoric acid until the solution is only faintly alkaline, when it will be quite liquid. On heating, the product becomes thick, and can be used as an agglutinant; it may also be evaporated at a low temperature, the dry product being suitable for use as a substitute for egg albumin.—T. F. B.

## (B.)—SANITATION; WATER PURIFICATION.

## ENGLISH PATENT.

*Air; Apparatus for the Purification of* —, and the *Generation of Ozone.* J. Harris. Eng. Pat. 18,144, Aug. 22, 1904. XI A., page 281.

## UNITED STATES PATENT.

*Separating Oily Impurities from Water; [Electrical] Apparatus for* —, H. T. Davis and E. Perrett. U.S. Pat. 783,107, Feb. 21, 1905. XI A., page 281.

## XIX.—PAPER, PASTEBOARD, Etc.

*Waste Paper; Removal of the Printers' Ink from* —, C. Wurster. Papier-Zeit. 1905, 30, 611.

WASTE printed papers can be worked up very advantageously in the pulping engine without boiling, provided that the pulp is afterwards sufficiently washed in the washing hollander. The printed paper is fed in the dry state into the pulping engine together with a

stream of warm water and a regulated proportion of caustic soda solution. The soda dissolves the ink in the paper size and in the printers' ink, and the soda forms an emulsion with the carbon. In the case of papers a proportion of soap may be added. The effect of the resulting stock depends on the thoroughness of the washing process; with sufficient washing in the hollander a dull white is obtainable. It is desirable to make the washing waters faintly alkaline to facilitate emulsification of the carbon. When mechanical pulp is present, the action of the alkali produces a tint, which, however, is discharged by alum. Long loading and short fibres are lost in the washing. Bleaching of the pulp is unnecessary, since the pulp is coloured as it would be if the paper were boiled with sodium carbonate.—J.F.B.

## ENGLISH PATENTS.

*Silky Finish on Textile Fabrics or Paper; Equipment of Bowls or Rollers for Producing an improved* —, J. Pope and J. Hübner. Eng. Pat. 4907, Feb. 22, 1904. V., page 273.

*Cotton Seed Hulls; Treatment of* —, to Obtain Products therefrom [Cellulose, Sugar and Fuels]. C. F. Cross, London. Eng. Pat. 8545, April 13, 1904.

COTTON-SEED hulls are heated with twice their weight of an alkali solution (e.g., a 3–5 per cent. solution of soda) for 6–8 hours, at a pressure of 20–40 lb. The solution thus obtained is suitable for use as a size in the manufacture of paper and boards. The fibrous material is washed and treated with chlorine until the colour of the product is uniform. The mass is then washed with water, digested, at 80°–100° C., with an alkaline solution (preferably six parts of sodium carbonate and three parts of sodium silicate dissolved in 300 parts of water, to 100 parts of the chlorinated product). The product consists mainly of a mixture of two forms of cellulose differing in length of the individual fibres. These may be separated either by suspending in water and passing through a series of tanks, when the shorter cellulose settles first; or they may be separated by washing on a sieve of suitable mesh (e.g., 40 to the inch). The longer cellulose form of cellulose may be used for many of the purposes to which cotton cellulose is applied; the shorter cellulose is characterised by the fact that, on hydrolysis, it yields a considerable quantity of an easily crystallisable furfural may be obtained from the syrup residue after the crystallisation of the sugar, by distilling with 30 per cent. sulphuric acid.—T. F. B.

## UNITED STATES PATENT.

*Paper Pulp; Process of Manufacturing Chemicals from* —, R. Roe, jun., Amberg, Wis., Assignor to R. Roe & Co., Providence, R.I. U.S. Pat. 783,137, Feb. 21, 1905.

THE raw material ("natural vegetable substance") introduced in small fragments into the digester, with a suitable quantity of the chemical liquor at an excess strength, is then introduced at or near the top of the digester. The contents of the digester are then subjected to the proper concentration by the introduction of steam near the bottom, at which place also steam is passed.—J. F. B.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Ether; Oxidising Action of Impure* —, A. J. Limon. Ber. 1905, 38, 774–775.

ETHER which is not specially purified is liable to contain in addition to water, alcohol and free acid, traces of hydrogen peroxide, ozone, aldehyde and ethyl peroxide. The action of these oxidising agents is not often apparent, but the author quotes a case in which, during the ext



ine alkylidide from an aqueous solution, the portion acquired a yellow colour and a copious sation of insoluble periodides took place. Direct ents showed that ether to which hydrogen peroxide n added, possessed this property of oxidising the lide to a slight extent, but the oxidising power of roxide would appear to be a much greater one, since vely small quantity of the ether in question was of decomposing the alkylidide completely with on of periodides. This ether had been taken from of perfectly pure ether, but it had remained in a ttle exposed to the action of the air for about three uring which period evaporation had been ing slowly.—J. F. B.

[Formaldehyde]; Commercial Preparation of —. Morel. J. Pharm. Chim., 1905, 21, 177—183.

Formal formol is obtained by passing the vapour spirit, in the presence of air, over copper heated ess.

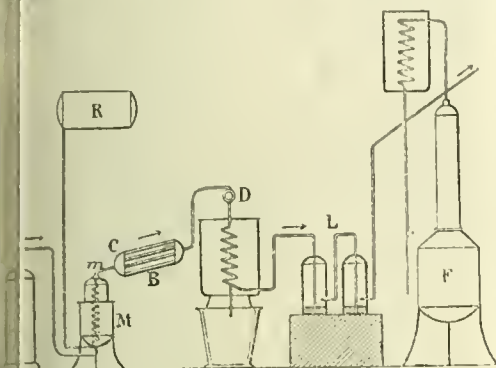


figure illustrates the plant used in the French works of the Côte d'Or, in which wood spirit d from the destructive distillation of wood in rguindy and Champagne districts, is used as the of the formaldehyde.

essential part of the apparatus is the metal chamber which the feed-tube *m* enters, and from which four copper tubes or oxidisers *B* discharge by a exit tube. This chamber is fitted with inspection es, through which the course of the process may ehed and controlled. The wood spirit, stored in ervoir *R*, falls into the mixer *M*, where it is vola- and intimately mixed with air from the chamber *A*, s connected with a force-pump. The gases after ing the oxidiser are led into the condensing coil *D*; e crude formol is discharged into the receiver i. The small amount of uncondensed gas is then ough a series of two washers *L*. The "formol" obtained is a mixture of water, methyl alcohol and 0 per cent. of formaldehyde. It is rectified in the y which the free methyl alcohol is removed and formol obtained, containing 40 per cent. of formal-, chiefly in the form of the acetal. Rectification ot be pushed too far, otherwise the formaldehyde come polymerised into trioxymethylene. n once oxidation starts, the heat generated is at to keep the oxidisers red-hot, so that the process automatically.—J. O. B.

; Metallic —. Maystre. Schweiz. Ver. anal. n., Jan. 17, 1905; Chem.-Zeit., 1905, 29, 199.

strates of barium, strontium, calcium, lead, man-, and zinc were examined. All contain water of lisation. The solubilities in water of the calcium, nd zinc salts diminish with rise of temperature, at the barium salt increases, while those of the um and manganese salts first, increase and then sh. For the quantitative determination of the acid rium and lead salts are best suited; the latter is nsoluble in presence of alcohol.—J. T. D.

Endimino-triazoles. M. Busch. Ber., 1905, 38, 856—860. SYMMETRICAL trialkyl derivatives of aminoguanidines react with carboxylic acids to form heterocyclic compounds —endiminotriazoles. The compound obtained from triphenylaminoguanidine and formic acid according to the equation:



is characterised by forming a nitrate almost insoluble in water, and well suited for the detection and determination of nitric acid (see page 291). It can be prepared in the following manner:—Twenty grms. of thiocarbamide are heated with about 0.5 litre of dry benzene under a reflux condenser, and dry mercuric or lead oxide is added in small portions, so long as a black precipitate is produced. The metallic sulphide is filtered off, the hot solution treated with the calculated quantity (10 grms.) of phenylhydrazine, and concentrated to 50 c.c. On cooling, if necessary with addition of some gasoline (petroleum spirit), the liquid solidifies to a crystalline mass of triphenylamino-guanidine. This is drained, washed with ether, dried, and then heated for two hours in a sealed tube at 175 C. with twice its weight of 90 per cent. formic acid. The product is treated with 10 times its volume of water, filtered, and the new base, 1,4-diphenyl-3,5-endanilodihydrotriazole, precipitated by ammonia, and extracted with chloroform. The chloroform solution is dried with potassium carbonate, concentrated to one fourth, and after addition of a few drops of petroleum ether, allowed to crystallise.—A. S.

*Calycanthus Glaucus*; Crystalline Alkaloid of —. H. M. Gordin. J. Amer. Chem. Soc., 1905, 27, 144—155.

CALYCANTHINE was obtained from the seeds of *Calycanthus glaucus* (which contain about 2 per cent.) by extraction with hot alcohol, converting into the sulphate, washing with acetone (in which it is insoluble) and liberating from the aqueous sulphate solution by means of potassium hydroxide. Calycanthine crystallises from a mixture of acetone and water in colourless crystals containing half a mol. of water of crystallisation; *m. pt.* 216°—218° C. By heating for three or four hours at 120° C., it loses its water of crystallisation, the anhydrous alkaloid melting at 243°—244° C. Its composition is represented by the formula  $\text{C}_{11}\text{H}_{14}\text{N}_2$ ; it is monobasic, and the solutions of its normal sulphate and hydrochloride are strongly acid to litmus. The hydrochloride, hydrobromide, hydriodide, chloroplatinate, acetate, and sulphates are described, and also some reactions of the alkaloid; these include the rapid reduction of gold salts in alkaline solution (with a 1/1,000,000 solution of alkaloid, a purple coloration is produced); the production of a pink colour with sulphuric acid and sugar, and of a green colour with nitric acid. Physiologically, the alkaloid produces depression of the heart and stimulation of the spinal cord, the symptoms being very similar to those associated with strychnine.—T. F. B.

Organic Acids; Electrolysis of —, by means of Alternating Currents. A. Brochet and J. Petit. XI A., page 280.

#### ENGLISH PATENTS.

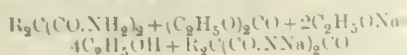
Formic Acid from Formates; Process for the Manufacture of Concentrated —. M. Hamel, Grünau, Germany. Eng. Pat. 7534, March 30, 1904.

SEE Fr. Pat. 341,764 of 1904; this J., 1904, 911.—T. F. B.

Barbituric Acid; Manufacture of Derivatives of — [Dialkylbarbituric Acids]. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 8302, April 11, 1904.

DIALKYL-BARBITURIC acids are prepared by the condensation of the corresponding dialkylmalonic acid diamide with a dialkylcarbonate in presence of an alkali alcoholate, with

or with out the use of a suitable solvent. The reaction takes place according to the equation—



when diethyl carbonate has been employed. The sodium salt of the dialkylarbituric acid is decomposed by the addition of mineral acid to its aqueous solution.—T. F. B.

*Cresosote: Process of Treating —, and Product of same [for Medicinal Purposes].* A. G. Meyer, San Francisco, U.S.A. Eng. Pat. 28,997, Dec. 30, 1904.

NITRIC acid is added to a mixture of beech-wood creosote, acetanilide, and ammonium carbonate, and the product crystallised from dilute alcohol. The solution of the resulting crystals in a mixture of water, alcohol and ether is intended for use in the treatment of diphtheria, tuberculosis, &c., and also as a local antiseptic. —T. F. B.

#### UNITED STATES PATENTS.

*Pseudo-cyclohexalidene Acetone and Process of Making same.* G. Werling, Frankfurt, and R. Welde, Assignors to Farbwerke vorm. Meister, Lucius und Brüning, Höchst on the Maine, Germany. U.S. Pat. 782,689, Feb. 14, 1905.

PSEUDO-CYCLOHEXALIDENE acetone is obtained by condensing with acetone the mixture of aldehydes produced by distilling the calcium salt of trimethylcyclohexene-carboxylic acid with calcium formate. (See Eng. Pat. 3173 of 1903; this J., 1904, 204.) It is a colourless oil, b. pt. 133° C.—135° C. (8 mm. pressure), soluble in alcohol, ether and benzene, and possesses the odour of violets. Its homologues are similar in character, all possessing floral odours, and being suitable for the preparation of perfumes.—T. F. B.

*Cream of Tartar; Process of Making —.* G. W. Hooven, Englewood, N.J., and S. T. H. K. Endemann, Brooklyn, Assignors to California Products Co., Jersey City. U.S. Pat. 783,524, Feb. 28, 1905.

ONE ton of pomace is extracted with a solution of 36 lb. of oxalic acid in 1200 gallons of water and the solution is evaporated to produce cream of tartar. The residual pomace is extracted with hot water, and a further quantity of oxalic acid is added to the resulting liquor, which may then be used again for the extraction of a fresh quantity of pomace. A potassium salt may, if desired, be added to the oxalic acid solution used for the extraction. The method of converting calcium tartrate into potassium bitartrate by boiling with a solution of oxalic acid and a potassium salt is also claimed.—T. F. B.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*Photographic Impressions produced by feeble Illuminations; Intensity of —.* C. Gutton. Comptes rend. 1905, 140, 573—575.

PHOTOGRAPHIC plates, half of each being protected by an opaque screen, were exposed for one minute in an otherwise dark room to the light from an electric lamp, at different distances, starting from the greatest distance at which any effect was produced. The plates were developed, and the density of the photographic impression was measured by photometric comparison of the exposed and unexposed halves of the plates. The results show that for very low illuminations the density of the impression increases very rapidly with increase in the illumination, but that this rate of increase diminishes very much at higher illuminations; contrasts of light and shade are thus exaggerated in a negative. When, however, a positive is printed from a negative, the same process is

effective, so that the exaggeration is reduced; the densities of impression are proportional to the illuminations, and the differences of illumination are faithfully reproduced.—J. T. D.

*Hydrogen Peroxide: "Radiation" of —.* J. and C. Otsuki. Verhandl. der Deutsch. Physik 1905, 7, 53—56.

GRAETZ (this J., 1905, 43) has recently explained the action of hydrogen peroxide on a photographic plate as being due to a kind of radiation. The authors' experiments on the subject showed that in all the cases examined where photographic action took place, the presence of hydrogen peroxide could be detected on the film; reaction with titanium-sulphuric acid. They conclude that the action on the photographic plate is caused by hydrogen peroxide which has condensed thereon. —also Russell, this J., 1899, 516.)—A. S.

*Ozone: Photographic Activity of —.* K. S. Physik. Zeits., 1905, 6, 73—74. Chem. Centr., 1, 580.

OZONE acts on photographic plates even when no substances are present, and therefore when no hydrogen peroxide can form. The reason why Graetz (this J., 1905, 43) did not observe any action is probably the remarkable differences in sensitiveness of the different kinds of plates on the market. Agfa plates when subjected to a current of ozonised oxygen for a few minutes were strongly acted upon, whilst reversal image began after 8 minutes. The different behaviour of the plates is due to the gelatin used in preparing the films.—A. S.

*Metals: Spontaneous Action of — on Photographic Plates without Direct Contact.* G. W. A. Kai and M. Steffens. Physik. Zeits., 1905, 6, 1. Chem. Centr., 1905, 1, 579.

IN the earlier experiments (this J., 1905, 104) the action of radium on the photographic plate had been observed on metals which had been frequently exposed to light, and it was thought that a concentration of radio-activities at the surface of the metal might have taken place. However, further experiments have shown that plates which have not been exposed to radium rays or to light behave exactly like those which have been so exposed. Also, plates of aluminium and zinc which had originally produced images on a film placed above them, lost the property after exposure to X-rays, but still acted on a film placed below them. The authors state that none of their results is opposed to the view previously put forward that the effects produced ("actinographs") are due to an emanation which is subject to the law of gravity. Occasionally a light image on a dark background was produced. Zinc, aluminium and uranium produced "actinographs" on plates placed both above and below the other metals only on the lower plates.—A. S.

#### ENGLISH PATENTS.

*Photographs; Impts. Relating to —.* O. Fulton, Chesham, and W. M. Gillard, Twickenham. Eng. Pat. 11,219 of 1904, March 11, 1904.

THIS specification relates to the production of "double exposure" photographs (see Eng. Pat. 11,219 of 1903; this J., 1904, 622) upon paper or similar material. The treatment of a celluloid solution, which is employed for developing photographs on woven fabrics (*loc. cit.*), is not applicable to paper, since it makes it too transparent. The paper may be impregnated with a solution of gum or gelatin and then hardened with chrome alum or formaldehyde, but it is preferable to use a solution of cellulose (e.g., 5% or a solution of cellulose in cuprammonium solution) upon which the photograph is to be produced, preferably of the "parlament paper" type; it should be more transparent than ordinary paper, and more resistant than a waxed or varnished paper. The paper is



with a solution of cellulose, as defined above, then dried, calendered, and coated on both sides with a sensitive gelatin emulsion. The subsequent operation of the duplex photographs, and the results obtained are similar to those described in the above-mentioned specification.—T. F. B.

*or other Material for Photographic Purposes; Making or Preparation of* —. J. H. P. Gillard, R.; and H. H. Molyneux, Hampstead. Eng. Pat. 27, Nov. 28, 1904.

ture of starch and agar-agar is employed in place of gelatin, &c., as an emulsifier for the sensitising salts in photographic paper, &c. A solution of 36 grs. of agar in 5 oz. of water may be added to a solution of 1 lb. of starch in 8 oz. of water; if a somewhat softer texture be desired, sugar, glycerin, &c. (e.g., 60 grs.) may be added to the above mixture. The preparation may be applied to the paper, and the whole sensitised by immersion in a suitable solution, or the sensitising agents may be incorporated with the mixture, and the product applied to paper. (Compare Eng. Pat. 26,247 of 1904; 1905, 152.)—T. F. B.

## XXII.—EXPLOSIVES, MATCHES, Etc.

*Explosives; Preparation of* —. M. Nenmann. Eng. Pat. VII., page 276.

### ENGLISH PATENTS.

*Explosives; Manufacture of* —, and of Caps for use with. R. A. Hadfield, Sheffield, Yorks. Eng. Pat. 7882, April 5, 1904.

A projectile is preferably made of nickel-chromium containing carbon (0.6 per cent.), nickel (2 per cent.), and manganese as low as possible. The purpose of hardening it is heated to 720° C., and is then dipped, point downwards, to "zone" into oil or water, the remainder of the projectile being out of the cooling medium. By this means a portion which has been dipped in the cooling medium is hardened, and the projectile gradually becomes harder towards the base. Caps for projectiles are hardened by heating them to between 950° C. and 1100° C., quenching in water, re-heating between 600° C. and 700° C., and cooling slowly.—G. W. McD.

*Explosives; Sulphur Compounds and Priming or Igniting Positions suitable for the Manufacture of* —. J. Vetter, London. From the Firm of J. D. Riedel, Berlin. Eng. Pat. 7893, April 12, 1904.

Eng. Pat. 342,040 of 1904; this J., 1904, 911.—T. F. B.

### UNITED STATES PATENT.

*Explosives [Chlorate]*. J. C. Mitchell, Reynolds, Ind. U.S. Pat. 783,844, Feb. 28, 1905.

Eng. Pat. 23,973 of 1904; this J., 1905, 250.—T. F. B.

## XXIII.—ANALYTICAL CHEMISTRY.

### APPARATUS, Etc.

*Apparatus for Determination of Nitric Acid; Loss of Weight*. L. L. Kreider. Z. anal. Chem. 1905, 44, 154—157.

The apparatus consists of the test-tube A (see figure), which fits as closely as possible the second test-tube B, and has a small hole blown in the bottom, and

in which slides loosely the third test-tube C, drawn out to a capillary, and provided with a tight cork and glass tube, the latter furnished with a rubber tube and glass-rod stopper. The hole in B is loosely plugged with cotton-wool, the capillary passed through it and calcium chloride packed in B to a convenient height. A tube very slightly smaller than B is placed in A, and a good paraffin joint made between them; the joint is then warmed and the inner tube withdrawn, leaving the paraffin on the walls of A. The weighed substance for analysis is placed in A, and the reacting liquid sucked into C, and retained by closing the stopper. The apparatus is put together, the paraffin joint made good by a hot wire, and the whole weighed. The liquid is gradually run in, and after reaction is over, a current of air is passed through till the gaseous product of reaction is expelled, when the final weighing is made. Results of decomposition of carbonates by acids, of acids by magnesium and zinc, and of urea and ammonium salts by hypobromite, are given, and show that a high degree of accuracy is attainable.—J. T. D.



### INORGANIC—QUANTITATIVE.

*Benzene as an Indicator in Iodine Titrations*. B. Schwesow. Z. anal. Chem., 1905, 44, 85—88.

If a few cubic centimetres of pure benzene be added to a solution containing free iodine, and the latter then titrated in the usual way, the end point is shown by the disappearance of the last trace of violet-red coloration from the benzene. The colour change is stated to be more easily observed than is the case when starch solution is employed. Benzene is also the more sensitive indicator, 1 c.c. of N/10000 iodine solution giving a distinct coloration in 5 c.c. of benzene, whilst 5 c.c. of starch solution required 2.5 c.c. of the iodine solution, both experiments being performed at a temperature of 15° C. The objection to this indicator is that the titration must be carried out in a stoppered vessel, so that the solutions can be well shaken to remove the last traces of iodine dissolved in the benzene.—W. P. S.

*Persulphate; Quantitative Separations by means of* —. G. v. Knorre. Z. anal. Chem., 1905, 44, 88—96 (See this J., 1904, 133.)

FURTHER experiments are described which were carried out for the purpose of ascertaining whether the author was justified in his previous statement that the precipitated manganese peroxide always carried down with it traces of other metals present in the solutions employed. It was found that copper oxide was always precipitated together with manganese peroxide from solutions containing manganese and copper salts, and that it was not possible to free the precipitate from copper by boiling with 2 per cent. nitric acid. The author, therefore, considers his former statement confirmed.—W. P. S.

*Nitric Acid; Gravimetric Determination of* —. M. Busch. Ber., 1905, 38, 861—866.

THE author finds that diphenylendianilodihydrotriazole (for its preparation see page 289) is a very suitable reagent for the detection and gravimetric determination of nitric acid. For ordinary use, the name "Nitron" is proposed for the new base.

*Detection of Nitric Acid, free and combined*.—Five to six c.c. of the solution under examination are acidulated with 1 drop of dilute sulphuric acid, and 5—6 drops of a 10 per cent. solution of "Nitron" in 5 per cent. acetic acid are added. If nitric acid be present, a voluminous white precipitate is produced, or if the quantity be very small, fine needles separate after some time. One part of nitric acid in 60,000 can be detected at the ordinary temperature, and 1 in 80,000 at 0° C. The addition of sulphuric acid favours the reaction, but may be omitted if necessary.

Some other acids also give precipitates, but these can in most cases be easily removed before making the test, namely, hydrobromic acid by means of chlorine, hydriodic acid by oxidation with iodate and separation of the iodine, and nitrous and chromic acids by treatment with hydrazine sulphate. Chloric (1:4000), perchloric (1:50,000), thiocyanic (1:15,000), ferrocyanic, ferricyanic and picric acids also interfere.

**Determination of Nitric Acid.**—The substance (containing about 0.1 gm. of nitric acid) is dissolved in 80–100 c.c. of water, 10 drops of dilute sulphuric acid are added, the liquid is heated nearly to boiling and treated with 10–12 c.c. of the solution of nitron in acetic acid. The mixture is allowed to stand for 1½–2 hours in ice-water, the precipitate collected in a Neubauer crucible (*Z. angew. Chem.*, 1901, 923), washed with the filtrate, and then with 10–12 c.c. of ice-water in small portions. The precipitate is dried at 110° C., and weighed, the weight multiplied by  $\frac{1}{57}$ , giving the amount of nitric acid. The nitron may be regenerated from the precipitate by shaking with ammonia and extracting with chloroform.

**Detection and Determination of Nitrate in presence of Nitrite.**—The substance is dissolved in a small quantity of water, and the solution allowed to drop gradually on to finely-powdered hydrazine sulphate contained in a beaker cooled externally with flowing water. When the evolution of nitrogen, due to the decomposition of nitrite, has ceased, the solution is made up to 100 c.c., and treated with nitron in the manner described above.—A. S.

**Bismuth Ammonium Molybdate; Application of — to Gravimetric Analysis (Determination of Bismuth).** E. H. Miller and E. V. D. Cruser. *J. Amer. Chem. Soc.*, 1905, 27, 116–121.

THE precipitate of bismuth ammonium molybdate obtained by precipitating acidified bismuth solutions with excess of ammonium molybdate, may be utilised for the gravimetric determination of bismuth, since it is converted on ignition into a mixture of bismuth and molybdenum oxides of the composition  $\text{Bi}_2\text{O}_3 + 4\text{MoO}_3$ . By washing the molybdate precipitate with ammonium nitrate solution, drying at 160° C., and igniting at a dull red heat, results were obtained which showed that this process was capable of as great accuracy as the volumetric method of Miller and Frank (this *J.*, 1903, 1149). In the course of preliminary experiments, it was found preferable to carry out the ignition of bismuth nitrate in a porcelain crucible, the results obtained when a platinum vessel was used, being somewhat low. In the precipitation of bismuth ammonium molybdate, Congo Red is preferable to Methyl Orange as an indicator, and washing the precipitate with ammonium nitrate solution gives more accurate results than when ammonium sulphate solution is used.—T. F. B.

**Phosphorus [in Iron and Steel]; Colorimetric Determination of —.** T. E. Hewitt. *J. Amer. Chem. Soc.*, 1905, 27, 121–124.

It is proposed to determine phosphorus by comparing the colours produced by passing sulphuretted hydrogen in excess into solutions of sodium phosphomolybdate in alkali hydroxide. The standard phosphomolybdate solution is of such a strength that 10 c.c. contains 0.00009122 gm. of phosphorus; 10 c.c. of this are diluted to 25 c.c., saturated with sulphuretted hydrogen, and made up to 50 c.c. For the determination of phosphorus in iron or steel, 2 grms. of the latter are dissolved, and the phosphorus obtained as phosphomolybdate; this is dissolved in decinormal sodium hydroxide solution, and the volume made up to 100 c.c. Portions of this solution are saturated with sulphuretted hydrogen, made up to 50 c.c., and compared with the standard.—T. F. B.

**Tungsten [in Tungsten Steels, &c.]; New Method of Determining —.** G. v. Knorre. *Ber.*, 1905, 38, 783–789.

BENZIDINE hydrochloride precipitates not only sulphuric acid, but also tungstic acid, from its solutions. The benzidine tungstate so obtained is insoluble in cold, but slightly soluble in hot water. When precipitated in the cold

it readily passes through the filter: it must, therefore, be precipitated from a boiling solution, which is allowed to cool completely before filtration, or a little sulphuric acid may be added to the cold solution before precipitation in which case the mixed benzidine sulphate and tungstate settle rapidly and filter clear. The benzidine solution is made according to Raschig's directions (this *J.*, 1906), but using half the quantities there given, so that 1 litre contains 20 grms. of benzidine; 1 c.c. is equivalent to about 0.025 gm. of tungstic acid, or about 0.01 of sulphuric acid. The precipitate is washed with solution diluted with 30–40 times its volume of pure water carries some of the precipitate through. To the solution (of sodium tungstate, for example) containing about 0.5 gm. of tungsten, 10 c.c. of N/10 sulphuric acid are added, and an excess of the benzidine solution; after 5 minutes the liquid is filtered, the precipitate washed with the weak benzidine solution, moist filter and precipitate placed direct into a platinum crucible, ignited, and the resulting tungstic anhydride weighed.

In the case of tungsten compounds which have been fused with sodium carbonate, the aqueous solution of fusion is neutralised with hydrochloric acid, using an orange as an indicator, 10 c.c. of N/10 sulphuric acid added, and the precipitation and further operation carried out as above. Practically all the cobalt matter goes down with the precipitate, but is, of course, burnt off during the ignition.

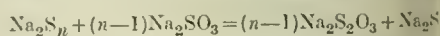
Tungsten steels are dissolved (5 grms.) without the aid of air in dilute hydrochloric or sulphuric acid, the residue of the tungsten remaining undissolved. The solution is filtered, the residue washed on the filter with the benzidine solution, ignited, fused with sodium carbonate, the fusion extracted with water, filtered, and the solution treated as above. Results in a sample of tungsten steel

Solution by hydrochloric acid:—	Tungsten Per cent.
Crude residue calculated as $\text{WO}_3$ .....	1.45
Tungsten by benzidine process.....	1.25
Solution by sulphuric acid:—	
Crude residue calculated as $\text{WO}_3$ .....	1.31
Tungsten by benzidine process.....	1.20
Tungsten by method hitherto used.....	1.11

The precipitation of benzidine tungstate is interfered with by ferric salts, but not by ferrous salts. In presence of tartaric or citric acid added to prevent the oxidation of ferrous salts, the results are always too low. Considerable quantities of free acid also interfere with the precipitation of benzidine tungstate. (Compare this *J.*, 1905, 106.)—J. T. D.

**Copper Sulphide; Solubility of — in Solutions of Polysulphides.** V. Hassreider. *Z. angew. Chem.*, 1905, 29, 292.

COPPER sulphide is soluble in solutions of yellow polysulphide, particularly so in the presence of polysulphides such as are formed on fusing metallic oxides with sodium hydroxide and sulphur. Thus, in determining tin, e.g., tin, by fusing the oxides with equal parts of sodium and sodium hydroxide and extraction of the mass with water, from 3 to 64 per cent. of the total copper pass into solution (Prost and van de Castele). The author has shown that nearly all the sulphide remains in residue if the fused mass be extracted with cold water, whilst a current of hydrogen is simultaneously introduced. The author recommends the simpler method of extracting the solution of the polysulphides with repeated additions of sodium sulphite until the liquid becomes colourless, sodium thiosulphate and monosulphide being formed.



This method is stated to have given quantitative results in the separation of copper from antimony and lead. A similar treatment with sodium sulphite has been recommended by Leerenier to convert polysulphides into monosulphides so as to obtain solutions suitable for electrolytic determination of antimony.—C. A. M.



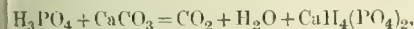
*Assay of —.* E. Victor. Chem.-Zeit., 1905, 29, 179.

ample, if not in the form of borings or filings, is rolled into a thin sheet and cut into small pieces. 5 grms. are heated with 100 c.c. of hydrochloric acid (121) to a moderate temperature until the decomposition is complete. After cooling, potassium chlorate is added in small portions until the black residue consisting of antimony and arsenic is dissolved, and the clear solution is boiled until the chlorine is completely off. After cooling, a solution of ammonium and ammonia in slight excess, is added; the solution should then be blue, or, if iron be present, greenish. Copper, lead, iron, and bismuth are precipitated by unfiltered hydrogen water. Lead and copper may be removed electrolytically, bismuth and iron, gravimetrically. For the determination of antimony, the blue solution sample is reduced with "ferrous reductum" and metallic antimony is precipitated. This is filtered off, together with the iron, and dissolved in hydrochloric acid with the aid of potassium chlorate. The solution is then made alkaline, the ferric hydroxide is removed by filtration through asbestos, the other metals are precipitated by sodium sulphide and a little potassium cyanide. In the remaining solution the antimony is determined electrolytically.

Samples containing less than 96 per cent. of tin, are determined volumetrically. The sample is dissolved as described above, and the solution is reduced by aluminium powder in a current of hydrogen. Hydrochloric acid is added to dissolve the residue which is titrated by ferric chloride and iodine. Starch solution as an indicator.—R. L.

*Phosphates; Technical Method for the Determination of Phosphoric Acid in —.* Gerhardt. Chem.-Zeit., 1905, 29, 178.

Stomachy titration of the aqueous or alcoholic solution from superphosphates is not very accurate. The author recommends adding a certain quantity of the phosphate solution to a weighed excess of calcium carbonate:



For determining the unattacked calcium carbonate, the solution is left undissolved, is filtered off, introduced into a 200 c.c. flask together with the filter paper, and 5 N/4 hydrochloric acid added, the solution made clear, filtered through a dry filter, and an equal part of the filtrate titrated with N/2 sodium hydroxide solution with methyl orange as indicator. The presence of iron and alumina does not affect the accuracy of the result.—R. L.

*Ammonia in Milk; Determination of —.* W. N. Berg and I. C. Sherman. J. Amer. Chem. Soc., 1905, 27, 136.

In order to determine ammonia in milk by distillation, sodium carbonate at atmospheric pressure invariably gives false results, even when very small amounts of alkali are used; the use of corrections deduced from the amounts of ammonia given off on further distillation gave little improvement. The most accurate method was found to be modification of the Boussingault-Schaeffer method, and is as follows:—A mixture of 50 c.c. each of 10 N and methyl alcohol, with 10 grms. of sodium carbonate and 0.5 gm. of sodium carbonate, is distilled under a pressure of about 50 mm. (56°–62° C.) for about 15 minutes, the distillate being collected in standard sulphuric acid. The total volume of the distillate should be noted. A correction for methyl alcohol is necessary (0.5 c.c. of 10 N alkali for 40–50 c.c. of distillate). The use of sodium chloride is not necessary in the case of fresh milk, but in old milk considerably less ammonia was generally found when sodium chloride was present. In the latter case the difference in the amounts of ammonia obtained with and without sodium chloride is considered

to be of value as an indication of the condition of the proteid matter. The presence of formaldehyde in the milk had no effect on the results.—T. F. B.

### ORGANIC QUALITATIVE.

*Sugar in Water of Condensation; Test for —.* H. and L. Pellet. Bull. Assoc. Chim. Sucr. Dist. 1905, 22, 582–584.

The maximum of coloration in applying the  $\alpha$ -naphthol test for sugar is obtained at a certain temperature; the best conditions are attained by measuring 5 c.c. of sulphuric acid into a test-tube, running 2 c.c. of the water to be tested, cautiously down the side of the tube, adding two or three drops of the reagent and shaking the mixture. It is easy to detect 2 to 3 mgrms. of sugar per litre. As Drenkmann has shown, the presence of 150 mgrms. of nitric acid per litre obscures the reaction. Ammoniacal waters do not interfere. By comparison of weak sugar solutions made up with distilled water and with the water of condensation, it may be determined whether the water obscures the test or not. Suspended matters should be removed by filtration through paper and washed with distilled water. Grease should be removed with petroleum ether. If the organic matter present in the sulphuric acid itself gives the sugar reaction even with distilled water, it suffices to heat such acid until white fumes are evolved. After cooling it gives no colour reaction unless sugar be present.—L. J. DE W.

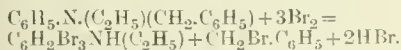
### ORGANIC QUANTITATIVE.

*Sulphur [in Coal]; Determination of —.* by Eschka's Method. C. Bender. Z. angew. Chem., 1905, 18, 293.

The author has obtained completely concordant results by Sauer's and by Eschka's methods of determining sulphur in coal. In the former method the combustion in oxygen was accelerated by placing a roll of platinum foil in the constricted portion of the tube. A modification of Eschka's method is used in Westphalia to prevent contact of the products of combustion with Eschka's mixture. The mixed coal and soda-magnesia are ignited in a tube of hard glass, about 18 cm. long and 2.8 to 3 cm. in diameter, which is closed at one end. The mixture is placed near the closed end of the tube, which is held horizontally. It is then heated gradually from behind forwards until the combustion is complete, after which the determination is completed in the usual manner. The tube should be heated in an air-bath before the introduction of the mixture.—C. A. M.

*Benzylethylaniline and Benzyldine-aniline; Determination of —.* W. Vaubel and O. Scheuer. Z. Färb.-u. Textil-Ind., 1905, 4, 88–89.

BENZYLETHYLANILINE and benzyldine-aniline can be quantitatively determined by the bromination method. In the case of the former, the benzyl group is split off and tribromomethylaniline formed, whilst with the latter, the benzyldine group is removed and tribromaniline produced.



The bromination is performed in the usual manner, the bases being dissolved in glacial acetic acid, hydrochloric acid and potassium iodide added, and the mixture titrated with a standard solution of potassium bromate, the end point being determined by spotting on starch-iodide paper. Benzylethylaniline and benzyldine-aniline have very weak basic properties and cannot be approximately determined by titrating with hydrochloric acid with the use of Congo Red paper, as is possible in the case of mono- and di-methylaniline and of mono-ethylaniline.—A. B. S.

*Acetyl Groups; Determination of —.* A. G. Perkin. Chem. Soc. Trans., 1905, 87, 107–110.

The method is recommended more particularly for acetyl

derivatives of phenolic compounds. About 0.5 gm. of the substance is treated with 30 c.c. of alcohol and 2 c.c. of sulphuric acid, and the mixture gently distilled for about three-quarters of an hour, a little fresh alcohol being added from time to time. The ethyl acetate which distils over is collected in 20 c.c. of standard alcoholic potash solution, which at the end of the distillation, is boiled for a few minutes under a reflux condenser, the excess of alkali being finally titrated with standard sulphuric acid. When the method is applied to acetylamino compounds, 4 c.c. of sulphuric acid are used, and the mixture is distilled for a longer time.—A. S.

*Fats; Bromine Absorption Value of* — [New Method for the Determination of]. F. Telle. J. Pharm. Chim., 1905, 21, 111—117, 183—187.

THE following method obviates the disadvantages which pertain to the customary processes, due to the volatility of the bromine, and the unstable titre of its solutions. At the same time only the total additive bromine is determined, and errors due to more or less complete substitution are avoided.

The requisite solutions are:—*Solution of arsenic trioxide*.—4.95 grms. of pure dry arsenic trioxide are dissolved in 10 c.c. of caustic soda solution, rendered acid by the addition of 100 c.c. of hydrochloric acid, and made up to 1 litre with distilled water. This is equivalent to N/10 bromine solution.

*Solution of sodium hypochlorite*, prepared by diluting 35 or 40 c.c. of the commercial solution to 1 litre. This is then titrated against the standard arsenical solution as follows:—Five c.c. of 10 per cent. potassium bromide solution are added to 20 c.c. of the solution of arsenic trioxide; the liberated bromine is then titrated with the hypochlorite solution until only a feeble yellow tint remains.

*To determine the bromine absorption of a fat*.—1.25 grms. of oil (or 0.625 gm. of a drying oil) are dissolved in chloroform, or preferably carbon tetrachloride, and the solution is made up to exactly 50 c.c. Ten c.c. of this solution are mixed in a stoppered flask with 5 c.c. of 10 per cent. potassium bromide solution, 1 c.c. of pure hydrochloric acid, and then slowly and with constant agitation with a known volume of the sodium hypochlorite solution. In order to avoid too great excess of free bromine, the amount of hypochlorite should not be excessive. For cod-liver and sweet almond oils 30 c.c. will be sufficient; for ordinary oils, 25 c.c.; for lard and margarins, 20 c.c.; for butters and tallows, 15 c.c.; for cocoa-nut fat, 10 c.c. The mixture is set aside in a dark place for about 20 minutes, then 20 c.c. of the standard arsenic solution are run in, and the whole well shaken. Finally, standard hypochlorite solution is run in until the aqueous solution assumes a yellow tint, which passes into the chloroform or carbon tetrachloride on agitation. The total number of c.c. consumed, minus the amount equivalent to the 20 c.c. of arsenical solution added, will be the equivalent of the bromine absorbed by the oil. This is then expressed in terms of bromine for 100 grms. of oil, in the usual manner.

*Bromine absorption values by the above method*.—Sweet almond oil, No. 1, 69.87, No. 2, 74.37; arachis oil, first pressing, 53.24; cotton-seed oil, 64.52; poppy-seed oil, No. 1, 76.28, No. 2, 78.69; olive oil, No. 1, 51.20, No. 2, 52.24, No. 3, 54.00; sesame oil, No. 1, 66.00, No. 2, 65.70; lard, No. 1, 35.52, No. 2, 38.3; No. 3, 40.30; butters from Rheims, 24.38; from Aisne, 23.23, from Ardennes, 25.23; oleomargarin, 28.96; cocoa-nut fat (vegetaline), 5.13; castor oil, cold drawn, 52.24; cod-liver oil, pale, 83.44, brown, 83.1; cacao-butter, 23.69; linseed oil, No. 1, 96.15, No. 2, 95.07; colza oil, 64.32; neatsfoot oil, 56.03; tallow, No. 1, 25.41, No. 2, 23.86.—J. O. B.

*Glycerol; Direct Method of Determining* —. A. A. Shukoff and P. J. Schestakoff. Z. angew. Chem., 1905, 18, 294—295.

THE method is based upon the fact that on mixing the glycerol solution with sodium sulphate dehydrated by ignition, and extracting the mass with anhydrous acetone,

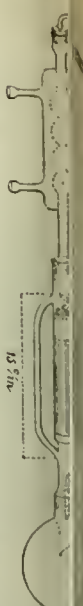
the whole of the glycerol passes into solution. The liquid to be analysed is concentrated to a syrup (or to a paste in the case of soap lyes) at a temperature not exceeding 80° C., care being also taken that the evaporation does not last too long. The amount of material taken should yield not more than 1 gm. of pure glycerol. The concentrated liquid is mixed with the ignited powdered sodium sulphate (about 20 grms.) and the nearly dry powder placed in the paper cartridge of a Soxhlet extractor, arranged as shown in the figure, and fitted together by ground glass connections. The extraction with anhydrous acetone is continued for about four hours, after which the acetone is distilled off, and any particles of fat, &c., seen on the surface of the glycerol washed off by means of petroleum spirit of low boiling point. The residue is then dried in the extraction flask, which is placed in an air-bath maintained at a temperature of 75° to 80° C., until practically constant in weight (four to five hours). The flask should be closed with a ground-in glass stopper before the final weighing. As thus obtained the glycerol is absolutely free from ash and shows over 99 per cent. of pure glycerol when analysed by Hehner's method. If the original solution contain more than 40 per cent. glycerol the preliminary concentration can be omitted and the liquid treated directly with the sodium sulphate. The method is shown to give results in close agreement with those obtained by Hehner's method, or (in the case of pure glycerol) calculated from the sp. gr. For instance, in the case of an impure soap lye, the results were 12.19 per cent. respectively.—C. A. M.

*Tanning Materials; Analysis of* —, by method of "Spongy" Alumina. H. Wislicenus. Z. anal. Chem., 1905, 44, 96—106.

THE "spongy" aluminium oxide may be obtained by strongly igniting aluminium sulphate, nitrate or chloride, but its absorptive power is too small for the purpose. The most absorbent material is obtained by the oxidation of aluminium powder in the presence of a trace of mercury. The resulting hydroxide is washed with ether and ignited. It can be used for the determination of tannin in the case of ordinary tanning materials, such as oak and quercus extracts. The results obtained, agree closely with those obtained by the hide powder method. The tannin and colouring substances are so firmly combined with the alumina that nothing is extracted by the precipitate by treating it with hot water, ether, or alcohol. The precipitate of tannin and aluminium hydroxide is ignited to obtain the latter again in a fit state for subsequent analyses.—W. P. S.

*Pentoses; Tollens' Phloroglucinol-Hydrochloride Reaction for* —. E. Pinoff. Ber., 1905, 38, 76.

THE author recommends the following modified Tollens' reaction for pentoses:—1.5 grms. of pentose are boiled for a quarter of an hour under a reflux condenser with 75 c.c. of absolute alcohol and a sufficient quantity of a solution of phloroglucinol in concentrated hydrochloric acid (sp. gr. 1.19). When the product is washed with alcohol and subsequently with ether, it gives a permanent solution, the colour of which is permanent for weeks. A study of the absorption spectra of the colorations showed that, according to the value effected in the relative proportions of the three components: pentose, phloroglucinol and hydrochloric acid, solutions showing one, two or three absorption bands simultaneously could be obtained. The three absorption bands correspond to three different compounds. Under suitable conditions, solutions each showing





the three bands were obtained. The band in the portion of the spectrum, which is the characteristic pentose coloration in aqueous media, belongs to the most stable of the three compounds. The bands in the blue portions have only been observed in solutions produced in alcoholic solutions as above; and belong to labile compounds, which are converted into the more stable compound by heating with hydrochloric acid.—J. F. B.

*Dextrose and Levulose; Simultaneous Determination of —.* L. Lindet. Bull. Assoc. Chim. Dist., 1905, 22, 574—577.

When the rotation of levulose is increased in the presence of strong acids, the influence on the results from Clerget's formula is insignificant and within limits of errors of analysis. The author prefers to use actions before and after inversion, and the polarisation before inversion as data for the calculation of the age of sucrose, dextrose and levulose.—L. J. DE W.

*Potatoes; Determination of Moisture in —.* Hoffmann's Method. E. Parow and G. Ellrodt. Mittheil., 1905, 28, 80.

A procedure originally proposed by Hoffmann for the determination of moisture in grain (this J., 1902, 1088) gave correct results in the case of desiccated slices. The following modification, however, numbers which agree sufficiently closely with those obtained by direct drying:—400 c.c. of oil of turpentine used in the Hoffmann apparatus and 50 grms. of powdered potatoes are thoroughly mixed therein. Contents of the distilling vessel are rapidly heated to 158° C., the temperature is then slowly raised in 20° to 158° C., care being taken to see that not much turpentine distils over with the water. If this be the case, the rise of temperature must be effected more slowly. After a temperature of 158° C. has been reached, inversion is conducted rapidly with a large flame until the shaped portion of the apparatus is three-fourths full of distillate. The flame is then removed and the water is read off after a short time, 0.2 c.c. added to allow for the emulsified portion.

Authors have not been able to obtain satisfactory results in the case of potato starch by the method described by Hoffmann and Schulze (this J., 1903, 655).—J. F. B.

*Freezing Points in Aqueous Solutions; Determination of —, by the aid of the Freezing Point.* R. Gaunt. Z. anal. Chem., 1905, 44, 106—108.

Flowing results were obtained in a number of determinations of the freezing point of dilute solutions of —

Alcohol grms. of solution.	Decrease of Freezing Point in Relation to that of Water.		Calculated Decrease for each 1 per cent. of Alcohol.	
	I.	II.	I.	II.
1.00	0.428 °C.	0.420 °C.	0.428 °C.	0.420 °C.
2.00	0.853 "	0.845 "	0.426 "	0.422 "
3.00	1.271 "	1.267 "	0.424 "	0.422 "
4.00	1.692 "	1.690 "	0.423 "	0.422 "
5.00	2.120 "	2.135 "	0.424 "	0.427 "
6.00	2.554 "	2.570 "	0.425 "	0.428 "
7.00	3.010 "	3.020 "	0.430 "	0.431 "
8.00	3.510 "	3.520 "	0.439 "	0.440 "
9.00	4.525 "	4.530 "	0.452 "	0.453 "
2.00	5.590 "	5.600 "	0.466 "	0.467 "

It is seen that, for solutions containing from 1 to 7 per cent of alcohol, the decrease is proportional to the amount of alcohol present, but that for more concentrated solutions the proportion is greater. An ordinary Beckmann's thermometer was used in the determinations, and the freezing mixture consisted of ice, salt and water, with a temperature about —8° C.—W. P. S.

*Metals; Metallic —.* Maystrse. XX., page 289.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*"Bologna Phosphorus"* [Phosphorescent Sulphides]. L. Vanino and J. Gans. J. prakt. Chem., 1905, 71, 196—200.

THE luminosity of the phosphorescent masses, obtained by heating strontium thiosulphate or barium thiosulphate at about 1300° C. for three-quarters of an hour, is greatly increased by the addition, before heating, of small quantities of nitrate of uranium, bismuth, or thorium. If these nitrates be added to calcium thiosulphate, however, no useful result ensues. Strontium thiosulphate yields more luminescent products than barium thiosulphate. Of the many phosphorescent preparations known, the following are found to be the finest:—

1. *Lennard's Mass.*—Strontium carbonate, 100 grms.; sulphur, 100 grms.; potassium chloride, 0.5 gm.; sodium chloride, 0.5 gm.; manganous chloride, 0.4 gm. By heating the mixture for three-quarters of an hour at about 1300° C., a product is obtained which emits a fine golden yellow light.

2. *Monrelo's Mass.*—Strontium carbonate, 100 grms.; sulphur, 30 grms.; sodium carbonate, 2 grms.; sodium chloride, 0.5 gm.; manganous sulphate, 0.2 gm. This mass emits a bright yellow light.

3. *Vanino's Mass.*—Strontium thiosulphate, 60 grms.; bismuth nitrate, 12 c.c. of a 0.5 per cent. solution in acidified alcohol; uranium nitrate, 6 c.c. of a 0.5 per cent. alcoholic solution. By heating the mass for three-quarters of an hour at about 1300° C., a product is obtained which emits an emerald-green light.

4. *Balmain's Mass.*—Calcium oxide (iron-free) 20 grms.; sulphur 6 grms.; starch, 2 grms.; bismuth nitrate, 1 c.c. of a 0.5 per cent. solution; potassium chloride, 0.15 gm.; sodium chloride, 0.15 gm. The mass after being heated emits a violet light.

For exciting the luminescence of these preparations, the best source of light, in absence of sunlight, is the Heraeus mercury lamp, a few minutes' exposure to its light being sufficient. Strong incandescent gas light is practicable, but is slower in its action.—H. B.

*Mercury Compounds; Photographic Radiation of some —.* R. de Jersey Fleming-Struthers and J. E. Marsh. Chem. Soc. Proc., 1905, 21, 67.

THE authors found that the double compound of mercuric cyanide and phenylhydrazine acted upon a photographic plate without being in contact with the same, and even through a layer of paper or aluminium foil; on developing the exposed plate, a deep black patch appeared. The action of phenylhydrazine was slower and more diffused than that of the mercury compound. Of different specimens of mercuric cyanide, some were active and others inactive; the active specimens were rendered inactive by heating them. Inactive specimens became active when slightly moistened with water, but remained inactive when covered with water. Mercuric cyanide prepared from inactive mercuric oxide and hydrocyanic acid was active. Of other mercuric salts, mercuric chloride was active and remained so when distilled; mercuric bromide and mercuric and mercurous nitrates were also active. Mercuric iodide, sulphate, acetate, sulphide and oxide, and mercuric ammonium chloride were inactive, or only very slightly active; as also were mercurous chloride, sulphate, acetate and oxide. Redistilled metallic mercury and cuprous, silver and potassium cyanides were quite inactive.—A. S.

*Acids; Detection of the Formation of Complexes in Mixtures of — by the aid of Isohydric Solutions.* R. Hofmann. Z. physik. Chem., 1905, 51, 59—64.

THE author has previously shown by the aid of the law of isohydric solutions that a complex is formed in a mixture of hydrochloric and chromic acids (Z. physik. Chem., 1903, 45, 584). Further experiments along similar lines show that sulphuric acid (4.49-N) and iodic acid (2.72-N) are isohydric (i.e., the electric conductivity of a mixture of equal volumes of the two acids is the arithmetical mean of the conductivities of the individual acids), and therefore do not form a complex. With iodic and

chromic acids, on the other hand, a complex is formed, since solutions of these acids which are isohydric with 4-49-N-sulphuric acid are not isohydric with each other. Complexes are probably formed also in mixtures of phosphoric acid with sulphuric acid and with hydrobromic acid, since all attempts to prepare isohydric solutions of the two pairs of acids failed.—A. S.

*Salt Formation in Solutions, especially of Tautomerisable Compounds. [Pseudo Acids, Pseudo Bases.]* II. J. W. Brühl and H. Schroeder. *Z. physik. Chem.*, 1905, 51, 1—18. (See this J., 1904, 1242).

The authors show that as in the case of the alkyl esters of camphocarboxylic acid (*loc. cit.*), the formation of the sodium salt of acetoacetic ester from the ester itself, is associated with a transformation of the ketonic ester,  $\text{CH}_3\text{CO}\cdot\text{CH}_2\cdot\text{COOC}_2\text{H}_5$ , into the enolic oxygen salt,  $\text{CH}_3\text{C}(\text{ONa})\text{:CH}\cdot\text{COOC}_2\text{H}_5$ . It is also shown that no formation of an addition compound of sodium acetoacetic ester with sodium ethylate takes place.—A. S.

## Educational.

### LIVERPOOL UNIVERSITY.

Mr. E. K. Muspratt, President of the Council of Liverpool University, has offered to provide for an extension of the chemical laboratories, at an estimated cost, including equipment, of £10,500.

## New Books.

REPORT OF THE DEPARTMENTAL COMMITTEE APPOINTED BY THE BOARD OF AGRICULTURE AND FISHERIES TO INQUIRE INTO AND REPORT UPON THE WORKING IN GREAT BRITAIN OF THE FERTILISERS AND FEEDING STUFFS ACT, 1893, WITH COPY OF MINUTES APPOINTING THE COMMITTEE. 1905. Price 4½d.

This Report contains Copy of Minutes appointing the Committee, with names of members, and it fills 38 pages, and is subdivided as follows:—Analysis of the Evidence. (i) Administration of the Act. (ii) Causes of Inefficiency of Act. (iii) Deficiencies in Safeguards to Purchaser. (iv) Deficiencies in Safeguards to Seller. (v) Miscellaneous.

MINUTES OF EVIDENCE TAKEN BEFORE THE DEPARTMENTAL COMMITTEE APPOINTED BY THE BOARD OF AGRICULTURE AND FISHERIES TO INQUIRE INTO AND REPORT UPON THE WORKING IN GREAT BRITAIN OF THE FERTILISERS AND FEEDING STUFFS ACT, 1893, WITH APPENDICES AND INDEX. Wyman and Sons, Ltd., Fetter Lane, London, E.C. 1905. Price 2s. Purchasable through any bookseller, or from Wyman and Sons, Ltd., Fetter Lane, E.C., and 32, Abingdon Street, Westminster, S.W., or Oliver and Boyd, Edinburgh, or E. Ponsonby, 116, Grafton Street, Dublin.

GOVERNMENT blue-book, containing 167 pages of evidence, &c., and a series of 36 Appendices, filling 63 pages.

TABELLÄRISCHE ÜBERSICHT ÜBER DIE KÜNSTLICHEN ORGANISCHEN FARBSTOFFE UND IHRE ANWENDUNG IN FÄRBEREI UND ZEIGDRUCK. VON DR. ADOLF LEHNE. Zweiter Ergänzungsband, Erste Lieferung. Julius Springer's Verlag, Berlin. 1905. Price M.6.

This Part I. of the supplementary volume of Dr. Lehne's work, the first edition of which received full notice in this J., 1893, 384, has just appeared. It is of quarto size, and contains a brief preface, table of contents, and illustrated tables filling 16 pages. There follows a scheme for testing

the colours for fastness on the fibre, and another for testing and discriminating the colours themselves on the fibre, and finally one of methods for systematically applying the colours with or without mordants to the fibre. I. Wool; II. Silk; III. Cotton and Linen; and IV. An additional scheme is added of printing recipes for Wool and Silk; II. Cotton (Linen); and III. Jute, after a list of abbreviations of the names of firms sent, including both British and American, the names themselves follow, commencing with 1 and 2 represent the AZOXY DYE STUFFS, and like all the others are illustrated with dyed specimens. Then follow AZO DYE STUFFS; the Monoazo dyestuffs being sent in Tables 3 to 27, and the Di-azo DYE STUFFS primary, Table 28; secondary, Tables 29—32; Di-azo dyestuffs from Diamines, Tables 33—47.

THE BREWING INDUSTRY. By JULIAN L. E. Methuen and Co., 36, Essex Street, London, W.C. Price 2s. 6d. nett.

SMALL 8vo volume, containing 173 pages of matter with 28 illustrations, and an alphabetical index. The matter is subdivided and treated in the following groups:—I. Historical. II. Barley, Malt and Malts. III. Hops. IV. Water. V. Preparation of Beer. VI. Production of Beer from Beer. VII. Brewery Operations and the Duties and Qualifications of a Brewer. VIII. Licensing and Tied Houses. IX. Present Position and Future Prospects of the Industry in the United Kingdom.

LES INDUSTRIES INSALUBRES. Rapports sur les dangers et les moyens de les Prévenir, particulièrement dans l'Industrie des Allumettes et celles qui fabriquent ou emploient des Couleurs de Plomb. Par A. T. Bassia; E. P. Bérard, la Commission de Réformes Sociales à Madrid; Laurent Dechesne; E. M. Dementieff; D. ment de labour de la nouvelle Galles du Sud; Hochler; Kaup; Kiaer; J. J. Klompe; Leclerc de Pulligny; Prof. Matsuzaki; Harrison Ord; L. von L. H. Rauschenbach, &c., &c., and G. H. Wood. Published in the name of the International Association for the legal protection of Workpeople. Prefaced by Prof. ETIENNE BAUER, Directeur de l'Internat. du travail. Gustave Fischer, Jena. Price 10 Frcs. A. Francke vorm. Schmid and Fr. Berne; Le Soudier, 144/76, Boulevard St. Germain, Paris.

8vo volume, containing 438 pages of subject matter with alphabetical Indexes of names and subjects. The following are the leading subjects treated of:—I. Introduction by Prof. E. Bauer. The struggle with the dust of Phosphorus in the Industries (A. Hölzer). The Dangers of White Lead (Th. Sommerfeld). Lead Poisoning in the Austrian Industries (Kaup). Critical Examination of Lead and Lead preparations with regard to Industrial Hygiene (Sten). Insanitary Industries of Belgium (H. Vande). Responses to Inquiries from the International Office of Labour (Laurent Dechesne). Insanitary Industries of Match Manufacturers of Spain. Report on the regulating Labour in the Insanitary Industries of Match and Lead Manufacture, and Manufacture of Compounds, in France (Leclerc de Pulligny). Injurious Trades in Great Britain (G. H. Wood). Match Manufacture in Japan (Matsuzaki); New Zealand (E. T. Victoria (H. Ord); Greece (T. Bassia); Hungary (A. C. Kiaer); Rumania; Russia (E. I. tief); Sweden (A. Raphael); Switzerland (H. Rauschenbach), &c., &c. Insanitary Industries in all the foreign countries are also reported.



## Trade Report.

### I.—TAR PRODUCTS, PETROLEUM, Etc.

AL OILS AND SPIRITS: RESTRICTIONS ON THE IMPORTS INTO AUSTRALIA OF—.

*U.S. Cons. Rep. No. 2192, Feb. 25, 1905.*

A proclamation issued by the customs department of India, declares the restrictions under which mineral spirits may be imported into the Commonwealth. The federation, each state of Australia had its own laws regarding the importation of the oils and referred to, and the proclamation, which is to take effect from April 1, 1905, provides that the flashing of mineral oils and spirits shall be uniform for the Commonwealth.

#### PROCLAMATION OF THE AUSTRALIAN CUSTOMS DEPARTMENT.

No mineral oil shall be imported as kerosene unless the flashing point of 73 degrees Fahrenheit or over. All mineral oil and all productions therefrom, and mixtures containing mineral oil which has or have a flashing point of under 73 degrees Fahrenheit shall, for purposes of this proclamation, be deemed to be mineral spirits.

No mineral spirits shall be imported unless contained in vessels so constructed as not to be likely to be damaged in handling or to become defective or insecure during conveyance, or to allow the mineral spirit to leak or to be accidentally opened, and unless such vessels shall be plainly marked with the name of their contents, "naphtha," "benzine," "benzoline," or "gasoline," or as the case may be, together with the words "highly inflammable."

In this proclamation the words "flashing point" mean the degree of temperature at which the mineral spirits give off an inflammable vapour upon tested by the "Abel-Pensky" test apparatus, or by any other method as the minister from time to time may direct.

### II.—METALLURGY.

#### MINERAL RESOURCES OF INDIA.

*Times, March 13, 1905.*

It is stated that American mining experts have established the existence in the Rajpur district of the Central Provinces of quantities of a rich iron ore. A company has been formed at once for the exploitation of this field. In a recently published review, by Mr. T. H. Holland, Director of the Geological Survey of India, of the last six years' progress in the development of Indian mineral resources, is the first under the system, adopted in 1898, of dealing with a series of years instead of merely with the output of a single year. During these six years the total output has risen in value by 44·37 per cent.; the total scarcely touches £5,000,000 for minerals, including which trustworthy statistics are available, and has, on an average, imported annually ten millions' worth of minerals and mineral products which exist, or are produced, in the country. This figure does not include such things as hardware, porcelain, railway rails, or many other articles manufactured from metals which are known to be present in large quantities in India. Four-fifths of the value of the mineral output is accounted for by gold, coal, and petroleum. These, as salt, which accounts for a large portion of the output, being one-fifth, are all won with comparative ease, and are assumed by direct process, and are workable at a cost without consideration of the value of by-products. Minerals as rubies, mica, and manganese ore, which, in the case of the latter, go to make up almost the whole balance of the output, are at present worked solely for export. Iron represents but a trifling value.

The review lays special stress on the intimate relationship in all countries between various chemical and metallurgical industries, on their dependence one upon another, and on the consequent necessity for their simultaneous development. Take for instance the case of copper sulphides. To work these for the metal alone is rarely profitable, but the situation is saved by the sulphuric acid which can be simultaneously produced in the process of extracting copper. Sulphuric acid, in turn, is dependent for its value on the demand created by innumerable other industries to which it is essential. So far, India has had to import all her sulphuric acid, and practically all her copper. Manganese ore is another instance. Its production in India dates from only 12 years ago; now the output is second only to that of Russia—a bad second, it is true, but the deposits are of very high value. The principal application of this mineral is to the manufacture of steel, which is still in its early infancy in India. In the absence of local demand, the manganese miners are compelled to export their ore to the steel works of Europe and America. This they can afford to do only with the best of the ore, and the cost of freight even then leaves but half the European market value for division between the producers and the railways carrying ore to the coast. India is again out of pocket by the freight of the steel which brings back, in its utilised form, some of this manganese. Aluminium is yet another case in point. There are in India vast quantities of laterite, resembling bauxite. The cost of freight prohibits export of the mineral, which can be profitably used only by extraction of aluminium at the quarries. For this process caustic soda is requisite. That substance is not at present made in India, though it easily might be, provided there were a demand for it, as well as for its by-product chlorine. The prime mover in most of these economic cycles is sulphuric acid. There seems no doubt that it could be produced in India more cheaply than it can be imported. When once this is accomplished, not only will the imported article be displaced, but fresh industries, depending for their profitable working on cheap sulphuric acid, will spring up, increasing the demand and still further cheapening the cost of production.

The Barakur ironworks, operating in the vicinity of the great coalfields of Bengal, have at last succeeded in producing some 500 tons a week of steel which is said to bear comparison with any produced in Europe or America. The new project, to which reference has been made, contemplates more than the mere working of the iron ores of Rajpur, an operation which will be facilitated by the fact that direct railway communication exists with the Bengal coal mines, as well as with those of Warora in the Central Provinces and Umaria in Rewar. Simultaneously with the new demand for coke for the blast furnaces which are to be set up, arrangements are proposed to be made for its preparation at the coalfields by the most modern methods.

Another branch of industry contemplated by the promoters of the new scheme is the manufacture of sulphuric acid from the deposits of copper sulphide, which are asserted by the Geological Department to abound in the Central Provinces.

This, as has already been said, will at last make possible the profitable production of copper, for which there is a great demand in India. Increased production of coal will enable India to dispense with the import of coal tar. The manufacture of steel will create a local market for the manganese ore of the Central Provinces, of Bombay, and of the Madras coast, thus enabling even the inferior ores to be utilised, and retaining for the producers the whole market value of the commodity.

#### MINERAL DISCOVERIES IN INDIA.

*Chem. and Drug., March 4, 1905.*

The chromite deposits lately discovered in British Baluchistan are now being opened up for export, 1,516 tons having been raised in the first six months of 1904. The manganese industry in the districts of Nagpur, Bandara, and Balaghat is yearly attaining to considerable propor-

tions, giving at the present time employment to several thousands of persons. An abundance of tin is easily accessible parts has been discovered in Tenasserin, Burmah.

#### BESSEMER STEEL INGOTS AND STEEL RAILS; U.S. PRODUCTION OF —, IN 1904.

*Bd. of Trade J., March 2, 1905.*

The "Bulletin" of the American Iron and Steel Association for February 15 publishes statistics, received direct from the manufacturers, of the production of Bessemer steel ingots and castings in the United States in 1904; also of Bessemer steel rails by the producers of Bessemer steel ingots.

The total production of Bessemer steel ingots and castings in 1904 was 7,859,140 tons, against 8,592,829 tons in 1903, a decrease of 733,689 tons, or over 8.5 per cent. The production in 1902 (9,138,363 tons) was the largest hitherto recorded.

The production of all kinds of Bessemer steel rails by the makers of Bessemer steel ingots in 1904 was 2,084,438 tons, against a similar production in 1903 of 2,873,228 tons, a decrease of 788,790 tons. The maximum production of Bessemer steel rails by makers of Bessemer ingots was reached in 1902, when 2,876,293 tons were made.

The total production of rails in 1904 will include rails made from open-hearth steel, rails rolled from purchased Bessemer blooms, crop ends, and "seconds," and rails re-rolled or renewed by non-producers of Bessemer steel ingots, and iron rails. The total from all these sources in 1903 amounted to 119,249 tons, of which quantity 45,054 tons were open-hearth steel rails and only 667 tons were iron rails. In 1904 the total from these sources will amount to about 200,000 tons, making the total rail production for that year about 2,300,000 tons.

In 1904 the United States exported 414,815 tons of steel rails and 1,405 tons of iron rails, and imported 37,776 tons of iron and steel rails.

#### XII.—FATS, FATTY OILS, Etc.

##### WAX, JAPAN —. U.S. CUSTOMS DECISION.

*Feb. 14, 1905.*

Wax from Yokohama, which on analysis was shown to be Japan wax of vegetable origin, has been declared free of duty as "vegetable wax," under paragraph 695 of the present tariff. The assessment of duty at  $\frac{1}{2}$  cent per lb. as "tallow" was overruled.—R. W. M.

#### XIII. B.—RESINS, VARNISHES, Etc.

##### NINGPO VARNISH (LACQUER).

*U.S. Cons. Rep. No. 2194, Feb. 28, 1905.*

"Ningpo varnish" is made from the sap of the "varnish tree" (*Rhus vernicifera* or *Vernix vernicia*), which grows very extensively in western and south-western China. The sap is gathered in the interior and brought to Huichouin, in the southern part of Anhui Province, where it is refined. It is sold by the retailer in the raw or pure state—that is, the pure, refined sap, and in the prepared form, which is a mixture of the refined sap with certain proportions of "wood oil." It is in the proper blending of these that the skill of the varnisher is shown, as the colour desired, the wood to be varnished, moisture of the atmosphere, and temperature are conditions that enter into the problem. The uses of the varnish are manifold. It is particularly adapted to floors, tables, cabinets, and such articles as are in constant use. It is also excellent for furniture of all kinds, as it does not scar easily and may be scrubbed with boiling water without the slightest injury to the very high polish of which it is capable.

The greatest drawback to its use is the danger of "lacquer poisoning" to the workmen who use it. This is similar to "ivy poisoning," and when the sap is fresh is regarded as rather dangerous. Once the varnish is dry there is no danger whatsoever. It may be used in any climate that has a rainy season or wet weather. The

varnishing is always done during the wet season and allowed to dry slowly as the moisture of the atmosphere decreases.

The market value of the pure sap, after refinement about 1.15 dols. Mexican coin per catty (about 1 per lb.), while the mixed varnish may be had for 0.50 per catty. It may be mixed ready for use before shipment and does not deteriorate when once it has been prepared. About a hundred years ago the Ningpoes had a monopoly of the varnish trade; but they have no right to the Huichau firms. Practically all the varnish at the present time comes from Huichau, as its monopoly depends on a knowledge and skill which the Hu people seem to be able to guard most effectively.

The supply of the crude sap would seem to be unlimited as the trees from which it is derived are found in abundance in all the middle western and south western provinces. With proper methods of gathering and refining the sap, it should be made one of the most profitable industries of China.

#### XIV.—TANNING; LEATHER; GLUE, Etc.

##### MANGROVE BARK INDUSTRY OF MOZAMBIQUE

*Bd. of Trade J., March 9, 1905, 459.*

Extensive forests of mangroves are found throughout all the bays, estuaries, and river mouths of East Africa and are composed of bushy, evergreen trees and shrubs. In certain localities these are found to be extensively intermixed with a plant probably inaccurately designated as the "White Mangrove." These trees grow thick on the coasts at all points accessible to tidal influence and propagate themselves with astonishing rapidity. In some places the trees are so thickly produced that it is well nigh impossible for a man to push his way through them. The wood of the red mangrove is hard and durable, much used for building purposes, and said to be impervious to the attacks of white ants and other destructive agencies.

The quantities of mangrove bark exported from Mozambique, Parapat, Ibo, Porto Amelia (Pemba Bay) and Palma during the past year are reported as follows:—

Mozambique (to end of October, 1904), 1,725 tons; Parapat, 1,080 tons; Ibo, (about) 5,000 tons; Porto Amelia, 2,300 tons; Palma, 2,000 tons; total, 12,105 tons. Of the exports from Mozambique, 1,655 tons were sent to Germany, 65 to British Possessions, and 5 tons to the United Kingdom. The whole of the shipments from Parapat found their way to Hamburg, whilst at Mozambique considerable quantities are known to have been despatched both to the United States and to Russian ports on the Baltic from Ibo, Port Amelia, and Palma, the figures in relation to the respective quantities are not available. In addition to the quantities mentioned a large amount of mangrove bark was, at the end of 1904, lying in the various ports awaiting collection by coasting steamers.

The value of this export in the various European markets at the end of 1904 fluctuated between 40 and 60 l. 10s. per ton. The demand in Germany was to be somewhat on the decline, but that in Russia and the United States continued firm. Freight to Hamburg about 32s. per ton, whilst cost of collection, cartage, and outlay for sacks obtained from India, as also the duty of 2 per cent., may be reckoned as amounting in aggregate to between 20s. and 30s. for the same quantity.

#### XVI.—SUGAR, STARCH, GUM, Etc.

##### SUGAR IN EUROPE.

*U.S. Cons. Rep. No. 2189, Feb. 21, 1905.*

Owing to a very dry summer the sugar-beet crop in Europe is smaller than it has been for several years in spite of an increased acreage, the total crop is about 10 per cent. less than it was in 1903. While Europe produced 5,772,000 tons of raw sugar in 1903, the 1904 production will not exceed 4,650,000 tons, and the estimates of



best European authorities are even below this

various sugar-producing countries of Europe may be divided into exporting and non-exporting, or treaty and non-treaty countries. The former, all parties to the Convention, consist of Germany, Austria-Hungary, Belgium, and The Netherlands. Their aggregate production of raw sugar in the current season is estimated at 60,170 tons. As these countries produced 4,208,996 tons last year, their loss amounts to nearly 850,000 tons. Reductions made in customs and internal duties have resulted, in the various treaty countries, an increase in the consumption of sugar ranging from 15 to 30 per cent, and this has diminished correspondingly the quantity available for export.

In the non-treaty countries—Russia, Sweden, Spain, Denmark, and Roumania—the estimated production in the present season is 1,262,570 tons. Compared with the year 1903-4, there is a loss of over 300,000 tons, this loss (except in the case of Russia, which is still almost self-supporting), must be made up by increased imports.

The following table gives estimates of the quantities of sugar produced during the current season, together with quantities produced during the season ended September 1904:—

Only the Netherlands and Denmark made slight gains, while all the other countries sustained losses ranging from 1 to 50 per cent.

TOTAL BEET AND CANE SUGAR PRODUCTION.

On September 1, 1903, when the Brussels convention came into effect, the world's surplus of sugar was, in round numbers, 2,000,000 tons. At the beginning of the present season this surplus was reduced to 1,427,000 tons. Adding to this the estimated production of the year 1904-5, namely, 4,623,000 tons of beet sugar and 6,900,000 tons of cane sugar, we have for the current year a total of 12,950,000 tons available for consumption. As the world's consumption in the year ended August 30, 1904, was somewhat in excess of 13,000,000 tons, it follows that sugar will have to be used somewhat more sparingly in 1905 than it was in 1904, and this explains the recent sharp rise in the price of the article.

It is, however, not likely that the present prices will continue for more than eight or ten months. There will be, in consequence of the high price which sugar now commands, not only a decrease in the consumption of the article, but also a large increase in the acreage of beets and cane planted; and a propitious season may cause prices to be as low or even lower next autumn than they were at the time of the Brussels convention.

Production of beet sugar in the several European countries in 1903-4 and 1904-5.

Country.	Production of 1903-4.	Estimated production of 1904-5.	Country.	Production of 1903-4.	Estimated production of 1904-5.
Exporting.	Tons.	Tons.	Non-exporting.	Tons.	Tons.
Austria-Hungary	1,929,415	1,518,070	Russia	1,160,660	945,370
Belgium	1,158,800	914,800	Sweden	107,241	88,200
Denmark	794,431	614,300	Spain	90,000	85,000
Germany	202,850	179,100	Italy	140,000	80,000
Netherlands	123,500	133,900	Denmark	47,000	48,000
			Roumania	18,000	16,000
Total	4,208,996	3,360,170	Total	1,562,901	1,262,570
			Grand total	5,771,897	4,623,740

XVII.—BREWING, WINES, SPIRITS, Etc.

FUSEL OIL; GERMAN —

Chem. and Drug., March 4, 1905.

Exports of German fusel oil to the United States in 1901 amounted to 223 metric tons, in 1902 to 260 and in 1903 to 342 tons. During the first eight months of 1904, however, only 57 tons was exported, as against 286 tons during the same period of 1903. There are no available statistics showing the total production of fusel oil in Germany, but nine-tenths of the quantity produced is absorbed by the United States, the remainder being sent to Great Britain. The trade in Germany is concentrated in comparatively few hands, principally in Hamburg, and Berlin. A few years ago fusel oil was looked upon as practically a waste product, but in the United States it is used in the manufacture of dynamite, and to a less extent in varnishes and medicines.

ALCOHOL IN FRANCE DURING 1904.

Z. Spiritusind., 1905, 28, 92.

The official statistics for 1904 as compared with 1903 are as follow:—

	1904.	1903.
(1) Industrial distilleries:—	Hl.	Hl.
From Grapes	88,509	26,810
Fruit	22,175	2,274
Grape marc	70,922	21,796
Grain, &c.	380,710	352,928
Beetroots	992,149	926,159
Molasses	626,722	670,969
Other materials	175	207
Total production	2,181,362	2,001,143
(2) Small distilleries (estimated):—		
From Grapes	247	3,398
Fruit	411	6,233
Grape marc	75,228	36,266
Total production	75,886	45,897

—J. F. B.

ALCOHOL FOR INDUSTRIAL PURPOSES IN BELGIUM.

Foreign Office Annual Series, No. 3325, Feb. 1905.

Table showing Consumption of Alcohol in Belgium.

		1895.	1896.	1900.	1902.	1903.	1904.
Production	Hectols.	678,703	590,183	716,951	657,165	492,213	633,310
Consumption	"	18,286	17,642	13,960	11,850	10,471	10,423
Total	"	696,989	607,825	730,911	669,015	502,684	643,733
in manufactures	"	15,000	15,000	20,047	40,129	65,172	81,218
used in drink	"	677,225	589,085	627,297	576,599	370,099	389,115
Production	Number	6,373,922	6,436,653	6,698,810	6,826,219	6,893,403	6,061,248
Estimated consumption per head	Litres	10.62	9.15	9.37	8.45	5.37	5.73

Two industries which owe their existence to the release of methylated alcohol from duty, viz., the production of ether and the manufacture of artificial silk, have already become important: the amount of alcohol used in these two industries in 1903 exceeded 40,000 hectolitres.

The following table shows the rapid increase that there has been in recent years in the amount of methylated alcohol used for industrial purposes consequent on relief from taxation:—

Year	Alcohol Denaturated.	Duty Remitted.
	Hectolitres.	£
1896 .....	4,811	8,383
1897 .....	10,800	19,525
1901 .....	21,367	63,628
1902 .....	35,128	124,047
1903 .....	60,172	319,225

The amount of alcohol applied to industrial uses in 1904 is estimated at 76,218 hectolitres, and the amount of tax remitted at £427,672.

The following table shows the chief industries in which alcohol is used, and the amount used in the past two years in hectolitres:—

Class of Industry.	1902.	1903.
	Hectolitres.	Hectolitres.
Vinegars .....	7,918	12,585
Varnish .....	2,237	2,329
French polish .....	1,976	2,052
Other varnishes .....	1,113	1,219
Sulphuric ether .....	14,034	25,826
Artificial silk .....	6,568	14,783
Antiseptic cotton wool .....	171	270
Pegamoid tissues .....	310	20
Felt and hats .....	146	106

#### XIX.—PAPER, PASTEBOARD, Etc.

##### NYLONITE AND CELLULOID.

*Chem. and Drug., March 11, 1905.*

A memorandum, dated February 1905, has been issued by the Home Office (Form 828) dealing with the measures of precaution required in the storage and use of xylonite and celluloid. It is recommended that where large quantities are stored, fireproof rooms should be provided; where it is used, or temporarily stored, the material not in actual use should be kept in metal or other fireproof receptacles: that xylonite or celluloid shavings or dust should not be allowed to accumulate on the floors, but should be swept up daily and placed in receptacles of non-inflammable material, not in the sacks or wooden boxes now commonly employed for the purpose. The use of naked lights should be avoided as far as possible; where cutting or sawing of xylonite is done, the saw or other cutting instrument should run in water, or by other means be kept thoroughly cool; the shanks of tools used for boring the scales for table knives and forks should be of such form as to avoid friction caused by contact with the material bored; in addition to a supply of water, buckets filled with damp sand should be kept at hand in constant readiness in every shop in which xylonite or celluloid is being worked, in order that any accidental fire may be immediately smothered before it attains serious proportions.

##### WOOD PULP TRADE OF NORWAY.

*Ed. of Trade J., March 9, 1905.*

There is every probability of there being a considerable shortage in the supply of Norwegian timber and wood pulp during the current year. Up to the present time there has been scarcely any snow in Norway, and snow is an essential element for the transport of timber by sleigh to routes of communication. Consequently a great deal of timber has had to remain where it was felled

and the season is too far advanced for there to be prospect of its now being conveyed to the markets.

The weather throughout last summer and autumn also exceptionally dry, and there is great fear that the necessary water to drive the saw mills will fail during the present year. Even if rain were to fall now in a dance, the frozen condition of the soil in the morning would prevent its absorption and retention. The outlook, therefore, for the timber, pulp, and wood fibre trade is far from reassuring.

#### XX.—FINE CHEMICALS, Etc.

##### SULPHURIC ETHER AND COLLODION FREE OF DUTY IN THE NETHERLANDS.

*U.S. Cons. Rep. No. 2194, Feb. 28, 1905.*

Sulphuric ether and collodion required in the preparation of photographic paper, and collodion required in the preparation of whalebone are now exempted from customs dues on importation into the Netherlands, regulations governing their free admission are as follows:

*Article 1.*—Sulphuric ether and collodion required in the preparation of photographic paper and collodion required in the preparation of whalebone shall be exempt from customs dues under the following regulations:—

*Article 2.*—Anyone desiring such exemption must address the minister of finance, stating the place in the factory is situated, the surveyor's section, an number of the factory and the quantity of each liquid estimated to be used annually. The minister of finance shall determine the quantity of material that annually be exempt from dues as well as the minimum of each importation.

*Article 3.*—On the importation of sulphuric ether and collodion in regard to which exemption is desired, must be made of such desire in the declaration prescribed by article 120 of the general law of August 26, (Official Gazette, No. 28.) To that declaration, subject to the deposit of security for the customs dues, a warrant shall be attached mentioning the said desire. The quantity of the liquids to the factory shall be effected under the same conditions.

*Article 4.*—The importation to the factory shall be effected under the supervision of the officials of customs and excise, in whose presence the quantity of sulphuric ether shall be immediately mixed with 1 kilo. of acetone per 100 kilo., and the collodion with 2 kilo. pure methylated spirits and 0.5 kilo. of acetone per kilo. The officials shall make a statement on the warehouse respecting the imported quantity and the mixing. The materials required for the mixture shall be supplied by the tax collector at the manufacturer's expense.

*Article 5.*—The mixture shall be used for no other purpose but the preparation of photographic paper and shall not be removed from the factory.

*Article 6.*—The collector within whose district the factory is situated shall keep an account with the manufacturer of the quantity of sulphuric ether and collodion imported free from dues. In case more should be imported than the quantity in regard to which exemption from duties has been granted the waybill shall not be cleared to excess and the dues deducted from the security.

*Article 7.*—At the end of every year the party enjoying exemption shall tender the collector a written statement of the quantity of sulphuric ether and collodion admitted free from dues and still on hand at the end of such period. This quantity shall be regarded as the first importation in the ensuing year, and as such be entered in the account referred to in Article 6. In case such statement is tendered no new importation shall be allowed.

*Article 8.*—The officials authorised thereto by the collector are empowered within eight days of the expiration of the year to inspect the quantity of sulphuric ether and collodion in the factory, no matter whether the statement mentioned in the preceding article has been made or not.

*Article 9.*—On evidence of abuse or any attempt to evade the provisions of the provisions of this order the minister of finance is authorised to refuse the manufacturer all further free importation of sulphuric ether and collodion.



**WOL AND MORRHUOL: U.S. CUSTOMS DECISION.**

Feb. 14, 1905.

Following a decision of the United States Circuit Court of Appeals, the Board of General Appraisers overruled its assessment of duty on gaduol and morrhuol at 55 cents per lb., as "medicinal preparations in the preparation of which alcohol has been used," and decided them to be taxable at 25 per cent. *ad valorem* as "chemical compounds" under paragraph 3 of the tariff.—R. W. M.

**Patent List.**

In these lists, [A.] means "Application for Patent," and [C.S.] means "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an *affix* is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptance of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to opposition at the Patent Office immediately, and to opposition elsewhere two months of the said dates.

**—PLANT, APPARATUS, AND MACHINERY.**

- 4271. Binder. Centrifugal extractors. [U.S. Appl., March 25, 1904.]\* March 1.
- 4330. McNeil. Apparatus for separating liquids from vapours.\* March 2.
- 4331. McNeil. Apparatus for separating liquids from vapours.\* March 2.
- 4332. McNeil. Apparatus for separating liquids from vapours.\* March 2.
- 4352. Liebhenthal, Bieber, and Inhalatorien Ges., system Dr. Heryng. The conversion into gas or vapour and the distillation of difficultly volatile and other liquids.\* March 2.
- 4426. Mundy, Broadley and Rhodes. Disintegrating, drying and mixing machine. March 3.
- 4522. Bieksey. Annular kilns. March 4.
- 4671. Scott. Evaporating pans. March 6.
- 4792. Simm. *See under H.*
- 5072. Ljungström. Centrifugal separators for liquids.\* March 10.
- 5108. Crofield and Markel. Separation of solids from liquids. March 11.
- 9355 (1904). Holl. *See under XVI.*
- 9516 (1904). Lennox. Evaporators for evaporating the liquid in brewer's wash, sewage, waste or spent dyes, &c., and concentrating the solids in the same. March 15.
- 12,253 (1904). Barnes and Tory. Pyrometers. March 8.
- 14,869 (1904). McWhirtir. Apparatus for heating, steaming, and chemically treating wood and goods of different kinds, and for drying such goods. March 15.
- 23,183 (1904). Wells. Drying apparatus. March 15.
- 25,796 (1904). Projekki. *See under X.*
- 29,573 (1904). Lennox. Filters. March 8.

**II.—FUEL, GAS, AND LIGHT.**

- [A.] 4020. Torda and Bornand. Photometers. Feb. 27.
- " 4043. Smith. Suction gas producers.\* Feb. 27.
- " 4044. Smith. Regulating air supplied to suction gas producers.\* Feb. 27.
- " 4087. Sellars, Wallace and Capel. Gas generating plant.\* Feb. 27.
- " 4291. Knops. Process for manufacturing artificial fuel. March 1.
- " 4352. Liebhenthal, Bieber, and Inhalatorien Ges., system Dr. Heryng. *See under I.*
- " 4498. Broadhead. Gas purifiers. March 4.
- " 4792. Simm. Extracting moisture from peat and the like. March 8.
- " 4917. Whitfield. Suction gas producer plant. March 9.
- " 4930. Morton. Liquid fuel burners. March 9.
- " 4931. Morton. Apparatus for burning liquid fuel. March 9.
- " 4956. Busse. Process and apparatus for producing coal gas. March 9.
- " 5008. Bowman and Southworth. Gas producers. March 10.
- " 5077. Jahns. Process and apparatus for the production of producer gases. March 10.
- [C.S.] 6957 (1904). Bowing. Treatment of coal and other carbonaceous materials for the production of gas and coke or other carbonised substances. March 8.
- " 9622 (1904). Crossley. Incandescent mantle. March 8.
- " 26,917 (1904). Whitney. Electrodes for arc lamps. March 8.
- " 26,922. (1904). Weedon. Arc light electrodes. March 15.
- " 28,152 (1904). Kline. Gas enriching machines. March 15.
- " 28,376 (1904). Maxim. Manufacture of a self-combustive compound. March 15.
- " 29,474 (1904). Cutler. Gas purifiers. March 8.

**III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.**

- [A.] 10,466A (1904). Dreyman. *See under XII.*
- " 4113. Bingham. Enrichment of liquid hydrocarbons. Feb. 28.
- " 4766. Lessing and Wilton. Manufacture and recovery of pyridine and similar organic bases. March 7.
- " 4925. Buchanan. Kilns for making or revivifying animal or other charcoal, or carbonising or charring other substances. March 9.
- " 5029. Du Boulay. *See under XXIII.*
- [C.S.] 7793 (1904) Phillips. Method of enriching hydrocarbons and the like. March 15.
- " 9953 (1904). Newton (Bayer und Co.). Manufacture of new phenol compounds and the separation of phenols from phenol mixtures. March 8.
- " 2139 (1905). Jarvis and Jarvis. Composition of lubricants. March 15.

**IV.—COLOURING MATTERS AND DYESTUFFS.**

- [A.] 4359. Newton (Bayer und Co.). Manufacture of azo dyestuffs. March 2.
- " 4363. Imray (Meister, Lucius und Brüning). Manufacture of a red azo dyestuff and of lakes therefrom. March 2.

- [A.] 4647. Inray (Meister, Lucius und Brüning). Manufacture of preparations of indigo white. March 6.
- .. 4708. Hirschberger and Hoffa. A new base and new sulphuretted azo colours derived therefrom. March 7.
- [C.S.] 4997 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters, and of intermediate products therefor. March 15.
- .. 9516 (1904). Lennox. *See under I.*

#### V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 4143. Shepherd. Waterproofing composition. Feb. 28.
- .. 4211. Burdick. Methods of and apparatus for colouring or decorating fabrics, paper, and other materials. Feb. 28.
- .. 4222. Davies and Ewing. Applying colour to fabrics, or colour or paint to other surfaces for producing designs thereon. March 1.
- .. 4534. Denis. Apparatus for producing threads from collodion and recovering the solvents employed [Fr. Appl., March 5, 1904].\* March 1.
- .. 4593. Roberts. *See under XI.*
- .. 4755. Linkmeyer. Manufacture of artificial threads. [Ger. Appl., June 8, 1904.]\* March 7.
- .. 4761. Linkmeyer. Manufacture of lustrous threads of cellulose. [Ger. Appl., Aug. 26, 1904.]\* March 7.
- .. 4765. Linkmeyer. Manufacture of lustrous cellulose threads. [Ger. Appl., Oct. 17, 1904.]\* March 7.
- .. 4829. Armitage. The finishing of certain fabrics. March 8.
- .. 4947. Kübler. Method of and apparatus for producing mottled colouring effects in fabrics.\* March 9.
- .. 4971. Walker. Compounds and processes for fire-proofing textile fabrics and the like.\* March 9.
- [C.S.] 7745 (1904). Pope and Hübner. Engraved bowls or rollers for producing an improved reflecting finish on textile fabrics, paper, and other lamellar materials. March 15.
- .. 7790 (1904). Dawson. Wool washing and scouring machinery applicable for carbonising wool, &c., and for continuously dyeing and bleaching wool, cotton, and other fibrous material. March 8.
- .. 9323 (1904). Pease, Parker and Hustler. Washing, scouring, extracting, neutralising and dyeing machinery for wool and the like. March 15.
- .. 9455 (1904). Abel. (Act.-Ges. f. Anilinfabr.) *See under VI.*
- .. 9516 (1904). Lennox. *See under I.*
- .. 9787 (1904). Ellis. Machine for washing, bleaching, dyeing, or similarly treating hanks of yarn, slubbing, warps, and the like. March 8.
- .. 29,618 (1904). Rössler. Apparatus for dyeing textile fibres. March 8.

#### VI.—COLOURING WOOD, PAPER, LEATHER, ETC.

- [A.] 4211. Burdick. *See under V.*
- [C.S.] 7745 (1904). Pope and Hübner. *See under V.*
- .. 9455 (1904). Abel (Act.-Ges. f. Anilinfabr.). Process for dyeing furs, hairs, and feathers. March 8.

#### VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 4245. Schmatolla. Kilns for burning limes dolomite, and the like. March 1.
- .. 4334. Sanders. *See under X.*
- .. 4353. Niedenführ. Process of manufacture of nitric acid.\* March 2.
- .. 4648. Russ. Method for increasing the electrolytic activity of chlorine. March 6.
- .. 4762. Johnson (Badische Anilin und Soda Fabrik). Manufacture of dehydrated or nearly dehydrated caustic alkalies.\* March 7.
- [C.S.] 6143 (1904). Mills. Manufacturing salts of soda. March 15.
- .. 7452 (1904). Von Grätzel. Catalytic process of producing hydrogen. March 8.
- .. 26,790 (1904). Johnson (Deuts. Gold- und Silber-Scheide Anstalt vorm Rössler). Manufacture of metallic perborates. March 8.

#### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 4194. Boulton (Reiche). Process for manufacturing hydraulic binding substances or cements. Feb. 28.
- .. 4200. Klein. Refractory material for furnace bottoms, fire bricks and the like. Feb. 28.
- .. 4255. Schmatolla. *See under VII.*
- .. 4445. Love. Material for constructive and decorative purposes. March 3.
- .. 4693. Rogers. Method of applying pure Portland cement powder as an insulating covering.\* March 7.
- .. 4733. Wynne. Production of a material for manufacture of hydraulic cement. March 7.
- .. 5130. Prost and Michéy. Manufacture of incombustible materials. [Belg. Appl., March 14, 1904.]\* March 11.
- [C.S.] 5712 (1904). Shedlock. Manufacture of asphalt. March 15.
- .. 5853 (1904). Brothers. Manufacture of plaster of Paris and apparatus therefor. March 15.
- .. 9769 (1904). Lefranc. Manufacture of artificial stone in imitation of marble or granite. March 15.
- .. 10,170 (1904). Grau. Manufacture of cement. March 8.
- .. 23,473 (1904). Gibbs. Art of decomposing refractory silicates. March 15.
- .. 27,991 (1904). Williams and Stauffer. Manufacture of firebricks, crucibles, refractory substances and the like. March 8.

#### X.—METALLURGY.

- [A.] 4052. Deister. Ore concentrators.\* Feb. 27.
- .. 4334. Sanders. Treatment of galvanisers' waste products for the recovery of metal, and the formation of other substances. March 2.
- .. 4395. Moss. Magnetic separators for ores. March 3.
- .. 4744. Draper and Hay. Almagamators. March 7.
- .. 5091. Cowper-Coles. Process of welding aluminium. March 11.
- .. 5144. Andrew and Bellis. Treatment of low grade steels. March 11.
- [C.S.] 5648 (1904). Stringfellow. Treating blast furnace slag and utilising the products thereof. March 5.



- 6997 (1904). Zenzen. Production of iron suitable for the manufacture of malleable castings. March 15.
- 7935 (1904). Minnis. Method and apparatus for galvanising and coating metal sheets. March 15.
- 9928 (1904). Smallwood. Muffles or furnaces. March 8.
- 25,796 (1904). Drojecki. Reverberatory furnaces. March 8.

—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

4100. Thompson (Decker Manufacturing Co.). Electrolytic apparatus.\* Feb. 27.
4109. Wade. Galvanic batteries. Feb. 28.
4287. Marino. Secondary batteries. March 1.
4544. Cowper-Coles. Electrolytic manufacture of metallic wire or strip. March 4.
4545. Cowper-Coles. Electrolytic production of metallic strip. March 4.
4593. Roberts. To use electric currents so as to electrolyse baths made of different acids for the purpose of destroying all vegetable matter in wool, rags, and other fibres. March 6.
- 11,470 (1904). Atkins. Poles or electrodes of electrolytic apparatus or the like. March 15.
- 20,627 (1904). Bosquet. Method for the electrolytic manufacture of water jackets, casings, and the like. March 15.

—FATTY OILS, FATS, WAXES, AND SOAP.

- 10,466A (1904). Dreyman. Utilisation of fatty acid esters for alimentary fats, illuminating oils, and the like.\* March 8.
4092. Krebitz. Process for the manufacture of insoluble soap and for converting same into soluble soda soap or potash soap. Feb. 27.
- 10,156 (1904). Hall. Method and means for removing oil and grease from sponge cloths, cotton waste, and all kinds of grease laden textile materials. March 15.

—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(A.)—PIGMENTS; PAINTS.

4363. Imray (Meister, Lucius und Brüning). See under IV.
4646. Imray (Meister, Lucius und Brüning). Manufacture of red colour lakes. March 6.
- 9674 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matter lakes. March 15.
- 9861 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matter lakes. March 15.
- 12,512 (1904). Newton (Bayer und Co.). Manufacture of new colour lakes. March 15.
- 22,732 (1904). Kollinger. Manufacture of paint. March 15.
- 29,245 (1904). Ojeda and Quesdas. Copying inks. March 8.

(B.)—RESINS, VARNISHES.

- 9975 (1904). Godfrey. Manufacture of linoleum. March 8.
- 9976 (1904). Godfrey and Linoleum Manufacturing Co., Ltd. Manufacture of linoleum. March 8.

(C.)—INDIA-RUBBER.

- [A.] 5154. Gubbins. Method of treating rubber waste. March 11.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

- [C.S.] 19,323 (1904). Petersen. Preparation for cleansing and dyeing skins, leather, and the like. March 15.

XV.—MANURES, ETC.

- [A.] 4294. Garrigou. Method of producing solid fertiliser from sewage sludge and other organic refuse. March 1.

XVI.—SUGAR, STARCH, GUM, ETC.

- [C.S.] 9355 (1904). Holl. Apparatus for cooling and drying granular materials such as moist sugar. March 15.

XVII.—BREWING, WINES, SPIRITS, ETC.

- [C.S.] 9516 (1904). Lennox. See under I
- „ 21,380 (1904). Friswell. Maturing of potable spirituous liquors. March 8.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(A.)—FOODS.

- [A.] 10,466A (1904). Dreyman. See under XII.
- „ 4304. Sarason. Milk preparation. March 1.
- „ 4351. Hatmaker. Process of preserving animal tissues and mixtures of such tissues and other substances. March 2.
- [C.S.] 5789 (1904). Leatham. Process of bleaching, conditioning or sterilising flour, milk, and other food products. March 8.
- „ 9703 (1904). Shackleton. Treatment of flour. March 8.
- „ 825 (1905). Köhler. Nutritive preparations. March 8.

(B.)—SANITATION; WATER PURIFICATION.

- [A.] 4192. Ellis (Schulze). Apparatus for the bacterial purification of sewage and other waste waters.\* Feb. 28
- „ 4294. Garrigou. See under XV.
- „ 4436. Candy. Sterilisation of water. March 3
- „ 4451. Fairbairn. Treatment of sewage. March 3.
- „ 4980. Travis. Purification of sewage and other foul or impure waters, and apparatus therefor. March 9.
- [C.S.] 4730 (1904). Gray. Apparatus for the purification of sewage and polluted water. March 8.
- „ 9516 (1904). Lennox. See under I.

(C.)—DISINFECTANTS.

- [A.] 4493. Wilkinson. Insecticide. March 4.

XIX.—PAPER, PASTEBOARD, ETC.

- [A.] 4552. Wootton and Wootton. Manufacture of pulp for use in the formation of cases, boxes, &c.\* March 4.

- [C.S.] 5280 (1904). Ortmann. Manufacture of celluloid. March 8.  
 .. 7745 (1904). Pope and Hübner. *See under V.*  
 .. 28,283 (1904). Boulton (Molling und Co.). Process for preparing picture and like surfaces. March 8.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 4055. Newton (Bayer und Co.). Manufacture of a new pharmaceutical compound. Feb. 27.  
 .. 4278. Foelsing. Method of preparing an aqueous solution of trioxymethylene free from formaldehyde. March 1.  
 .. 4564. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of alkyl derivatives of malonyl-*p*-phenetidine. March 4.  
 .. 4565. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of a new derivative of *p*-phenetidine. March 4.  
 .. 4958. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of double salts of 1,3-dimethylxanthine and 1,3,7-trimethylxanthine. March 9.  
 .. 4959. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of soluble compounds of theobromine. March 9.  
 [C.S.] 12,440 (1904). Newton (Bayer und Co.). Manufacture of a pharmaceutical compound. March 15.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 4290. Butler. Three colour photography. March 9.  
 .. 4964. Newton (Bayer und Co.). New flash-light powders. March 9.  
 [C.S.] 10,898 (1904). Bloxam (Neue Photographische Ges.). Method of toning silver pictures. March 11.

## XXII.—EXPLOSIVES, MATCHES, ETC.

- [A.] 4057. Wetter (Westfälisch-Anhalt. Sprengk. A.-G.). Explosives containing nitro-glycerine. Feb. 27.  
 .. 4189. Judd. Explosive.\* Feb. 23.  
 .. 4372. Louis. Explosives having as a base alkaline chlorates. [Fr. Appl., March 2, 1905] March 2.  
 .. 4968. Gonsalves. Manufacture of explosives. March 9.  
 .. 4969. Gonsalves. Manufacture of explosives primers. March 9.  
 [C.S.] 7511 (1904). Selwig. Nitrating fibrous materials. March 8.

## XXIII.—GENERAL ANALYTICAL CHEMISTRY

- [A.] 5029. Du Boulay. Detecting the presence and measuring the quantity of petroleum or oil vapour or gas present in air. March 10.



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† Deceased.

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### ANNUAL GENERAL MEETING, 1905.

The Annual General Meeting will be held in London in July next, and the proceedings will commence on Monday, July 10th. Full particulars will appear later.

### SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

At a meeting of the Organising Committee of the Sixth International Congress of Applied Chemistry, held in Rome on March 2 last, Prof. E. Paternò in the chair, it was decided to divide the Congress into the same number of sections as was the case at Berlin in 1903. At the suggestion of the Presidents of foreign Committees, the date of meeting was fixed for April, 1906, during Easter week.

All communications with respect to the Congress should be addressed to the President, Prof. E. Paternò, Via Panisperna 89, Rome.

## Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

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# Liverpool Section.

ing held at the University, on Wednesday, February 8th, 1905.

MR. EUSTACE CAREY IN THE CHAIR.

## METHODS OF TEMPERATURE INDICATION.

BY ERNEST J. BATY, B.SC.

attempt seems to have been made to classify the methods employed for indication of temperatures, so of which have been devised of recent years, both for practical purposes and for the extremely exact requirements of the research laboratory.

For exact work with the mercurial thermometer, several conditions are necessary. Though a fine capillary is required owing to the small expansion of mercury, it must not be too fine, or a jerky motion of the mercury will be caused by friction in the mercury column, combined with the elasticity of the large bulb with thin walls, which is essential for quick and accurate reading of the thermometer.

For temperatures above the range of the ordinary mercury thermometer, nitrogen filled thermometers are containing this gas under high pressure, to prevent the mercury boiling. The high boiling point liquid of sodium and potassium is also used, but for this class only can be used owing to the action of the liquid on ordinary soft glass.

The first pyrometers were designed for pottery works, for firing of clays requiring a carefully regulated temperature. Wedgwood's pyrometer consisted of a number of half-baked clay cylinders put into the furnace for pottery, and taken out one at a time till the required contraction was produced, this denoting not so much that the temperature was correct, but rather that the firing had been sufficiently high for a long enough

time. He measures temperatures by the appearance of certain tiles: his table is as follows:—

Very dull red .....	525° C.
Dull red .....	700° C.
Bright red .....	800° C.
Cherry red .....	900° C.
Bright cherry red .....	1000° C.
Very deep orange red .....	1050° C.
Deep orange red .....	1100° C.
Orange red .....	1200° C.
Whitish .....	1300° C.
Brilliant white .....	1400° C.
Dazzling white .....	1500° C.
Blue white .....	1600° C.

pyrometers measuring the temperature of incandescent bodies by comparing the whiteness of their light with that of a standard may be used for temperatures between 1000° C.

The Holborn-Kuhrbaum instrument, a telescope pointed to the furnace contains an electric lamp the intensity of which is regulated by a resistance until the light is comparable to that of the furnace. A voltmeter and ammeter shows the electric energy supplied to the lamp, from which the temperature of the furnace is calculated. A second method on the principle consists in comparing the luminosity of the furnace with a standard and less bright light, the latter light being cut down by crossing Nicol prisms until the intensities seen at the end of the telescope are equal; the angle of the prisms then gives the temperature of the body examined.

The melting of alloys of varying composition was used to find whether the temperature attained a certain value: silver-gold and gold-platinum alloys were used. Pieces about the size of pins heads, exposed in a small cupel; these tests could only be used once owing to molecular changes in the alloys. The expansion of a metal rod has long been used, one end being bedded in porcelain and the other moving through a train of levers and pinions. Guillaume found that a nickel steel containing 36 per cent. of

nickel has a practically negligible expansion (less than 1/100th of that of brass); it is likely to find use in pyrometers depending upon comparative expansion of metals.

When two metals of widely differing expansions are soldered on either side of a strip of soft metal, the compound strip thus produced tends to roll up on change of temperature; such a method is in use for testing the temperature in the blast main of iron furnaces, a pencil on a lever marking the temperature on a revolving drum.

A rough method of finding the temperature of the hot blast consists in taking out a plug from the gooseneck and finding how long it takes a piece of aluminium or zinc to melt in the issuing gas. A simple pyrometer consists of an iron bar inserted into a furnace wall and projecting on either side. A certain amount of cooling takes place before the heat arrives at the end of the bar, where a mercury thermometer gives approximate values.

This method has been replaced by air and water current pyrometers. Air current thermometers may be used for temperatures up to 4000° F. A pipe in two separated sections is inserted in the furnace and air is drawn in from outside into the lower section and after passing through the heated bulb returns through the upper section where it heats a mercurial thermometer. The outlet for the air being considerably above the inlet, a current of air is kept flowing in the one direction. A water current pyrometer on very much the same principle is in use at the porcelain works of Sèvres and Limoges.

Another method of measuring the temperature of the hot blast consists of an injector for gases. The hot gases passing through the first cone draw in and thoroughly mix with a proportional amount of cold air, the temperature of the mixture being within the range of a mercurial thermometer.

Thermopiles depend upon the increase in vapour pressure of liquids with rise of temperature. They consist of a tube three to six feet long, surmounted by a pressure gauge. For temperatures between 95° and 350° F. ether is the liquid used. Mercury is used for temperatures up to 1400° F.

For higher temperatures than these Lamy's pyrometers are in use; they depend on the dissociation pressure of limestone, according to the temperature, a mercurial manometer being used. Calorimetric methods are also employed.

Siemens' water pyrometer has its capacities adjusted so that the furnace temperature is read off directly on the scale of the thermometer of the calorimeter. Loss of heat in transit has been a grave objection to calorimetric methods; if, however, such exactness is needed, a carrier of copper or graphite may be provided for the mass of metal, heated up with it to the furnace temperature and removed only just before dipping into the calorimeter. Aniline is found to be rather more satisfactory than water for some calorimetric methods, owing to the larger rise in temperature produced in it as compared with water.

For laboratory experimenting on high temperatures, thermo-couples are largely used, the best combination being that of platinum and platinum-rhodium, containing 10 per cent. of the latter.

Holborn and Wein state that the readings of different thermo-elements may be expected to agree within ± 5° C. at 1000°, whilst different observations of the same instrument may agree better than this.

There is a large number of thermo-electric pyrometers on the market, each of which has its own special merits; the junctions are in most cases of platinum and a platinum alloy for high temperatures, and of iron or copper and "constantan" for low temperatures, the voltmeter being always of the D'Arsonval type, this being the most sensitive. Temperatures registered by these instruments may be from refrigerating temperatures up to 1600° C., the reading of the galvanometer being usually directly in degrees.

The platinum resistance thermometer has already been fully described in this Journal.

## DISCUSSION.

The CHAIRMAN asked, with respect to the Wedgwood clay pyrometer, if it was correct that a clay pyrometer

continued to shrink almost indefinitely by repeated exposures to a high temperature. Mr. Baty had also spoken about an alloy which he understood took two days to indicate the temperature.

Mr. BATY said the alloy that he mentioned had a very small expansion, and it might be used more on account of that for comparative purposes; he imagined that during the two days there was some alteration in the molecular constitution of the alloy.

The CHAIRMAN also alluded to a rough but useful method of indicating approximately the temperature of the interior, for example, of a cast iron pot, which it might be desired to keep as nearly as possible at 500° or 600° F. The pot would probably have a thick flange, which would be or might be exposed to the air. If a hole were drilled in that flange, and an ordinary mercury thermometer placed in the hole in contact with the metallic iron, the thermometer would give a sufficiently accurate indication from time to time of the temperature of the interior, and it appeared to him that that method of indicating temperatures might be further developed.

Dr. J. T. CONROY said at Widnes they had a fairly large experience of high temperatures. One of the first pieces of work he had to do there was to find out with some degree of accuracy the dissociation temperature of limestone. They had no accurate pyrometers in the laboratory at that time, so they constructed a pyrometer on the Siemens principle. He wound a platinum wire round a glazed porcelain tube, and found it most satisfactory at temperatures up to 600° to 700° C. Beyond that he found the instrument never went back to its zero point again. Shortly afterwards, Heycock and Neville published the results of their investigations with the Siemens pyrometer as modified by Callender, and described the instrument which Mr. Baty had shown them with platinum wire wound round mica plates and carefully compensated. At the same time they described the evil results which followed the contact of the platinum wire with the porcelain glaze at high temperatures, and gave the clue to his own difficulties. They had recently bought for the laboratory one of the instruments made by the Cambridge Scientific Instrument Company, and so far as their experience went, the instrument was accurate, sensitive and constant, but expensive to buy and likely to be expensive in repairs, because of the fragile nature of the porcelain covering tubes. He had also made one of the Le Chatelier "couple" pyrometers with platinum and platinum rhodium wires. That he found more satisfactory than the home-made resistance pyrometer, but it was not nearly so sensitive, although, as Mr. Baty had told them, provided no gases were allowed to act on the wires, the pyrometer was accurate in its readings and always went back to zero. For general works purposes they used a modified form of the Siemens calorimeter. Instead of using platinum they employed an iron bolt. The water was measured by filling a small tin vessel to the brim, and was then transferred to a leaden cup which served as calorimeter. The operation was simple, and only the thermometer breakable. For rough purposes and for medium temperatures up to 400° or 500° C., that instrument was very satisfactory. Of course the readings were not absolute, but they enabled the workman to always work his furnace under constant conditions, and they were very easily replaced.

The CHAIRMAN confessed that he believed these calorimeters which Dr. Conroy had referred to were good enough for almost all works purposes.

Dr. CONROY said they were not suitable for high temperatures, owing to the iron bolt becoming oxidised. If they used platinum, they might do quite as well for higher as lower temperatures, for approximate measurement.

Mr. J. BOON said he had also experienced considerable difficulty in preserving the porcelain tubes, but he had found that that difficulty was partly overcome by wrapping the tubes in asbestos. He thought that the carburetting of metal was a very important point in connection with the electric pyrometers. The metals they used were platinum and platinum with 10 per cent. of iridium, and these became so altered after exposure to a high temperature that the instrument was no longer reliable.

Mr. E. J. BATY, in reply to the Chairman's question as to the shrinkage of the clay, said that he mentioned that

the Wedgwood pyrometer was used chiefly in pot furnaces, and it did not matter whether the clay contracted with continued heating. It was more for the color tiles, the chief difficulty in the variation of temperature being that the tile would contract more downwards across. With tiles, of course the pattern must be expanded. He mentioned the measuring by the iron very shortly, because he had not heard of any practical applications of it. A very small amount of impurity in the platinum appeared to produce these molecular alterations, and he believed the platinum for all resistance thermometers was supplied from one melt.

## Manchester Section.

*Meeting held at Manchester, on Friday, March 3rd,*

MR. J. CARTER BELL IN THE CHAIR.

### AN IMPROVED METHOD OF INDIGO TESTING

BY J. GROSSMANN, PH.D., F.I.C.

On the 31st December, 1897, I read before this Society a paper on indigo testing by permanganate. Prior to that date, in June of the same year I had published some notes on Indigo testing in the Journal of the Society of Dyers and Colourists, in which I brought down the bibliography of the subject from 1885 to the date of publication, and pointed out that an enumeration of methods up to 1885 could be found in the paper published by Mr. Christopher Rawson in that year. Since that time a number of methods, partly new, and partly modifications of the old methods have been proposed, abstracts of which may be found in the following numbers of the Journal of the Society of Chemical Industry:—J., 1896, p. 100; J., 1897, p. 938; J., 1898, p. 495; J., 1898, p. 609; J., 1899, p. 251; J., 1899, p. 712; J., 1899, p. 302; J., 1900, p. 100. Also E. Knecht, Journ. Soc. Dyers and Colourists, 1899, p. 100.

Generally speaking, all the methods which have been proposed for the testing of indigo may be divided into five classes.

1st. Those methods in which the indigotin is extracted by substances in which it is soluble, and after purification weighed as pure indigotin.

2nd. Methods in which the indigotin is sulphonated, the sulphonic acid determined volumetrically by oxidising agent.

3rd. Methods in which the indigotin is sulphonated, determined by the addition of substances which react quantitatively to a leuco indigo compound.

4th. Methods in which indigo is reduced and separated as leucoindigotin and oxidised to indigotin.

5th. Methods in which indigotin is determined gravimetrically.

The extraction methods have the great disadvantage that only small quantities can be dealt with for an analysis, and that none of them yield the indigotin at once in a pure state that it could be directly weighed; they apply to the methods mentioned under 4 and 5. The time taken up for an analysis is considerable, the manipulation required of a delicate nature which requires considerable and almost continuous attention, and methods which depend upon the sulphonation of indigo and subsequent titration by oxidising or by reducing agents have therefore been found most suitable for commercial valuation, and I have pointed out in my paper on communication that of all the methods which have been proposed those worked out by C. Rawson, and published in 1885, are the best and most convenient, and for all purposes, there has been no better method than the one proposed by Rawson of salting out the pure indigotin, and testing it with permanganate. The time taken back to that method has been that the salting out takes several hours, the filtration of the sulphindigotate is



does not readily filter, and some of the sulphindigo remains in the filtrate in solution, and has to be allowed a correction which is more or less arbitrary. In a published in 1899, C. Rawson proposed an improvement of his method by adding chloride of barium to the solution of the sulphonated indigo for the purpose of mechanically throwing down any impurities. No doubt, this method is an improvement as far as the time required for an analysis is effected by it, but is questionable in that it will affect a certain class of impurities in the natural indigo which become sulphonated, and are not thrown down by the sulphate of baryta.

The method which I wish to lay before you to-night, which was worked out by me in the year 1891, which has been used in my laboratory since then, which I have found very reliable. I have tested hundreds of samples by it, and have been on several occasions checked by Indigo brokers who have sent me a series of samples which I have previously tested for without my knowing that they were duplicates, in each case the results were identical to those which have been received from me before. The principle of the method is based on the fact that the impurities in the natural indigo are only soluble as long as the solution is neutral.

If the solution is neutral, these impurities fall out and are carried down along with the insoluble precipitate. I form in neutralising the solution; and the way in which I proceed is as follows:—

1 gram. of indigo is finely ground with glass powder mixed with 20 c.c. of strong sulphuric acid of 45 sp. gr. It is heated for an hour at 90° C. then transferred into a litre flask containing water, and the flask is filled up to the mark with water. At this point I follow Rawson's instructions. I now add to my own method, which consists in placing 1 c.c. of this solution in a 500 c.c. flask, and gradually adding a sufficient quantity of pure calcium carbonate, is about 6 gm. to the solution. The flask is filled up to the mark and well shaken; after the calcium sulphate and the impurities which it has carried down have subsided, the liquid is filtered, and 249 c.c. corresponding to 250 c.c. with an allowance for the space occupied by the precipitate are measured into a porcelain beaker; a few centimetres of diluted sulphuric acid added, and the solution may be titrated in the usual manner with permanganate of potash.

The solution obtained by treating indigo in this manner, requiring it for titration has the great advantage that the pure solution which may be used either for an oxidising or a reducing test. It may, moreover, be used for a test or for a colorimetric test. It, therefore, does not depend upon the permanganate method, but may be used as a preliminary preparation for nearly every kind of analytical work proposed for the valuation of indigos, with the exception of those which are based on the estimation of indigotin by solvents, direct reduction, or oxidation. The method has the drawback which all estimating methods have of determining the indigo as indigotin; but as a rule, with the exception of special make of indigo, the quantity of indigo rubine or natural indigos is exceedingly small.

I have not had an opportunity of checking my method on samples of Java indigo containing the yellow colouring which Rawson found in them, nor have I been able to examine the accuracy of my method in the case of natural indigos containing impurities arising from their manufacture, which will be most likely of a difference to those occurring in natural indigo. I trust others will take up this line of investigation, and ascertain how far my method will apply in these cases.

In view of the extended use which artificial indigo is finding, and considering the fact that the sulphonating of both in the case of artificial and natural indigo may give wrong results in such cases where indigo was combined with certain aniline colours which can be imitated, such as aniline blue, &c., every sample of indigo of which the original source is not authenticated should be qualitatively examined before sulphonating by it with alcohol or other solvents which do not act on indigo. But as regards those cases the fault is one which is adherent to all methods which depend upon

previous sulphonation and subsequent oxidation and reduction, and is not one which is peculiar to my method.

I can thoroughly recommend my method as being one which is exceedingly quick and gives most concordant results. A test can be made in two hours from the time that the sample has been ground, and as it requires very little manipulation, half a dozen or more tests can be conveniently carried on at the same time. The solution of indigotate which is obtained after neutralisation with calcium carbonate is of extremely pure tint, and can, therefore, be most conveniently used either for dyeing out tests or for colorimetric determinations.

#### DISCUSSION.

Dr. GERLAND thought to sulphonate at 90° might be at too high a temperature. He asked Dr. Grossmann whether he had tried lead acetate as a precipitant for impurities, and expressed his hope that Dr. Grossmann's method of neutralising the solutions of indigo with calcium carbonate would overcome the great difficulties which had stood in the way of a quick and reliable test for indigo up to the present.

Professor KNECHT said he thought it might be taken for granted that Rawson's original salting out process was now obsolete, the far more convenient and rapid barium chloride process of the same chemist having taken its place. With regard to Dr. Grossmann's proposal to use calcium carbonate for precipitating the impurities from the solution, he would like to ask in the first instance whether any of the indigotin was mechanically retained by the calcium sulphate. It would further be interesting to know to what volume the lecturer diluted his indigo solution for titration, what strength of permanganate he used, and what factor he adopted for calculating the amount of indigotin present. It was well known that the factors given by Rawson and by the Badische Co. respectively differed materially from each other, and that they were neither in accordance with the theoretical value. It was not quite clear to him whether the lecturer actually filtered his solution from the calcium sulphate, or whether he decanted an aliquot part of the clear liquid after allowing time to settle. In the former case, the filter paper might absorb some indigo, and a slight correction would then be necessary. The lecturer had given 90° C. as the temperature used for sulphonating. He wished to point out that there was now a tendency to use for sulphonating temperatures below 90°, and to correspondingly increase the duration of the sulphonating process. Although he could not say from actual experience that a temperature of 90° would cause any loss in indigo through oxidation, he had ascertained in a series of experiments on pure indigotine that at 100° there was an actual loss amounting to about 1 per cent. per hour. With regard to his own process of estimating indigo by reduction with titanous chloride in tartaric acid solution, he had pointed out in a paper read before the Society of Dyers and Colourists that it gave accurate results on pure indigotine, but that the impurities present in commercial indigos so obscured the end-reaction that the process was rendered valueless for industrial purposes. He would gladly adopt the suggestion of Dr. Grossmann to try the effect of his calcium carbonate process on the reduction method.

Mr. BARNES also laid stress upon the importance of proper sampling.

Dr. FEILMANN wished to know whether indigotin sulphonation was carried down by the sulphate of lime.

Dr. GROSSMANN, in reply to Dr. Gerland, said that in sulphonating he had followed the careful work which Rawson had done, and accepted his method. In fact, up to the point where he added calcium carbonate to the solution of indigo he had adopted exactly the method which Rawson used for his process of preparing the indigo solutions for testing. As a matter of fact, the errors in sulphonating would not affect his method any more than any other method in which indigo was dissolved by sulphuric acid. He had never tried the action of lead acetate. The principle of his method was to

obtain a neutral solution, and this, of course, would not be the case if he were to use acetate of lead, as after precipitation the solution would contain free acetic acid. As regards the sampling, it was the usual method to take an average sample of the dock samples. Where the check came in was that the dock samples were not always to be relied upon, and where important contracts were in question, it was always advisable to obtain a special sample and compare that sample with the ordinary dock sample test. In answer to Dr. Knecht and Dr. Feilmann, there was no doubt whatever that no indigotin was carried down with the precipitate. In answer to further questions of Dr. Knecht, he must reiterate that the volume of solution and the strength of the permanganate were exactly those proposed by Rawson. With regard to the factor which he used for calculating the strength of the indigo from the permanganate solution, he could only refer to his previous publications in which he had always advocated that in matters connected with volumetric analyses the titre of the solutions should not be determined in a roundabout way, but with the use of the identical substances which one required to test. He applied the same principle in this case, and in the first instances, therefore, prepared a solution of pure indigotin carefully prepared and known to be pure in sulphuric acid. He took care that the sulphonation took place at the same temperature at which he was going to sulphonate in dealing with commercial samples and that practically the same quantity of indigotin was taken for the standard as would be used in his future tests. He diluted the pure solution of indigotin to the same volume as he would use in every subsequent analysis, and in that way obviated as much as possible those mistakes which might be inherent to these operations. Of course once the relation between permanganate and pure indigotin was obtained in this way, the strength of the permanganate could be ascertained in its relation to a pure ferrous salt and the permanganate solution, and in future could be standardised by means of such a ferrous salt. With regard to the absorption of indigotin solutions by filter paper he did not think that it would affect any method very much. At the same time, there was no need in his method of filtering as the precipitate settled out very rapidly, and left a clear solution which could be decanted after half an hour's settling or even less.

## New York Section.

Meeting held at Chemists' Club, on Friday, February 24th, 1905.

DR. RUSSELL W. MOORE IN THE CHAIR.

### CARBON TETRACHLORIDE AND ITS USE AS A SOLVENT FOR DIFFERENTIATING BITUMENS.

BY CLIFFORD RICHARDSON AND C. N. FORREST.

Carbon tetrachloride has attracted of late very considerable attention owing to the fact that it has been made available at a lower price and in a purer form than heretofore, and it has been suggested as a substitute for carbon bisulphide as a solvent. Tetrachloride, as is well known, is made by exposing a mixture of the vapour of the bisulphide and chlorine to a red heat, forming thereby carbon tetrachloride and sulphur chloride. If the heat is too low, carbon bisulphide remains in the tetrachloride, and, if too high, carbon trichloride ( $C_2Cl_6$ ) is formed. As a result of this, or because of insufficient purification, much of the tetrachloride that has been on the market heretofore has contained from 1 to 2 per cent. of bisulphide, thus impairing its suitability for certain purposes.

The physical properties of the two solvents may be compared with interest:—

	$CCl_4$ .	$CS_2$ .
Odour .....	aromatic	rank
Inflammability .....	non-inflammable non-explosive	149° C. ve inflammable explosive
Specific gravity <sup>15, 15° C.</sup> .....	1.604	1.270
Vapour tension .....	low	high
Specific heat .....	high	low
Index of refraction ..	1.464	1.028
Boiling point .....	76.6° C.	46° C.
Toxic effect .....	none	poisonous

The early supplies of carbon tetrachloride which came into the writers' hands had a sp. gr. of 1.593, a pale straw colour. On distillation, this material began to boil below 43° C., showing the presence of some substance of even lower boiling point than carbon bisulphide. On continuing the distillation through an 18-in. Young dephlegmator the following results were obtained on a common tetrachloride of sp. gr. 1.593:—

Below 43° C.	..	..	0.13 per cent.
43 to 47 ..	..	..	0.31
47 to 50 ..	..	..	0.10
50 to 60 ..	..	..	0.31
60 to 70 ..	43 to 60 (total)	..	0.85
70 to 75 ..	..	..	0.22
75 to 76.5 ..	..	..	0.05
			0.61
Total .....			1.73 per cent.

It appears that 1.73 per cent. of the tetrachloride boiled below the boiling point of the pure tetrachloride. On further fractionation 1.5 per cent. of pure carbon bisulphide was obtained from the lower fractions, the residue boiling above 77° C. left, on spontaneous evaporation, a substance which sublimed very readily into quite pure crystals of carbon trichloride,  $C_2Cl_6$ .

More recently a tetrachloride has been put upon the market by the Acker Process Co. of Niagara Falls, which has been found to be much purer than the ordinary commercial supply. On distillation under conditions similar to those followed in the examination of the sample, the most volatile constituent was found to boil over between 70 and 75° C., and amounted to but 0.1 cent. It contains a small amount of bisulphide, the boiling point then ran up rapidly to that of pure tetrachloride, the entire distillate in the first fraction below that point amounting to but 2.7 per cent. material as supplied to the trade by the Acker Co. is practically pure tetrachloride, having a specific gravity shown of 1.604 at 15° C. The solvent leaves no residue on evaporation, although it contains a small amount of carbon trichloride, and is consequently an extremely pure material at least from a commercial point of view.

Considered merely as a standard for extraction on a commercial scale, it is the equal in its solvent power to almost all other solvents, exceeding them to some extent with certain substances. It is miscible with all other solvents of the same class, resembling in this respect carbon bisulphide, and, like the latter, it dissolves a large trace of water.

The greater advantage in the use of tetrachloride as a solvent lies in the fact that while bisulphide is inflammable at 149° C., in consequence of which it takes fire when vapour comes in contact with a heated steam pipe, explosive when mixed with three volumes of air, it is only quite unflammable, but imparts this property to other inflammable substances, such as benzol, turpentine and naphtha, when mixed therewith. Sixty parts by volume of tetrachloride to 40 of naphtha, 40 of turpentine, 60 of benzol, and equal parts with turpentine prevent the ignition of these otherwise inflammable substances. The vapour of tetrachloride is not unpleasant, nor does it appear to have any toxic effect, both of which properties make this material preferable to bisulphide in this respect. Tetrachloride has a much higher specific gravity, a higher boiling point and specific heat than carbon bisulphide, but a lower vapour tension and index of refraction. Owing to its



specific gravity its volume weight is much greater, and a larger amount of it must be employed to obtain the volume of solvent as can be seen from the following table:—

Volume of 1 kilo. in litres.	
62° naphtha .....	1.366
Benzol .....	1.131
CS <sub>2</sub> .....	0.788
CCl <sub>4</sub> .....	0.6231
Water .....	1.000

appears that a pound of bisulphide will go as far as 1.366 of tetrachloride, while a pound of naphtha has the volume as nearly 2.25 lbs.

Experiments have also shown that its solvent action, bitumens at least, is not as prompt as that of carbon disulphide, probably the lower rate of diffusion being due to greater density.

The value of carbon tetrachloride as a solvent in the extraction of bitumens lies in the fact that it exercises a selective action on the hydrocarbons and their derivatives composing many of the native bitumens, residual oils and tars, while the true asphalts are dissolved only to the same extent as by carbon bisulphide. The same may be said in regard to gilsonite, but native bitumens as grahamite are not soluble in tetrachloride at air temperatures to the same extent as in carbon bisulphide, as much as 75-3 per cent. of an insoluble nature having been found in a sample from Colorado, although the type of grahamite from West Virginia contained but 1.3 per cent. in this respect.

The value of the solvent for differentiating the bitumens, to which any native bitumen has been weathered or condensed is, therefore, apparent.

The addition of additional value in another way in revealing any bitumens which may be brought about in a bitumen which is quite soluble in tetrachloride in its native state, but is injured by treatment at excessively high temperatures in industrial processes. For example, residual oils carefully prepared from California and Texas bitumens having an asphaltic base, are entirely soluble in tetrachloride at air temperatures, but, as they are used industrially, they contain from 1 to 7 per cent. of bitumen in a form not soluble in tetrachloride, very strong evidence that the original bitumen has suffered a change in character at the high temperature to which it has been submitted, this often reaching 700° to 900° F. In the same way, in the careless refining of asphalt for road purposes, the bitumen may become more or less insoluble and insoluble. If this has taken place it can be detected by determining if anything is present in the tetrachloride which is soluble in carbon disulphide. As an example, an asphalt recently introduced on the market, the facilities for refining which were inadequate, showed 17 per cent. of bitumen insoluble in tetrachloride, but, with improvement in the process of refining, this form of bitumen gradually disappeared.

Carbon tetrachloride is a solvent of value in determining the character of bitumens seems, therefore, to be well established. It must for this purpose, however, be employed at a temperature not exceeding 25° C., and should be free from carbon bisulphide, and, as used in this way, the author can cordially recommend it to those interested in the purification of native bitumens.

## Scottish Section.

Meeting held at Glasgow on March 7th.

MR. JAS. HOPE IN THE CHAIR.

### GOLD EXTRACTION BY CYANIDE: A RETROSPECT.

BY JOHN S. MACARTHUR.

Now about 15 years since I read the first paper on this subject to this section of the Society of Chemical

Industry. If this were a chemical society only, I would not feel free to offer this paper, but the Society being industrial as well as chemical, my hesitation is less, as it appeals specially to the undeveloped aspect of chemical invention and progress.

At the date when I had the honour of appearing before you previously, the process had not been long before the public, and it was not so well known or understood then as infinitely extended practice has caused it to be known and understood since.

In order to make everything clear, I shall, in a few sentences, broadly describe the general operation of gold extraction from ordinary gold ores apart from alluvial operations or smelting methods.

The ore, which may be taken as composed principally of silica with a small proportion of metallic sulphides, as brought from the mine is broken and finally crushed into sand by powerful machinery and forthwith washed over mercury-coated copper plates which collect, entangle and amalgamate with the small particles of free gold, while the partially exhausted sand passes on. But the sand is not nearly exhausted, as this operation often recovers less than half the total gold contents, and seldom more than two-thirds. The gold thus escaping may be closely associated with the metallic sulphides very finely divided, or, for some other reason, not capable of true molecular contact with the mercury. A proportion of the escaping gold could in many cases be recovered by collecting the heavy metalliferous portion of the escaping sand, now called tailings, and treating by chlorination or smelting. Allowing for this economy, the total recovery must be regarded as low, and the total loss high. Indeed, there were many cases where the amount of gold recoverable by the recognised processes was so low that the ores, though richer than many, were not worked, simply because the mercury-coated (amalgamated) copper plate would not do its work. Ores were roughly classified as "free-milling" when they yielded their gold freely to the amalgamation process, and as "refractory" when they did not respond to it.

The cyanide process was designed to treat gold ores generally, and is well suited to do so, but for various good reasons has found its principal sphere of usefulness in treating tailings or residues from amalgamation.

The cyanide process consists in treating the crushed ore or tailings, as the case may be, with a weak solution of an alkali cyanide, containing generally under 0.5 per cent. of cyanide, which substantially dissolves the gold and substantially leaves the other constituents of the ore undissolved.

The gold solution being drained off, or displaced by water, is caused to flow through a mass of zinc shavings or threads, which precipitate the gold as a fine powder, while the solution passes on, containing a large proportion of active cyanide available for the next operation.

The circumstances which led up to this invention were these:—

About midsummer of 1886 the "Cassel" process of gold extraction, by the solvent action of electrolytically generated chlorine on the gold ore, was attracting great public attention. It was then reported that this process had solved the problem of gold extraction from all sorts of refractory ores, and that millions of tons of ore and tailings scattered over the world could now be profitably treated. It had already been discovered and admitted that the nascent chlorine acted so energetically on the pyritic constituents of the ores, that the base metal compounds were dissolved and the gold neglected. This difficulty was understood to be overcome by the addition of lime, so that the gold was dissolved by nascent chlorine in an alkaline solution which was a precipitant rather than a solvent of base metal compounds, principally those of iron.

The process was at the stage of large scale testing, with works in London under the charge of the inventor Mr. H. R. Cassel, when suddenly circumstances compelled him to abandon his post, and he left the country, at the same time leaving the affairs of The Cassel Gold Extracting Company in great confusion.

Having had occasion to look critically into this process, and in course of writing an article on the subject for a

weekly journal. I came to the conclusion that the same result, i.e., the dissolving of gold freely, with greatly restricted action on the base metals, could be accomplished without the electric current and without unsency, by the use of chlorine or bromine in presence of a salt which

(a) Would not absorb chlorine or bromine.

(b) Would not precipitate gold.

(c) Would precipitate base metal compounds.

Perhaps there is no salt that absolutely fulfils these conditions, but bleaching powder and borax and bicarbonate of soda approximate to it, and, generally speaking, the salts that are (or then were) used in toning photographs were of this type. I proved that chlorine and bromine, along with such salts, did dissolve gold, but the action on pyritic and base metal compounds was less easy of proof. At any rate, this method was tried on a sample of gold ore with such success that a Research Syndicate, consisting of Dr. R. W. Forrest, Dr. W. Forrest, Mr. Geo. Morton and myself, was formed to investigate and, if possible, develop the process into a commercial success; but we failed in this, for again the halogen, notwithstanding the moderating effect of the added salts, worked too vigorously and spent its expensive energy on the base metals, and to our disgust neglected the more valuable gold.

At this juncture, the Directors of The Cassel Gold Extracting Company requested me to undertake the task of resuscitating and perfecting the Cassel Process, and the arrangement was completed on the footing that the Cassel Gold Extracting Company should have the first right to acquire any discovery or invention which might result from the efforts of the MacArthur-Forrest Research Syndicate. Thus the work on the Cassel process and investigation on independent lines were carried on simultaneously.

We had soon found that our sub-alkaline halogen solution was not to be effective, but, encouraged by the confidence of our far-seeing financial partner, we continued our researches to find a gold solvent that would not be a base metal solvent. Naturally this excluded all reagents of the *aqua regia* and acid type, and restricted us to solutions alkaline to test paper or at least neutral. We could not hope to restrain an acid solution from a vigorous attack on the base metals which, owing to their stronger affinity and greater mass, competed unfairly with the gold. In fact, the industry of molecular attack on gold had to be protected to prevent the indiscriminate dumping of base metals into the solution.

Having regard to the many who, like ourselves, were then searching for a process of extraction, and to the fact that results were frequently reported from the difference between original assay value of the ore and final assay value of the residue—a method frequently open to grave objection—we decided not to consider as extracted any gold unless we actually handled and weighed it. As the most generally useful and applicable precipitant of gold we used sulphuretted hydrogen.

Among the various solvents on our programme for trial, we had included potassium cyanide, and in November, 1886, we tried the effect of it on the tailings of one of the Indian gold mines, and, as usual, treated the solution with sulphuretted hydrogen for recovery of the gold, and, getting none, we passed on to our next solvent, meanwhile observing our rule of labelling the residue and laying it aside. We had neglected to notice that sulphuretted hydrogen did not precipitate gold from its solution in cyanide, and thus our experiment was, for the time, literally relegated to the shelf.

About eleven months after, I had occasion to devise a rapid method of gauging approximately the gold contents in weak solutions of gold chloride, and used for the purpose tin chloride to produce the well-known purple of Cassius. One solution that I had to test contained mercury, and, using potassium cyanide to separate the mercury and the gold, I was apprised of the fact that sulphuretted hydrogen did not precipitate gold from its cyanide solution. Instantly my mind reverted to the experiment carried out nearly a year before, and I saw that it might have been successful without the success being recognised. Immediately a sample of rich concentrates from a Californian mine was treated, and on this occasion we examined the residue rather than the solution, and found a high per-

centage of extraction. A sample of poor concentrate from India was now treated, and again a high extract was obtained.

The results were startling. We unearthed the residue from the old experiments (all our work was done in duplicate) and to our intense satisfaction we found they too had transferred their gold to the cyanide solution. There was now no doubt about the importance of the discovery, and at once a provisional specification was drafted and lodged. The guidance on this subject obtained from chemical and technical text books was scanty, meagre and sometimes misleading. The standard books of reference on chemical matters must copy largely from a few original sources, and, if an inaccuracy or error occurs at the fountain head, it is sure to be perpetuated. We could get no information whatever on the action of cyanide solutions on gold ore, and no direct or reliable information as to the action of cyanide on the ores of base metals. We did get, however, some information regarding the action of cyanide solutions on the metals themselves. For instance, Elsner states (J. Prakt. C. 37 [1846], 441) that iron is soluble in cyanide solution; mercury is not acted on—both statements palpably erroneous. Other investigators stated that mercury dissolved in cyanide solution, but the fact that commercially pure iron was not appreciably acted on was noted, I believe, in the course of my own work. Possibly the iron used by Elsner contained some silicon—hydrogen would be evolved, but no iron would be dissolved.

Let me give another instance of the imperfect and contradictory information obtainable from standard works. In a most valuable work, published quite recently, occurs the following statement:—

"Some of the insoluble cyanides are readily decomposed by dilute acids, e.g., cyanide of lead and cyanide of zinc."

and a dozen pages further on in the same book:—

"No cyanide of lead has been isolated."

I now do not hesitate to accept the latter of these contradictory statements as correct.

There was a similar confusion as to the action of cyanide solution on gold. Elsner stated that oxygen was necessary for the reaction. Percy (referring to silver) says that either hydrogen is evolved or oxygen derived from the air, but from any cyanates that might be present (Percy's Metallurgy, Part I., pp. 114–115). G. also thinks the cyanates may supply oxygen. Faraday indicates clearly that air contact and the formation of air voltaic circles are necessary for the reaction. He does not hint at any oxidising action being necessary (Trans., Vol. 147, p. 147). As Faraday may fairly be taken to represent the high-water mark of knowledge on this subject in his generation, I think it well to quote his words. Referring to the dissolving of gold leaf in cyanide solution, he says:—

"Air voltaic circles are formed in these cases, and gold is dissolved almost exclusively under their influence. When one piece of gold leaf was placed on the surface of a solution of cyanide of potassium, and another moistened on both sides, was placed under the surface, both dissolved; but twelve minutes sufficed for the solution of the first, whilst above twelve hours were required for the submerged piece. In weaker solutions and with silver also, the same results were obtained. From sixty to a hundredfold as much time being required for the disappearance of the submerged metal as that which, floating, was in contact both with the solution and the solvent. An action of this kind has produced much to do with the formation of the films described hereafter."

These references and all others available refer to the action of cyanide on metallic gold with which we have little concern, and did not touch on its behaviour towards ores or the minerals usually found in ores.

Amid all this confusion of authority, we had to work out a metallurgical process rather than attempt to solve delicate chemical questions concerning reactions of pure materials.

On the general assumption that the addition of oxygen or at least air contact was necessary for the reaction, we constructed our first apparatus with a won-



ement of ploughshares which turned the ore, with cyanide solution, over and over, always giving fresh surfaces to the air. This apparatus gave good results that we tried the simplification of plain g., which also did well, and we came down to a ing barrel, which did equally well. After this we down to a plain percolation of the cyanide solution h the ore, which gave such satisfactory results e concluded that, even if air contact or oxygen were ary, it was not necessary to devise any special form aratus to introduce air to the mixed ore and cyanide m. Thus all special mechanism was eliminated e process became less of a complex process and of a simple operation.

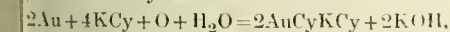
le this practical work was being carried on, the al aspect was not neglected. Experiments were l out on ores treated with cyanide solutions which e made from water boiled to expel all dissolved air, e extractions were the same as under normal con- s. At this time I also suspended a sheet of gold fine thread in a cyanide solution, about an inch e surface of cyanide solution, and found that it ed surely and steadily. It was clear that there was d for air contact, and as no one had ever suggested ir or oxygen was dissolved and held unchanged in e solution, all appearances went to show that the al action was independent of oxygen.

at period I expressed my opinion on the subject ection, thus:—

Elsner has stated that metallic gold dissolves in ide of potassium only in presence of oxygen. Not ng seen the original account of Elsner's researches, a not in a position to criticise his experiments, b ver could find that the presence of oxygen was ssary either to dissolve gold by itself or from ores by ide. If a piece of gold be immersed in cyanide tion, so that air to act on it would have to penetrate inches or three inches of the solution, the gold will ion in its usual slow and steady fashion. The tion shows that either oxygen must be absorbed or rogen evolved. I have seen no evidence of the ier, and can adduce no proof of the latter; but I k the latter the more probable, because I cannot eive oxygen penetrating even a film of cyanide tion without at once oxidising the cyanide to ate.....

However, we do not concern ourselves much with eactions of pure gold, but, as a matter of fact, we ot find that oxygen plays any part in the cyanide ection of gold from ores. We have treated an ore e cyanide with free access of air, and then a parallel eperiment was done with boiled water, the bottle filled e stopper with solution and ore, and the stopper ed. The extraction was the same in both cases." r and over again this guarded statement of a reave- owedly imperfectly understood, has been con- into an absolute assertion that oxygen was ssary.

question was solved as regards metallic gold *per se* eLaurin of Auckland, New Zealand, who discovered ndamental fact that oxygen remained uncombined eous solution along with cyanide, and did not, as ally stated and assumed, oxidise the cyanide to e (Proc. Chem. Soc., 1893 [122] 81). He confirmed uation usually attributed to Elsner:—



yanide process had been in general and increasing veral years before MacLaurin instituted his research, e fact of its economical working proving the ility of the solutions in spite of protracted air ure naturally carried with it the suggestion that, ing the necessity for oxygen in the chemical reaction, st be soluble, unchanged, in the cyanide solution. s, however, left to MacLaurin to prove definitely b had been mistakenly called Elsner's equation, which, tice, now ought to be called MacLaurin's equation. a matter of fact Elsner does not give this equation. ous experimenters, myself included, had not reckoned ygen being held free and in solution in cyanide on, but had gone on the text book assumption that

cyanide solutions readily absorbed and combined with oxygen to form cyanates—another mistake. In practice cyanide solutions of the fixed alkalis are now found to be stable in air for all ordinary purposes.

There is a strong general tendency to assume that the reaction between cyanide and metallic gold is reproduced exactly in the case of the gold contained in ores, and this general assumption has often obscured metallurgical investigation. No allowance has been made for the number and variety of mineral substances, possibly unacted on themselves, but still capable of modifying the reaction between gold and cyanide. Highly suggestive work directed towards the elucidation of this complicated problem has been carried out by Gore, who found that metallic gold was dissolved more quickly when in contact with some minerals than with others, and that such inert substances as ground glass and sand had a distinctly accelerating influence. He found that a gold disc lying on clean white sand dissolved nearly five times as quickly as when merely immersed in cyanide solution. What is the nature of the action in this case, I do not pretend to say. No one has yet suggested that sand has any chemical action under the circumstances. Possibly they occlude oxygen—I cannot say.

Another investigator found that the merest trace of ferric oxide induced the action. Again I do not pretend to explain; but, if this is so, the comparatively easy and rapid dissolving of gold from ores is accounted for, as practically all auriferous ores contain more or less ferric oxide.

Acting on the assumption that the chemical action is the same in the case of gold ores as in the case of gold already extracted, refined and prepared, many propositions have been made to apply air or oxygen by mechanical means to the ore and cyanide mixture—compressed air in all forms, mazes of perforated pipes and stirring apparatus have been tried in all countries; but, as far as I know, not one has been worth the trouble involved or has justified its existence, and all have therefore dropped out.

Many chemical means of oxidation have also been suggested—peroxides of barium and calcium, bichromates and even nitroglycerine; but they are little heard of now.

Other methods of oxidation (without oxygen) have been proposed, by which cyanogen has been generated direct to combine with the gold. The principal of these are the addition of ferri-cyanide (of any alkali metal) to the usual cyanide solution, used in the laboratory by myself, but afterwards independently worked out and patented by Moldenhauer in 1892; and bromide of cyanogen suggested by Dr. E. J. Mills to myself in 1888; but independently worked out by Sulman and Teed in 1894-95. This last method—the Sulman-Teed—is the only modification of the original Cyanide Process as invented and described by the Forrests and myself that has taken root. It has been found of great utility in working the tellurides of Western Australia, but not much heard of elsewhere.

So far, we have dealt with the problem of getting the gold into solution, which is by far the most difficult part of the question. The precipitation from solution is comparatively easy. We knew well that zinc precipitated gold from its cyanide solution; but it remained to make this reaction industrially applicable. We used various forms of finely divided zinc with more or less advantage; but a picture of some fine zinc shavings, bought with other things in a shilling box of chemicals in my boyish days, haunted my mind, and repeatedly I described it to one of the works foremen without effect, until one day, when making a zinc case for packing cyanide, he made a shaving by a sharp tool and came asking me if this was what I wanted. My reply was "Yes," and in half an hour he had prepared the first bundle of zinc shavings for gold precipitation—the pioneer bundle of hundreds of tons of this flimsy but useful material.

We had of course to design an apparatus for using the zinc. Here the difficulties of small scale work hampered us seriously. It seemed such an easy matter to put the zinc in a jar with a hole at the bottom and allow the gold-cyanide solution to run through it; and this simple scheme did very well for a few hours; but gradually the interstices in the zinc mass became choked with extremely

fine precipitated gold, the solution flowed more and more slowly, till finally the zinc mass became impervious and the solution overflowed. A small tank, really a water-tight box with compartments arranged for the well-known alternate up-flow and down-flow, was used; but the down-flow compartments did not work satisfactorily. Finally the form now in use, in which the down-flow is through zinc-less compartments and the up-flow through zinc-full compartments, was devised in its first form by the metallurgists then in charge of the MacArthur-Forrest installation in New Zealand. It was modified in detail by myself, to economise space and give ease of working, and was used in 1890 in substantially its present form.

Zinc precipitation is one of the weak points in the process. With care, the precipitation is complete to a few grains per ton, but the gold is collected in such fine mud, drying into dust, that loss is inevitable. Various modifications have been suggested in the method of precipitation, to avoid this and other inconveniences. Zinc itself has been used in the form of a fine dust which was mixed with the cyanide-gold solution into almost an emulsion. The gold was quickly precipitated and the gold precipitate with a large excess of zinc allowed to settle, and was then collected. This, however, did not get over the trouble of the gold being in soot-like dust, liable to loss with each breath of wind. This method was worked in conjunction with the cyanogen-bromide modification of the cyanide process by Messrs. Sulman and Teed.

The use of aluminium as a precipitant was proposed by Moldenbaner, and its use advocated on the grounds that the gold was precipitated in reguline form on the aluminium wires used and no cyanide was consumed in the reaction. This method, however, never took root, because the gelatinous precipitate of alumina which formed in the reaction was a greater trouble than the powdery gold.

Electricity was proposed and brought into use as a precipitant by Messrs. Siemens and Halske. The cathodes were made of sheet lead, and the anodes generally of iron. The current was of low voltage and moderate ampère density.

The precipitating tanks were enormous in size as compared with zinc boxes. The gold coated cathodes were fused and cupelled at regular intervals. By this means the gold was recovered as gold without the risk of loss of dust.

Electricity is well-known and much used as a precipitating agent for electro-plating and for refining metals, but its use in these industries did not involve the complete precipitation of all the metal in solution—there always remained a store of metal which maintained its conductivity. The solutions used were maintained as true mother liquors.

The case in the precipitation of gold is very different—the proposition involves the precipitation of the gold to the last molecule as nearly as possible. The electric current is obviously not economical in this respect because as the solution becomes weaker and weaker in gold, it becomes, if anything, a worse conductor. The current must increase somewhat in electro-motive force and spend its energy on the gradually weakening solution. In fact, the weaker the solution became in gold, the stronger, the more wasteful, the more costly and the less effective the current became.

In practice there was always a comparatively high amount of gold left in the solution which, though used over and over again on fresh lots of ore, led to loss by leakage and dissipation. In fact, it is a wonder to me and a credit to the technical staff concerned that good results were really obtained. The electric precipitation method is less used now than ever and seems to be dying out.

When solutions are very weak in free cyanide or when they contain copper, they are not easily precipitated by zinc in the ordinary manner (though the difficulty in weak solutions has been greatly exaggerated), but this difficulty has been overcome by using zinc coated over with precipitated lead. This is carried out by adding a small quantity of a lead salt to the gold-cyanide solution as it enters the zinc box. This method was devised by me, and patented in 1894. The application for a patent in the Transvaal was refused on an objection lodged on

behalf of the Chamber of Mines—thus the process dropped out of sight in the Transvaal until 1898, when it was rediscovered by Betty, who worked it most successfully. The introduction of the lead coated zinc had much to do with the desertion of the electro-precipitation process.

The precipitation of gold by charcoal has been used in various places, but, if it survives at all, it is only in Victoria. It is difficult to imagine why it was ever installed, as it has all the disadvantages both of the chemical and electrical methods. The gold-bearing solution passed through a great mass of wood charcoal in which the gold deposits. After a comparatively short time of use the charcoal ceases to act and the gold is recovered by slowly burning the ashes which, being of the dust-like texture, are blown about by every breath of air. This danger is escaped, the gold dust and ashes are transferred to a crucible and fused into bars in the ordinary way. The chemical action involved in this precipitation is not generally understood—the assumption is that it is due to occluded hydrogen and hydrocarbons. In any case this method combines the inconvenient size of an electrical precipitation plant with the duty form of precipitation, which is too prone to vanish with the wind.

When I first went to Johannesburg, in May, 1890, gold production was less than 40,000 oz. per month, the boom was off, the town was one third empty, there were more rooms than occupants, stores were either empty or filled with derelict goods and everything looked gloomy. In the course of a year or so, the potentialities of the cyanide process were dimly realised, the gold output increased steadily, confidence was restored, moribund mines re-opened, fresh capital provided, the once dry "blue ground" in the lower levels where the old ores gave place to more pyritic ores was now covered with valuable asset, deep claims were pegged off, and the value of mines, shares, town properties, mercantile businesses, and of the country itself, rose enormously. Production increased, the country became more and more attractive, controlling, till at last one of the fiercest and most profitable wars of the age was fought because of the immense successful application of an industrial invention.

What has happened on a huge scale in the Transvaal has occurred in analogous cases in New Zealand, Queensland, Western Australia, United States of America—in fact, in gold producing countries generally. In these countries heaps of tailings, worse than valueless, became the mother earth of springs of gold. Ore deposits known to exist, but of doubtful nature as to profit, became valuable—one in New Zealand offered in Glasgow and in London in the pre-cyanide days at £3000 was refused, fortunately for the owners, as its market value is now about £500,000.

It is not easy to enumerate the advantages conferred on the gold industry and on the world generally by the cyanide process. It adds directly to the world's supply of gold about 20 per cent., and indirectly very much more because of greater profit accruing to the cyanide operators which permits mining and mill amalgamation to be done in conjunction with them where they would not have yielded enough profit to stand alone. In fact, in cases where ordinary milling would not recover enough gold to pay for itself and for mining, cyanide steel recovers another moiety of gold at a cheap rate, and makes a profit for the complete chain of operations. It is an industry of the two stages of mining and milling; it is not able to exist where, with cyanidation added, the industry obtained a new lease of life. Speaking generally this may be said to be the case in South Africa. If they were to be withdrawn from the Rand, the huge gold industry now so firmly established would dwindle in many individual cases, die. This is true, in degree at least, of many gold fields.

The question is often asked—How would the world have fared with its increasing population and relatively decreasing supply of gold if the ratio had not been maintained or restored by the advent of cyanide? I cannot answer this question, and must leave it to the metallurgists and bi-metallists to settle between themselves.

One of the most beneficial effects of the cyanide process has been the introduction of exact methods and where rule of thumb had reigned supreme. The



There is also improvement wanted in widening the range of operations in which cheap cyanide or a cheap method of cyanide recovery may play an important part. The cyanide solution must contain a small amount of copper absorbed so much so that they cannot be commercially worked. This

"If I get free of this present business I will resolutely bid adieu to it eternally, except what I do for my private satisfaction or leave to come out after me; for I see a man must either resolve to put out nothing new or to become a slave to defend it."

When we have to advise an engineering firm as to the comparative value of certain lubricants submitted to us we always make a fairly thorough chemical examination. We have found the lighter class of lubricants, such as those used for spindles, to consist mostly of hydrocarbons. Cylinder oils are frequently found to consist of about one part of lard, or neatfoot, or olive oil, with about five parts of a heavy hydrocarbon oil. Rarely we have found the saponifiable oil present in such a mixture to consist of rape or even cotton oil. Solid or semi-solid lubricants have given us such substances as lime soap, potash soap,

palm oil, ceresin wax, graphite and semi-solid hydrocarbons.

The examination of these complex mixtures with a view to a report as to their actual value for lubricating purposes is a matter of great difficulty. The chemist is generally asked to give the gravity and viscosity at certain temperatures and flash points (open and close test). We have never found the specific gravity to be of any practical value, although it may be of use in ascertaining the class to which an oil belongs. Possibly where pure hydrocarbon oils are under consideration the gravity may be of indirect value. For lubricants for light machinery the viscosity taken at the highest temperature the bearings are likely to attain is undoubtedly a very valuable and necessary factor, as also is the surface or film tension—what we might term the "wetting power" taken at the same temperature. The flash point is chiefly of service for insurance purposes, and as a rule tells one little or nothing as to the lubricating value of an oil.

Engineers' specifications for cylinder oils require the viscosities at 212° F., and in some cases at 250° F. From our examinations as well as those made by Messrs. H. W. Wells and Scott Taggart ("Cylinder Oil and Cylinder Lubrication," by H. W. Wells and Mr. Scott Taggart, Part I. Henry Wells Oil Co., Manchester) one fact appears very plain:—at from 500°—600° F. all cylinder oils, good, bad and indifferent, have a very similar viscosity, however much they may differ at 212° F. or 250° F. The curve goes down very rapidly as the temperature approaches these higher temperatures, and from the dip of the curve as the oil reaches 250° F. from 212° F., it is not possible to always say what the dip may be over 500° F. As the super-heat of steam is now often very high, it is quite obvious that the viscosity figures at 212° F. and 250° F. can be of very little real value.

The oil analyst often finds himself confronted with the problem of grading a number of samples submitted for his decisive opinion, and it may be found that to all ordinary tests the oils are very much alike; or, perhaps, there may be certain divergences which are difficult of interpretation. It is in such a case as this where the analyst's real difficulty arises.

We tried to get the film-tension before and after oxidation of the oil in shallow layers in a current of hot air; unfortunately no reliable method of determining the film tension of oils with even approximate accuracy seems to have been devised.

Several treatises on physics give methods of an apparently easy character for the purpose in question.

We have had no difficulty in measuring the diameter of a drop of the oil as required by the method of Sentsis ("Physical Determinations," W. R. Kelsey (Edward Arnold), p. 71), using a microscope with micrometer eye-piece; but the measurements thus obtained do not allow of sufficient nicety to make the figures obtained of any real value.

The method of drops promised to be more reliable, but after much experimenting we decided that the difference between two results with the same oil when heated to 250° F., was such as to show that the process is of very doubtful value.

Proctor Hall's glass-frame process appeared to be capable of giving the results we desired, but the difficulty of establishing an equilibrium was found to be very great, or at least to be so troublesome that we had to discard the method for oils at high temperatures. No doubt for other fluids under ordinary conditions Mr. Hall's glass-frame may prove satisfactory.

Hall's modification ("Lubrication and Lubricants," by L. Archbold and R. M. Deeley, page 46), of Wilhelmey's method (Archbold and Deeley, *ib.*, page 47), with a thin rectangular glass, metal or mica plate in place of the glass frame took up many hours of our time, and proved to be very disappointing as the plate would separate from the oil in a very erratic and mostly in a quite unexpected manner. We regret that as far as our work with those two

processes with oils is concerned we cannot endorse statement that the results are "concordant" "admit of extremely accurate work."

Supplied with the Metzger's Medical Centrifuge (supplied by Messrs. Gallenkamp) are small, almost capillary blood-tubes about 2 in. long and graduated in 1/100 it occurred to us that if we measured the diameter of the liquid retained by these tubes and noted the height to which an oil would ascend in a given time, using delicate cathetometer we should be able to get an approximate idea of the film tension.

We devised a special copper vessel which enabled us to heat a shallow layer of the oil without fumes of kind interfering with the conditions of the experiment. In this layer we immersed our tube, which had previously been cleaned with caustic alkali and acid.

Four cylinder oils were thus tested:—

	At 181° F.		At 250°
	1st Expt.	2nd Expt.	
	mm.	mm.	mm.
A .....	30.0	30.8	28.5
B .....	30.25	30.1	29.0
C .....	31.25	31.6	26.5
D .....	31.75	31.75	28.5

The weight of column is  $\pi R^2 H d$ , and the upward pressure surface tension is  $2\pi R T$ .

$$\text{Therefore } \pi R^2 H d = \frac{2\pi R T}{2}$$

The density of the oils may be assumed to be 0.89.  
The radius of the inside of the tube was 0.32 mm.  
 $0.32 \times 30.0 \times 0.89$

$$\text{In A, 1st expt., we get } T = \frac{0.32 \times 30.0 \times 0.89}{2} = 4.272$$

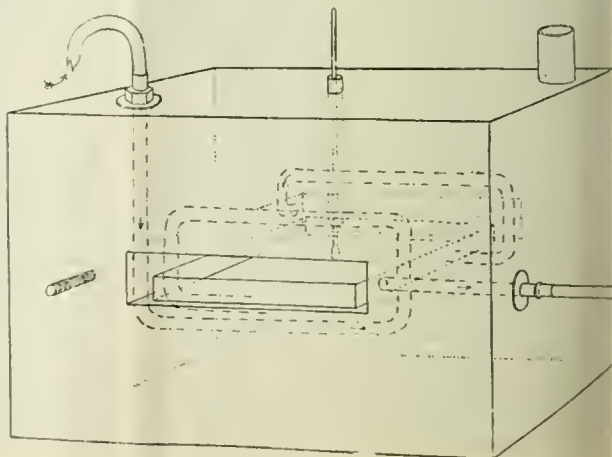
$$\text{In A, 2nd } \dots T = \frac{0.32 \times 30.8 \times 0.89}{2} = 4.385$$

$$\text{In A, at 250° F. } \dots T = \frac{0.32 \times 28.5 \times 0.89}{2} = 4.058$$

The method is more promising than any we have tried, but the results obtained with it scarcely enable us to grade oils possessed of much similarity.

In Goppelsroeder's test (compare his "Capillaranalyse" the filter-paper strips did not take up the oils with sufficient uniformity to make them other than useful as a means of distinguishing between one class of liquid and another.

**Oil Oxidation and Viscosity.**—Most oil-testers will pass a mixture, say, of 10 per cent. of a seed oil and 90 per cent. of a good heavy hydrocarbon oil, as a





ory, inasmuch as the "gumming" test as ordinarily applied would indicate but little difference. We should remember that a cylinder oil is exposed in very shallow layers, in fact, to high pressure and therefore to temperature steam, and that a rational method of testing should take this fact into consideration. To this we have constructed two special copper ovens in which shallow layers of oil can be submitted to the action of steady currents of air at 212° F. and 400° F. respectively. By means of a meter, we measure the air, heated by a flame and the volume passed in four hours should be practically the same in each case.

We use water at the boiling temperature in one, and cedar oil at 400° F. in the other oven, to heat both the inner and layers of oil, which are contained in shallow iron dishes, into which 10 c.c. of the oil have been added, the weights being calculated.

The oven is made of stout copper brazed throughout, outer dimensions are 10 in. by 10 in. by 7 in.

The oil jacket surrounds a chamber 5 in. by 7 in. by 1 in. in height.

The tin plate tray measures 4 in. by 6½ in. by ½ in. deep, the inner chamber is surrounded by half-inch diameter copper tube in eight coils; the last coil enters the chamber at the back at one corner and the exit is at the opposite corner diagonally, and is connected with a half inch copper tube joined to the meter, which is connected with a rubber pump.

The tube leads from the centre of the chamber to the air, which is fitted with a thermometer and asbestos joint.

After introducing the tray containing 10 grms. of the

oil, the entrance to the oven is covered with an asbestos sheet upon which, by means of two projecting screws (only one screw shown in the diagram) a brass plate is firmly secured by means of fly nuts. (In the diagram only two coils of the hot air tubing are shown.)\*

A broad gas burner allows of the temperature in the inner chamber being easily raised to 400° F., and we find no difficulty in maintaining a steady current of air at this degree.

The viscosities of the oils are determined before and after oxidation by means of the simple apparatus we now describe. A 5 c.c. pipette graduated in 1/10ths, is secured in a Liebig's condenser by means of corks, with a glass side tube connecting the vessel with a supply of water kept rapidly boiling. The viscometer is tested from time to time with water and a standard olive oil. We make three tests to secure an average result and find the viscosimeters obtained to agree within 1/5th of a second. The results are simply comparative.

We have not attempted to calculate the absolute viscosities, for the simple reason that the readings in 1/5th of a second are all that we require. All vegetable and animal oils increase in viscosity when heated in air or steam.

Linseed oil is not used in the compounding of lubricants but we submitted it to our process because it shows in more striking manner the identity of the action of hot air and steam.

The following are some of the results which we have obtained at a temperature of 400° F. :—

LINSEED OIL.

	Air at 400° F.			Steam at 400° F.	
	Before Expt.	½ hour.	½ hour.	1 hour.	4 hours.
Viscosity after cooling to 60° F. ....	fluid	semi-fluid	semi-fluid	fluid	semi-fluid
Viscosity 1/5th sec. at 210° F. ....	57	78	112	77½	154
Refractive index by a butyro refractometer, degrees at 121° F.—					
Oil .....	66	70½	73	—	—
Fatty acids .....	55	60	66	67½	82
Melting point of fatty acids ° C. ....	19½	22½	23½	24.8	25.9
Refractive index (Hübl) value of the oil .....	175	171	161	153	144

These data establish the fact that superheated steam acting upon a "drying" oil, produces changes of a similar character to those resulting from the action of hot air; the action is much less rapid, as one might naturally expect. The conclusion deducible from this fact is that the change produced by oxidising an oil in a hot air current is a test as to its "gumming" properties in actual use as a lubricant. In super-heated steam as well as in air at the same temperature saponifiable oils increase in viscosity, refraction and melting point of the fatty acids, whilst the iodine number decreases considerably.

In our view these changes in general are due largely to polymerisation and only in a secondary degree to oxidation, hence the increase of viscosity of the refractive index and the melting point of the fatty acids.

We suggest that the progressive decrease of the iodine number and part of the increase of the melting point may be due to the conversion of oleic constituents into dihydrostearic acid or similar oxidation products. What may be the exact chemical changes oils undergo on oxidation we know that physically the change is in the direction of increased viscosity and the production of hard, gummy substances insoluble in ether. No lubricants which have given very similar results in the ordinary tests may not only prove very different in oxidation test, but also in actual use. Hydrocarbon oils frequently contain small amounts of substances which become resinous in character when heated in a steady current of air at 400° F., yet the presence of these is not revealed by any of the ordinary tests. We have used steam at 400° F., but we should remember that the super-heat in cylinders often gives temperatures

over 600° F., and we are safe in assuming that with such steam the oxidation of the filmy layers of the lubricant will be very much greater.

As the transit of the oil in a cylinder is comparatively brief, it might appear at first sight that there would be no time for polymerisation to take place; but we must remember two salient facts :—

(1) The oil is made to produce a rapid succession of film surfaces;

(2) The steam is not only very hot but is under high pressure.

We have been surprised at the great changes which take place even in the best olive oil when film-surfaces of it have been exposed to hot air or steam for only a few seconds.

Olive and cotton oils undergo similar changes to linseed oil but in a lesser degree, the cotton oil naturally suffering the greater change of the two in every particular; indeed the oil soon becomes solid and varnish-like and only partly soluble in ether.

Before we adopted the temperature of 400° F. we made a large number of tests at 210° F., allowing the current of air to pass for six hours. The chief interest in these results lies in the close connection between the viscometric and refractometric changes :—

\* Messrs. Reynolds & Branson, Chemists, of Leeds, will supply this special oven.

## 4 SAMPLES OF OIL.

	A.	B.	C.	D.
Specific gravity at 210° F. ....	0.85032	0.85300	0.84904	0.84440
Saponifiable—				
Free fat acids .....	trace	trace	trace	trace
Neutral oil .....	22.42	12.10	12.89	25.18
Unsaponifiable (hydrocarbons) .....	77.58	87.90	87.11	74.82
	100.00	100.00	100.00	100.00
Viscosity at 250° F. ....	60	68	61	50
Flash point (close test) °F. ....	436	528	489	460
Oxidation test at 212° F.—				
Per cent. increase in viscosity .....	0.37	0.57	3.85	3.54
Oxidation test at 400° F.—				
Per cent. increase in viscosity .....	24.6	20.8	34.6	62.3
The saponifiable fat acids—				
Melting point °C. ....	33.5	36.5	30.0	35.5
Iodine number .....	71.5	63.8	68.6	66.2
Refractometer at 121° F. ....	39.5	38.5	39.0	35.5

D oil was reported as being unsatisfactory, and we were told that our opinion was in harmony with the results obtained actual use.

If we exclude sperm oil it will be seen that a close ratio exists between the increase of viscosity and the increase of refractive power. We would therefore suggest that a good method of testing the value of a lubricating oil would be to expose it in very shallow layers; much shallower than those we have used, to a stream of air at 210° F., for 12 hours, and then observe the increase of refractive index, which safely could be taken as a measure of the polymerisation.

We have tried to devise a process which would enable us to predict the results of using cylinder oils as far as their tendency to form non-lubricating bodies is concerned. To all the ordinary tests the defective cylinder oil included in the above table seemed excellent; but when we found that shallow layer oxidation at 210° F. for six hours had increased the viscosity by nearly 10 per cent., we inferred that it was unsuitable for the purpose required, and we were gratified to learn that this very oil had given very unsatisfactory results; indeed in

this way and on several occasions, we have been at grade oils in a manner which has fully met the approval of engineers who had made long tests in cylinder lubrication.

We are aware that a seeming difficulty may arise in regard to pure hydrocarbons which undergo but apparent change on oxidation as compared with vegetable and animal oils; yet even with these very apparent differences are shown, and when we know how very rapidly these changes take place in the cylinder, how viscosity increases and film tension decreases, we can readily understand how it is that even pure hydrocarbon oils differ so much amongst themselves in actual use.

We append some tabulated results from the analysis of several samples of lubricating oil, and suggest that without such data it would be difficult to formulate a very definite opinion as to the value of a lubricant.

## Viscosities and Refractions of Oils Before and after Oxidation, in Shallow Layers at 210° F. for Six Hours.

	Loss, Per Cent.	Gain, Per Cent.	A. Viscosities Before Oxidation.	B. Viscosities After Oxidation.	B A	Refractions at 19° C. Bliss Butyrorefractometer.		D C	I A
						C. Un- oxidised.	D. Oxidised.		
Cotton oil .....	—	1.68	42.5	171.5	4.035	68.5	76.0	1.139	4
Arachis oil .....	—	1.07	41.5	89.5	2.156	68.0	73.0	1.074	2
Rape oil .....	—	2.02	50.5	106.5	2.109	71.0	75.0	1.056	2
Cod liver oil .....	—	3.10	55.0	113.5	2.063	81.5	87.0	1.068	2
Maize oil .....	—	1.71	39.5	76.0	1.924	73.0	81.0	1.110	2
A defective olive oil .....	—	1.00	43.0	85.0	1.977	65.5	71.0	1.084	2
(X.) Lard oil .....	—	1.38	46.0	70.5	1.533	65.0	68.0	1.046	1
Seville olive oil .....	—	0.67	46.0	61.0	1.328	65.0	67.0	1.031	1
(XX.) Neatsfoot oil .....	—	—	50.5	63.5	1.260	61.5	64.5	1.050	1
Another lard oil .....	—	—	52.5	64.5	1.23	64.0	64.0	1.00	1
Hydrocarbon cylinder oil .....	0.5	—	209.0	207.5	0.99	—	—	—	—
Hydrocarbon cylinder oil (4) .....	—	—	180.0	206.5	1.15	—	—	—	—
(X.) Lard oil (1) .....	—	—	141.5	159.5	1.13	—	—	—	—
(XX.) Neatsfoot (1) .....	—	—	43.0	47.5	1.105	63.0	64.0	1.016	1
Best Gallipoli oil 21.3 per cent. fat acids ..	0.49	—	34.0	36.5	1.073	59.0	74.0	1.254	1
Sperm oil .....	—	—	158.0	159.0	1.006	—	—	—	—
Excellent cylinder oil .....	—	0.25	184.0	201.0	1.092	—	—	—	—
Defective cylinder oil .....	—	—	—	—	—	—	—	—	—

## DISCUSSION.

Prof. GOODMAN said he had tested cylinder oils by mechanical methods, but found these useless as the results obtained by different operators and at different times were not concordant.

Mr. COHN thought that the complication of the change whose effects it was desired to measure probably accounted for the conflicting results usually obtained. The rise of temperature primarily lowered the internal friction, but the accompanying thermal changes, in the case of these oils, increased internal friction, and the total

effect was of a differential character. Mr. RICHARDSON seemed to attach little importance to oxidation and much to polymerisation, but one of his previous examples was linseed oil. Was it not definitely proved that oxidation took place in this case, and was it the main cause of its change in physical nature? It would be interesting no doubt to the members to know exactly what changes Mr. Richardson regarded as occurring in linseed oil subjected to hot air and to heated steam, each process resulting in a lowered refractive value. The two agents were so different in their nature that it was desirable to proceed with caution.



ing that the effect of super-heated steam could be had at once from that of hot air.

WARD understood that Mr. Richardson proposed the oils on the basis of viscosity caused by high temperature, but discarded viscosities at ordinary temperature. He could not see how viscosity was to be the ruling element in one case and not in the other.

YOUNG could not agree in condemning viscosity and thought a curve constructed from observations at various temperatures very useful. Mr. Richardson suggested method would show a pure mineral oil to be superior to the same oil mixed with 10 per cent. of oil, whereas in practice the latter mixture was to be superior. He agreed that olive and other vegetable oils, which Mr. Richardson would condemn, were oxidisable, but they should not be condemned as lubricants on this account. He suggested that experiments were not long enough in cylinders to undergo the actions Mr. Richardson described. Physical tests of opinion were very useful in determining the source of impurities in pure mineral oils. Did Mr. Richardson know of hydrocarbon oils mixed with fatty oils in the experiments tested? He thought the explanation of the results obtained by using mixtures of hydrocarbon and fatty oils was that the small amount of fatty oil in the mixture to break up into minute particles mixed more readily with steam. He agreed with Goodman in condemning mechanical testing as being unreliable.

MACKEY did not think Mr. Richardson meant to do in the viscosity test, which greatly helped to differentiate mineral oils. Combining viscosity with oxidation, he took it Mr. Richardson was trying to show the effect in gumming. He agreed with Mr. Young that experiments were not sufficiently long in cylinders to undergo change. The increase of acidity in cylinder oils was a valuable point which had been left unmentioned. He found in practice that a good mixture of fatty with mineral oils, which did not increase in acidity during use, through the cylinder, gave best results.

MARSDEN would have preferred comparative tests with Redwood's viscosimeter and Mr. Richardson's. The latter he thought liable to give varying results owing amongst other things to narrowness of tube and consequent capillary attraction and friction. The viscosity test was of great value, as the more perfect a mixture produced in the cylinder the better the lubricant. The best mixture was perhaps one in which the proportions of fatty oil and hydrocarbon were so arranged that the lubricant, having done its work, would be carried off the exhaust without deposition of any decomposition products. As the hydrocarbon constituent was important, the effect of oxidation on it must be noted.

PROCTER thought that polymerisation, as well as oxidation, took place in oils during heating. In the case of oils boiled without blowing, although oxidation was present, there was much increase of viscosity. He drew attention to oils used for gas and motor engines, &c., where the temperatures were very high and the oil in many cases remained for a considerable time in the cylinder and was used.

EMER said Mr. Richardson's paper raised the question of what really took place inside a cylinder. The experiments must be different from inside and outside. Greasiness and not viscosity must express the condition of an oil.

SLATTERY thought there was no comparison between the action of superheated steam in their action upon oils. He asked how many of the oils tested were pure mineral oil and if lard oil or tallow was mixed with them.

HOLGATE said, in comparing oils such as olive and mineral oil, some account must be taken of the fruits, good or bad, and the district from which obtained. Vegetable oils, before gumming, whilst hydrocarbon oils were evanescent. Exact results could not be expected in testing oils in different layers of oil in the same case were not of the same composition.

DILLON said that linseed, cotton and other vegetable oils, heated to 400° F., produced varnishes, and would offer lubricants containing them. He

thought that increase in viscosity at high temperatures was due to decrease in volume and development of higher fatty acids. As small samples often had to be tested ordinary viscosimeters could not always be used.

Mr. RICHARDSON, in reply, said that experiments which he had made with certain oil-testing machines agreed with Prof. Goodman's experiences. Free oleic acid in oils did not oxidise or produce gumming to any greater extent than the neutral glycerides themselves. He maintained that lubricants were materially affected in cylinders owing to high pressure, the rapid production of fine films of oil, &c., and also that changes under the influence of steam and hot air were identical, as had been shown. The fact that some oils, which satisfied the usual physical and chemical tests, did not give good practical results or confirm behaviour when submitted to the action of hot air supported this. The film tension indicated the wetting power. Vegetable and animal oils helped greasiness and emulsification. For this reason 10 to 15 per cent. of lard or neatsfoot oil was a very valuable addition. The viscosity test was used to show the gumming which would be produced if the oxidation was carried far enough, and not as a factor of any special value in itself. A rapid increase in viscosity with hot air indicated a bad lubricant. The great bulk of changes, he thought, were due to polymerisation and densification rather than oxidation. Polymerisation would also account for the reduction of the iodine number. The authors had not found any appreciable increase of acidity when glycerides were oxidised. Many pure hydrocarbon oils which he had tested varied considerably in viscosity after being submitted to the oxidation process which he and his colleague had described.

## Obituary.

ALBERT B. PRESCOTT, M.D.

DEAN OF THE SCHOOL OF PHARMACY OF THE UNIVERSITY OF MICHIGAN. MEMBER OF THE SOCIETY OF CHEMICAL INDUSTRY, &C.

Albert Benjamin Prescott was born December 12, 1832, in Hastings, New York. In 1861 he entered the University of Michigan, receiving the degree of Doctor of Medicine three years later. In July, 1894, having previously passed the regular army examination for the medical service of the United States Volunteers, he was commissioned as assistant surgeon and assigned to duty in one of the hospitals in Louisville, Kentucky.

His medical career, however, was of short duration. As a medical student he had specialised in chemistry and at the close of the war he resumed his chemical studies as a teacher and investigator, which became his life work. In the autumn of 1865 he was appointed Assistant Professor of Chemistry and Lecturer on Organic Chemistry at the University of Michigan. When the School of Pharmacy was organised in 1868, its administration was placed in his hands; in 1870 he was appointed Professor of Organic and Applied Chemistry and Pharmacy, and in 1884 he was made Director of the Chemical Laboratory. Michigan was one of the pioneers to give laboratory instruction in chemistry, and Professor Prescott was the pioneer in demanding laboratory work of his pharmacy students. He not only succeeded in making elementary laboratory instruction compulsory, but he also led his students to advanced work, to which the "Contributions from the School of Pharmacy of the University of Michigan" in 1875 and 1876, and also the "Laboratory Notes" of 1877, &c., bear ample evidence.

In 1879, Prescott published his "First book in Qualitative Chemistry," and another work, his "Outlines of Proximate Organic Analysis," next developed into the well-known and complete work on "Organic Analysis," published in 1887. One of his latest contributions is a chapter entitled "The Alkaloids in Toxicology."

ecology" for the American text-book of toxicology edited by Dr. Walter H. Haines of Chicago, and as Chairman of the Chemical Section of the American Association for the Advancement of Science, at the New York meeting in 1887, he discoursed on "The Chemistry of Nitrogen as disclosed in the Constitution of the Alkaloids."

He devoted much time and attention also to chemical industry and analysis, toxicology, matters of sanitation and hygiene, and the fact that the School of Pharmacy

of the University of Michigan stands pre-eminent day is known to all who have followed the progress of pharmaceutical education in the United States.

Dr. Prescott was elected President of the American Pharmaceutical Association in 1899. The last year on which he was associated with the Society of Chemical Industry was on the occasion of the memorable meeting at Detroit last September.

He died at his home in Ann Arbor, Mich., February 24, aged 74 years.

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### I.—PLANT, APPARATUS & MACHINERY.

*Pyrometry; Optical*. — C. W. Waidner and G. K. Burgess. U.S. Bureau of Standards, Bull. No. 2, 1905, 189–254.

THE subject is discussed under the following headings:—(1) General discussion of optical pyrometry. (2) Laws of radiation: (a) Stefan-Boltzmann's law; (b) laws of energy distribution; (c) Wien's laws; (d) Planck's law. (3) Methods of optical pyrometry: (a) colour estimation; (b) photometric methods; (c) ratio of intensities of two wave-lengths; (d) upper limit of the spectrum; (e) maximum energy in spectrum; (f) total radiation; (g) interference method. (4) Description of instruments and investigation of their calibration, range, sources of error, and precision. (a) Le Chatelier optical pyrometer (this J., 1893, 290); (b) Fery absorption pyrometer; (c) Mesuré and Nouel's pyrometric telescope (this J., 1889, 314, 1891, 139); (d) Wanner pyrometer (compare this J., 1903, 761); (e) Holborn-Kurlbaum pyrometer; (f) Morse pyrometer (this J., 1901, 343); (g) Fery thermo-electric telescope (this J., 1904, 681; 1905, 210). (5) Comparison of various types of optical pyrometers. (6) Special problems in optical pyrometry.

In comparing the various kinds of optical pyrometers, the authors point out that the Mesuré and Nouel pyrometric telescope cannot be considered an instrument of precision, although it is serviceable for the approximate control of temperatures above 800° C., and answers the requirements of many furnace operations sufficiently well. The other instruments examined are all capable of an accuracy of

1 per cent. in absolute temperature-measurements, ranges for which they are adapted. For relative temperature measurements, the precision attainable is better than 1 per cent., except perhaps in the case of the Fery pyrometer, and may even be as good as 2° at 1000° C. with the Holborn-Kurlbaum instrument. For the temperature which can be measured optically (about 1000° C.), the Le Chatelier, Holborn-Kurlbaum and Morse pyrometers and the Fery mirror telescope are available. The lower limit of the Wanner pyrometer and the Fery thermo-electric telescope is about 900° C. With regard to the upper limit, this is about 1100° C. in the case of the Morse pyrometer, and 1600° C. with the Fery thermo-electric telescope, but with the other instruments it is higher. For the temperatures attainable in industrial practice. For very high temperatures, above 1500° C., in the region of which temperatures can only be determined by extrapolation in terms of some law of radiation, the most reliable results are obtained with the Wanner pyrometer, and the Fery thermo-electric telescope with fluorite lens can be used directly in terms of Stefan's law. These two instruments are also the best with regard to ease of calibration, control; and the Fery telescope appears to be especially suitable for adaptation as a recording instrument (see also this J., 1904, 623).—A. S.

#### ENGLISH PATENTS.

*Pyrometers; Impts. in*. — H. T. Barnes. M. Tory, Montreal, Canada. Eng. Pat. 12,253, 1904.

SEE Fr. Pat. 344,718 of 1904; this J., 1904, 1203.—F.



*strating and Evaporating Liquids; Vacuum Apparatus for —.* A. Neumann and G. Stadel, in. Eng. Pat. 26,255. Dec. 2, 1904.

claim is for the combination of any devices reducing circulation in such a manner that the steam pan is divided into three vertical co-axial chambers. Further, in so placing the heating tubes, for instance below the intermediate compartment, that the liquid is forced, when flowing in one direction, to pass in two separate or partial currents through the innermost and outermost compartments respectively; and when flowing in the opposite direction to pass in one united current through the intermediate compartment. In this way a very thorough heating of the liquid undergoing evaporation is obtained.

—W. H. C.

*off Cock for Viscous Liquids.* M. F. C. Möller, Hamburg. Eng. Pat. 29,039. Dec. 30, 1904.

plug *k* of the cock is made spherical, and has two ends *b* and *c* at right angles to one another, and is

FIG. 1.

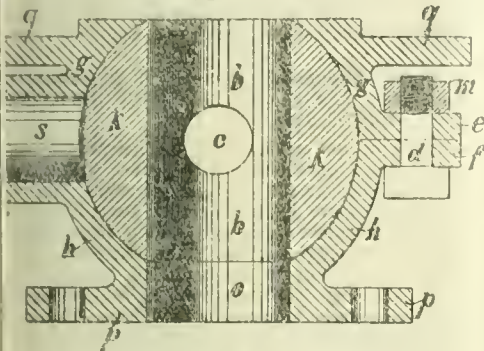
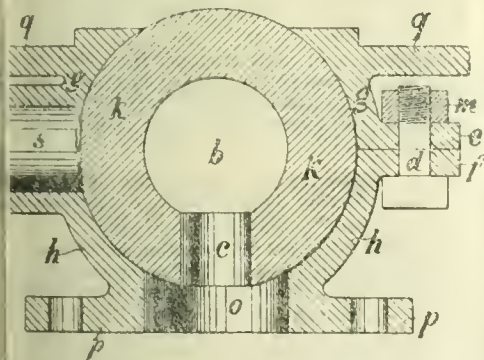


FIG. 2.



provided with a spindle *s* having a square head *t*. (By the use of such a spherical plug, the difficulty usual with cocks for liquids which on cooling set to a semi-rigid stiff mass, is obviated.) The body is in two parts *g* and *h*, held together by bolts and nuts, *d*, *m*, through the flanges *e* and *f*. The upper part of the plug projects, so that when the cock is closed, it acts as a spherical segment, preventing the flow of liquid through the passage *c* of the vessel to which the cock is attached by the flange *e*. The lower part of the cock-body has an opening *o* of the same bore as the passage *b*, and a flange *p* for connection to the delivery pipe. Figure 1 shows the cock closed, and Figure 2, closed, in which case the passage *c* is closed by the opening *o* and any material in the passage *b* is forced away. It is claimed that the stoppage of the passage *b* by material solidifying in the bore of the plug *b*, and the bore of the cock above the plug is thus avoided.

—W. H. C.

*Imps. in —.* A. B. Lennox, Newcastle-on-Tyne. Eng. Pat. 29,573. Dec. 31, 1904.

The invention is for a vessel of inverted truncated cone shape

having either an open or closed top, and a dome-shaped bottom in which an outlet pipe is provided. In the bottom of the vessel is a wire gauze or perforated metal basket containing the filtering medium, and at intervals above it are perforated trays also supporting filtering medium. The basket and trays are carried on brackets projecting from the inside of the vessel, and so arranged that the upper brackets do not hinder the withdrawal of the trays situated below. The material to be filtered, may either be forced through an opening in the closed top of the vessel, or drawn through by suction applied to the delivery pipe at the bottom, in which case the top is open. The vessel is mounted on trunnions and supports so that, when the filtering medium becomes choked, the whole can be tilted over and emptied.

—W. H. C.

# UNITED STATES PATENTS.

*Liquid-Separator; Centrifugal —.* A. T. Salenius, Assignor to W. Moynhardt, Stockholm, Sweden. U.S. Pat. 779,445. Jan. 10, 1905.

FIG. 1.

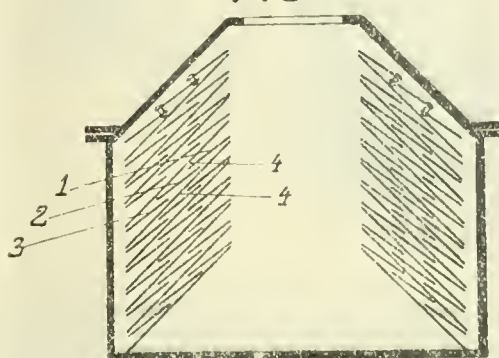


FIG. 2.

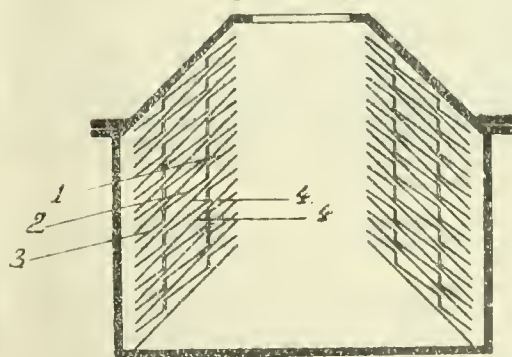
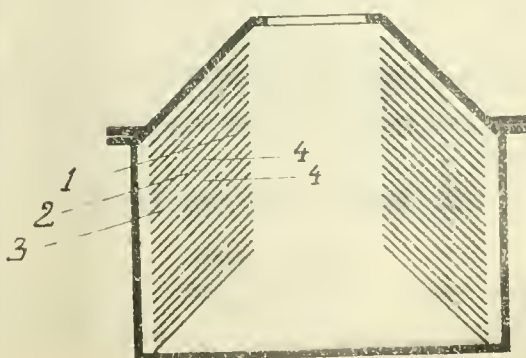
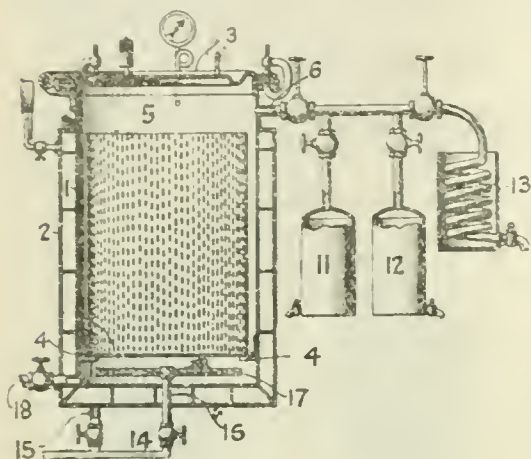


FIG. 3.



CLAIM is made for the combination with the "conical plates" 4, which are co-axial with the separating drum, of a series of "plate members" 1, 2, 3, between the plates. These "plate members" may take different forms as shown in the figures. The object of the invention is to facilitate the separation, by affording means for the oppositely flowing currents of liquid, to gather through the openings in the "plate members" on the surfaces along which they flow, and thus to avoid the great friction between the currents of liquid.—W. H. C.

*Distilling Apparatus.* J. I. Pittman, Valdosta, Ga. U.S. Pat. 783,307, Feb. 21, 1905.



AN inner casing 1, forming the still proper, is arranged, within an outer casing 2, so as to leave a steam space between the two. The inner casing extends above the top of the outer casing, and is provided with a hinged cover 3, with supports 4, for the "basket" 5, containing the material to be distilled, and with a delivery pipe 6 for the vapours. The latter is provided with four valves as shown, and is connected to the condensing coils 11, 12, 13. Steam is supplied from the main 14, to the steam space by the valve and pipe 15, and to the inner chamber by the valve and pipe 16, and the "spider-like" perforated distributor 17. A pipe 18, provided with a valve extends from the inner casing, through the steam space, to the outer casing, and is used for drawing off "tarry products."—W. H. C.

*Furnace; Regenerative* —. S. Groh, Assignor to S. A. Groh, Alexandria, Va. U.S. Pat. 783,429, Feb. 28, 1905.

THE air- and gas-conduits each leading through chequer-work are provided with reversing valves. Beneath the conduits is a flue connected with them and with the stack. A "butterfly-valve" and gate-valve are combined, so that the major portion of the products of combustion can be passed through the air-conduit.—W. H. C.

#### FRENCH PATENT.

*Filter-Press Plate.* Niles-Bement-Pond Co. Fr. Pat. 347,696, Nov. 5, 1904.

SEE U.S. Pat. 776,024 of 1904; this J., 1905, 20.—T. F. B.

## II.—FUEL, GAS, AND LIGHT.

#### ENGLISH PATENTS.

[Peat] *Fuel.* R. I. R. Roman, Dublin. Eng. Pat. 700, Jan. 11, 1904.

AIR-DRIED peat cut into small sods, is disintegrated by a

machine, and the peat dust then separated by a winnowing device from the residue. The peat dust is then heated in a revolving drum by exhaust steam or other means till it only contains from 14 to 15 per cent. of moisture. The dried dust is conveyed to a measuring and pressing machine, the dies and mould of which are heated to between 110° and 180° C., and compressed at a pressure of 180 to 2000 atmospheres.—L. F. G.

*Peat; Treatment of —, and Apparatus therefor.* Kennedy, Cambridge. Eng. Pat. 6308, March 1, 1904.

PULPED or squeezed peat is placed in a chamber through which pass three conduits connected to a steam boiler heater. Two of the conduits are open at the ends in the chamber, and fans placed inside these openings draw the steam given off by the peat into the superheater. The superheated steam issues from perforations in the third conduit, and further heats and dries the peat. A non-return valve placed near the bottom of the chamber permits the escape of air as the quantity of steam generated increases. The gases of combustion from the steam boiler heater furnace may also be led through flues placed beneath the floor of the chamber. After drying, powdered peat is compressed into briquettes.—L. F. G.

*Peat Fuel; Manufacture of —.* J. B. Bessey, London. Eng. Pat. 17,497, Aug. 11, 1904. Under Int. Conv., April 25, 1904.

FRESHLY-CUT peat or turf which has been freed from the bark by mechanical treatment, is subjected to the action of an alternating current of small strength and voltage, about 20 kilowatts being employed for 1.5 cubic feet of peat, the current strength falling from 200 to 100 amperes in twenty minutes. The current ruptures the cell walls and liberates the resin, oil, pectins and other constituents without causing carbonisation. After expressing the water, the mass is moulded, and hardens of itself, without heating, pressing, or storing.—L. F. G.

*Fuel; Smokeless* —. S. S. Bromhead, London. La Compagnie des Charbons et Briquettes de l'Ouest, Nantes, France. Eng. Pat. 2,100, Dec. 22, 1904.

THE agglomerated fuel, prepared from coal or other materials in any known manner, is distilled in retorts heated to a sufficient temperature to drive off the smoke-forming constituents and increase the firmness and cohesion of the briquettes.—C. S.

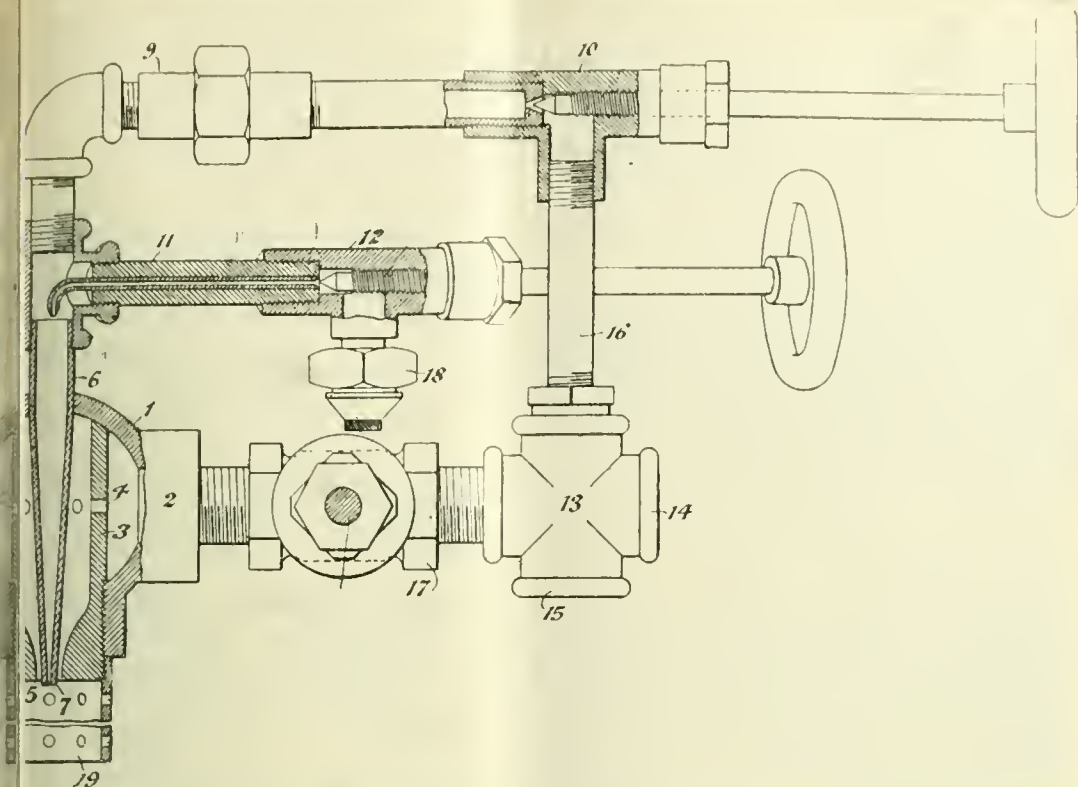
*Burners; Hydrocarbon —, for use in Furnaces and for other Heating Purposes.* F. A. Murphy, Oldham, Lancs. Eng. Pat. 29,564, Dec. 31, 1904.

THE essential feature of the invention consists of a rotating fan with suitably formed blades attached to a distributing cone, the whole rotating about a shaft inside the oil-supply tube. Heated air under pressure is forced through a tube surrounding the arrangement, which sucks out oil through a hole in a nipple placed at the end of the oil-supply pipe, the mixture of oil and air being atomised by the fan and cone. The surface of the burner may be smooth or corrugated, or provided with a series of arms.—L. F. G.

*Liquid Fuel Burners for Heating Purposes.* H. H. Jackson, London. From B. F. Jackson, Boston, Mass. U.S. Pat. 21,488, Oct. 6, 1904.

THE burner consists of an outer chamber 1, connected to the blast supply by the collar 2, and having a sleeve 3, with perforations 4, 4, and contracted at the end. The atomised fuel is conveyed by the pipe 6, terminating in the jet 7, and passing concentrically through the outer casing 1 and the sleeve 3. The pipe 6 is connected to a T-piece 8 with the blast-pipe 9, controlled by the valve 10, and also with the liquid fuel jet 11, controlled by the valve 12. The pressure medium, which may be compressed air or steam, is led to the four-way fitting 13 by the pipe 14; a portion goes by the branch 15 to the reservoir of liquid fuel and forces the latter by the connection 18 to the atomising jet 11, another part passes by the branch 16 to the





ve 10 and the pipe 9, and serves to atomise the  
 ich it meets at the point 8, a third portion of the  
 medium passes by the branch 17, into the chamber  
 entering through the perforations 4, of the sleeve 3,  
 an annular stream around the jet 7. A Bunsen  
 may be used around the jet in order to increase  
 efficiency of the burner.—W. H. C.

*1 Coke or other Carbonised Substances; Treatment  
 of Coal and other Carbonaceous Materials for the Pro-  
 duction of —.* J. Bowing, Tilbury. Eng. Pat.  
 March 22, 1904.

aim is for the production of coal-gas, water-gas  
 mixture of both by treating coal or other  
 carbonaceous materials in a retort with superheated  
 steam. In the case of coal, the coal gas is first driven  
 off at temperatures of from 300° C. to 400° C.,  
 leaving coke, but only "soft cinder" is left behind.  
 The residue, by raising the temperature of the steam,  
 as is produced, it is claimed, at a temperature  
 slightly below 1000° C. If coke is required instead  
 of "soft cinder," then the temperature of the steam  
 is about 650° C. and from this coke water-gas is  
 obtained at 1000° C. The coal-gas and water-  
 gas may be obtained together, if desired, by using steam  
 of higher temperature from the first. It is further  
 claimed that water-gas can be obtained from sawdust at  
 1000° C., and hydrocarbon distillates at proportionally  
 higher temperatures. The apparatus described consists  
 of a retort, filled with chequer-work, through  
 which the heating gas and the steam to be superheated  
 pass. The retort is provided with charging and discharging openings;  
 it is fitted with pipes for the admission of the superheated  
 steam and an outlet for the gas produced. The gas passes  
 through the retort through a series of condensers immersed  
 in a tank of water to the ordinary purification plant.  
 —W. H. C.

*Producers.* J. H. Hamilton, Sandiacre, Derby.  
 Eng. Pat. 7767, April 2, 1904.

The producer described is of the vertical type, to which

air and steam are supplied from the bottom. The grate  
 is conical in shape and can be rotated step by step by  
 means of a ratchet and pawl. A cleaning bar is arranged  
 with its upper end on the grate, while the lower end is  
 connected with a lever, by which the bar can be moved  
 lengthways. Means are provided to ensure that this bar  
 shall be drawn back while the grate is being rotated. To  
 prevent loss of gas the poke-holes are provided with  
 a neck, in which is a valve held in its seat by a counter-  
 poise, "but opened by the insertion of the poking bar  
 which, however, first closes the orifice of the neck, whereby  
 the escape of gas in a pressure plant, and entrance of air in  
 a suction plant, is prevented." This poke-hole can also  
 be used for the introduction of a tube closed at one end  
 by a plate of glass, whereby the fire can be examined.

—W. C. H.

*Producer-Gas; Manufacture of —, and Apparatus  
 used therein.* W. W. Tonkin and S. Puplett, London.  
 Eng. Pat. 8827, April 16, 1904.

THIS patent relates to improvements on the producer  
 described in Eng. Pat. 15,498 of 1902 (this J., 1903, 860).  
 The chief modifications are in the heat exchanger, the  
 water-tube boiler, and the air saturator. The hot gases  
 from the producer are made to pass down the middle  
 division of the heat exchanger, which is provided with  
 cleaning doors, and the air-blast to pass up the two outer  
 divisions. In the water-tube boiler the tubes are connected  
 at the bottom to a branch piece, communicating with a  
 vessel containing a plunger, by which the height of the  
 water in the tubes can be regulated; this is done auto-  
 matically by means of suitable valves. By the improved  
 air-saturator dry air can be applied at first to the producer,  
 "and subsequently the amount of aqueous vapour is  
 automatically regulated by the temperature of the outlet  
 gas," which heats the water of the scrubber, the overflow  
 of which saturates the air to the required extent.—W. C. H.

*Gas-Producers.* E. Schweich, London. Eng. Pat. 11,268,  
 May 16, 1904.

THE claims cover modifications in the construction of  
 producers, in which air, or air and steam, are supplied at

the top and bottom of the fuel, and the gas is drawn off from the middle. One wall may be extended out beyond the vertical line of the upper part of the chamber to form a space free from fuel, and opening into the gas exit. Or a central vertical gas exit may be arranged, whereby the upper part of the chamber is divided into two parts. Or the upper part of the producer may be formed with a smaller diameter than the lower, and a gas collecting space formed which communicates with the gas exit. —W. C. H.

*Water-Gas; Plants for Making* — L. A. Payens, Nymwegen, Holland. Eng. Pat. 21,317, Oct. 4, 1904. Under Internat. Conv., Oct. 6, 1903.

Two or more pairs of generators are connected with one boiler, so that any one or more pairs can be disconnected from the boiler, when it is desired to throw it or them out of work; during the air-blast stage, air is drawn through both generators of a pair and through the boiler, and then steam is introduced, when the fuel is at a suitable temperature, into one generator, and the steam and water-gas produced are passed into the second generator of the pair and on to the boiler and gas-holder. (Comp. Fr. Pat. 322,721 of 1902; this J., 1903, 358.) —W. C. H.

*Power-Gas; Process and Apparatus for the Manufacture of* — E. Fleischer, Dresden-Strehlen, Germany. Eng. Pat. 26,770, Dec. 8, 1904. Under Internat. Conv., Dec. 11, 1903.

This is a process for the manufacture of power-gas from bituminous fuel, to which air is supplied at the top and the bottom of the producer, while the gas is withdrawn from the middle. The tar-vapours are burned by means of a secondary air-supply, which is introduced at a point beneath the upper air supply and about the vertical axis of the mass of fuel. To accomplish this a ring is arranged in the upper part of the producer, the fuel being supplied to the annular space between the two. The ring is of such a width that when the fuel takes up its natural angle of rest, it forms a crater-shaped depression under the ring. The secondary air supply reaches this crater through slits in the side of the ring. —W. C. H.

*Gas Generators.* A. von Kerpely, Vienna. Eng. Pat. 28,966, Dec. 30, 1904.

The generator consists of a vertical, double-walled shell, which is rigidly connected to supporting brackets, and cooled by circulation of water. The lower end of this shell dips into a circular trough, mounted on balls, and caused to rotate by a worm arrangement gearing with the periphery of the trough. This trough carries a rotating grate by which the fuel is kept constantly in motion; air is uniformly distributed through the fuel and the gasification is thus increased. —W. C. H.

*[Gas] Retorts; Furnaces with Horizontal* — H. Gielis, Berlin. Eng. Pat. 92, Jan. 2, 1905.

The furnaces described, are gas fired, and the combustion chamber, which receives the gas from the generator, is arranged transversely to the retorts, and communicates directly with the longitudinal channels formed by the walls of adjacent retorts, by which channels the heating gases are distributed through the furnace. The ends of the retorts, nearer the generator are made wider than the other ends, to obtain a uniform reduction of the charge to correspond with the reduction of heat in the direction away from the generator and combustion chamber. —W. C. H.

*Gas-Purifiers.* S. Cutler, G. B. Cutler, and S. Cutler, jun., London. Eng. Pat. 5479, March 5, 1904.

COLLECTING or distributing chambers extend along the sides, ends or bottom of the purifiers, and are provided with orifices leading to the gas-conduits within the purifiers; these orifices are provided with baffles or fenders to prevent purifying material from entering them. —W. C. H.

*Gas-Purifiers.* S. Cutler, G. B. Cutler, and S. Cutler, jun., London. Eng. Pat. 6860, March 21, 1904.

To these purifiers there is attached an external chamber or pipe connected by branches with distributing conduits

within. The claims also include an arrangement of or slabs for carrying filtering material, used either singly or combined to form grids, with or without intermediate and border gratings as described in Eng. Pat. 19,644 of (this J., 1903, 287). (Reference is also made to Eng. Pat. 14,970 of 1903, and 5395 of 1904.) —W. C. H.

*Gas Purifiers; Impts. in* — S. Cutler, jun., London. Eng. Pat. 29,474, Dec. 31, 1904.

THE invention relates to purifiers constructed according to the Jager system, described in Eng. Pat. 19,644 of 1902 and 14,970 of 1903 (this J., 1903, 287). The inlet and outlet conduits of such purifiers are divided into two or more compartments, the purifier being thus divided into sections, through which the gas passes successively so that two or more kinds or grades of purifying material can be used in the same purifier. This is possible on to the low pressure required to pass gases through purifiers fitted on the Jager system. —W. H. C.

#### UNITED STATES PATENTS.

*Fuel.* S. P. Sadtler, Philadelphia, Pa., Assignor to Car.-Bo. Company, Camden, N.J. U.S. Pat. 782, Feb. 21, 1905.

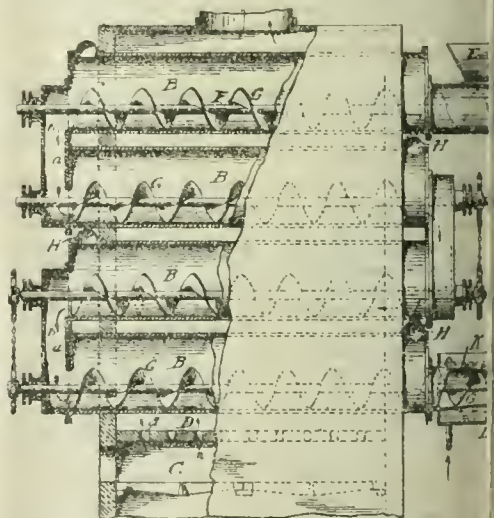
A MIXTURE having approximately the following composition is claimed:—200 lb. of anthracite slack, 5 of finely-powdered coke, 1 gal. of concentrated sulphuric acid, 1 gal. of concentrated sulphuric acid pulp (sulphite) residual liquor, and 5 lb. of aluminium sulphate. —W. H. C.

*Fuel; Composition* — C. H. Carpenter, Assignor to J. L. White, South Bend, Ind. U.S. Pat. 782, March 7, 1905.

SEE Eng. Pat. 24,336 of 1904; this J., 1905, 189.—T.

*Fuel; Apparatus for Making Artificial* — by distillation. J. T. Davis, San Francisco, Cal. U.S. Pat. 783,624, Feb. 28, 1905.

THE apparatus consists of a series of superposed or heating "passages" B, comprising lower po



open at both ends and "upper confined vapour space" set in a casing above a furnace C. The stills have conveyors G, which serve to push forward the material which is fed through the hopper E, the conveyors F, being all geared together. The stills are connected alternate ends by the channels b, are provided with vapour exits H, and with a tapering chamber K, at the end of the series, through which the residuum is discharged by the screw G, after being cooled by the water-jacket L.—W. H. C.

*Gas; Process of Making* — J. C. H. Kramers, Maastricht, and J. G. Aarts, Dongen, Assignors to V



*Maatschappij Systeem Dr. Kramers and Aarts*, Amsterdam, Holland. U.S. Pat. 784,407, March 7, 1905.  
Eng. Pat. 2750 of 1901; this J., 1902, 331.—T. F. B.

*Gas: Apparatus for the Manufacture of —*, J. H. Kramers, Maastricht, and J. G. Aarts, Dongen, assigns to Watergas-Maatschappij Systeem Dr. Kramers and Aarts, Amsterdam. U.S. Pat. 785,040, Feb. 14, 1905.

Eng. Pat. 324,177 of 1902; this J., 1903, 547.—T. F. B.

*Fasher*. H. Gerdes. Assignor to the Firm of J. Tech, Berlin. U.S. Pat. 784,556, March 14, 1905.

Eng. Pat. 9733 of 1903; this J., 1904, 317.—T. F. B.

#### FRENCH PATENT.

*Oils: Combustible Liquid Prepared from Heavy—, which can be used in Ordinary Burners without Clogging*. L. Serpollet. Fr. Pat. 347,626, Nov. 3, 1904.

The oil which may be used in ordinary (serpentine) without choking them is produced by incoring with heavy tar oils about 10 per cent. of a mixture of ether and alcohol of the same density as the oil.—T. F. B.

## II.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

*Tar from Lignite Tar Oil*. G. Schultz and K. Th. J. Gasbeleucht., 1905, 48, 125—131, 152—158, 182, 200—203.

The authors examined an oil-gas tar prepared from a lignite tar oil, which yielded the following oils on distillation:—190°—220° C., 5.5; 220°—240°, 24.0; 240°—260°, 21.5; 260°—280°, 22.5; 280°—300°, 30.0; 300°—320°, 8.5; 320°—360° C., 1.5; residue, 1 cent. The tar was first subjected to a rough fractionation, 10,000 kilos. yielding 400 kilos. of water, 1 flight oil (sp. gr. 0.937), and 8100 kilos. of residue (1.166). The light oil and residue were then separated by numerous fractional distillations, in some under reduced pressure, into a large number of fractions, which were tested by known methods for the presence of various compounds. The compounds found were:—Water, benzene, heptane (?), toluene, three xylenes, ethylbenzene, styrene, pseudocumene, mesitylene, hydrindene (?), indene, coumarone homologues, durene, naphthalene, phenanthrene, xylene, pyrene, chrysene, thiophen, thietelen, cresols, pyridine and free carbon. The quantities of more important constituents of the tar were as follows:—Benzene, 1.0; toluene, 2.0; xylenes, 1.3; oils below 150° C. and which resinify, 1.0; oils distilling between 150° and 200° C., 1.5; oils distilling between 200° and 300° C., 26.6; oils distilling between 300° and 360° C., 12.6; naphthalene, 4.9; crude anthracene, 0.58; "asphaltum," 22.0; free carbon, 20.5; bases, traces; and water, 4 per cent.—A. S.

*Vaseline Spirit; Vaseline Oil; Vaseline*. P. Adam. Bull. Soc. Chim., 1905, 33, 274—284.

*Vaseline Spirit*.—Owing to the great demand for motor fuel the very light fractions, which were formerly burned in the stills or included in the next heavier grade of fuel, are now collected separately, and the light products of the cracking process are also utilised as motor spirit. Petroleum spirit used as a solvent in the laboratory, or, the presence of ethylenic hydrocarbons resulting from the cracking process, has the disadvantage of falsifying the bromine absorption value of the solutions. These hydrocarbons are easily eliminated by treatment with sulphuric acid, the ordinary light distillates being suitable for laboratory use.

Several samples of different kinds of spirit were examined by the author. One of them, dating from about 1850, distilled from crude oil mixed with light cracking

products, contained ethylenic hydrocarbons and absorbed always over 10 per cent., in one case, 140 per cent. of bromine, in the cold and the dark, without liberating hydrogen bromide. The ordinary light spirit of the present day (sp. gr. 0.655) has been treated with sulphuric acid, and does not absorb bromine, but is attacked by the latter, hydrogen bromide being liberated.

A sample of crude spirit, obtained by cracking, boiled at 60°—135° C., and had the sp. gr. 0.712; it was pale yellow in colour, and gradually deposited an amber-coloured resin. In presence of bromine it fumed, and absorbed 60 per cent. before liberating hydrogen bromide. Sulphuric acid absorbed 21.15 per cent. of the spirit, and turned black, whilst hydrochloric acid assumed a yellow tinge, and left a slight residue on evaporation. Nitric acid turned pink, and became hot, gas being liberated. On the other hand, a sample of ordinary light spirit, free from cracking products, boiled at 40°—130° C., and had the sp. gr. 0.675. It was of a pale yellow colour, slightly dichroic, and gave no reaction with mercuric hydrogen sulphate. A 10 per cent. solution of bromine in carbon tetrachloride reacted only very slightly in the cold; and the bromine absorption was only 0.6 per cent., a crystalline white precipitate being formed, accompanied by liberation of hydrogen bromide. Sulphuric acid decolorised the spirit and acquired a brown coloration. The smell was improved, and the refined oil no longer combined with bromine, nor was there more than a slight liberation of hydrogen bromide. This spirit, refined with sulphuric acid and soda, is commercially known as gasoline. The winter product has the sp. gr. 0.64, and distils between 30° and 85° C., the sp. gr. of the summer product being 0.65, and the lowest b.pt. 40° C. It does not combine with bromine in the cold, and substitution proceeds slowly, though warmth and light accelerate the reaction. There is no reaction with mercuric hydrogen sulphate.

The sample of vaseline oil examined had the sp. gr. 0.875, and distilled completely, without alteration, between 335° and 440° C. It was free from nitrogen, and practically free from substances absorbed by sulphuric acid; and bromine had but very little action in the cold, even in sunlight.

The best vaseline for pharmaceutical purposes melts between 35° and 39° C. Distillation converts it into crystalline paraffin-wax and liquid hydrocarbons, a little gas being evolved. The liquid portion absorbs bromine and contains ethylenic hydrocarbons, whereas the residue in the still does not. The gas consists chiefly of methane, the volume liberated being about 800 c.c. per 100 grms. of vaseline. The presence of paraffin-wax prevents the differentiation of pure and artificial vaseline by the aid of solvents, but the following tests furnish useful indications. Acidity is determined by warming the sample on the water-bath with an equal volume of neutral litmus tincture. The sample should volatilise completely, without liberation of acid vapours, when heated in a capsule. Heated with water and caustic potash, the filtrate obtained should remain clear on acidification. No coloration should occur when the sample is heated with sulphuric acid of sp. gr. 1.50, and the rise in temperature produced by agitation with nitric acid of sp. gr. 1.35 should not exceed 2° C. On the other hand, the thermal reaction furnished under this treatment by a sample composed of 25 parts of white vaseline, 60 of vaseline oil, and 15 of white ceresin, was 7° C., increased to 12° C. when the vaseline oil was replaced by "French neutral" oil. The viscosity affords a means of distinguishing natural vaseline from mixtures. Thus, the viscosity of vaseline free from paraffin is 680 at 60° C., 1 per cent. of paraffin lowering the result to 625, and 4 per cent. to 560, whereas artificial vaseline has the low viscosity of 390, and the "industrial" variety 300—360. In the absence of a viscosimeter, the vaseline may be warmed to the desired temperature in a wide tube, into which a dry pipette is then introduced, note being taken of the time taken by the vaseline to rise up to the mark in the pipette, and the result compared with that furnished by a sample of known purity.—C. S.

*Oils, Lubricating; Testing the Behaviour of —, in the Cold*. R. Hackel. XXIII., page 352.

## ENGLISH PATENT.

*Petroleum Oils; Process for Purifying* — E. W. Wynne, Seacombe, Cheshire. Eng. Pat. 26,198, Dec. 2, 1904.

THE oils are mixed with: carbon, 4: "borax dry soap," 10; naphthalene, 2; camphor, 2; water, 1; alum, 10; pearl ash, 10; soda ash, 10; lead acetate, 1; and sulphuric (or hydrochloric) acid, 1 part per 1000 galls., and are treated with an air blast, filtered, and treated with a blast of ozonised air, which raises the flashing point and density of the oils. They are afterwards mixed with about 6 lb. each of potassium chlorate and naphthalene, and again treated with an air blast for 15–30 minutes. The apparatus consists of separate vessels, fitted with perforated air-pipes, for the various operations, in connection with an oil filter and filter for the ozonised air, means for conveying the oil from one vessel to another and a blower for the air blast.—C. S.

## FRENCH PATENTS.

*Pitch from Heavy Tar Oils; Process for the Manufacture of* — Rud. Rütgers Chem. Fabr. f. Theerprodukte. Fr. Pat. 347,498, Oct. 28, 1904. Under Internat. Conv., July 1, 1904.

PITCH can be prepared from heavy tar oils by blowing air, preferably heated, through the heated oil, and distilling the product. Thus, a hard, brittle pitch may be obtained from tar oil of sp. gr. 1.079 by passing air, heated to 100° C., through the heated oil for 100 hours. The yield of pitch is stated to be about 40 per cent.—T. F. B.

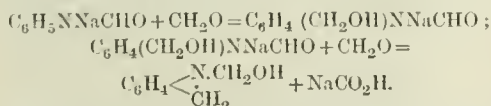
*Hydrocarbons such as Petroleum and Benzine; Solidification of* — G. van der Heyden. First Addition, dated Oct. 26, 1904, to Fr. Pat. 346,860, Oct. 7, 1904.

THE emulsion of mineral oil and glue prepared as indicated in the principal patent (this J., 1905, 236) is mixed with tannin, or a substance containing tannin, and then melted and run into moulds. The amount of tannin should not exceed 10 per cent. of the weight of glue used. Good results are said to be obtained by using 6.7 parts of glue, and 0.67 part of tannin for each 100 parts of mineral oil.—T. F. B.

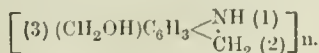
#### IV.—COLOURING MATTERS AND DYE-STUFFS.

*Amines; Introduction of the CH<sub>2</sub>OH and CH<sub>2</sub> Groups into Primary Aromatic* —, and the Preparation of Imine Bases. E. Orloff. J. russ. phys.-chem. Ges., 1904, 36, 1303–1311. Chem. Centr., 1905, 1, 674–675.

THE formamide of the base (aniline, naphthylamine, or the like) is treated with caustic soda to form the sodium compound, and the latter is heated with formalin. With the sodium compound of formanilide, the reaction proceeds according to the equations:

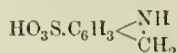


The product is a yellowish non-volatile oil, which on treatment with dilute acids is transformed into the imine base



The latter is insoluble in water, alcohol and ether, but soluble to some extent in acids and in a mixture of ether and chloroform. It can be purified by precipitation with potassium carbonate from acid solution, and is then obtained as a white powder which turns yellow on heating. With sodium nitrite it yields a nitroso compound which

forms a red azo dyestuff on treatment with an alkaline solution of  $\beta$ -naphthol. The imine base obtained from sulphanilic acid has the constitution



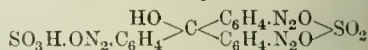
When treated with sodium nitrite it yields a nitroso compound which readily combines with  $\beta$ -naphthol in alkaline solution to form an orange-coloured dyestuff. —A.

*Carbinols; Ketone Decomposition of* — G. Georgievics. Ber. 1905, 38, 884–886.

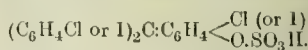
WICHELHAUS (this J., 1886, 318) effected a decomposition of Magenta and Methyl Violet by boiling them for several days with hydrochloric acid, and quite recently O. F. and W. Hess (Ber., 1905, 38, 385) described a similar decomposition of nitro- and haloid derivatives of triphenylcarbinol by oxidation with chromic or nitric acid. The author found that Magenta and allied dyestuffs under certain circumstances undergo an analogous decomposition at ordinary temperature, especially if present in quinonoid colour bases. *p,p'*-Diaminobenzophenone always formed although in small quantities by treating Parafuchsine solution with caustic alkali. The reaction becomes complete in the presence of hydrogen peroxide, already at the ordinary temperature. The obtained showed a yellowish-grey colour, m. pt. 24°, yielded a hydrochloride soluble with difficulty and further identified by transformation into the corresponding dihydroxybenzophenone, according to Stædel and his (see Ber. 1878, 11, 1748). Methyl Violet is still readily reacted upon than Magenta, yielding tetramethyldiaminobenzophenone, m. pt. 175° C., which was identified by its picrate, m. pt. 156–157°.—R. L.

*Dibenzalacetone and Triphenylmethane*. A. Baeyer. 1905, 38, 569–590.

THE author prepared tri-*p*-chloro- and tri-*p*-iodotriphenylcarbinol. To prepare the former compound *p*-chlorobenzene, obtained from *p*-chloro-aniline by diazotising with amyl nitrite and then reacting with potassium iodide, was treated with magnesium powder and then with the ester of *p*-chloro-benzoic acid, according to Grignol reaction. The tri-iodo-derivative was prepared by diazotising parosaniline with strong sulphuric acid and amyl nitrite in methyl alcoholic solution, isolating parosaniline tridiazoniumsulphate



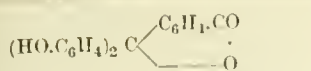
and treating this with a solution of iodine in aqueous potassium iodide. Both compounds are colourless crystalline solids, but their sulphates are strongly coloured. That of the trichloro compound forming brown plates with slight green metallic lustre, whilst the tri-iodo-derivative forms a sulphate which closely resembles Magenta in appearance. Neither of these sulphates react with silver salts under normal conditions to silver chloride or iodide, showing that they cannot form quinonoid salts of the formula—



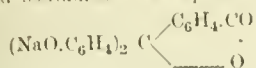
Both tri-*p*-chloro- and tri-*p*-iodotriphenylcarbinol react readily with a mixture of aniline and aniline hydrochloride to form triphenylrosaniline (Aniline Blue).

The remainder of the article consists of theoretical considerations on the constitution of dyestuffs, more especially the triphenylmethane series. The facts given lead to formulae of the type  $(\text{C}_6\text{H}_4\text{X})_3\text{C}.\text{O}.\text{SO}_3\text{H}$  for coloured salts of *p*-substituted triphenylcarbinols. The author considers that coloured triphenylcarbinol compounds contain an "ionisable carbonium value," which he represents by a zigzag line. Thus the sulphate of triphenylcarbinol has the formula  $(\text{C}_6\text{H}_5)_3\text{C}.\text{O}.\text{SO}_3\text{H}$  whereas triphenylcarbinol itself, which is colourless, has the formula  $(\text{C}_6\text{H}_5)_3\text{C}.\text{OH}$ . Phenolphthalein has the formula

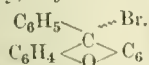




coloured sodium salt is represented as



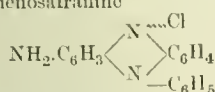
illustrated by these two examples the non-ionisable character of the ordinary type may be converted into an ionisable carbonium valency" either by making the carbon portion of the molecule more negative, as in the triphenylcarbinol sulphate, or the positive portion more positive, as in the case of the sodium salt of phenolphthalein. Werner's coloured xanthone compounds are illustrated similarly, e.g.—



On the other hand the author considers such compounds as fuchsone, aurin and Homolka's base to be undoubtedly coloured and to owe their colour to a characteristic carbonium double bond" which he denotes by a double line, e.g., fuchsone  $(\text{C}_6\text{H}_5)_2\text{C}=\text{C}_6\text{H}_4\text{O}$ ; dimethyl-

aurin  $(\text{CH}_3)_2\text{C}=\text{C}_6\text{H}_4\text{O}$ ; aurin  $(\text{HO.C}_6\text{H}_4)_2\text{C}=\text{C}_6\text{H}_4\text{O}$ ; and Homolka's base,  $(\text{NH}_2.\text{C}_6\text{H}_4)_2\text{C}=\text{C}_6\text{H}_4\text{O}$ . Coloured base of Magenta is formulated  $(\text{NH}_2.\text{C}_6\text{H}_4)_3\text{C}=\text{C}_6\text{H}_4\text{O}$  and Magenta itself  $(\text{NH}_2.\text{C}_6\text{H}_4)_3\text{C}=\text{C}_6\text{H}_4\text{O}$ . Crystal base, and the dyestuff are formulated in an analogous manner; dibenzalacetone as  $(\text{C}_6\text{H}_5.\text{CH}:\text{CH})_2\text{C}=\text{O}$  and its hydrochloride as either  $(\text{C}_6\text{H}_5.\text{CH}:\text{CH})_2\text{C}=\text{O} \cdot \text{HCl}$

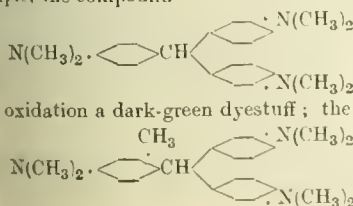
or  $(\text{C}_6\text{H}_5.\text{CH}:\text{CH})_2\text{C}=\text{O} \cdot \text{H}^+\text{Cl}^-$ . The author also formulates quinone-imine and azo dyestuffs in a similar manner, with the help of the conceptions of "azonium bonds" and "ionisable azonium valencies." Thus he formulates Phenosafranine



phenol,  $\text{O}:\text{C}_6\text{H}_4=\text{N}.\text{C}_6\text{H}_5$ ; and benzene,  $\text{C}_6\text{H}_5=\text{N}.\text{C}_6\text{H}_5$ .—E. F.

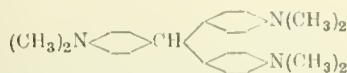
**Triphenylmethane Dyestuffs. Influence of the Position of Methyl- and Nitro-groups relatively to the Methane Carbon Atom on the Tinctorial Properties of —.** E. Fritzenstein and O. Runge. J. prakt. Chem. 1905, 71, 7—132.

The authors submit a very large amount of experimental material concerning the synthesis of triphenylmethane dyestuffs, more especially of those obtained by condensing tetramethyldiaminodiphenylcarbinol and tetramethyldiaminoditolylcarbinol with aromatic bases and nitro-compounds and oxidising the resulting leuco-compounds. Comparing their results and those of other investigators they arrive at the following general conclusions:—(1) A methyl group in *o*-position to the methane carbon atom in triphenylmethane dyestuff does not adversely affect length of shade; in certain instances, these are increased. When further methyl groups in the *o*-position to the methane carbon atom are introduced, however, the tinctorial character of the resulting dyestuff is in some cases almost entirely destroyed. This is more particularly the case when in two of the three benzene rings the methyl- and amino-groups are in the *m*-position, the third in the *p*-position, relatively to one another. For example, the compound

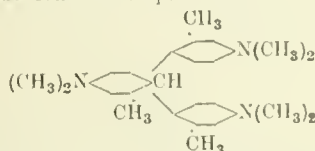


on oxidation a dark-green dyestuff; the compound

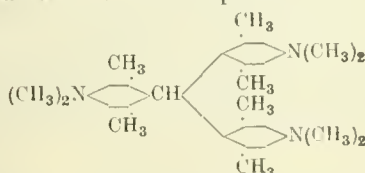
gives a brighter, bluer and more intense dyestuff, whilst the corresponding compound which is methylated in each benzene nucleus in the *o*-position to the methane carbon atom yields a very weak bluish-green dyestuff. With the accumulation of systems of dialkylamino- and methyl groups in *m*-position to one another, the colour changes from violet to blue and finally to green. Thus the dyestuff from the compound



is violet, that from the compound



is blue, and that from the compound

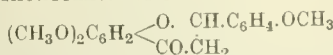


is green.

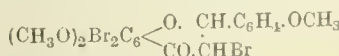
The effect of a nitro-group on the shade of a triphenylmethane dyestuff is in itself small. In the *o*-position to the methane carbon atom, it influences the shade towards blue, in the *p*-position towards yellow and in the *m*-position, it leaves the shade unaltered. The presence of methyl- and alkylamino-groups in the *m*-position relatively to one another in two nuclei, and of methyl- and dialkylamino- or methyl- and nitro-groups in the *p*-position to one another in the third nucleus leads to worthless dyestuffs. Thus the leuco compounds formed by condensation of tetramethyldiaminodiphenylcarbinol with dimethyl-*p*-toluidine and with *p*-nitrotoluene yield valuable dyestuffs, whilst when the diphenylcarbinol is replaced by tetramethyldiaminoditolylcarbinol (with the methyl groups in *o*-positions to the methane carbon atom) the resulting dyestuffs are of no value. The authors find that when tetraethyldiaminodiphenylcarbinol is condensed with aniline in presence of hydrochloric acid, condensation takes place mainly in the *p*-position, but partially in the *o*-position to the amino group. In concentrated sulphuric acid solution the *o*-amino compound is mainly formed, accompanied by both *m*- and *p*-compounds. When tetramethyldiaminoditolylcarbinol is condensed with aniline, similar mixtures are obtained. The resulting dyestuffs are in this case dull. New leuco-compounds were prepared by condensing various aminotriphenylmethane leuco-compounds with 1,2,4-chlorodinitrobenzene, and oxidising, thus forming dyestuffs containing a dinitrophenylamino group. These dyestuffs show a greatly increased affinity for the animal fibre in an acid bath, but retain a certain basicity if the dinitrophenylamino group is in the *m*-position to the methane carbon atom. When it is in the *o*- or *p*-position, the basic properties of the dyestuff are destroyed.—E. F.

**Apigenin: Second Synthesis of —.** M. Breger and S. v. Kostanecki. Ber., 1905, 38, 931—933.

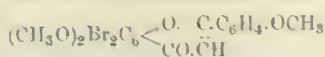
### 1.3.4'-TRIMETHOXYFLAVANONE



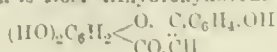
was brominated, forming 2,4,6-tribromo-1.3.4' trimethoxyflavone,



On treatment with alcoholic potassium hydroxide solution, this formed 2,4,6-dibromo-1.3.4' trimethoxyflavone



which was converted by boiling with hydriodic acid into apigenin, which is 1.3.4'-trihydroxyflavone



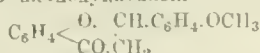
—E. F.

3'-Hydroxyflavonol. A. Gutzeit and S. v. Kostanecki. Ber., 1905, 38, 933—935.

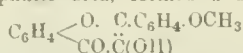
By interaction of *m*-methoxybenzaldehyde and *o*-hydroxyacetophenone, the authors prepared 2'-hydroxy-3-methoxychalkone



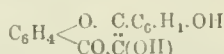
By boiling with dilute sulphuric acid and alcohol, this was converted into 3'-methoxyflavanone



This was converted by means of amyl-nitrite and hydrochloric acid into an isonitroso-compound, which, on boiling with dilute sulphuric acid, formed 3'-methoxyflavonol



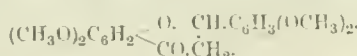
which dyes in light yellow shades on alumina mordant. By boiling with hydriodic acid it is converted into 3'-hydroxyflavonol



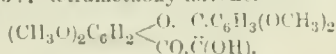
which also dyes on alumina mordant in light yellow shades. —E. F.

Quercetol; An Isomeride of —. S. v. Kostanecki and F. Rudse. Ber. 1905, 38, 935—938.

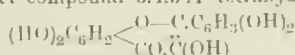
2'-HYDROXY-3'.4'.3.4-TETRAMETHOXYCHALKONE,  $(\text{CH}_3\text{O})_2\text{C}_6\text{H}_2(\text{OH}) \cdot \text{CO} \cdot \text{CH} : \text{CH} \cdot \text{C}_6\text{H}_3(\text{OCH}_3)_2$ , was obtained by the interaction of the dimethyl ether of gallacetophenone and veratric aldehyde. By boiling its alcoholic solution with dilute hydrochloric acid, this compound was converted into 3.4.3'.4'-tetramethoxyflavanone,



This was converted in the usual manner into an isonitroso compound, which, on heating with dilute mineral acids, formed 3.4.3'.4'-tetramethoxyflavonol



By treatment with hydriodic acid the authors obtained from the latter compound 3.4.3'.4'-tetrahydroxyflavonol



which is an isomeride of Quercetol. It is said to be an excellent mordant dyestuff, as was to be expected from the presence of two *o*-dihydroxy systems, and dyes on alumina mordant in orange-yellow to yellow, and on iron mordant in grey to black shades. —E. F.

Chromane, Synthesis of —. J. v. Braun and A. Steindorf. Ber., 1903, 38, 850—855.

CHROMANE,



the hydrogenised mother-substance of the chromanes, coumarins, &c., has never been isolated hitherto, though alkyl derivatives have been prepared. The authors benzoylate tetrahydroquinoline, and treat it with phosphorus pentachloride, forming *o*- $\gamma$ -chloropropylbenzanilide  $\text{C}_6\text{H}_4(\text{C}_6\text{H}_5\text{CH}(\text{NH} \cdot \text{CO} \cdot \text{C}_6\text{H}_5))_2$ . They saponify this, obtaining a salt of the corresponding non-benzoylated amine, from which by diazotising and warming with mineral acid, they obtain the corresponding phenol,

$\text{C}_6\text{H}_4(\text{C}_6\text{H}_5\text{CH}(\text{OH}))_2$ . On warming this substance with an alkaline solution it forms chromane, which is a white solid with an intense peppermint-like smell, somewhat soluble in hot water. —E. F.

Organic Dyestuffs; Absorption Bands shown by in the Ultraviolet. P. Krüss. Z. physik. Chem., 1905, 51, 257—296.

THE author has made numerous experiments on absorption of ultra-violet rays by a large number of organic dyestuffs, including triphenylmethane derivatives and some specially-prepared azo dyestuffs. It is found that organic dyestuffs exhibit, in the ultra-absorption-bands of a smaller intensity and width in the visible spectrum. Dyestuffs belonging to the group or class show, in general, similar absorption differences of constitution in dyestuffs of the same class causing only a more or less considerable displacement of the absorption bands. It is possible in many cases to determine the class to which a dyestuff belongs by means of its absorption spectrum. Aurin absorbs comparatively few ultra-violet rays. A layer 1 mm. of a solution of 1 mgrm.-mol. of aurin in 100 c.c. of water will allow, in addition to red and yellow rays, all violet and ultra-violet rays up to  $\lambda = 285\mu$ , to pass through. Such a solution, when used in combination with a strongly coloured cobalt glass, would, like the nitrosodiphenylamine, examined by Wood (this J., 1903, 440), be a light-filter almost opaque to the rays of the ultra-violet spectrum, whilst exhibiting great transparency for violet rays. The azo dyestuff from diazotised resorcinol is still more transparent for the extreme ultra-violet. A layer, 1 mm. thick, of a solution of 1 mgrm.-mol. of this dyestuff in 100 c.c. of concentrated sulphuric acid will allow the ultra-violet rays from  $\lambda = 347\mu$  to  $\lambda = 251\mu$  to pass through, while of the visible spectrum only the red and yellow are able to pass. The absorption spectra of many azo dyestuffs are different in concentrated sulphuric acid from those in aqueous or alcoholic solutions, probably owing to chemical change. Sulphonated azo dyestuffs show absorption spectra in sulphuric acid and in aqueous or alcoholic solutions. The absorption of ultra-violet rays increases with the number of "double linkings" in the molecule. The colourless bases obtained by the reduction of triphenylmethane dyestuffs all behave as colourless bodies, with strong absorption-bands in the ultra-violet region of the spectrum. When exposed to light, they are again oxidised to the dyestuffs, the oxidation being caused by the ultra-violet rays which are absorbed. On further exposure to light, the colour appears again more or less rapidly, not owing to redox as is frequently stated, but by further oxidation (Gros, this J., 1901, 888, 1104). The dyestuffs show to a greater degree the same absorption-bands in the violet as the colour-bases. It can be proved by exposure under suitable light-filters that the fading of dyestuffs depends in all cases upon the absorption of ultra-violet rays, but the extent of this absorption does not serve as a measure of the fastness to light, except in the case of dyestuffs of similar constitution. (See also this J., 1904, 767; 1893, 823.)—A. S.

#### ENGLISH PATENT.

Azo Dyes; Mordant; Manufacture of —. Lake, London. From K. Ochler, Offenbach, Germany. Eng. Pat. 28,596, Dec. 28, 1901.

2.6-NITRO-AMINOPHENOL-4-SULPHONIC acid is diazotised and combined with *o*- or *m*-cresotinic acid. The resulting dyestuffs dye wool from an acid bath in reddish shades which change to claret-red on subsequent treatment with a chromium compound. These dyestuffs are said to be very fast to light, milling and steaming. A dyestuff from *o*-cresotinic acid yields the blue shade.

#### UNITED STATES PATENT.

Dichlorodimethylfluorane [Pyrono Dyestuff] and Method of Making same. P. Julius, Assignor to Badische Anilin- und Soda-Fabrik, Germany.

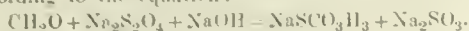


FRENCH PATENTS.

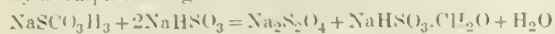
changes described have reference to raw cotton, free from contamination with added foreign matter, such as the presence of which is very liable to set up action. The injurious substance was found to contain "Blauzudulose," a species of fungus resembling it in appearance, although not identical therewith, tending to give a violet colour with iodine. It was found in silky fibres only, and these on dyeing yielded

*Behaviour of Hydrosulphites to Aldehydes in presence of Alkali.*—A solution containing 1 mol. of sodium hydro-

sulphite was shaken with 1 mol. of sodium hydroxide and 1 mol. of formaldehyde, and the mixture cooled and treated with an equal volume of alcohol, which caused precipitation of normal sodium sulphite. The alcoholic solution when evaporated *in vacuo* yielded a syrup, which, after standing for some time, set to a solid mass generally with a faint yellow colour. The product was purified by crystallisation from water and from alcohol, and was found to consist of formaldehyde-sodium sulphonylate, which has been obtained in other ways by Baumann, Thesmar and Frossard (this J., 1904, 1211; 1905, 237; also preceding abstract) and by Reinking, Dehnelt and Labhardt (see following abstract). The reaction proceeds according to the equation:—



Formaldehyde-sodium sulphonylate is not precipitated from aqueous solution by calcium or barium chloride, but with milk of lime or barium hydroxide solution, it yields slightly soluble salts containing 1 atom of the alkaline-earth metal to 1 atom of sulphur. With sodium hydroxide a disodium salt is formed, which dissolves much more readily than the monosodium salt. With sodium bisulphite, formaldehyde-bisulphite is produced and sodium hydrosulphite is regenerated:

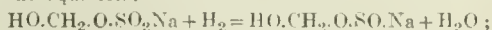


Other aldehydes form sulphonylates in a similar manner to formaldehyde. The author concludes from these results and from the fact discovered by Bernthsen that sodium hydrosulphite when oxidised with iodine, yields sulphuric and not polythionic acid, that in hydrosulphurous acid the two atoms of sulphur are united by an atom of oxygen. Hydrosulphurous acid may be regarded as a mixed anhydride of sulphurous and sulphonylic acids. The aldehyde-sulphonylates are regarded as derivatives of an ortho-sulphonylic acid  $\text{H}_2\text{SO}_3$  or  $\text{H}_2\text{SO}_2 + \text{H}_2\text{O}$ . According to this view, formaldehyde-sulphonylate would, for example, be an inner anhydride of the constitution:

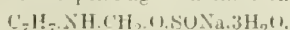


*Aldehyde-Sulphurous Acid Salts and Hydrosulphurous Acid: Constitution of —.* K. Reinking, E. Dehnelt und H. Labhardt. Ber., 1903, 38, 1069–1080.

THE authors' experiments confirm the view that the aldehyde-sulphurous acid compounds are esters of sulphurous acid,  $\text{R.CH(OH).O.SO}_2\text{H}$ , and not hydroxy-sulphonic acids,  $\text{R.CH(OH).SO}_3\text{H}$ . If formaldehyde-sodium bisulphite be reduced with zinc and acid in the proportions of 1 atom of zinc to 2 mols. of the bisulphite compound, formaldehyde-sodium hydrosulphite is produced, but if double the quantity of zinc be employed in presence of acetic acid, a product having a reducing power twice as great is obtained. Comparative experiments showed that true sulphonic acids yield on reduction sulphinic acids, which have no reducing action on Indigo Carmine, whereas esters of sulphurous acid give products having reducing properties similar to those of the compound from formaldehyde-sodium bisulphite. These results lead the authors to express the reduction of formaldehyde-sodium bisulphite by the equation:—

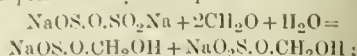


the hydroxymethyl group remaining unchanged, whilst the residue of the sulphurous acid,  $\text{HO.SO}_2\text{H}$  is reduced to the residue of a new acid,  $\text{HO.SOH}$ , named by the authors sulphonylic acid. (The reduction product of formaldehyde-sulphurous acid is named empirically formaldehyde-sulphonylic acid, and its salts, formaldehyde sulphonylates.) Formaldehyde-sodium sulphonylate has already been described by Baumann, Thesmar and Frossard (this J., 1904, 1211; 1905, 237) under the name of formaldehyde-sodium bihydrosulphite. It reacts with aromatic amines, but the products, in the dry condition, are readily decomposed on exposure to the air. The product from *o*-toluidine has, however, been prepared and analysed, giving results corresponding with the formula

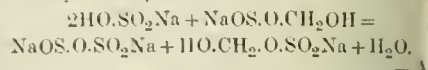


*Constitution of Hydrosulphurous Acid.*—From the ease with which sodium hydrosulphite is decomposed by

formaldehyde, and from the nature of the product formed, the authors conclude that hydrosulphurous is a mixed anhydride of sulphonylic and sulphurous. The reaction between sodium hydrosulphite and formaldehyde is represented by the equation:—



and the regeneration of sodium hydrosulphite by the action of sodium bisulphite on formaldehyde-sodium sulphonylate by the equation:—



*Hydrosulphites; Analysis of Solutions of —.* Formaline. E. Orloff. XXIII., page 348.

#### ENGLISH PATENTS.

*Silk, Artificial; Manufacture of —.* R. V. Lyons, France. Eng. Pat. 20,637, Sept. 26, 1904. SEE Fr. Pat. 344,660 of 1904; this J., 1904, 1212.—T

*Scouring and Milling or Fulling of Woollen Cloth, other Woollen Goods, and Scouring Wool, Cotton, and Woollen Yarns, and Cotton, Linen and Flax Cloths.* R. H. Adamson, London. Eng. Pat. 20,637, Dec. 31, 1904.

THE use in milling and scouring textile materials of "powdered or desiccated" soap, in place of ordinary soap, is claimed.—E. B.

*Textile or other Materials or Substances; Apparatus for Subjecting — to the Action of Liquids under Pressure for the Purpose of Dyeing, Mordanting, Bleaching, Washing, Exhausting, Extracting or Performing Operations thereon.* L. D  tr  , Reims, France. Eng. Pat. 25,208, Nov. 19, 1904.

THE claims comprise:—Apparatus for applying the liquid and other liquors, definite regulated pressures, produced by means of compressed air, carbon dioxide or other gas media, to cause the liquors to penetrate into and through textile materials; pumps for circulating the liquid under pressure; a four-way valve, connected by pipes or conduits with liquor reservoirs and with the vessel, and arranged in such a manner as to enable the direction of the liquors through the materials to be altered or reversed as desired, the duration of the action of circulation in a given direction being independent of the action of the pressure medium; and a meter or mechanism for automatically actuating the four-way valve.—E. B.

*Yarns; Manufacturing or Treating Printed — in Making Tapestry, Tapestry Velvet Carpets, Covers and Similar Printed Fabrics, and Apparatus therefor.* J. W. Anderson, jun., and A. F. Inverness, Worcester. Eng. Pat. 10,767, May 10, 1904.

YARNS, which have been printed and steamed in the form of bunks, are washed and placed in the same form in a stretching frame, where they are dried under tension. Printed yarns are, it is stated, thus obtained so that in length that great economy of time in manipulating yarns in the setting frame results and the necessity of setting the pattern in short lengths is obviated.—T

*Sulphur Colouring Matters from Dye Liquids and Wastes; Method and Apparatus for Recovering the Same.* J. Schmitt, Paris. Eng. Pat. 11,317, May 17, 1904.

THE dye-liquor is treated with a suitable precipitant such as sulphuric acid, and passed through a tank into compartments by hollow partitions, which are filled with faggots, straw or other suitable straining material that the liquid in passing from one compartment to the next is freed from suspended colour.—E. F.

*Brewers' Wash, Sewage, Waste or Spent Dyes; Apparatus for Treating and Concentrating —, the Apparatus also applicable as a Smoke Washer.* A. B. I. Eng. Pat. 12,145, May 28, 1904. XVIII. B, page 348.



## FRENCH PATENTS.

*Use of Gorse and Similar Materials; Utilisation of for Manufacturing Artificial Silk, Celluloid, Plastic Substances, Dynamite, and for other purposes.* Horteloup. Fr. Pat. 347,353, Oct. 24, 1904. N., page 344.

*Artificial; Process for Manufacturing* —. P. neuve. First Addition, dated Oct. 26, 1904, to Pat. 346,693, Oct. 1, 1904. (See this J., 1905, 194.) Cellulose can be "denitrated" by treating its solution with metallic sulphides or hydrosulphide instead of treating the formed threads with an aqueous solution of these substances. By this process it is stated that a solution in acetone of "true aminocellulose" is obtained, which is specially adapted to the formation of threads.—T. F. B.

*Process for Weighting* —. H. J. M. Lerondier. Fr. Pat. 339,245, Dec. 29, 1903.

A preliminary weighting with tin in the usual manner, silk is immersed successively in baths of a zinc silicate, the process being repeated until sufficient weight has been taken up. The zinc salt bath may be replaced by baths of aluminium, iron, or magnesium. The silk is finally "fixed" by means of dilute hydrochloric acid or tannin. It is stated that by this process, using only one tin bath, the silk may be weighted to the extent of 80 to 100 per cent.—T. F. B.

*Proceeding with the Aid of Tin Salts; Treatment of* —. Patent for its Deterioration. Soc. Anon. Coop. per la Confezione e l'Assaggio delle Sete ed Affini. Fr. Pat. 339,245, Nov. 5, 1904. Under Internat. Conv., June 8, 1904.

Fr. Pat. 25,728 of 1904; this J., 1905, 129.—T. F. B. *and Treating Textiles with a Liquid in Circulation; Machine for* —. G. de Keukelaere. Fr. Pat. 347,677, Nov. 5, 1904.

The machine is made on the principle of a centrifugal pump, a perforated basket of which contains the material to be treated, supported in suitable receptacles: for instance, the material is wound on perforated bobbins may be employed. The basket is provided with a double bottom; the upper part is pierced with conical holes, into which the shaped material holding the bobbins fit. The space between the material constitutes a liquid-distributing chamber, the material being supplied by a pump, through a pipe which is connected with an opening in the lower bottom of the basket; the liquid thus passes up through the material, and is forced out of the perforated basket into the main vat, whence it is pumped off. The shaft to which the basket is fixed is vertically displaced by means of a wedge-shaped support operated by a lever, so that, when the treatment with liquid or liquids is completed, the basket may be raised, disconnected from the liquid-supply pipe, when it is free to be rotated, thus constituting a centrifugal pump apparatus.—T. F. B.

*Working under Pressure; Apparatus for* —, which can be regulated. L. Déré. Fr. Pat. 347,809, Nov. 11, 1904.

Fr. Pat. 25,208 of 1901; preceding these.—T. F. B. *sulphates; Production of* —, Dry and quite Stable. Deutsche Anilin u. Soda Fabr. First and Second Additions to Fr. Pat. 341,718, Mar. 28, 1904. VII., page 333.

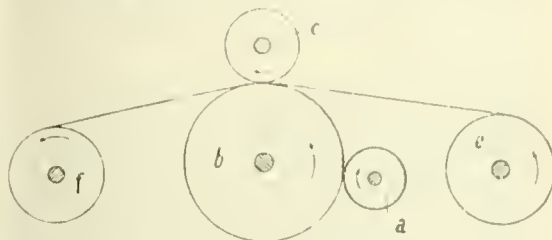
## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

## ENGLISH PATENTS.

*For Furs, Hairs, and Feathers; Process for* —. D. Abel. London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 9455, April 25, 1904.

Fr. Pat. 342,714 of 1904; this J., 1904, 982.—T. F. B.

*Paper and Other Materials in the Web; Machines for Figuring Continuous* —. G. Hennessen and P. Spix. München-Gladbach, Germany. Eng. Pat. 26,532, Dec. 6, 1904.



THE object of this invention is to produce designs upon paper and other materials by rendering certain parts of the surfaces of these smooth and glossy, while leaving other parts more or less rough and lustrous. To this end, the paper, &c., is passed in a continuous sheet or web between a friction roller *c* (see figure) and an "elastic roller" *b*, composed of or covered with cotton, paper, leather, asbestos, indiarubber or other suitable material. The design to be reproduced is engraved upon a roller *a*, from which it is constantly impressed upon the surface of the roller *b*, as the two rollers revolve in contact with each other. The surface of the paper, &c., which is to be ornamented being turned towards the friction roller, those parts of the paper, &c., which lie upon the raised portions of the surface of the roller *b*, as this revolves under the friction roller, are made smooth, the design temporarily raised by the roller *a* upon the surface of the roller *b*, being at the same time effaced. The rollers *a* and *b* rotate with the same surface speed, which is less than that of the roller *c*.—E. B.

## VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

*Sodium and Magnesium Sulphates; Equilibrium between* —. R. B. Denison. Paper read before the Faraday Society, Jan. 30, 1905.

At 25° C., the only double salt hitherto obtained is astrakanite  $\text{Na}_2\text{Mg}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ ; whilst at higher temperatures loewite  $\text{Na}_2\text{Mg}_2(\text{SO}_4)_4 \cdot 5\text{H}_2\text{O}$ , and vanthoffite  $\text{Na}_6\text{Mg}(\text{SO}_4)_4$  are known. The author has endeavoured to obtain the sodium analogue of langbeinite,  $\text{K}_2\text{Mg}_2(\text{SO}_4)_3$ . No evidence of its existence, however, could be obtained. A solution of astrakanite with excess of magnesium sulphate and one of magnesium sulphate with excess of astrakanite, show the same vapour pressure, both being saturated with astrakanite and magnesium sulphate; whereas if langbeinite were formed, the solution saturated with it and astrakanite would probably have a different vapour pressure from that saturated with langbeinite and magnesium sulphate. Moreover, though dilatometric experiments with a solution of magnesium sulphate and astrakanite in molecular proportions showed that the system undergoes a change at 58° C., while the dehydration of astrakanite and formation of loewite occurs at 71° C., yet on evaporation at 58° C., no langbeinite, only loewite crystallised out. The transition temperature is thus apparently lowered from 71° to 58° by the excess of magnesium sulphate.—J. T. D.

*Thiosulphates; Time required for the appearance of a Precipitate in the Decomposition of* —. G. Gaillard. Comptes rend., 1905, 140, 652—655.

As the concentration of the thiosulphate solution to which a given reagent is added is increased, the interval between the addition of the reagent and the appearance of turbidity is lessened. The curves representing the connection between the two variables are hyperbolic in general character. When the reagent is varied the curves obtained vary in position and form, though maintaining a general likeness; and when the reagents are related, as, for

example, hypochlorous, chloric, and perchloric acids, hydrochloric, hydrobromic and hydriodic acids, or when the same reagent acts on related salts as ammonium, sodium, and strontium thiosulphates, the curves obtained are similar, and differ only in their distances from the axes. When the same solution of thiosulphate is used, the interval increases with the quantity of a given reagent added.

When other substances are mixed with the thiosulphate solution before adding the reagent, the appearance of the precipitate is usually retarded; and where the added substances are related (chloride, bromide, iodide, or salts of magnesium, zinc, and cadmium) the retardation is usually greatest with the element of highest atomic weight. In many cases, if a substance be added to the precipitating acid, it produces no effect, whilst if it be added to the thiosulphate solution it causes retardation. Different diluents (water, glycerin, alcohol) of the thiosulphate solution retard the action unequally; alcohol more than glycerin, glycerin more than water.—J. T. D.

*Bleaching Powder; Pink Coloration of* —. N. Tarugi. *Gaz. chim. ital.*, 1905, **34**, 466–468. *Chem. Centr.*, 1905, **1**, 584.

The pink coloration which is produced when bleaching powder or a hypochlorite is acted upon by carbon dioxide, or simply warmed to a temperature below 50° C., has been attributed to the presence of small quantities of manganese, which, by the oxidising action of the hypochlorite, are converted into permanganate. The author found, however, that the residue obtained by the evaporation of solutions of bleaching powder which had been coloured by carbon dioxide or by heating contained iron but no manganese. The coloration is therefore attributed to the presence of iron, probably in the form of calcium ferrate. Bleaching powder, which is free from iron, is not coloured pink by carbon dioxide, but the coloration appears if a small quantity of an iron salt be added. The iron present in bleaching powder cannot be determined by the permanganate method.—A. S.

*Phosphorus; Manufacture of* —. W. Hempel. *Z. angew. Chem.*, 1905, **18**, 401–402.

NEUMANN, in criticising the author's paper (this J., 1905, 195), has misunderstood him in several places. An electric resistance furnace, not a carbon arc, was used, as being more certainly regulated and controlled; but the author has not suggested that this should be used on the large scale. With metaphosphoric acid the yield of phosphorus that can be collected was poor, but the author did not say that "absolutely negative results" were obtained; this process was not farther investigated, because Wöhler's gave such good results. The author considers that on the large scale internal arc-heating will be more economical than externally fired retorts, as the slow heat-conduction through the retorts will more than compensate for the lower cost of fuel. Further experiments in the author's laboratory have shown that Wöhler's process, using arc-heating, is by far the best method of preparing phosphorus. If Neumann only obtained by this process 60 per cent. of the theoretical yield, his furnace must have been incorrectly constructed or the process improperly carried out.—J. T. D.

*Arsenic; Production of Yellow* —, by means of the Electric Arc. A. Stock and W. Siebert. *Ber.*, 1905, **38**, 966–968. (See also this J., 1905, 28.)

LARGER quantities of yellow arsenic can be obtained by the action of an electric arc between arsenic electrodes under carbon bisulphide. The arsenic volatilises and is condensed and dissolved by the carbon bisulphide. The anode need not necessarily be of arsenic, but might be a carbon rod. Fused arsenic becomes very brittle in cooling; it is therefore difficult to make the anode from the pure metal. The authors employed an alloy of arsenic and antimony. In the arc the antimony is reduced to a very fine black powder, absolutely insoluble in carbon bisulphide. The operation was carried out in a beaker containing 500 c.c. of the solvent, the whole placed in a larger vessel filled with water and ice. Using a current

of 12 ampères, 5 grms. of the alloy were decomposed in 5 minutes, when the experiment was interrupted to allow the solution to cool down. Working for a 1 per cent. solution gives best results. The solution, separated from the water and filtered, is colourless, but turns yellow some time. At -80° C. all the arsenic crystallises out of the solution. By evaporation of the solution the modification of arsenic almost free from sulphur is obtained.—R.

*Nitric Acid; Detection of* —, by the Diphenyl Reaction. G. Frerichs. *XXIII.*, page 348.

*Phosphoric Acid; Volumetric Determination of* —. F. Raschig. *XXIII.*, page 350.

*Acids combined with Aluminium; Determination of* —. O. Schmatolla. *XXIII.*, page 349.

*Hydrosulphurous Acid; Formula of* —. A. Berntsen. *V.*, page 329.

*Hydrosulphurous Acid.* M. Bazlen. *V.*, page 329.

*Aldehyde-Sulphurous Acid Salts and Hydrosulphurous Acid; Constitution of* —. K. Reinking, E. Decker, and H. Labhardt. *V.*, page 339.

*Hydrosulphites; Analysis of Solutions of* —, as Formaline. E. Orloff. *XXIII.*, page 348.

#### ENGLISH PATENTS.

*Catalytic Processes [Sulphuric Acid], and Apparatus therefor.* A. von. Grätzel, Hanover. Eng. Pat. Mar. 29, 1904.

A CONTACT mass of granulated ferrosilicon, placed betwixt the poles of a source of electricity, and supported on a perforated plate, within a vertical closed cylinder by the necessary inlets and exits, is sprayed with sulphur dioxide gas, or a mixture of the same with air, is caused to traverse the mass. The oxygen necessary for the production of sulphuric acid is thus provided at least in part, by electrolysis of the water supplied.—S.

*Lime-water and Milk of Lime; Preparation of* —. J. H. Paul, Blackheath, Kent. Eng. Pat. 9265, April 1904.

THE process, which is intended for the preparation of lime-water or milk of lime of definite strengths, consists in treating an aqueous solution of calcium chloride with the equivalent quantity of sodium hydroxide solution.—A.

*Perborates; Manufacture and Production of Metallic* —. G. W. Johnson, London. From the Deutsche und Silber-Scheide Anstalt v. Rössler, Frankfurt-am-Maine, Germany. Eng. Pat. 26,790, Dec. 8, 1904.

TO obtain zinc or magnesium perborate, sodium perboric acid, and a suitable salt of zinc or of magnesium are caused to react on each other, in aqueous solution or suspended in water. Or, sodium perborate may be ground in water together with a salt of zinc or of magnesium. Or, sodium perborate in aqueous suspension may be decomposed by a mineral acid, a solution of a zinc or magnesium salt added, and the perborate precipitated as a caustic soda lye. Or, zinc or magnesium peroxide in aqueous suspension, is ground with boric acid.—E. S.

#### UNITED STATES PATENT.

*Chromates; Process for Making* — [from Chromatone]. R. Suchy, Griesheim, Assignor to C. G. Fabr. Griesheim-Elektron, Frankfurt-on-Maine. Pat. 781,610, March 14, 1904.

SEE Fr. Pat. 334,712 of 1903; this J., 1904, 116.—T. J.

#### FRENCH PATENTS.

*Sulphuric Acid Manufacture; Process for the Production of the Nitric Gases into the Lead Chambers in* —. Soc. Anon. Ing. L. Vogel per la Fabbr. dei Con-



imici. Fr. Pat. 347,415, Oct. 25, 1904. Under  
ternat. Conv., Oct. 27, 1903.

Eng. Pat. 6848 of 1904; this J., 1904, 1088.—T. F. B.

*Hydrated; Apparatus for Making—from Quick-*  
e. J. Reaney, jun. Fr. Pat. 347,401, Oct. 25,  
04.

U.S. Pat. 773,029 of 1904; this J., 1904, 1088.—T. F. B.

*ates and Perchlorates; Electrolytic Manufacture*  
—, P. Corbin. Fr. Pat. 339,251, Dec. 31, 1903.

juvency relates to the manufacture of chlorates  
he electrolysis of neutral alkali chlorides. Resin is  
d in small quantities in the presence of compounds  
etals of the alkaline earths, and, in addition, dilute  
cehloric acid is introduced into the solution during  
intervals in, the electrolytic treatment of the same  
ion.—B. N.

*ides; Purification of —*, Soc. Badische Anilin u.  
Soda Fabrik. Fr. Pat. 347,373, Oct. 24, 1904.

ne cyanides are distilled with a solution of an ammo-  
salt, preferably under diminished pressure, and the  
onium cyanide formed is received in an acid or an  
ine solution, as may be required. For example,  
sium cyanide containing cyanate, is dissolved in  
c to which ammonium chloride is added, and on  
ng, the distillate is received in a solution of sodium  
oxide, the sodium cyanide solution obtained being  
sequently concentrated under diminished pressure.  
e case of crude barium cyanide, this is suspended in  
through which carbon dioxide is passed, and  
onium carbonate is added to the cleared liquid in  
alent proportion. The solution is distilled *in vacuo*  
all the ammonium cyanide has passed over, which  
be received in caustic soda solution.—E. S.

*osulphites; Production of — Dry and quite Stable.*  
e. Badische Anilin und Soda Fabrik. First Addition,  
ted Oct. 25, 1904, to Fr. Pat. 341,718, of March 28,  
14. (This J., 1904, 900.)

n alternative to the process of dehydrating hydro-  
lites, described in the main patent, they are, under  
addition, treated in hot saturated solution with an  
ol, ether, or other liquid, capable of abstracting  
water. For instance, to 3 volumes of 95 per cent.  
ol, at about 70° C., 1 vol. of a saturated sodium  
sulphite solution is added, and the mixture is stirred  
ome time. The deposited salt may be filter-pressed,  
ashed with a volatile liquid and dried in a vacuum.  
—E. S.

*osulphites; Production of — Dry and quite Stable.*  
e. Badische Anilin und Soda Fabrik. Second  
dition, dated Nov. 7, 1904, to Fr. Pat., 341,718, of  
arch 28, 1904. (This J., 1904, 900.)

DES the processes described in the main patent and  
e first addition thereto (see the preceding abstract)  
hydrosulphites may, under the present addition,  
eated, under various specified conditions, with caustic  
is. According to one of the examples given, 100  
e each of concentrated sodium hydrosulphite and  
m hydroxide solutions, are mixed with 30 litres of  
ol at a stated temperature. Hydrosulphite free  
water of crystallisation is quickly deposited and  
be collected by filtration.—E. S.

## I.—GLASS, POTTERY, AND ENAMELS.

### FRENCH PATENT.

*s; Process and Apparatus for Manufacturing —*.  
J. Forster. Fr. Pat. 347,491, Oct. 26, 1904.

Eng. Pat. 20,444 of 1904; this J., 1905, 29.—T. F. B.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

*Portland Cement; Relation between the Solubility of*  
*Calcium Sulphate and the Hydration of Plaster and*  
*of —*, P. Rohland. Z. angew. Chem. 1905, 18;  
327—330.

THE author has shown that the increase of the solution  
pressure, and the acceleration, diminution, and retarda-  
tion of the velocity of hydration stand in close relation  
to one another, and consequently the velocity of hydration  
is dependent upon the size of grain. From the relation  
between size of grain, solubility and velocity of hydra-  
tion, the conclusion can be logically drawn that the  
body to be hydrated must first go into solution, before  
the reactions of hydration can take place.

The size of grain of the dihydrate of calcium sulphate  
is of importance in the case of Portland cement, the rate  
of hydration of which is retarded by this "negative  
catalytic agent." By a number of observations it has  
been shown that for every Portland cement the addition  
of a determinate quantity of gypsum is necessary to  
reduce the rate of hydration to a desired amount, so that  
almost every Portland cement in this respect behaves  
individually—the reason depending upon the constitution  
of the cement, which again influences the solubility.

Since both the hemihydrate and the anhydrous modifi-  
cation of gypsum first go into solution before the hydrating  
reaction occurs, it must be concluded that from time to  
time before the solution product is reached, hydrating  
molecules exist in the solution.

Jones and Getmann state that since hydrates form in  
concentrated solutions, a portion of the solvent combines  
with the dissolved substance, and that such solutions  
therefore are more concentrated than they would appear  
to be from the amount of dissolved substance; further  
that those bodies which crystallise with the largest  
crystal masses, combine probably under otherwise similar  
conditions in solution with the largest amounts of water;  
and finally that the hydrates in solution at higher tempera-  
tures must be unstable, so that for their formation a  
greater concentration is necessary.

It may be noted that calcium sulphate attains a maxi-  
mum solubility in dilute solutions of electrolytes such  
as sodium chloride, magnesium chloride, sulphuric acid, &c.  
which N. Orlow explains by the formation of complexions.  
The author has established the fact that the maximum  
solubility of gypsum in the solutions mentioned corres-  
ponds with the maximum rate of hydration; in pure  
water, also, between 35°—40° C., the maximum amount  
of solubility corresponds with the maximum rate of  
hydration.—W. C. H.

### ENGLISH PATENTS.

*Firebricks, Crucibles, Refractory Substances and the like*  
*[from Clay]; Manufacture of —*, D. B. Williams,  
Washington, and J. R. Stauffer, Scottsdale, Pa., U.S.A.  
Eng. Pat. 27,991, Dec. 21, 1904.

SEE U.S. Pat. 779,195 of 1905; this J., 1905, 136.—T. F. B.

*Grinding Wheels and the like [from Clay]; Manufacture*  
*of —*, D. B. Williams, Washington, and J. R.  
Stauffer, Scottsdale, Pa., U.S.A. Eng. Pat. 27,992,  
Dec. 21, 1904.

SEE U.S. Pat. 779,196 of 1905; this J., 1905, 136.—T. F. B.

*[Cement] Kilns; Rotary —*, T. Don, Upper Beeding,  
Sussex. Eng. Pat. 8973, April 19, 1904.

IN order to tighten up each ring of firebrick lining, iron  
keys or wedges are inserted between two or more blocks,  
and by means of a screw and yoke resting on the bricks,  
the wedges are drawn towards the centre of the kiln and  
the space behind the wedge packed with, say, metal or fire-  
brick. A portable arch piece is employed to temporarily  
support the firebricks which form the upper portion of  
each ring of the lining, and is provided with wedges or  
screws by which the blocks can be thrust into position and  
retained there until the whole ring is tightened up. Strips  
or plates of metal are inserted between the blocks, and

extend beyond them radially into the kiln, forming a series of points to which the lining of cement clinker can be fastened. To repair thin portions of this lining of clinker, finely-divided iron or steel filings may be employed, and can be introduced into the kiln while hot, by a shovel, or by being blown in through a tube.—W. C. H.

*Cement; Manufacture of* — [from Slag]. B. Grau, Kratzwieck, Germany. Eng. Pat. 10,170, May 3, 1904. SEE Fr. Pat. 343,152 of 1904; this J., 1904, 985.—T. F. B.

#### FRENCH PATENTS.

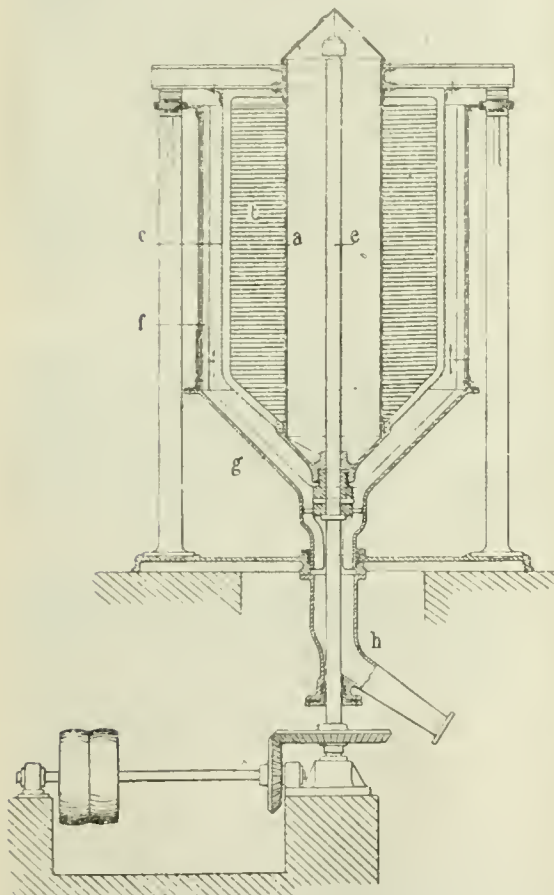
*Wood, Fibrous and Porous Materials, &c; Solution for the Treatment of* —. T. Gare. Fr. Pat. 347,455, Oct. 27, 1904. Under Internat. Conv., Nov. 3, 1903.

SEE Eng. Pat. 23,786 of 1903; this J., 1904, 1148.—T. F. B.

*Emery; Process for Making Artificial* —. A. Gacon. First Addition, dated Oct. 31, 1904, to Fr. Pat. 332,770, June 4, 1903.

SEE Eng. Pat. 23,492 of 1904; this J., 1905, 92.—T. F. B.

*Rocks, Kaolin-containing and other; Method and Apparatus for Decomposing* —, by Washing and Separating their Constituents. R. Frugier. First Addition of Nov. 8, 1904, to Fr. Pat. 336,490, of Nov. 9, 1903.



THE rock to be treated is fed into the annular space *t*, and there is subjected to the action of the water, which is introduced through the pipe *h*, which also serves for the removal of the separated sand, which passes through the lattice-work *c* surrounding the rock. To assist the action, the outer vessel *g* revolves at varying speed around the axle *e*; or else this outer vessel is fixed, and a vertical agitator rotates around the axle in the space outside the lattice-work.—A. G. L.

#### X.—METALLURGY.

*Steel; Structure of Hardened* —. I. Reagen. Distinguishing the Different Phases. W. Kur. J. russ. phys.-chem. Ges., 1905, 36, 1524—1539. Centr., 1905, 1, 839.

THE author has studied the behaviour as etching agents solutions of nitric, hydrochloric and picric acid on different fatty alcohols, with and without addition of organic nitro compounds. The results obtained show the difference between austenite and martensite, and other fine differences of microstructure can be defined by using the following solutions as etching agents:—(1) A 4 per cent. solution of nitric acid in cumyl isoamyl alcohol; (2) a mixture of one part of solution (1) with three parts of a saturated solution of nitric acid in acetic anhydride; (3) a mixture of three parts of solution (1) with one part of a saturated solution of nitric acid in acetic anhydride; (4) a mixture of one part each of solution (1) with one part of a saturated solution of nitric acid in acetic anhydride.—A. S.

*Ammonia-Copper Cyanide Process; Note on the* —. H. L. Sulman. Inst. of Min. and Metall., March 10, 1905.

ALKALI cyanides mixed with certain quantities of ammonia and a cupric salt are amongst the most rapid and efficient solvents of gold, when freshly prepared; the reaction depending initially upon the instability of cupric cyanide. If therefore potassium cyanide solution together with a working excess of ammonia be added to an ore containing a sufficient amount of cupric salt to saturate the former, it will, while liberating some cyanogen, become a compound of the cuprammonium cyanide type, and are capable of yielding further supplies of nascent cyanogen available for dissolving gold, until the final stage, marked by the appearance of small bright green acicular crystals of ammonium di-cuproso-cupric cyanide having composition  $4\text{NH}_3 \cdot 2\text{Cu}_2(\text{CN})_2 \cdot \text{Cu}(\text{CN})_2$ , insoluble in cold water and but slightly soluble in dilute ammonia. (See also this J., 1905, 199.)—J. H. C.

*Gold Slimes; Fluxing of* —. C. E. Meyer. J. Metall. and Mining Soc., S. Africa, 1905, 5, 168—169.

THE author has effected considerable improvement in the amount of flux required, and the proportion of gold recovered from gold slimes, by using a flux of borax and manganese dioxide. Analysis of the slimes shows they contained rather more than enough silica to form a silicate, with formation of the silicate. The excess of silica rendered the slag more fluid. Two per cent. of borax was found to be sufficient to flux the oxides, 17 per cent. being mixed with the slime, and a remaining 3 per cent. added as a cover. An addition of 2 per cent. of manganese dioxide was found to effect an improvement in the fineness of the resulting bar of gold. It is recommended that the slimes be carefully purified with a view of obtaining, as far as possible, a product of constant composition, and that in particular, the sulphates be completely removed.—A. S.

*Aluminium as an Antidote in Acute and Chronic Mercurialism [also Detection of Mercury]*. N. Tarugi. chim. ital., 1905, 34, 486—492. Chem. Centr., 1905, 1, 757—758.

BY the action of mercury vapour on metallic aluminium an aluminium amalgam is formed, and the reaction may serve as an extremely sensitive test for mercury. A solution of 1 part of mercuric chloride in 1000 parts of water is acidulated with dilute sulphuric acid, the solution is boiled for about 10 minutes in contact with a spiral of aluminium wire, and the latter then withdrawn, with filter paper, and exposed to the air, the characteristic coating of aluminium amalgam can be perceived. It is stated that 0.0001 mgrm. of mercury can be detected in this manner. Aluminium amalgam can be heated to 200° C. in presence of metallic aluminium, without the escape of mercury vapour.

THIS action of aluminium in fixing mercury may be applied for the purpose of preventing the injurious effects of mercury vapour.



reury vapours in mines, &c. The author has a respirator (patented in Italy, Austria and Spain) in which the air charged with mercury is caused to pass through layers of aluminium gauze before being breathed.

—A. S.

*Cobalt and Nickel; Physical Characters of Pure* —. Copaux. *Comptes rend.*, 1905, 140, 657—659.

The author has carefully prepared and fused pure cobalt metal, containing not more than 0.025 to 0.05 per cent of non-metallic impurities, and determined some of the physical constants of the metals. His results, along with previously accepted figures, are as follows:—

	Observed Values.		Former Figures.		Units.
	Cobalt.	Nickel.	Cobalt.	Nickel.	
gravity at 15° C.....	8.8	8.8	7.96—9.5	8.3—9.2	Water at 4° C.=1
point.....	5.5	3.5	—	—	Mohs' scale.
heat (20°—100° C.).....	1530° C.	1470° C.	1600°—1800°	1480°	
resistance at 0° C.....	0.104	0.103	0.103	0.103	Water at 15° C.=1
expansion, 0—20° C.....	5.5	6.4	—	6.9	Microhms.—cm.
stress.....	0.0055	0.0061	—	0.0061	
	50	42	115	90—35	Kilos. per sq. mm.

—J. T. D.

*Adsorption in* —. W. H. Weed. *Eng. and Mining J.*, 1905, 79, 364.

The author refers to the discovery by E. Kohler (*Z. prakt.*, 1903, 49) that colloidal substances, such as clays, possess the power of extracting metals from very dilute solutions. For example, if a 1 per cent. aqueous solution of cuprammonium sulphate be passed through a filter coated with kaolin, the copper is retained in the form of copper oxide by the filter, whilst the filtrate contains ammonium sulphate. This power of "adsorption" by clays is considered by Kohler to account for the position of ore in clayey ore-bodies such as the bearing limestone of Commern, Germany, and the bearing sandstone of Freihung. The author points out that his theory may also throw some light on the occurrence of "silver" in the kaolins of the Broken Hill silver mine, and also on the association of specially rich copper ores with clays in many copper mines. In some experiments with copper solutions, it was found that 90 per cent. of the copper could be extracted by means of crushed kaolin.

*Fluoride Ores; Comparison of the Wet and Crucible Methods for the Assay of* — with Notes on the Results occurring in the Operations of Fire Assay and Smelting. W. F. Hillebrand and E. T. Allen. *XXIII.*, 1904, 349.

*Separation and Parting in [Gold] Ore Assaying* —. T. Kirke Roscoe. *XXIII.*, page 349.

*Some Applications of Metallic* —. E. Beckmann. *XXIV.*, page 354.

#### ENGLISH PATENTS.

*Iron, Ingot Steel, and the like; Deoxidation of* —. J. Imray. London. From the Soc. Anon. pour l'industrie de l'Aluminium, Neuhausen, Switzerland. *Eng. Pat.* 10,902, May 11th, 1904.

Molten metal is run into a second furnace, electric or otherwise, and cooled down until the oxidation products are separated. It is then heated up under a neutral atmosphere, the further necessary ingredients such as carbon, manganese, silicon, chromium, &c., being added before being cast into ingots.—J. H. C.

*Improved* — [for Electric Conducting Wires]. *Process for Manufacturing the same.* W. P. Simpson. London. From U. T. fu Carlo, F. F. di Tito, Pollak and Rothschild, Paris. *Eng. Pat.* 19,251, *St. 6*, 1904.

The alloy consists of copper, preferably electrolytic, 95 kilos.; silver, 800 to 1000, 0.2 to 0.3 kilos.; manganese, 0.6 to 1.5 kilos.; aluminium, 4.8 to 10 kilos.; amorphous phosphorus 0.005 to 0.015 kilo. The temperature of fusion of the components is about

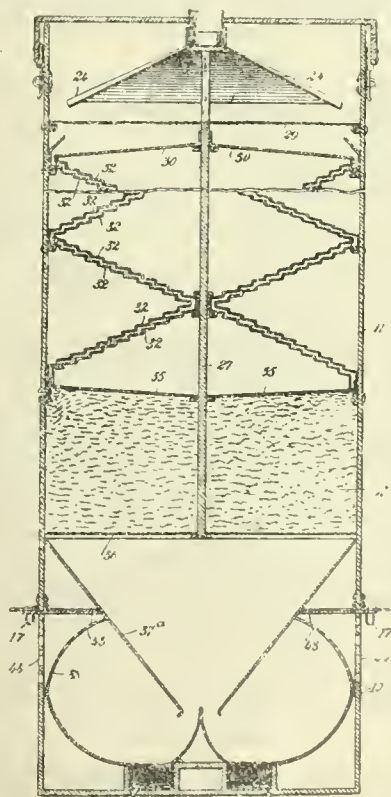
1100° C., that of the alloy is lower. The copper is melted first in a crucible, the ingots of manganese having been heated are then added, next the phosphorus previously combined with a portion of the copper is wrapped in paper and placed in a cap or cover over the molten copper so that when the paper burns it may fall into the molten copper, and finally the silver, which has been alloyed with the aluminium, is added.—J. H. C.

*Furnaces; Impts. in Reverberatory* —. M. Drojecki, Stawachowice, Russian Poland. *Eng. Pat.* 25,796, *Nov. 26*, 1904.

The furnace is divided above the hearth bottom by one or

more partitions extending from one side-wall to the other, and built of, or covered with non-conducting material, whereby the flame is prevented from spreading over the arch and compelled to pass beneath the partition, so producing a prolongation of its path, widening of the combustion zone, and consequent increased utilisation of heat, with better protection of the arch. The partitions may be water-cooled.—J. H. C.

*Amalgamators; Impts. in* —. B. A. Langridge, Boulder, Colo., U.S.A. *Eng. Pat.* 28,490, *Dec. 27*, 1904.



The apparatus is formed of a body section 11, divided into two compartments by the partition 27, and a base section 10, fastened together by locks on the staples 17. The ore pulp is fed on to the spreader-plate 24, which

distributes it over the perforated plate 29, through which it falls first on to the amalgamated copper plates 30, and then through the amalgamated copper riffles 32. The pulp then passes through the amalgamated, soft-annealed copper shavings 37, held between the perforated copper plates 35 and 36, and finally through a trap formed of the funnel 37a, and the bowl 38, the latter and the basin section 10 being provided with overflow outlets 43 and 44 respectively.—A. S.

#### UNITED STATES PATENTS.

*Iron : Process of Hardening* ——. F. L. Ramon, Assignor to P. D. Bailey, San Francisco, Cal. U.S. Pat. 784,124, March 7, 1905.

AN alloy of iron and aluminium is produced by heating the two metals together to a white heat, a small quantity of sulphur is added, and the whole is fused.—A. S.

*Iron and Steel : Manufacture of* ——. J. H. Hudson, Philadelphia. U.S. Pat. 785,002, March 14, 1905.

AN improved method of manufacturing iron and steel is claimed, which consists in placing "a combined charge of charcoal and the material to form the metal upon the hearth" of a reverberatory furnace, where it is melted by the aid of an air-blast, and then maintained at a boiling temperature until sufficiently refined. Suitable fuel is added from time to time as may be found necessary.—J. H. C.

*Copper : Process of Extracting* — from Ores. G. H. Waterbury, Denver, Colo., Assignor to the Waterbury Metals Extraction Co., Spokane, Wash. U.S. Pat. 783,700, Feb. 28, 1905.

AFTER suitable pulverisation, the ore is placed in a tank containing a solution saturated with sulphurous acid, and containing a comparatively small quantity of sulphuric acid and agitated with air and steam. The solution thus obtained is drawn off into a precipitation-tank containing "metal" in a sufficiently divided condition to allow of the circulation of the solution, and is there treated with air and steam.—J. H. C.

*De-Tinning ; Process of* ——. F. V. Kugelgen and G. O. Seward, Holcombs Rock, Va. Assignors to the Willson Aluminium Co., New York. U.S. Pat. 783,726, Feb. 28, 1905.

TINNED metal is treated with anhydrous liquid stannic chloride containing dissolved dry chlorine in excess of that necessary to convert the tin into stannic chloride.—J. H. C.

*Ore : Method of Smelting*. R. Baggaley, Pittsburg, Pa. U.S. Pat. 784,651, March 14, 1905.

THE ore is charged on to a molten body of matte in a blast furnace or converter; air is then blown into the bath, the slag formed is removed from time to time, and fresh ore added as may be required.—J. H. C.

*Minerals ; Apparatus for Separating and Concentrating* ——. G. A. Gwyder and E. Laughton, Adelaide, South Australia. U.S. Pat. 784,999, March 14, 1904.

SEE Eng. Pat. 16,839 of 1903; this J., 1903, 1133.—T. F. B.

*Furnace ; Ore-Roasting*. H. M. Heath, G. Morrice, and P. L. J. Grass, Assignors to F. W. McAleer, Newton, Mass. U.S. Pat. 785,067, March 14, 1905.

AN oxidising-flue of zig-zag form and open at its upper end, where it receives the ore to be treated, is placed between two heating-flues, which communicate with each other at many points, their temperature being maintained by a combustion chamber. Oxygen generated in a separate vessel is supplied to the ore as it descends the oxidising-flue.—J. H. C.

#### FRENCH PATENTS.

*Minerals ; Process for Concentrating* ——. Minerals Separation, Ltd. Fr. Pat. 347,254, Oct. 20, 1901.

SEE Eng. Pat. 17,109 of 1903; this J., 1904, 902.—T. F. B.

*Furnace ; Crucible* ——. M. Harvey. Fr. Pat. 347,600, Nov. 2, 1904. Under Internat. Conv., Nov. 4, 1903.

SEE Eng. Pat. 23,903 of 1903; this J., 1904, 753.—T. F. B.

*Copper and its Alloys ; Process for Soldering* ——. Anon. L'Acétylène Dissous du Sud-Est. F. Pat. 347,608, Nov. 2, 1904.

THE pieces to be soldered are heated to a temperature slightly below the fusing point of copper, and, by the flame from an oxyhydrogen or oxy-acetylene pipe, a portion of a suitable metal or alloy, more than copper, is fused upon the joint, the heat causing superficial fusion of the copper and contact with soldering metal without attack of the former by it. The soldering metal recommended, is copper containing a certain proportion of copper phosphide with or without tin phosphide.—E. S.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A.)—ELECTRO-CHEMISTRY.

*Platinum ; Electrolytic Solution of* —, in Sulphuric Acid. A. Brochet and J. Petit. Comptes rend. Acad. Sci. Paris, 140, 655—657.

THE results of the authors' experiments show that (1) a current of varying intensity causes the solution of platinum in sulphuric acid; (2) an alternating current has no specific action as such, due to change of direction; (3) when the solution contains no oxidising agent, the solution of metal at the anode is exactly equivalent to the deposition at the cathode; (4) an oxidising agent does not produce a higher oxide of platinum, the solution of the metal; it simply prevents the reduction of the platinum, becoming itself reduced, and the metal remains dissolved, at least till its concentration reaches a certain limit; (5) if a continuous current is superimposed upon an alternating current, the rate of dissolution from the (continuous) anode, and deposition on the (continuous) cathode. The resultant effect of alternating current is zero, and the uniform corrosion current behaves as though it were a variable current.—J. T. D.

*Chlorates and Perchlorates ; Electrolytic Manufacture of* ——. P. Corbin. VII., page 333.

*Arsenic ; Production of Yellow* —, by means of the Electric Arc. A. Stock and W. Siebert. VII., page 333.

### ENGLISH PATENTS.

[Foods, Flour, Milk]; [Electrical] Process and Apparatus for Bleaching or Sterilising ——. S. Leatham. Eng. Pat. 5790, March 9, 1904. XVIII. A., page 333.

Flour; [Electrical] Treatment of ——. E. Shaw. Eng. Pat. 9703, April 28, 1904. XVIII. A., page 333.

Catalytic Processes, and Apparatus therefor. Grätzel. Eng. Pat. 7452, March 29, 1904. VII., page 333.

Peat Fuel; Manufacture of — [Electrically]. Bessey. Eng. Pat. 17,497, Aug. 11, 1904. II., page 333.

Alloy; Improved — [for Electric Conducting &c.], and Process for Manufacturing the same. Thompson. From U. T. fu Carlo, F. F. di T. Pollak and Rothschild. Eng. Pat. 19,251, Sept. 1, 1904. X., page 333.

### UNITED STATES PATENT.

*Electrolysis ; Apparatus for Effecting* ——. H. Wyandotte, Mich. U.S. Pat. 784,592, Mar. 14, 1905.

THE apparatus consists of a vessel having a non-conducting trough extending spirally from the bottom, and attached to the inner face of the outer wall; a feed-opening communicating with the upper end of the trough, and an outlet, provided with "a specific gravity valve," leading from the lower end. Mercury is supplied to the trough, which is maintained at a certain level by an overhanging covered portion at its lower end, and



closes the outlet when mercury ceases to flow, preventing the escape of electrolyte. The latter is applied by suitable means to the trough. Within the is a removable, hollow compartment acting as the a, this being composed of a series of carbon blocks aces, of sufficient dimensions when fitted together run a hollow cylinder within the turns of the spiral h, and the staves are held in position by rivetted lie hands or hoops, the latter being provided with to which the positive terminal is attached. The ive terminals pass through the outer wall of the l, and terminate at suitable intervals on the inner on the level of the bottom of the trough. The e anode is provided in its upper portion with a flange enters a trough in the cover of the vessel. The is also provided with a flange which enters a marginal h formed on the upper edge of the outer vessel.

—B. N.

FRENCH PATENTS.

of Electric Furnaces; Cooling Wings for —. F. Bourgeois. Fr. Pat. 347,398, Jan. 6, 1904.

inding pieces, for connecting the terminals of the t with the electrodes of electric furnaces, are hed with small wings or projecting pieces, inlaid or n to the binding posts, in order to obtain a great g surface, and therefore a great loss of heat by ion.—B. N.

ulator] Plates of Lead Peroxide; Process for paring — by Immersion [in Sulphuric Acid]. äegenberg. Fr. Pat. 347,297, Oct. 12, 1904.

ng. Pat. 21,913 of 1904; this J., 1904, 1223.—T.F.B.

; [Electrical] Method of Preparing — for Rapid ing. R. Berthon. Fr. Pat. 347,315, Oct. 22, b. XIV., page 339.

(B).—ELECTRO-METALLURGY.

Kjellin's Process for the Electrical Production of V. Engelhardt. Stahl u. Eisen, 1905, 25, 148—205—212, 272—278.

uthor describes the Kjellin electric furnace and ethod of working it, and gives results which have obtained with this process for the electrical pro-a of steel. He then makes a comparison between ellin process on the one hand and other methods ufacturing steel on the other. For the production l of special quality the Kjellin process is quite as t as the crucible method, and is also cheaper, the melting and of crucibles being at least 20—40 M. of steel by the crucible method as compared with 18—22 M. by the Kjellin process (the cost of electric being taken as 2 pfg. per k.-w.-hour).

, with regard to the production of Martin steel, the process appears to be quite capable of competing e Siemens-Martin furnace. The cost with the Martin is from 75—80 M. per ton of steel by the basic and 85—88 M. by the acid process. With a Kjellin of 736 k.w. capacity, the cost per ton of steel is in the following table:—

	cold cold 30 tons	molten cold 30 tons
energy, reckoning at 2 pfg. per k.-w. with a consumption of 0.6 k.-w.-hour		
do. when cold pig iron is used, and of k.-w.-hour with molten iron	12.00	10.00
s. of pig iron at 55 M. per ton	13.75	13.75
s. of iron scrap at 45 M. per ton	35.55	35.55
of ferro-silicon at 115 M. per ton	1.38	1.38
of ferro-silicon at 115 M. per ton	1.48	1.23
lining	0.18	0.15
materials	0.43	0.36
and amortisation	1.14	1.14
	1.30	1.00
	1.21	1.00
	3.00	2.50
Total	71.42	68.06

to this J., 1904, 258, 904; 1905, 33.)—A. S.

UNITED STATES PATENTS.

Electroplating Device. G. W. Clough, Cleveland, Ohio. U.S. Pat. 784,034, March 7, 1905.

A HOLLOW rotating cylinder of insulating material, such as wood, is carried by a metal shaft, which is mounted on the end walls of the electroplating bath. The anodes are electrically connected with the shaft, and extend downwards into the electrolyte. There is "a continuous metal flange spirally wound upon the inner surface of the cylinder," and projecting at one end to form a mouth for the introduction of the material to be plated. The flange, which acts as a carrier for the material, and also forms the cathode, is electrically connected with a metal band on the outer surface of the cylinder.—A. S.

Cyanide Treatment; Apparatus for —. E. L. Oliver, Oakland, Cal., Assignor to A. De Wint Foote, Grass Valley, Cal. U.S. Pat. 784,120, March 7, 1905.

THE apparatus is for the treatment of materials containing gold and silver, and comprises a tank, in which is a pipe opening directly into the upper portion thereof. The lower portion of the pipe communicates with the lower portion of the tank, and is connected, outside the tank, to a source of compressed air. Anodes and cathodes are arranged within the tank, the cathodes consisting of amalgamated plates, with which electrical connection is made by means of troughs containing mercury, into which metallic arms extending from the cathode plates dip, in such a manner that the mercury can flow freely over them.—A. S.

Metals; Extracting —, from Ores by Electricity. E. L. Priest, Oakland, Cal. U.S. Pat. 784,885, March 14, 1905.

THE ore in a comminuted condition is made into a coherent mass, and associated with a consumable electric conductor which is capable of reducing the ore. An electric arc is established and maintained between this body and a liquid electrode.—B. N.

FRENCH PATENTS.

Steel; Electro-Metallurgical Process for Manufacturing —. Soc. Electro-Métall. Française. Fourth Addition, dated Aug. 26, 1904, to Fr. Pat. 328,350, Jan. 7, 1903.

SEE Eng. Pat. 25,948, of 1904; this J., 1905, 243.—T. F. B.

Aluminium; Process for Electro-depositing Metals upon —. J. Creswick and H. Shaw. Fr. Pat. 347,239, Oct. 20, 1904.

SEE Eng. Pat. 21,609 of 1903; this J., 1904, 904.—T. F. B.

Sulphides, Arsenides and Antimonides; Treatment of Metallic —. N. H. M. Dekker. First Addition, of Oct. 22, 1904, to Fr. Pat. 345,834, of Aug. 13, 1904.

THE ore is treated electrolytically in a rotating vessel containing a number of vertical electrodes, which are alternately connected to the positive and negative poles. The object of the rotation is to cause the sulphides, &c., to pass continually in a thin layer over the surface of the electrodes. Contact with these is made by brushes outside the vessel. The liquid serving as electrolyte is led in by tubes passing through the axle-supports, on which the vessel rotates. These tubes are fixed and terminate above the level of the liquid inside the vessel.—A. G. L.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Oils, Lubricating; Testing the Behaviour of — in the Cold. R. Hackel. XXIII., page 352.

Palm Oil; Detection of — when used as a Colouring Material in Oils and Fats. C. A. Crampton and F. D. Simons. XXIII., page 351.

## ENGLISH PATENT.

*Oil from Cod Livers and the like: Means for and Process of Extracting* — W. R. Harrison, Kingston-upon-Hull, E. H. Wild, Barton-upon-Humber, and A. Robb, Kingston-upon-Hull. Eng. Pat. 25,683, Nov. 23, 1904.

THE oil is extracted from the livers in a jacketed vacuum pan, provided with agitators, and heated by means of steam, hot air or the like to a temperature of about 90° F. The oil outlet of the vacuum pan is connected to a vacuum filter, through which the oil passes to suitable tanks. Contact of the oil with the air is avoided as far as possible by exhausting the air from the tanks, or by filling them with water which is subsequently displaced by the incoming oil. The tanks of oil are placed in a refrigerating chamber, the stearine removed by settling and by means of a filter-press, and the oil is finally passed through any suitable filtering and brightening apparatus. The residue left in the vacuum pan is subjected to pressure to recover any oil contained in it.—A. S.

## UNITED STATES PATENTS.

*Fatty Edible Preparations*, J. E. Bloom. U.S. Pat. 782,820, Feb. 21, 1905. XVIII. A., page 341.

*Oils for Edible or other Purposes [resembling Human Fat]: Process of Preparing* — J. E. Bloom. U.S. Pat. 782,821, Feb. 21, 1905, XVIII. A., page 341.

## FRENCH PATENTS.

*Grease [from Waste]; Centrifugal Machine for Extracting* — Oil and Waste Saving Machine Co. Fr. Pat. 347,408, Oct. 25, 1904.

SEE U.S. Pat. 773,220 of 1904; this J., 1904, 1079.—T. F. B.

*Soap; Process and Apparatus for Rapid Moulding of* — F. Holonbek. Fr. Pat. 347,585, Oct. 31, 1904.

THE hot liquid soap is conducted into moulds which are open at the sides, the chambers being completed by refrigerating boxes through which passes a current of cold water. The moulds and refrigerating boxes are packed in alternate vertical layers so as to form a battery, which rests on a movable carriage. Claim is also made for a horizontal channel for the introduction of the soap, this being formed by connecting corresponding extensions at the top of each mould and cooling box. A vertical pipe from this communicates with the interior of each mould.—C. A. M.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

## (A).—PIGMENTS, PAINTS.

*Barytes; Bleaching [Decolorising]* — E. Higgins, jun. Eng. and Mining J., 1905, 79, 465; from Eng. News, Feb. 23, 1905.

THE crushed barytes ore is washed and then treated with sulphuric acid of 20°–30° B. in circular wooden tanks lined with sheet lead. A tank 4.5 ft. high and 8 ft. in diameter will contain about 14 tons of the crushed mineral when charged to a height of 3.5 ft. Each tank is provided with a coil of 1.5- or 2-in. lead pipe, closed at the end and provided with perforations; this coil can be connected at will with a supply of water or steam. The cost of heating and agitating the mixture of ore and acid may be considerably reduced by forcing in, by means of an injector, a mixture of air and steam instead of steam alone; the temperature is maintained at about 200° F. (93° C.). The mineral freed from discolouring iron compounds by this treatment, is washed free from acid and particles of clay, dried, and ground first by rolls and then by burr-stones. The "bleaching" is finished as a rule in 24 hours, and from 30–40 tons of the barytes (barium sulphate) can be milled in 24 hours by 12 burr-stones of 3.5 ft. diam. Barytes ore containing manganese

dioxide is ground, mixed with sodium nitrate, and sulphuric acid, heated in a furnace, and the product purified by washing and settling. *Blanc fixe* is produced by mixing finely-ground barytes with one-fourth volume of coal, heating the mixture to a high temperature, treating the product with water and precipitating barium sulphate from the filtered solution by the addition of sulphuric acid.—A. S.

## UNITED STATES PATENT.

*White Lead; Process of Manufacturing* — Rowley and J. H. Montgomery, Assignors to Shaughnessy, all of St. Louis, Mo. U.S. Pat. 782,820, March 14, 1905.

MOLTEN lead is atomised and oxidised, and the laden particles are subjected to the oxidising action of moisture in a closed chamber, in which they are treated with jets of water. The particles are then ground in water, and the liquid is stirred to prevent setting. The material is subjected to the action of carbon dioxide gas, to produce lead carbonate.—E. S.

## FRENCH PATENTS.

*Monazo Dyestuff [Azo Dyestuff]; Production of Red specially suitable for the Manufacture of Lakes*. Br. Pat. 213,411, Anilin und Soda Fabr. Addition to Fr. Pat. 347,408, Sept. 2, 1904. IV., page 329.

*White Lead Pigment; New —, and Process of Manufacturing the same*. Gebr. Heyl and Co., G. I. and A. Wultze. Fr. Pat. 347,311, Oct. 21, 1904. Internat. Conv., June 11, 1904.

THE new pigment is produced by treating a dilute solution of normal lead acetate with carbon dioxide under pressure. It contains on the average 16 per cent. of carbon dioxide, and thus consists almost entirely of normal lead carbonate. It is claimed to be superior in quality and covering power to ordinary white lead.—A. S.

### XIV.—TANNING, LEATHER, GLUE, SIE.

*Albumin Compounds; Hydrolysis of* — II. C. Zdz. H. Skraup. Monatsh. f. Chem., 1905, 26, 243.

SOME time ago the author discovered certain amino acids, such as diaminoglutaric, diaminoadipic and others among the products of the hydrolysis of gelatin by concentrated hydrochloric acid. He has now hydrolysed gelatin under similar conditions, and the following differences in the products of hydrolysis of casein and gelatin, besides those already known; casein and caseinic acids which are produced from casein in considerable quantity, as well as diaminohydroxyphenylacetic and hydroxyaminosuccinic acids could not be obtained from gelatin. Diaminoglutaric acid, on the other hand, is contained in gelatin in far greater quantity than in casein. Gelatin also yielded a new acid  $C_{12}H_{25}N_5O_4$  obtainable from casein and termed by the author "Leimsäure." The author attributes these results to which some alterations in the mode of working are due, to differences in the constitution of gelatin and casein. The hydrolysis was carried out by treating gelatin for 12 days with dilute hydrochloric acid at 100° until the specific rotation became constant. The solution was then subjected to fractional precipitation with phosphotungstic acid; the crystals obtained differed widely from the analogous kyrine precipitates from casein. By isolating glutaminic and similar acids from the filtrate liquor as hydrochlorides, cupric salts were formed, these divided into fractions by precipitation with ammonia. The cupric salt from gelatin which would correspond to the caseinic acid fraction of casein contained much glycocoll.—R. L.

## UNITED STATES PATENT.

*Agar-agar; Process for Manufacturing Limpid Solution of —, and Product of same*. W. Riebenschalm, et al. U.S. Pat. 784,349, March 7, 1905.

BY boiling agar-agar under pressure with a dilute acid



ion of an organic acid (e.g., citric acid), allowing to and filtering, a limpid solution is obtained, which sets stiff jelly on cooling. The weight of organic acid used should not exceed 1.5 per cent. of the weight of agar-agar to be dissolved.—T. F. B.

#### FRENCH PATENTS.

*ing Materials; Digester for the Extraction of —.* met, Spazin et Cie. Fr. Pat. 347 589, Oct. 31, 1904.

vegetable matter is charged into a large open or closed stion vessel, and is extracted by a heated liquid is kept in continual circulation. The liquid is rawn from the bottom of the vessel by means of a ejector, which forces it up an external pipe and rs it again at the top of the extraction vessel. The of the heat required for extraction is derived from eam jet of the ejector.—J. F. B.

*Method of Preparing —, for Rapid Tanning.* R. Berthon. Fr. Pat. 347,315, Oct. 22, 1904.

skins previous to being tanned are immersed in a solution and subjected to the action of an alter- electric current. For strong leather, a solution of a sulphate or phosphate is used, whilst for lighter e kinds of leather the electrolyte is a solution of a chloride acidulated with sulphuric acid.—A. S.

#### XV.—MANURES, Etc.

*en Compounds; Comparative Assimilability of in —.* L. Lütz. Comptes rend., 1904, 140, —667.

uthor has previously shown that the assimilability of amines is inversely as their molecular weights, no such rule is discoverable in the case of amides, trites are hardly assimilable at all. He now finds f all nitrogen compounds, amides are the most assimilated; amines occupy the second place, trites the third. The simplest molecule is thus the ource of nitrogen for plants.—J. T. D.

*te-Cellulose Lyes; Utilisation of Waste — s Manure.* F. B. Ahrens. XIX., page 343.

#### ENGLISH PATENTS.

*Coating —, with Germinating Substances.* A. ioult, London. From A. Re, Rome. Eng. Pat. , Feb. 13, 1904.

are coated in a rotary pill-coating machine with a e fertilising mixture, the ingredients of which may ided according to the character of the soil in which p is to be grown. A suitable mixture for general es is composed as follows:—"Vegetable earth," 3.3 calcium carbonate, 30; potassium carbonate, 8; s slag, 7; copper sulphate, 2; quick-lime, 2; a sulphate, 2.5; glue, 1; ammonium carbonate, ed, 12.5 parts.—J. F. B.

*ier; Process and Apparatus for the Production ew Chemical —.* X. M. Roux, Paris, and . Gonin, London. Eng. Pat. 6920, March 22, 1904.

anure, which is called "humate of calcium phos-" is prepared by mixing humus (three parts) with a phosphate (one part), the two constituents being ed to the mixing machine by means of a funnel is provided with a partition so as to form two com- nts of the desired sizes.—N. H. J. M.

*ers; Production of —, and Process of and Appa- e for the Recovery of Ammonia from Gases from Process of Manufacture.* X. M. Roux, Paris, and . Gonin, London. Eng. Pat. 6921, March 22, 1904.

ases containing ammonia are passed through a er in which peat, which has been previously treated a alkali, is suspended in wire baskets. The peat is

stated to absorb the ammonia and to be converted into a nitrigenised substance.—N. H. J. M.

*Humus for Fertilising Purposes; Process for the Treatment of —.* X. M. Roux, Paris, and B. W. Gonin, London. Eng. Pat. 6922, March 22, 1904.

THE manure, "humate of ammonia," is prepared by spraying a predetermined amount of humus, with the maximum amount of water, containing an alkali in solution, which the humus will absorb.—N. H. J. M.

#### FRENCH PATENT.

*Calcium Orthophosphate, Mono, [Fertiliser]; Preparation of —.* E. Burleigh and A. J. King. Fr. Pat. 347,307, Oct. 21, 1904.

CALCIUM phosphate, which may contain calcium carbonate, is treated with sufficient orthophosphoric acid to form monocalcium orthophosphate. The magna is dried and powdered for application as a manure. The phosphoric acid used may be obtained by treating calcium phosphate with sulphuric acid, and concentrating the solution, separated from the calcium sulphate formed.—E. S.

#### XVI.—SUGAR, STARCH, GUM, Etc.

*Sugar in Solution; Decomposition of — by Heat.* O. Molenda. Oesterr.-ungar. Z. Zuckerind., 1904, 33, 862. Bull. Assoc. Chim. Sucr. et Dist., 1905, 22, 712—714.

EXPERIMENTS with a faintly alkaline solution of pure sugar, containing only a small quantity of invert sugar, showed that there is no notable decomposition of sugar in consequence of superheating by contact with the heating surface. The loss of sugar due to decomposition is independent of the heating surface and of the temperature of the heating agent (steam), if other conditions are the same, that is, in the case of equal quantities of sugar solution at equal initial concentrations, boiled under equal vacuum to the same final concentration, the temperature of ebullition and the duration of boiling being also the same. In evaporating a definite amount of water from a sugar solution under a given vacuum, the loss of sugar decreases with the duration of boiling, or, in other words, the loss of sugar diminishes as the temperature of the steam and the area of the heating surface are increased. The colour of a sugar solution increases directly with a rise of temperature. Further experiments were made with pure and impure sugar solutions of varying alkalinity and concentration, heated for periods of 4 hours under atmospheric pressure. The results obtained indicate that *under these conditions* the decomposition of sugar, the decrease of alkalinity, the deepening of the colour, and the alteration of reducing power are all directly proportional to the temperature and the duration of heating. Neutral solutions rapidly become acid, and invert sugar and reducing substances are formed, the loss of sugar being greater than in alkaline solutions. The loss appears to be greater with pure than with impure neutral sugar solutions. There is no relation between the loss of sugar in saccharine solutions and the reducing power of the latter. The coloured substances formed on heating alkaline sugar solutions have practically no reducing power. The deepening of colour when sugar solutions are heated is greater in the case of alkaline than of neutral or acid solutions; it increases with the degree of alkalinity and is greater in the case of solutions made alkaline with soda or potash than in those made alkaline with lime. In general the solutions lose their alkalinity to phenolphthalein before reducing substances are formed. With regard to alkalinity in the sugar refinery, the author recommends working in such a manner that the masse-cuite has only a trace of alkalinity to phenolphthalein. It is preferable to use lime as alkali, especially in works where filtration is practised. In general it is best to work with a high vacuum, so that the heating is finished as quickly and at as low a temperature as is possible.—A. S.

*Maltose in presence of Dextrose; Detection and Determination of Small Quantities of —.* J. L. Baker and W. D. Dick. XXIII., page 352.

*Carbohydrates; Some Reaction of —.* R. and O. Adler. XXIII., page 351.

#### ENGLISH PATENT.

*Sugar; Manufacture of a Crystalline — from a form of Cellulose.* C. F. Cross, London. Eng. Pat. 8514. April 13, 1904.

The cellulose or hemicellulose of short cellular structure, obtained from cotton-seed hulls according to Eng. Pat. 8345 of 1904 (see this J., 1905, 288), is hydrolysed with, for example, four to five times its weight of 1 to 3 per cent. sulphuric acid. The solution is filtered and neutralised with barium carbonate or chalk. After filtration, the solution is evaporated until the sugar crystallises.

—T. F. B.

#### UNITED STATES PATENT.

*Starch; Apparatus for Making —.* W. H. Uhland. Leipzig-Gohlis, Germany. U.S. Pat. 784,450, March 7, 1905.

SEE Fr. Pat. 338,792 of 1903: this J., 1904, 795.—T. F. B.

#### FRENCH PATENTS.

*Sugar Juices or Syrups; Defecation of — by means of Pure Hydrosulphites [Hyposulphites].* L. Descamps. Fr. Pat. 339,253, Dec. 31, 1903.

SACCHARINE juices or syrups are treated with a regulated quantity of pure, concentrated calcium hydrosulphite (hydrosulphite). The products of the reaction are precipitated by the addition of barium hydroxide or carbonate. The action of the hydrosulphite in removing the viscous constituents and coloring matters of the juice is more efficient if the treatment be performed in two successive stages at a temperature of 50°–70° C. The treated juice is then mixed with some material, such as charcoal or silica, which facilitates clarification and filtration and removes the saline matters, &c., by coagulation; it is finally filtered and passed over bone charcoal.—J. F. B.

*Sugar Juices; Purification of Crude —.* P. Funck. Fr. Pat. 347,238, Oct. 20, 1904.

THE crude juice is treated at a temperature of about 80° C. with 0.05–0.25 per cent. of kieselnähr, the mixture is stirred for about 5 minutes, and 0.5–1.0 per cent. of lime is added. The juice is then filtered and carbonated in the usual way.—J. F. B.

*Molasses; Manufacture of Feeding Stuffs from —.* M. Kowalski. Fr. Pat. 347,259, Oct. 20, 1904. XVIII. A., page 341.

### XVII.—BREWING, WINES, SPIRITS, Etc.

*Spirit from Potatoes poor in Starch; Increased Yield of — by Addition of Kilned Malt.* A. E. Schneider. Z. Spiritusind., 1903, 23, 101.

THE author has found that kilned malt may be mashed together with potatoes instead of green malt, and that the yield of spirit per fermentation tun may be increased thereby, which is particularly advantageous when the potatoes are poor in starch. The procedure followed for a fermentation tun of 3000 litres was as follows:—The water from the Henze steamers was collected in the mash-tun and cooled to 65° C., 15 lb. of kilned malt grist were then introduced with constant stirring, and after five minutes the addition of the steamed potato pulp was begun. During the addition of the potatoes the rakes were kept in motion, and kilned malt grist was added simultaneously little by little until, after half an hour, 135 lb. of malt had been used. The mash was perfectly fluid and no different in appearance from those saccharified by green malt. The time allowed for saccharification was

40 minutes, and the filtered wort showed a sacchari reading 1° Bg. higher than a similar wort saccharified by green malt.

For subsequent mashes 1 cwt. of kilned malt employed in conjunction with 50 lb. of green malt the density of the wort in this case was 0.5°–0.7° higher than with green malt alone. In addition to denser worts, it was found that the attenuation of mashes saccharified by kilned malt was 0.3° Bg. higher than those prepared with green malt alone. The results of distillation showed an increased yield of 22 of 90 per cent. spirit per fermentation tun. The malt for the purpose is one which has been cured at a temperature of 52°–56° C.—J. F. B.

*Fusel Oil; Origin of —.* O. Emmerling, Ber. 38, 953–956. (See also this J., 1904, 1107.)

THE author has continued his investigations on the fermentation of molasses by bacteria present on skins, and the production of fusel oil. It was found necessary to dilute the molasses to a concentration of 10 per cent. of sugar, since with higher concentrations the fermentation soon subsided and the formation of lactic acid ensued. In most cases the ferment was started by potato skins, but in some cases the same fermentation was induced spontaneously by yeasts existing in the molasses. The yield of total alcohol averaged 4.3 per cent. on the molasses, or 8.9 per cent. on the sugar. The alcohols were isolated and found to contain a large proportion of ethyl alcohol and *n*-propyl alcohol, but the main constituent was *n*-butyl alcohol; amyl alcohol was practically absent. Bacteria ferment best in absence of air, but are found not to be obligatory anaerobes. In young cultures they are motile, but lose this property when spores are formed. Their dimensions are 2.5–5  $\mu$  in length and 0.6–0.8  $\mu$  in thickness. Their cell-contents are granular; spores are generally formed near the middle of the cell. The bacteria liquefy gelatin slowly and ferment cane sugar solutions with evolution of carbon dioxide and hydrogen, and formation of the alcohols enumerated above, but (in presence of calcium carbonate) the carbon of the sugar is converted into acids of the fatty series, chiefly butyric acid, with some acetic acid. Malt dextrose and glycerin are also fermented, but lactose is not.—J. F. B.

*Flaked Cereals; Analysis of —.* J. L. Baker. XXIII., page 353.

#### ENGLISH PATENTS.

*Spirituous Liquids [Brandy, &c.]; Maturing of —.* R. J. Friswell, London. Eng. Pat. 21,380, Oct. 1904.

IMMATURE spirits are heated in an autoclave to a temperature of 212° F. for six hours, and then cooled. The treatment the quantity of esters in the spirits is increased. The temperature may be increased, but not allowed to exceed 230° F., and the time of heating correspondingly shortened. Instead of using an autoclave, the spirits may be heated under a reflux condenser.—W. P. S.

*Brewers' Wash, Sewage, Waste or Spent Dyes; Evaporating and Concentrating —, the Evaporator being applicable as a Smoke Washer.* A. B. Lennox. Pat. 12,145, May 28, 1904. XVIII. B., page 342.

#### FRENCH PATENTS.

*Beers, English; Process for Preparing —, and also Cultures for use therein.* N. H. Claussen. Fr. Pat. 347,392, Oct. 25, 1904. Under Internat. Conv. 17, 1903.

SEE Eng. Pat. 28,184 of 1903; this J., 1904, 1230.—T. F. B.

*Beer Wort from Malt Grist or Malt Flour; Clarification of —.* L. Rübsam. Fr. Pat. 347,590, Oct. 3, 1904.

THE mash, prepared in any convenient manner, is maintained at the temperature of saccharification (7–



ring the whole period of running off the wort. By keeping up the temperature in the clearing tun, intended that a finer malt grist, or even flour, can shed without danger of clogging the filtering bed.  
—J. F. B.

*Fortification of Poor* — by Vapours of Aqueous Alcohol. E. Francon. Fr. Pat. 347,631, Nov. 3, 1904.

poor in alcohol may be fortified by distilling into the alcoholic vapours produced by boiling the washings the lees or other weakly alcoholic liquors. The washings are placed in a vertical boiler and the steam given off are condensed in a worm communicating with the reservoir of wine to be fortified. A system of recuperation is adopted by which the heat of the steam is imparted to fresh liquors for distillation.  
—J. F. B.

### III.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

#### (A).—FOODS.

*Beans: Natural Alkalinity of the Ash of* — Froehner and H. Lührig. Z. Untersuch. Nahrungsmitt. 1905, 9, 257—263.

samples of cocoa beans examined, one sample had 2.11 per cent. of water-soluble alkali, calculated as sodium carbonate on the dry cocoa powder, after extracting 30 per cent. of fat from the latter. The amount of alkali found, calculated to potassium carbonate was 0.99 per cent. The author considers that a massive quantity of added alkali can only be definitely to be present when the water-soluble alkali in a sample exceeds 3 per cent., calculated as potassium carbonate.—W. P. S.

*Husk: Analyses of* — H. Lührig. Z. Untersuch. Nahrungsmitt. 1905, 9, 263—267.

results are given of determinations of the water, ash, crude fibre and alkalinity of the ash of 28 samples of cocoa husk, the investigation being made to ascertain whether any striking peculiarity could be found by means of the detection of cocoa-husk would be rendered certain. As the percentages of crude fibre varied from 11.06 and 19.77 (average 13.05), of ash from 8.77 (average 6.46), and of alkalinity (calculated as sodium carbonate) from 0.36 to 4.80 (average 3.00), calculated on the dry substance, no reliable data for purposes were obtained. The water-soluble alkalinity of cocoa husk, being about three times that of ordinary powder, may give some indication of the presence of cocoa in chocolate, as this is usually prepared with cocoa which has not been treated with alkali.—W. P. S.

*Oil: Detection of* — when used as a Colouring Material in Oils and Fats. C. A. Crampton and F. D. Jones. XXIII., page 351.

*Alcohol [for Determination of Fat in Milk]; Impure Commercial* — H. D. Richmond and J. A. Goodson. XXIII., page 344.

#### ENGLISH PATENTS.

*Milk and other Food Products or Fermentable Media; Process for Bleaching, Conditioning or Disinfecting* — S. Leetham, York. Eng. Pat. 5789, March 9, 1904.

flour, or other material, is subjected to the action of a current of ozonised air into which is introduced a limited supply of nitrogen peroxide. The latter destroys disagreeable smell or flavour resulting from the use of the material alone.—W. P. S.

*Flour, Milk, &c.; Process and Apparatus for Bleaching or Sterilising* — S. Leetham, York. Eng. Pat. 5790, March 9, 1904.

The first passed through an apparatus of the silent

discharge type and then through a sparking box, or it may be separately treated in an ozoniser and a sparking apparatus and the two gaseous products afterwards mixed. The mixed gases are then brought into intimate contact with the article to be treated. Apparatus similar to that described in Eng. Pat. 21,971 of 1898 (this J., 1899, 1015) may be employed for treating the air. (See also this J., 1904, 1224.)—W. P. S.

*Food; Sterilisation of* — W. Thorp, Limerick. Eng. Pat. 6819, March 21, 1904.

In a process for sterilising foods by means of hydrogen peroxide (see this J., 1903, 158) the patentee adds enzymes to the foods for the purpose of decomposing the peroxide, especially in the case of those articles of food which are deficient in enzymes. The latter, in the form of sterilised yeast infusion, may also be added generally to hasten the process of sterilisation.—W. P. S.

*Flour; Treatment [Bleaching] of* — E. Shackleton, Carlow, Ireland. Eng. Pat. 9703, April 28, 1904.

The flour is treated with nitrogen dioxide (or other oxide) produced by the electrolysis of an acid solution of sodium nitrate. The nitrogen dioxide may be mixed with air or other suitable gas. The hydrogen liberated at the cathode is separately collected and utilised for heating, &c.  
—W. P. S.

#### UNITED STATES PATENTS.

*Fatty Edible Preparation*. J. E. Bloom, New York. U.S. Pat. 782,820, Feb. 21, 1905.

The preparation consists of a mixture of olein, palmitin, stearin, "trimyristine" and oleic acid in approximately the same proportions in which they exist in human fat. A "jellifying" ingredient may be added. The mixture melts at a temperature below 100° F.—W. P. S.

*Oils for Edible or other Purposes [Resembling Human Fat]; Process of Preparing* — J. E. Bloom, New York. U.S. Pat. 782,821, Feb. 21, 1905.

The process consists in melting fats or oils and then cooling them in order that the solid stearin and palmitin may separate from the more liquid olein. This part of the process is repeated several times. The solid and liquid portions are then analysed and re-mixed in the proportion in which they occur in human fat.—W. P. S.

*Butter; Process of Refining* — M. H. Greeley, Ottumwa, Iowa. U.S. Pat. 784,394, March 7, 1905.

BUTTER is melted at a temperature of 115° F. with constant stirring, then allowed to settle, and the fat separated from the water, curd, &c. The melted fat is now subjected to centrifugal action at a temperature of 90° F. and afterwards passed into a chamber, where it is thoroughly mixed with a greater quantity of pasteurised milk by means of a blast of air introduced at the bottom of the chamber, the temperature being kept at 130° F. The mixture is then withdrawn, cooled, the butter is separated, chilled for 18 hours and worked up as usual.  
—W. P. S.

#### FRENCH PATENTS.

*Molasses; Manufacture of Feeding Stuffs from* — M. Kowalski. Fr. Pat. 347,259, Oct. 20, 1904.

OIL-SEED cake or other suitable fodder is mixed with molasses and the mixture is incorporated with the products of the action of dilute acids on starch. The dextrinous components act as a binding material, so that the mass may be formed into briquettes and dried. When dry, the starch products form an elastic, impervious layer over the surface, and protect the interior from the deleterious action of air and moisture.—J. F. B.

*Gelatin; Process for Making an Alimentary* — Thüringer Gelatine-Fabrik E. Jetter und Kraus. Fr. Pat. 347,319, Oct. 22, 1904.

SEE Eng. Pat. 22,952 of 1904; this J., 1905, 39.—T. F. B.

*Milk; Process for Making a Dry — which does not Become Rancid.* A. Glas. Fr. Pat. 347,624, Nov. 3, 1903. Under Internat. Conv., Nov. 12, 1903.

SEE Eng. Pat. 23,100 of 1904; this J., 1905, 247.—T. F. B.

### (B).—SANITATION; WATER PURIFICATION.

*Nitrification of Sodium Nitrite by the Nitrifying Ferment; Influence of Ammonium Salts on the —.* E. Boullanger and L. Massol. XXIV., page 354.

*Nitrogen as Nitrites; Determination of — in Water.* R. S. Weston. XXIII., page 350.

### ENGLISH PATENTS.

*Brewers' Wash, Sewage, Waste or Spent Dyes; Evaporating and Concentrating —, the Evaporator being also applicable as a Smoke Flasher.* A. B. Lennox, Newcastle-on-Tyne. Eng. Pat. 12,145, May 28, 1904.

THE evaporator consists of a closed cylindrical vessel in a vertical position, divided into two compartments by a perforated plate, situated near the top, through which the duct conveying the heated air or gases passes into the lower compartment. The top of the upper compartment is connected with a fan which draws off the steam and waste gases. The liquid is continuously pumped from the bottom of the lower compartment into the upper compartment, from which it flows through the perforated plate in the form of a fine shower back into the lower chamber, and during its fall comes in intimate contact with the hot gases entering the apparatus.—J. F. B.

*Water and Impure Effluents; Apparatus for Mixing and Distributing Chemicals for purposes of Purification and Sterilisation of —.* A. Howatson, Paris, and W. Boby, London. Eng. Pat. 28,239, Dec. 23, 1904.

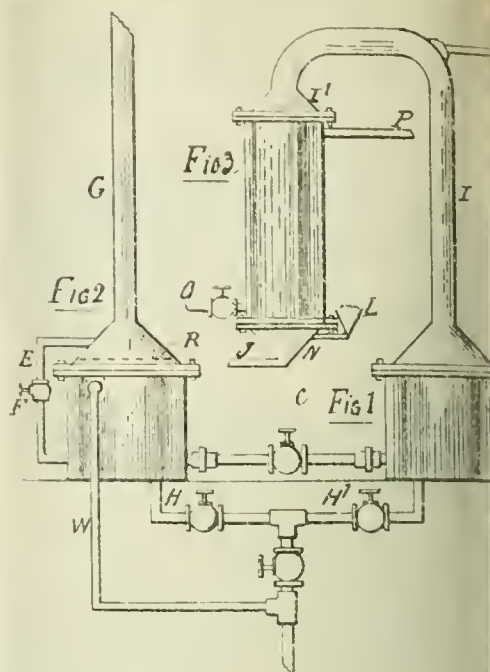
THE apparatus is principally intended for use with Duyk's "Ferrochlor" process (this J., 1903, 960). Three tanks placed side by side contain respectively the water to be treated and the two chemical solutions. Tubes, having regulated orifices, and attached to floats, are provided in the chemical tanks and allow predetermined volumes of the reagents to flow from the tanks into a mixing tube. Passing down the latter, the mixture comes into contact with the water flowing down a pipe from the water-tank, the supply of water also being regulated. Reagents and water then pass through a single pipe to the bottom of a large vessel and leaving this at the top flow on to filters. The filtered water is collected in a suitable tank or the like. An alternative method of mixing the chemical solutions is claimed. The solutions flow from the tanks through tubes to the bottom of a funnel-shaped mixing vessel, and leave the latter through holes provided at the top. From these holes the mixture falls down a tube and is mixed with the water supply.—W. P. S.

*Water; Methods and Apparatus for Purifying and Sterilising —.* E. Serpin and A. Bertrand, Paris. Eng. Pat. 18,983, Aug. 20, 1904.

SEE Fr. Pat. 338,586 of 1903; this J., 1904, 676.—T. F. B.

*Water; Combined Apparatus for Producing perfectly Pure — by Distillation, Automatic and Continuous in Operation.* J. S. Pearson, Glasgow. Eng. Pat. 20,984, Sept. 30, 1904.

STEAM from a boiler enters a coil in the vessel or "evaporating-tank" fig. 1, by the pipe B<sup>1</sup> and the valve B, and is condensed, giving up its latent heat to the water contained therein. The hot condensed water passes by the pipe and valve C to a coil in the second vessel or "heating tank" fig. 2, where it is partially cooled, at the same time heating the water contained in the vessel. Leaving the coil in the "heating tank" by the pipe F and E, the water enters the top of the vessel fig. 2, and drops on to the perforated plate R. The "organic or volatile gases" given off, escape by the pipe G, and the condensed water, after being heated by the coil, is fed by the pipe and valves H and H<sup>1</sup> into the "evaporating tank" fig. 1, any excess



being run off by the overflow W. In the vessel of this heated condensed water is evaporated again by heat of the steam condensing in the coil and the vapour produced passes by the pipes I, I<sup>1</sup> to the condenser and when condensed flows away by the cone N and pipe J. If desired, the steam can be mixed with carbon dioxide, oxygen or some other gas, introduced by the K; the mixture condenses together and the water becomes aerated. When this is not wished for, the pipe K is off, and air is allowed to enter the condenser through filter of cotton wool L, to prevent the formation of a vacuum which would hinder the free outflow of the condensed water. Cooling water enters the condenser fig. 3, at O and leaves at P, passing to a series of tanks, from which after treatment with suitable chemicals and settling, it passes through a feed-water heater to a boiler, to be converted into steam for use in the coils. Claim is not made for any special form of the different parts of the apparatus, but for the combination of apparatus; the utilisation of a coil for both condensing and cooling; the separation of volatile impurities; the subsequent redistillation and aeration of the water; and the automatic and continuous arrangement of the combined parts.—W. H. C.

### UNITED STATES PATENTS.

*Liquids; Apparatus for Removing — from Solids [Melted Grease from Garbage].* C. S. Wheelwright, Bristol, R.I., Assignor to American Extractor Co., Maine, U.S.A. U.S. Pat. 783,559, Feb. 28, 1905.

A WATER-TIGHT cylinder provided with an internal carrying screw fitting its internal periphery and with perforated plates and suction-boxes, is connected with a rendering digester, so that tankage, &c., from the digester can be pressed and the water returned again and again by means of a pump and connecting pipes. A water tank is also connected with the pump and digester.—C. A.

*Rendering Apparatus [for Garbage].* C. S. Wheelwright, Bristol, R.I., Assignor to American Extractor Co., Maine, U.S.A. U.S. Pat. 783,560, Feb. 28, 1905.

CLAIM is made for the combination of several digesters and water extractors (see preceding patent) with a water tank and forcing pump in common. The water tank which has a conical bottom and is capable of resisting steam pressure, is placed alongside the digesters so that its bottom is above the level of the tankage exits of



rs; and the pump is provided with suction and large pipes. The grease floated off by the hot water the garbage, &c., is received in trapped receivers, the water can then be separated from the tankage extractors and returned by means of the pump to the digesters or to the hot water tank.—C. A. M.

### (C).—DISINFECTANTS.

*Formaldehyde; New Method of Generating — for Fumigating Purposes.* H. V. Walker. J. Amer. Chem. Soc., 1905, 27, 277—278.

This method is based upon the addition of lime to the solution of formaldehyde, with the object of combining with the water and liberating the gas. A small quantity of lime must be added to combine with the water and thus effect dehydration. In order to effect the lime reacting with the formaldehyde in carbohydrates (formose, &c.), a substance, such as sulphuric acid or aluminium sulphate, that forms an insoluble compound with the lime, is also added. For example, the commercial 40 per cent. solution of formaldehyde mixed with about a third of its volume of concentrated sulphuric acid, and eight fluid ounces of the mixture mixed with 1 lb. of lime that slacks readily, for fumigating a room of 1000 cu. ft. of space. An objection to the sulphuric acid is that it causes polymerisation of the formaldehyde, a mixture containing aluminium sulphate is preferable from this point of view. It is prepared by dissolving 15 lb. of commercial aluminium sulphate in 5 galls. of water, and mixing the solution with 15 galls. of 40 per cent. formaldehyde solution. Lime in the form of powder or small lumps is added in the same proportion as used with the sulphuric acid mixture. The method is stated to have given excellent results in disinfection, effecting a reduction of micro-organisms (e.g., *Bacillus anthracis*) to the extent of over 90 per cent.—C. A. M.

### FRENCH PATENT.

*Disinfection; Process and Apparatus for —.* J. Gronwald. Fr. Pat. 347,407, Oct. 25, 1904.

The destruction of vermin and of pathogenic organisms in enclosed spaces, e.g., the hold of a ship, an apparatus is provided consisting of a reservoir containing a solution of formaldehyde, a mixing chamber provided with rotating paddles for saturating gases with formaldehyde, a condenser, water separator, distributing pipe, and an aspirator. A calculated quantity of formaldehyde solution is introduced into the mixing chamber where it is mixed with carbon dioxide and carbonic oxide gas from hot generators. The mixed gases and formaldehyde vapours are then aspirated into the space to be disinfected.—J. F. B.

## XIX.—PAPER, PASTEBOARD, Etc.

*Size [Paper Manufacture]; Rational Dilution —.* P. Klemm. Wochenbl. f. Papierfab., 1905, 36, 763—770.

The limits of concentration at which the solution of rosin added to the beater vary in practice between 15 and 25 per cent. per litre. The chief point is that the particles of rosin in the emulsion should be as minute as possible, requiring first the dilution of the rosin size by soft water. It is probable that a liberation of free rosin takes place owing to dissociation as well as by the action of carbon dioxide dissolved in the water. The fineness of the emulsion depends on the conditions under which the mixture of soap and water is made, the main factor being mechanical agitation. Direct dilution of size containing much free rosin by a large volume of water is impractical, since the diluting water must be heated to the melting point of the size and subsequently cooled. It is far more rational, if only crude agitating machines are available, to prepare first a concentrated solution of the size and to dilute this as soon as possible

with cold water. With Erfurt's steam-atomiser the minutest subdivision is obtained regardless of the conditions and a strong size may be blown direct into cold water. With soft water the concentration of the size solution is of little importance, but extreme dilutions are generally to be avoided. An alkaline reaction is essential for the maintenance of a permanent emulsion, and since very dilute solutions are deficient in alkalinity, the rosin soon settles out. With hard waters the result differs greatly according to the nature of the hardness. With waters containing carbonate, the diluted size is rich in free rosin and resinsates of alkaline earths, but these are still held in emulsion by the sodium carbonate produced by the action of the hard water on the soap. With sulphate waters, on the other hand, sodium sulphate is produced which is devoid of emulsifying power and favours precipitation. With such waters the size should be employed in a fairly concentrated condition, in order that a maximum proportion of undecomposed rosin soap may remain in the solution. Moreover, with strong solutions the effects of fluctuations in the composition of the water are less than when large volumes of water are used.—J. F. B.

*Paper; Sizing —with Rosin Soaps.* M. J. Griffin. J. Amer. Chem. Soc., 1905, 27, 258—263.

A LARGE proportion of the total rosin can be removed from sized paper by extraction with alcohol, but some is still left as resinate until the paper has been treated with hydrochloric acid. On the other hand, such paper when treated with dilute hydrochloric acid and then washed and dried, is very absorbent before removal of any of the free rosin by alcohol. Again, experiments made by the author have shown that it is not possible to size paper with free rosin alone without the addition of alum or other precipitating agent, and, in the author's opinion, this is conclusive evidence against claims made on behalf of free rosin sizes. He finds that alum precipitates the rosin effectually as a resinate, and that all three constituents—resinate, rosin and alumina—have a share in the sizing process, the resinate being partially broken up by the cellulose. Experiments were also made with other precipitating agents. Calcium sulphate and calcium chloride yielded an alkaline pulp, but the paper was not properly sized, the samples in which calcium chloride had been used being the poorer. Some improvement was effected by the use of an excess of sulphuric acid with the calcium sulphate to give an acid reaction. Zinc sulphate and lead acetate both yielded absorbent papers, and the author thus considers that the former cannot be regarded as a useful sizing material. He concludes that cellulose hydrates cannot directly combine with either free rosin acids or aluminium hydroxide to such an extent as to be "sized," but that when aluminium resinate is heated into the fibres and precipitated, decomposition occurs, and that both the rosin acids and the alumina (which is relatively acid) enter into combination with the basic cellulose hydrates. Finally, it is pointed out that papers treated with hard waters or those to which calcium sulphate has been added as a filling material cannot be effectually sized, owing to their causing the precipitation of the size before the addition of the alum.—C. A. M.

*Sulphite-Cellulose Lyes; Utilisation of Waste — [as Manure].* F. B. Ahrens. Chem.-Zeits., 1905, 4, 40—41. Chem. Centr., 1905, 1, 700.

THE author has examined the method proposed by Knoesel (this J., 1902, 489) for the utilisation of waste sulphite-cellulose lyes. The lye was concentrated to about 25° B., and mixed with an equal weight of Thomas slag-meal. In no case was a rise of temperature of more than a few degrees observed, nor was the citrate solubility of the phosphoric acid increased. The organic constituents of the lyes are in no way changed by the treatment with Thomas slag-meal, except that a small proportion combines with lime, and is thereby rendered insoluble, and the method cannot therefore be considered of any value.

—A. S.

*Paper from Rags; Testing —.* E. L. Selleger. XXIII., page 351.

## ENGLISH PATENTS.

*Paper and other Materials in the Web; Machines for Figuring Continuous* — G. Hennessen and P. Spix. Eng. Pat. 26,532, Dec. 6, 1904. VI., page 331.

*Celluloid; Manufacture of* — R. E. M. Ortmann, Forest Hill. Eng. Pat. 5280, March 3, 1904.

SEE Fr. Pat. 342,464 of 1904; this J., 1904, 949.—T.F.B.

*Sugar; Manufacture of a Crystalline* — from a form of Cellulose. C. F. Cross. Eng. Pat. 8544, April 13, 1904. XVI., page 340.

## UNITED STATES PATENT.

*Fuel [Utilisation of Waste Sulphite Liquor as Binding Agent]*. S. P. Sadler, Assignor to Cal. Car. Bo Co. U.S. Pat. 782,991, Feb. 21, 1905. II., page 324.

## FRENCH PATENTS.

*Bleaching Vegetable Textile Matter [Paper Pulp], Flax, Hemp, Ramie, Jute and Cotton*. A. Gagedois. First Addition, dated Oct. 17, 1904, to Fr. Pat. 306,276. Dec. 15, 1900.

CLAIM is made for the application of the process of bleaching vegetable textile material described in the principal patent (see Eng. Pat. 23,110 of 1900; this J., 1902, 48), to the bleaching of paper pulp.—T. F. B.

*Cellulose of Gorse and Similar Materials; Utilisation of* — for Manufacturing Artificial Silk, Celluloid, Plastic Substances, Dynamite, and for other Purposes. G. P. Horteloup. Fr. Pat. 347,353, Oct. 24, 1904.

CLAIM is made for the utilisation of cellulose obtained from gorse according to Fr. Pat. 327,136 of 1902, and 331,176 of 1903 (see this J., 1903, 879 and 1145) for preparing nitrocellulose for various purposes.—T.F.B.

*Plastic Material; Composition and Preparation of an Improved* — from Nitrocellulose. L. L. Béthisy and Soc. M. Rose et Cie. Fr. Pat. 347,303, Oct. 21, 1904.

NITROCELLULOSE is bleached in a solution containing bleaching powder and aluminium and magnesium sulphates and is then treated in the wet condition (40—50 per cent. of moisture) with 15—20 per cent. of a mixture containing crystallised zinc chloride, 75; a solution of citric acid (50) in 90 per cent. alcohol (100), 20; aspic (spike-lavender) oil, 5 parts; and if desired, also with some colouring matter. The mass is well mixed by grinding, pressed to remove moisture, and dissolved in the following mixture:—amyl acetate, 26.7 kilos.; ether, 15 kilos.; 90 per cent. alcohol, 7.5 kilos.; glacial acetic acid, 0.8 kilo.; and a solution of calcium chloride in its own weight of 90 per cent. alcohol, 20 kilos. The pasty mass is allowed to stand for 24 hours in a closed vessel, passed between rollers heated to 60° C., till it is of the proper consistency, then covered with a solution of gelatin, albumin or protein in glacial acetic acid, again rolled, and formed into the desired objects. (See also Fr. Pat. 340,622 of 1904; this J., 1904, 825.)—A. S.

*Celluloid and Nitrocellulose; Process for Rendering* — Non-inflammable. W. C. Parkin. Fr. Pat. 347,446, Oct. 27, 1904.

CELLULOID or nitrocellulose compositions are mixed with boric acid either in the form of an alcoholic solution or of a dry powder, for the purpose of making the product non-inflammable. (Compare Fr. Pat. 344,501; this J., 1904, 1111.)—J. F. B.

*Celluloid for Imitation Horn, Shell, Ivory, Pearl, etc; Manufacture and Application of* — T. Didier. First Addition, dated Oct. 28, 1904, to Fr. Pat. 336,970, Nov. 3, 1903 (this J. 1904, 453).

THE process of steeping articles in the celluloid paste (*loc. cit.*) is carried out in a closed chamber. The articles are fixed on a beam capable of being rotated on an axis. The vessel containing the pasty composition is raised by a rack and pinion until the articles are immersed. When the

steeping is finished, the vessel is lowered, the article drained, and the beam which carries them is rotated through an angle of 180°, so as to bring another set of articles to the steeping vessel. Meanwhile the first set is raised and the volatile solvents discharged from them recovered by condensation in a cooling worm.—J. B.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Amyl Alcohol; Impure Commercial* — H. D. Mond and J. A. Goodson. Analyst, 1905, 30, 77.

ATTENTION is drawn to the fact that amyl alcohol is to contain petroleum as an impurity, owing to the petroleum casks for packing the alcohol; the present as much as 4 per cent. of petroleum has been recovered. The authors have examined a sample of commercial alcohol which contained about 1 per cent. of petroleum and which gave excessive results when employed for determination of fat in milk by Gerber's method. Above proportion of petroleum is soluble in the mixture of amyl alcohol, sulphuric acid and water used in the Gerber method, but it is wholly or partially extracted from mixture by the fat of the milk. Amyl alcohol which has any visible insoluble layer when 2 c.c. are treated with 10 c.c. of water and 10 c.c. of sulphuric acid should be used for testing milk. The petroleum remains in residue when the amyl alcohol is distilled by fractionation to 131° C.—J. F. B.

*Acetone; Action of Magnesium Amalgam on* — F. Courturier and L. Meanier. Comptes rend., 1905, 140, 721—723.

WHEN dry acetone is gradually added to magnesium amalgam a violent reaction ensues, which ceases after about three molecular equivalents of acetone have been added for one atom of magnesium. The product is a greyish mass which contains finely divided mercury which is rapidly decomposed by moisture. This product, magnesium-acetone, is formed in reality by the union of two molecules of acetone with one atom of magnesium, the third molecule of acetone being acetone of crystallisation. When magnesium-acetone is decomposed by thoroughly extracted with boiling water, a copious deposit of crystals of pinacone hydrate ( $(CH_3)_2COH.CO_2H$ ) separates out. When the magnesium-acetone is subjected to dry distillation at a temperature of 250°—300° for 36 hours, the products of distillation consist of acetone (of crystallisation) isopropyl alcohol, pinacol (main product) and mesityl oxide.—J. F. B.

*Piperazine; Glycerophosphates of* — A. A. Comptes rend., 1905, 140, 727—780.

THE acid glycerophosphate of piperazine is prepared by evaporating a solution of 2 mols. of glycerophosphoric acid and 1 mol. of piperazine. It is an uncrystallisable white mass soluble in water in all proportions; the solution is precipitated by lead acetate, picric acid, &c., but not by barium chloride, silver nitrate and other precipitants. This body has a composition corresponding to the formula  $[H_2PO_3.O_3C_4H_{10}N_2(OH)_2]_2.C_4H_{10}N_2$ . It is neutral to methyl orange, but acid to phenolphthalein. In presence of the latter, it is neutralised by three equivalents of alkali, and is split up into  $NaOC_4H_9(OH)_2.C_4H_{10}N_2$ , and sodium glycerophosphate. Piperazine glycerophosphate,  $H_2PO_3.O_3C_4H_{10}N_2$  is prepared from a mixture of equimolecular proportions of glycerophosphoric acid and piperazine, preferably in alcoholic solutions, from which it separates in crystalline form, melting about 155° C. with decomposition. It is acid to phenolphthalein and alkaline to methyl orange, being neutralised by one equivalent of alkali or acid respectively.—J. F. B.

*Pyridine; Action of Formaldehyde on* — E. Formel. Ber., 1905, 38, 944—945.

IF pyridine be heated on the water-bath for some time with an excess of 40 per cent. formaldehyde solution,



ding, a condensation product is obtained in the form of a white crystalline paste, which finally sets to a solid. The product is regarded by the author as either a dition compound of formaldehyde and pyridine,  $\text{HCHO}$ , or an unstable alkine,  $\text{C}_5\text{H}_4\text{N}.\text{CH}_2\text{OH}$ , easily soluble in warm, less readily in cold water, crystallises from alcohol in rosettes of microscopic size. When heated, it is decomposed into formaldehyde and pyridine; some decomposition takes place even at ordinary temperature.—A. S.

*Alcohol and Terpenic Compounds; Successive Redistributions of —, among the Organs of an Annual Plant.* Charabot and G. Laloue. *Comptes rend.*, 1905, 1667–669.

ARISING from the results of all their former work, the authors come to the following conclusions:—During the period of inflorescence, an essential oil poor in estragol is in terpenic compounds accumulates in the green parts of the plant. It is relatively soluble, for the terpenic compounds, especially those other than linalöl, are more soluble than estragol. The early flowers contain an essential oil less soluble, but richer in estragol. When the plant is mature, the amount of essential oil diminishes in the green parts and increases in the flowers; and the quantity of that in the green parts diminishes and becomes less than that of the oil in the flowers. Yet the solubility of the latter does not increase, so that the oil in the plant, whole, diminishes, a result of its becoming poorer in terpenic compounds. Later, when the fruit has ripened, the amount of oil in the green parts has increased, that in the inflorescence has diminished; and, while the solubility of oil in the inflorescence has not diminished, that of the oil in the green parts has increased. There has been a variation both of estragol and of terpenic compounds, relatively greater in the case of the former.—J. T. D.

*Alkali and Cerium Groups; Action of some Organic Compounds on the Metals of the —.* H. Behrens. XXIII., page 348.

*Reactions in Organic Compounds; Determination of —, [Reactions of Mercury Succinimide].* E. Rupp. *Ph. Nöhl.* XXIII., page 350.

*Sulphites; Analysis of Solutions of —, and of Formaline.* E. Orloff. XXIII., page 348.

*Acids; Purification and Determination of —.* E. Rupp. XXIII., page 353.

*Pyridine; Volumetric Determination of —.* L. J. Simon. XXIII., page 353.

*Pyridine; Action of Potassium Permanganate Salts of —.* L. J. Simon. XXIII., page 353.

*Pyridine; Determination of —.* Utz. XXIII., page 353.

#### ENGLISH PATENTS.

*Pharmaceutical Product [m-Tolylsemicarbazide]; Manufacture of a New —.* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 7954, April 6, 1904.

Following additional methods are claimed for preparing m-tolylsemicarbazide, as described in U.S. Pat. 84 of 1904 (this J., 1904, 950):—(1) Treating m-tolylamine or its salts with urea, carbamic chloride, urethanes; (2) treating di-m-tolylcarbazide  $\text{H.NH.C}_6\text{H}_4.\text{CH}_3)_2$ , with ammonia or urea; (3) treating the esters of m-tolylhydrazine carboxylic acid  $\text{CH}_3.\text{C}_6\text{H}_4.\text{NH.NH.COOR}$ , with ammonia; (4) heating to above its m. pt. (e.g., to  $140^\circ\text{C}$ .), asymmetric m-tolylsemicarbazide,  $\text{CH}_3.\text{C}_6\text{H}_4.\text{N}(\text{NH}_2).\text{CONH}_2$ . The latter compound is obtained by treating benzaldehyde with m-tolylhydrazine with carbonyl chloride in the solution, converting the chloride thus produced into the amide, and boiling the amide with sulphuric acid.—T. F. B.

*Barbituric Acid; Manufacture of Derivatives of — [Dialkylbarbituric Acids].* C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 8543, April 13, 1904.

DIALKYLBARBITURIC acids are produced by the action of carbonyl chloride on dialkylmalonic acid diamides,  $\text{R}_2\text{C}(\text{CONH}_2)_2$  at temperatures above  $100^\circ\text{C}$ . The excess of carbonyl chloride is distilled off on the completion of the reaction, and the product may be recrystallised from water. Dialkylmalonic acid dinitrile is obtained as a by-product in this reaction. (Compare Eng. Pat. 8302 of 1904; this J., 1905, 289.)—T. F. B.

*Phenol Compounds; Manufacture of New —, and the Separation of Phenols from Phenol Mixtures.* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9953, April 30, 1904.

CRYSTALLINE additive compounds of phenols with the alkali salts of phenols are obtained by treating phenols with alkali hydroxides or carbonates, or with the alkali salts of phenols, with or without the use of a suitable solvent. Thus, p-cresol yields the compound  $\text{CH}_3.\text{C}_6\text{H}_4.\text{OK}.3\text{CH}_3.\text{C}_6\text{H}_4.\text{OH}$ , when treated with potassium hydroxide. The compound  $\text{C}_6\text{H}_5.\text{OK}.3\text{C}_6\text{H}_5.\text{OH}$  may be obtained in a similar manner from phenol. Two mols. of phenol or p-cresol form additive compounds with 1 mol. of the sodium salt of the phenol. These additive compounds are stated to possess valuable therapeutic (especially antiseptic) properties. This reaction of phenols may be utilised for the separation of phenols from each other or from other organic compounds, by the fractional solution of the additive compounds. Thus, a mixture of o- and p-cresol may be separated by heating with 13 per cent. of its weight of potassium hydroxide, filtering the crystalline mass from the cooled solution, and acidifying the filtrate, from which o-cresol separates. The crystalline mass is freed from the remainder of the o-cresol compound by washing with small quantities of benzene, and is heated with acid; p-cresol crystallises from the solution on cooling.—T. F. B.

#### UNITED STATES PATENTS.

*Pyrocatechuic Monoalkyl Ethers; Process of Making Compounds of — [with Protein Substances].* H. C. Fehrlin, Schaffhausen, Switzerland. U.S. Pat. 784,107, March 7, 1905.

SEE Eng. Pat. 449 of 1904; this J., 1904, 1236.—T. F. B.

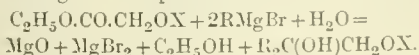
*Perfumes; Materials for —, and Process of Making Same [Cyclohexane and Cyclohexene Derivatives].* G. Merling, Frankfurt, and R. Welde, Assignors to Farbwerke vorm. Meister, Lucius and Brünig, Hoechst-on-the-Maine, Germany. U.S. Pats. 784,411 and 784,412, March 7, 1905.

SEE Eng. Pat. 11,137 of 1903; this J., 1904, 502.—T. F. B.

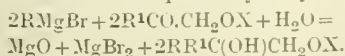
#### FRENCH PATENTS.

*Aldehydes  $\text{R}_2\text{CH}.\text{CHO}$  and  $\text{RR}^1\text{CH}.\text{CHO}$ ; Process for Preparing the —.* A. Behal and M. Sommelet. Fr. Pat. 347,399, Jan. 6, 1904.

ALDEHYDES of the general formula  $\text{RR}^1\text{CH}.\text{CHO}$  are prepared by the action of acids on the ethers of the corresponding dialkyl- or diaryl-glycols  $\text{RR}^1\text{CH}(\text{OH})\text{CH}_2\text{OH}$ . The simple disubstituted glycols  $\text{R}_2\text{C}(\text{OH})\text{CH}_2\text{OH}$  are obtained by the action of 2 mols. of the corresponding organomagnesium halide on alkyl- or aryl-alkoxy-acetic esters, according to the equation:—



The mixed disubstituted glycols, on the other hand, are obtained by the action of 1 mol. of organomagnesium halide on 1 mol. of the requisite hydroxyketone ether:



Ethoxy- or methoxy-acetonitrile, for use in the first

method, is prepared by the action of mercuric cyanide, in the cold, on monochloro-methylethyl- or dimethylether. The hydroxyketone ethers are prepared by decomposing with water the reaction product of ethereal solutions of organomagnesium halides and ethoxyacetoneitrile. The new ethoxyketones obtained by this process were ethoxybutanone; ethoxy-1-methyl-5-hexanone-2; and ethoxyacetophenone. A number of new glycol derivatives, obtained as above, are described, and also the following new aldehydes: Diethylacetaldehyde, dipropylacetaldehyde, di-isobutylacetaldehyde, ethylpropylacetaldehyde, di-isobutylacetaldehyde, methyl-2-octanal-1, and methyl-2-nonanal-1.—T. F. B.

*Tannin Substances and Use; Process for the Manufacture of Condensation Products of — with Formaldehyde.* R. Lauch and A. Voswinkel. Fr. Pat. 347,656, Nov. 4, 1904.

SEE Eng. Pat. 23,569 of 1904; this J., 1905, 103.—T. F. B.

*o-Hydroxybenzoic Acid [Salicylic Acid]; Process for Making the Phenyl or Naphthyl Ethers of —.* Act.-Ges. f. Anilinfabr. Fr. Pat. 347,734, Nov. 8, 1904.

PHENYL or naphthyl ethers of salicylic acid



may be prepared by heating the corresponding alkali phenolate or naphtholate with *o*-chlorobenzoic acid in presence of a small quantity of copper or a copper salt and excess of the free phenol. The new *p*-cresyl- and *o*-methoxyphenyl ethers of salicylic acid may be prepared by this method, and are described.—T. F. B.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*Photographic Processes; Theory of —.* Chemical Dynamics of Development. S. E. Sheppard and C. E. K. Mees. Proc. Roy. Soc., 1905, 74, 447—473.

It is proved experimentally that, in photographic development, the amount of silver deposited increases rapidly at first, then more slowly, and finally tends to a definite limit, which depends solely on the exposure. The velocity depends on the concentration of the developer. A soluble bromide reduces the velocity, but the retardation with time is not so great. It is shown that, if *T* be the optical transparency of the silver deposited in photographic processes, the density ( $= -\log T$ ) of that reduced silver is proportional to its mass. The equation:—

$$\frac{1}{t} \log \frac{Dx}{Dx - D} = K,$$

introduced by Hurter and Driffeld (this J., 1890, 455, 529), is shown, on mathematical grounds, to represent the reaction taking place in photographic development, and is also experimentally verified. It is considered that the velocity of development mainly depends on the rate of diffusion of the active halide. In this connection, it is found that the velocity, as measured from the above equation, is directly proportional to the concentration of the reducer, is affected by the age and condition of the plate, and is reduced by the addition of soluble bromides, but not in the proportion shown by the use of the simple chemical equation of reduction alone. The law of constant density ratios due to varying exposures is also confirmed experimentally. The development factor in the sensitometry equation is considered from the mathematical point of view.—T. F. B.

*Developer Amidol.* A. and L. Lumière and A. Seyewetz. Brit. J. Phot., 1905, 52, 205—206.

THE oxidation of developers composed of amidol (diaminophenol dihydrochloride) and sodium sulphite is due solely to the oxidation of the amidol by atmospheric oxygen, since the amidol is much less oxidised in presence of sulphite than in a simple aqueous solution. An increase in the quantity of sulphite present only increases

the stability of the solution up to the point when it contains 3 per cent. of sulphite; further additions of sulphite render the solution more susceptible to oxidation, increase in the concentration of the developer beyond normal strength is not advantageous, owing to the precipitation of diaminophenol, and to the rapidity with which oxidation takes place, even when air is excluded. On the other hand, the "normal" developer (a 5 grms., anhydrous sodium sulphite, 30 grms., 1 litre) will keep for a long time if stored in well-closed vessels.—T. F. B.

*Organic Dyestuffs; Absorption Bands shown by — the Ultraviolet.* P. Krüss. IV., page 328.

### ENGLISH PATENTS.

*Cyanine Dyestuffs [for Photographic Purposes]; Manufacture of New —.* C. D. Abel, London. Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 9456, 25, 1904.

SEE Fr. Pat. 342,656 of 1904; this J., 1904, 999.—T. F. B.

*Toning Silver Pictures [with Manganese Salts]; Manufacture of —.* A. G. Bloxam, London. From Neugebauer graphische Ges. Act.-Ges., Steglitz, Berlin. Eng. Pat. 10,898, May 11, 1904.

SEE Fr. Pat. 345,033 of 1904; this J., 1904, 1238.—T. F. B.

### FRENCH PATENTS.

*Photography in Colour; Process of —.* Soc. Anonyme des Plaques et Papiers Photographiques A. Lumière et ses Fils. First Addition, dated Jan. 13, 1904, to Fr. Pat. 339,223, Dec. 17, 1903.

SEE Eng. Pat. 25,718 of 1904; this J., 1905, 152.—T. F. B.

*Photographic Plates; Process for Preparing Sensitized —.* Soc. Anonyme des Plaques et Papiers Photographiques A. Lumière et ses Fils. Fr. Pat. 342,656, Jan. 13, 1904.

THE sensitising substance (e.g., silver chloride or bromide) is applied in powder form to the support, which has previously been coated with an adhesive layer of some inert varnish. The sensitive layer is then covered with a protective layer of varnish or of gelatin, albumin, &c., for the preparation of orthochromatic plates, may contain the necessary colouring matter.—T. F. B.

*p-Amidophenol and Aldehydes; Process for the Preparation of Condensation Products of — [Photographic Developers].* Soc. Dr. Lüttke & Arndt. Fr. Pat. 347,396, Oct. 25, 1904.

THE condensation products of *p*-aminophenol with aliphatic or aromatic aldehydes, especially formaldehyde and acetaldehyde, are found to possess much greater power than the parent compounds in developing the latent photographic image than *p*-aminophenol. The formaldehyde compound may be prepared by adding 100 grms. of 40 per cent. formaldehyde to a solution of 144.5 grms. of *p*-aminophenol dihydrochloride and 120 grms. of potassium bisulphite in 400 c.c. of water; the "sulphite compound" or "condensation product" is obtained from the resulting solution by evaporation. For use as a developer, 10 grms. of this sulphite compound, 5 grms. of potassium carbonate, and 5 grms. of sodium sulphite are dissolved in 100 c.c. of water.—T. F. B.

*Pigment Photographic Paper.* A. Höchheimer. Fr. Pat. 347,510, Oct. 28, 1904.

A LAYER of gum arabic or similar substance easily soluble in cold water, with which a chromium salt has been incorporated, is interposed between the paper support and the pigmented gelatin coating of "carbon" paper. This intermediate layer is almost as sensitive to light as the gelatin layer, and permits the easy removal of the film from the temporary support by simply immersing the paper in cold water.—T. F. B.



ographic Films; Self-detaching —. Soc. M. Br. t Cie. First Addition, dated Nov. 2, 1904, to Fr. 345,535, Aug. 12, 1904.

of using only one layer of collodion, viz., between mainoid film and the gelatin, as described in the patent (this J., 1904, 1238), a second layer is added between the gelatin film and the film of emulsion.—T. F. B.

Originals [Negatives] for Producing Designs Processings by the Chemical [Catalytic] Action of the metal; Process for the De-gradation of —. Xene photographische Ges. Act.-Ges. Fr. Pat. 347,732, S. 1904. Under Internat. Conv., Oct. 13, 1904.

res produced by the catalytic process (see this J., 380, 963 and 1015) are frequently found to prints showing too harsh contrast, owing to the action having been too powerful. It is necessary, e, to treat these negatives with substances which their catalytic action. For instance, "platinum e" negatives may be immersed in a solution of of thiourea or of 20 drops of a saturated aqueous of sulphur dioxide in 100 c.c. of a mixture of of alcohol with one part of water. A "man- negative may be "softened" by treatment e above mentioned thiourea solution. If this ding" or "softening" action has proceeded too if the catalytic power has been reduced too much, be strengthened again by washing.—T. F. B.

## XII.—EXPLOSIVES, MATCHES, Etc.

lulose; Rate of Decomposition of — and its tetric Determination. P. Obermüller. Berl. ksverein des Ver. deutsch. Chem., Oct. 11, 1904.

thor points out that whilst Bergmann and Jnnk's (this J., 1904, 953) gives excellent results mining the stability of nitrocellulose, it is too ated, and occupies too much time to be of service rolling the process of manufacture. The author's consists in heating the nitrocellulose *in vacuo* at a t temperature (140° C.), and measuring contin- y means of a mercury manometer, the pressure by the evolved gases, the latter being maintained tant volume. The rate at which the pressure s is a measure of the rate of decomposition of

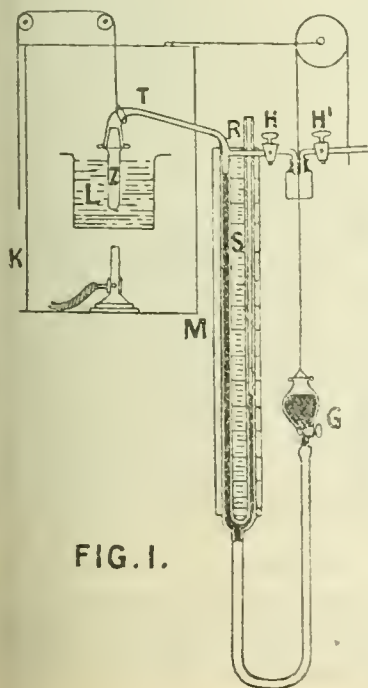


FIG. 1.

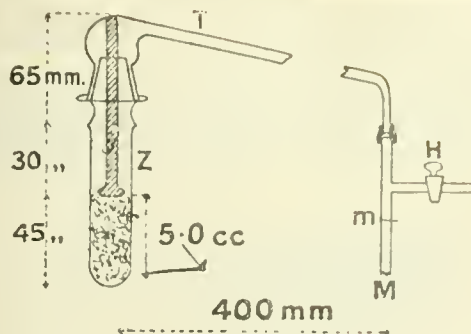


FIG. 2.

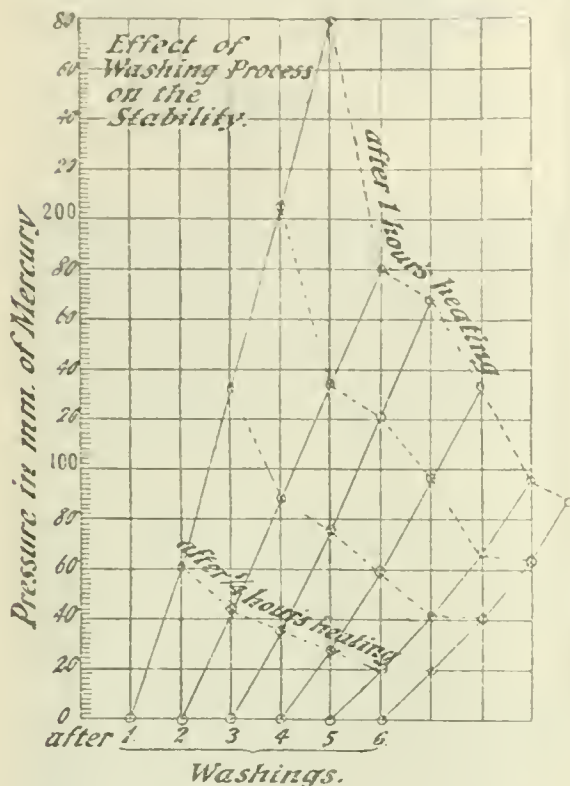
the nitrocellulose. The apparatus used is shown in figs. 1 and 2. The decomposition vessel Z, a small glass tube of about 12 c.c. capacity, and having a mark at 5 c.c., is connected by means of the tube T with the manometer M, which is provided with a movable mirror-scale S, and with a side tube R, by which it is joined to the pump. A receiver is interposed between the manometer M, and the pump beyond H<sup>1</sup>, and two taps H and H<sup>1</sup> are provided to cut off this receiver from the manometer or from the pump. By raising or lowering the mercury reservoir, G, the level of mercury in the left limb of the manometer can be adjusted to a predetermined mark, m, and thus a constant volume maintained. The decomposition-vessel is heated in a bath of calcium chloride solution, L, covered by a thin layer of paraffin oil, and this part of the apparatus is enclosed in a casing of sheet iron, K, provided with a window of strong glass. The nitrocellulose is pressed until it contains from 30 to 35 per cent. of moisture, and then forced through a sieve with 2 mm. mesh. About 2 grms. of the prepared sample are placed in the decomposition vessel and pressed down by means of a glass rod until it occupies a volume of 5 c.c., the glass rod is left in the vessel (see fig. 2). The apparatus is then evacuated, the tap H<sup>1</sup> closed, and the decomposition-vessel immersed up to a definite mark (1 cm. below the top) in the bath, which has been heated to 140° C., After about 10 minutes, the water which has condensed in the left limb of the manometer is forced into the receiver by raising the mercury reservoir, the level of mercury in this limb is then adjusted to the mark m, and the zero point of the scale is placed opposite the level of mercury in the right limb. After the decomposition vessel has been heated for 15 minutes, the tap H is also closed. (If a pump which acts continuously, e.g., a water-pump, be used, the tap H<sup>1</sup> is not needed.) The time is noted, and then after definite intervals, the increase of pressure is read off on the scale, the level of mercury in the left limb being adjusted before each reading. At the end of the test, the decomposition-vessel is removed from the bath, allowed to cool, cleaned and weighed. The pressures observed are reduced to the corresponding ones for 1 gm. of substance.

The following results were obtained with: (a) a sample of guncotton (12.9 per cent. of nitrogen; solubility in ether-alcohol, 8 per cent.); (b) a sample of collodion-cotton (12.4 per cent. of nitrogen; solubility in ether-alcohol, 98 per cent.).

Time. mins.	Guncotton.		Collodion Cotton.	
	Pressure. mm.	Increase of Pressure. mm.	Pressure. mm.	Increase of Pressure. mm.
0	0	19	0	15
15	19	22	15	16
30	41	25	31	20
45	66	29	51	24
60	95		75	

The results obtained by the author's method in one hour correspond well with those yielded by Bergmann and Junk's process in 7—8 hours.

As an example of the application of the method to the control of the manufacturing process, the author examined the influence of washing at the boiling temperature on gun-cotton. The results are shown in the following curve-diagram.



After the fifth washing in the boiling vessel, the stability of the product had attained the desired standard. The process of beating the gun-cotton in a hollander is next referred to, and the author states that the disintegration has a markedly favourable influence on the stability of the explosive, quite apart from its action in promoting the washing. In this connection it is pointed out that the specimen of gun-cotton which after five washings behaved satisfactorily with regard to stability, was tested after being ground; when tested in the unground condition, excessive pressure was developed in the first minute, and after a short time, the gun-cotton exploded. The relation between the state of division of the material and its stability was also clearly shown by cutting a specimen of dried, unground gun-cotton with scissors successively into smaller and smaller pieces, and testing it from time to time. It is recommended that all samples of gun-cotton before being tested, be beaten for one hour in a small hollander; and also that the technical heating process be continued, until successive test samples give constant results in the stability test.

—A. S.

Phosphorus; Manufacture of —. W. Hempel. VII., page 332.

#### ENGLISH PATENTS.

Nitrating Fibrous Matter. J. Selwig, Brunswick, Germany. Eng. Pat. 7511, March 29, 1904.

SEE Fr. Pat. 342,502 of 1904; this J., 1904, 950.—T. F. B.

Dinitro-glycerine and Dinitro-glycerine Explosive Powders; Process of Manufacturing —. A. Jajczak, Castrop, Germany. Eng. Pat. 8041, April 1, 1904.

SEE Fr. Pat. 341,911 of 1904; this J., 1904, 911.—

#### FRENCH PATENTS.

Explosive; New —. A. Vergé. Addition, Oct. 17, 1904, to Fr. Pat., 332,882 of June 8, 1903. (This J., 1903, 1308.)

CLAIM is made for the use of petroleum spirit as a solvent for incorporating the beeswax with the other ingredients. The solution of the wax is ground with the sugar, potassium chlorate and chromate, and the grinding even completed at about 25° C., in connection with a condenser so that the petroleum spirit can be evaporated and recovered.—C. A. M.

Explosive and Process for its Manufacture. J. C. M. Fr. Pat. 347,694, Nov. 5, 1904.

SEE Eng. Pat. 23,973 of 1904; this J., 1905, 250.—T.

Cellulose of Gorse and similar Materials; Use of —, for Manufacturing Artificial Silk, Cellulose Plastic Substances, Dynamite, and for other Purposes. G. P. Horteloup. Fr. Pat. 347,353, Oct. 24, 1904. XIX., page 344.

### XXIII.—ANALYTICAL CHEMISTRY

#### INORGANIC QUALITATIVE.

Nitric Acid; Detection of —, by the Diphenylamine Reaction. G. Frerichs. Arch. Pharm., 1905, 2, 1.

NITRIC acid is not the only compound which gives a blue colour with diphenylamine sulphate, but it is separated from all others by first extracting with ether. The substance is shaken with about 10 c.c. of concentrated sulphuric acid and 20 c.c. of ether. After the layers are separated, a little alcohol being added if necessary to hasten this process, 2—3 c.c. of the ether solution are added through a dry filter, a little diphenylamine added and cautiously 5—10 c.c. of concentrated sulphuric acid. In the presence of nitric acid, the well-known dark blue colour is developed. If the ethereal extract is coloured, it may contain iodine, bromine or chromic acid, which may be readily removed by shaking with aqueous sodium sulphate and then carrying out the test on a fresh quantity of the filtered ether.—F. Sps.

Yttrium and Cerium Groups; Action of some Acids on the Metals of the —. H. Behrens. Trav. chim. Pays-Bas, 1904, 23, 413—418. Centr., 1905, 1, 659.

FORMIC, glycollic, lactic, paralactic, hydroxy-lactic, hydroxyisobutyric, malic, succinic, glutaric, muonic, succinic, fumaric, and mesaconic acids form with the metals of the yttrium and cerium groups, characteristic salts suitable for the microchemical detection of the metals. The metals of the yttrium group form slightly soluble salts with formic and acetic acids; these salts crystallize out, if the aqueous solution of the formate be treated with acetic acid, or if the solution of the acetate be treated with formic acid. A double salt is also formed with yttrium lactate is dissolved in a hot aqueous solution of yttrium nitrate; it separates in the form of square crystals.

Aluminium as an Antidote in Acute and Chronic Arsenicalism [and Detection of Mercury]. N. S. X., page 334.

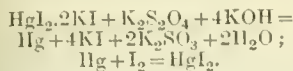
#### INORGANIC QUANTITATIVE.

Hydrosulphites; Analysis of Solutions of —, by Formaline. E. Orloff. J. russ. phys.-chem., 1904, 36, 1311—1317. Chem. Centr., 1905, 1, 69.

Determination of Hydrosulphites.—The method is



the reduction of mercuric-potassium iodide to metallic mercury by the hydrosulphite, and determination of mercury by means of iodine.



c. of a solution of mercuric-potassium iodide (60 of mercuric chloride and 260 grms. of potassium iodide per litre) are mixed with 10 c.c. of potassium iodide solution (500 grms. per litre), and 2 c.c. of the sulphite solution. The separated mercury is filtered on a plug of asbestos, washed with water, introduced into solution of sodium hydroxide (100 grms. per litre), c.c. of N/10 iodine solution added. The solution acidified with hydrochloric acid, and the excess of iodine titrated with N/10 thiosulphate solution.

*Determination of Formaldehyde.*—Formaldehyde reduces mercuric-potassium iodide according to the equation:



c. of the formalin solution (containing 10 c.c. of formaldehyde per litre) are treated with 10 c.c. of mercuric-potassium iodide solution, and the separated mercury filtered off and determined as described above.

—A. S.

*Aluminium; Determination of Acids combined with —.* O. Schmatolla. Ber., 1905, 38, 985—989.

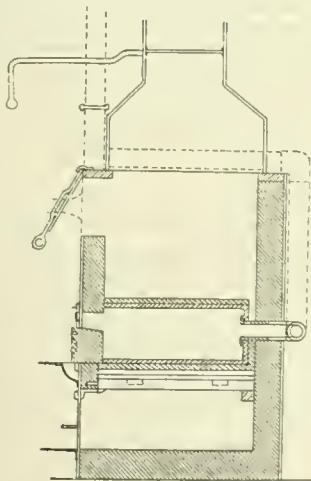
The author investigated the influence of carbonate, combined standard alkali solutions, on the results of the determination of acids combined with aluminium. He determined the quantity of sulphuric anhydride contained in a solution of aluminium sulphate by precipitation with barium chloride. The results of subsequent titrations of the same solution with alkali differed more or less from those obtained gravimetrically, according to whether the standard solution was prepared from chemically pure sodium hydroxide, from commercial caustic potash containing carbonate, or from sodium carbonate. Differences were also observed between the direct titration of the boiling solution and the titration in the cold after decomposition of the aluminium sulphate with barium chloride. This is due to the structure of the aluminium sulphate and to the formation of neutral salts. In the presence of the latter, it is, according to the author, impossible to precipitate pure aluminium hydroxide from a sulphate solution; the decomposition is incomplete even with an excess of alkali. This effect of the neutral salts is much stronger when caustic soda is used than with alkali carbonate, probably owing to the formation of basic alkali salts. Although the alkali carbonates are also affected in their power of reaction by the presence of neutral salts, they are preferable for the determination, as the percentage of aluminium sulphate they are undecomposed is always constant, and stated by the author to correspond to  $\frac{1}{140}$  of the total amount. However, the reaction to phenolphthalein, of which 10 drops are required for about 1 gm. of aluminium sulphate, is more distinct with carbonate than with caustic alkali. The author recommends as the most reliable method for the determination of acids combined with aluminium, the titration of the boiling solution of aluminium salt with alkali carbonate, till phenolphthalein turns distinctly red, subsequently titrating back with acid if necessary. To compensate for the incomplete decomposition of aluminium sulphate, the number of c.c. of standard solution used, should be increased by 0.75 per cent. For nitrates, nitrites and chlorides, the addition of an excess of sodium carbonate and back titration is always reliable on account of the volatility of the respective acids. —R. L.

*Parting.* W. F. Hillebrand and E. T. Allen. U.S. Geological Survey, Series E., Chem. and Physics., 44, Bull. No. 253.

The authors' experiments were made on telluride gold ores from Cripple Creek, Colo. The results, which are given in a series of tables, show that the crucible fire assay yields results quite as accurate as those obtained by the wet method, provided corrections be made for losses in cupellation and those due to retention of gold by the slag. The amount of gold retained by the slag is very small and generally negligible if a suitable charge be employed. The authors obtained the best results with the following charge:—Ore, 1 assay ton (29.166 grms.); sodium bicarbonate, 1 assay ton; litharge, 6 assay tons; fused borax, 10 grms.; with a covering of sodium chloride. The loss in cupellation is more considerable, that due to absorption by the cupel being greater than that caused by volatilisation. If the cupellation be carried out at a temperature at which "feather" litharge is abundantly formed, the loss due to volatilisation is generally negligible, or perhaps compensated for by the retention of lead by the gold bead. The loss of gold due to absorption by the cupel is very important, and increases with rise of temperature. It is greater with pure gold and alloys poor in silver than with alloys rich in silver. It is unnecessary to leave gold beads in the muffle for some time after brightening with a view to removing the last traces of lead. Experiments showed that the beads do not decrease in weight, but actually show a very slight tendency to become heavier. Silver can be completely extracted from quartation alloys by means of nitric acid, but it is necessary to repeat the treatment with acid more than twice, and to wash after each treatment. The losses of gold in parting are negligible in an ore assay.—A. S.

*Cupellation and Parting in [Gold] Ore Assaying.* T. Kirke Rose. J. Chem. Metall. and Mining Soc., S. Africa, 1905, 5, 165—168.

*Cupellation.*—The muffle shown in the illustration (see figure) has been found to give good results during the last twelve months in the Assay Laboratory at the Royal Mint, London. It is made of graphite, and there is no connection between the interior of the muffle and the space of com-



bustion, whether the fuel used be coke or gas. Air enters at the front near the top, and passes out through a hole in the back, which communicates with a tube of  $1\frac{1}{2}$  in. diameter leading to the flue. This tube is of graphite inside the furnace and iron outside, and is provided with a damper for regulating the draught of air through the muffle. A good temperature for the air in the muffle is 700° C., but if the buttons contain antimony, iron, &c., a much higher temperature must be used. The increase

*Telluride Ores; Comparison of the Wet and Crucible Methods for the Assay of —, with Notes on the Ores occurring in the Operations of Fire Assay and*

in the loss of gold with rise of temperature is shown by the following results:—

Charges.	Loss of Gold in	
	Cupelling at 700° C.	Cupelling at 900° C.
Gold, 0.001; silver, 0.006; lead, 25 grms.	0.45	1.05
Gold, 0.001; silver, 0.010; lead, 25 grms.	0.39	0.80

A comparison of magnesia- and bone-ash cupels showed that the most satisfactory results are obtained with bone-ash cupels of London make. The influence of various impurities in the lead buttons on the loss of gold and silver is shown in the following table. The cupellations were made at about 1000° C., and the charge consisted in each case of 1 mgrm. of gold, 4 mgrms. of silver, and 1 gm. of the impurity, with 25 grms. of lead:—

Impurity.	Loss of Gold.	Loss of Silver.	Remarks.
	Per Cent.	Per Cent.	—
None .....	1.2	11.8	—
Tin .....	2.0	13.9	Slight scoria
Arsenic .....	3.9	16.3	Much ..
Antimony .....	5.3	13.2	No ..
Zinc .....	9.3	17.6	Much ..
Cadmium .....	3.5	13.1	Ring of ..
Iron .....	4.0	16.6	No ..
Manganese .....	13.6	24.3	Some ..
Molybdenum .....	11.0	26.2	No ..
Vanadium .....	7.7	21.7	No ..
Copper .....	10.0	32.6	No ..
Bismuth .....	21.8	27.9	No ..
Thallium .....	23.1	34.4	No ..
Tellurium .....	55.8	67.9	No ..
Selenium .....	54.1	64.5	No ..

When tellurium and selenium were present, practically the whole of the missing gold and silver were recovered by fusing the cupels. In no case was there proof of any loss by volatilisation.

**Parting.**—The author has found the following method to be rapid, convenient and accurate. A porcelain crucible is nearly filled with nitric acid of sp. gr. 1.25 (4 of acid : 3 of water), and the liquid heated to boiling. The watch-glass cover is then raised for a moment, and the flattened bead dropped in. Beads of the following composition have been found to give good results:—Gold, 0.1 mgrm., silver, 4–5 mgrms.; gold, 0.2, silver, 2; gold, 1; silver, 6–10; and gold, 10; silver, 40 mgrms. The large beads were parted by the boiling acid in from 5 to 10 minutes, and no second treatment with acid was required.—A. S.

#### Phosphoric Acid; Volumetric Determination of —.

F. Raschig. Z. angew. Chem., 1905, 18, 374–376.

By using the method of filtration and washing he has described in his account of the benzidine method of sulphuric acid determination (this J., 1903, 1066), the author finds that ammonium magnesium phosphate, precipitated in the usual way, can be washed free from ammonia by a quantity of water insufficient to dissolve an appreciable amount of the precipitate, and that the latter can then be titrated by means of standard acid. A quantity of the substance is weighed for analysis, containing as nearly as possible (and not more than) 0.15 gm. of phosphoric anhydride. The solution is precipitated in a conical flask with magnesia mixture, and the precipitate collected on a 40 mm. filter prepared as described (*loc. cit.*), the filtrate being used to rinse on the latest portions of the precipitate. After the pump has completely drained off the mother-liquor, the precipitate is washed with 10 c.c. of water, then with 5 c.c. The filter is then lifted off by forceps, placed in a beaker, and the forceps and funnel rinsed with not more than 20 c.c. of water. A few drops of Methyl Orange are added, and the precipitate titrated with N/10 hydrochloric acid, shaking or stirring with a rubber-tipped rod. The change (which occurs when the reaction  $\text{NH}_4\text{MgPO}_4 + 2\text{HCl} = \text{MgCl}_2 + \text{NH}_4\text{H}_2\text{PO}_4$  is com-

plete) is not very sharp, but with a little practice observed within 0.05 c.c. of N/10 acid. The result with those obtained gravimetrically.—J. T. D.

#### Nitrogen as Nitrites; Determination of — in

R. S. Weston. J. Amer. Chem. Soc., 1905, 27, 281

A COMPARATIVE experimental study of the Griess-Warnton and Hlosvay methods of determining nitrogen as nitrites in water has shown that an excess of chloric acid interferes with the delicacy of the reagent but this does not apply to acetic acid. The speed of reaction varies with the amount of hydrochloric acid added, and is also affected to some extent by the reagents. The Hlosvay method is more rapid than the original Griess-Warnton method. The various modifications of the method do not yield any apparent differences in the colorations. An explanation of discrepancies results obtained by different chemists with the Hlosvay method is found in the differences in mixing. If liquids be mixed, the heavier acetic acid (Hlosvay's) becomes diffused through the whole; if not, they remain at the bottom and the reaction is retarded. In the Warnton method, the variation in the alkalinity of natural waters renders the use of small additions of hydrochloric acid inaccurate. To obviate this there should be enough acid present to nullify the effect of varying alkalinity, but to add the hydrochloric acid would retard the reaction. Acetic acid, however, may be added without this drawback, and for this reason the author gives the preference to Hlosvay's method. On treating a decolorised sample of water with each of Hlosvay's reagents, a colour is obtained which may be compared, after standing for 10 minutes, with standard solutions treated in the same manner. It is suggested as an improvement that the solutions be made more concentrated than Hlosvay directs, in order to prevent excessive dilution. The following solutions are recommended (a) 8 grms. of sulphanilic acid in 100 c.c. of dilute acetic acid (sp. gr. 1.044), and (b) 8 grms. of *a*-naphthylamine in a litre of the acetic acid, the solutions being filtered through cotton after standing a few minutes. Two c.c. of each of these solutions are to be used in the test.—C. M.

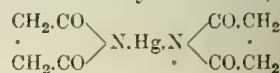
#### Mercury; Determination of — in Organic Compounds [and Reactions of Mercury Succinimide].

E. Rüchardt. Ph. Nöhl. Arch. Pharm., 1905, 243, 1–5.

THE volumetric determination of mercury by thionin (Ber., 35, 2015) has been adapted to the value of organic mercury compounds such as the drugs *Hydrarg. salicylicum* and *Hydrarg. succinimidatum*.

In order to oxidise the organic matter, 0.3 gm. of substance is heated in a 150 c.c. flask with 4 grms. of sodium sulphate and 5 c.c. of concentrated sulphuric acid to gentle boiling until quite clear. A reflux apparatus 40–50 cm. long is provided to prevent loss of mercury by volatilisation, and this is then rinsed with 5–10 c.c. of concentrated sulphuric acid and reboiled. 0.1–0.2 gm. of potassium permanganate is now added to ensure the mercury being in the mercuric condition, and the heating continued until the pink colour vanishes. After cooling, the liquid is diluted to about 100 c.c., allowed to cool, 2 c.c. of 10 per cent. iron alum solution is added as indicator and then titrated with N/10 potassium cyanate, the flask being frequently rotated. Each c.c. of thiocyanate corresponds to 0.010015 gm. of mercury and 93.93 per cent. of mercury salicylate was found in the drug, compared with 94.02 per cent. found gravimetrically.

The paper concludes with a description of two characteristic reactions of mercury succinimide,



When this compound is heated with zinc dust, pyrrol is liberated, and may be detected in the usual way by the red colour imparted to a pine shaving soaked with concentrated hydrochloric acid. Also the 10 per cent. aqueous solution added to 2 volumes of baryta-water gives a white precipitate turning greyish-black.



ing, owing to liberation of ammonia by hydrolysis subsequent formation of a mercuryamino compound. —F. Spx.

### ORGANIC—QUALITATIVE.

*Oil: Detection of* — when used as a Colouring Material in Oils and Fats. C. A. Crampton and F. D. Sins. J. Amer. Chem. Soc., 1905, 27, 270—274.

oil is used in admixture with cotton-seed oil as a drying agent for oleomargarine. Two commercial "rag oils" of this character, consisting of cotton-seed oil 2 to 5 per cent. of palm oil gave the following on analysis:—Sp. gr. at 15.5° C., 0.9119 and 0.9121; refractive index at 25° C., 1.4701 and 1.4706; iodine value, 107.8 and 110.3; and acid value, 3.1 and 3.2. For the identification of the small amount of palm oil it would be present in the oleomargarine prepared from these products (not more than 1 per cent.), the following place reliance on the following reactions:—*First Method:* 100 c.c. of the fat are dissolved in 300 c.c. of amyl spirit, and the solution shaken out with 50 c.c. of 5 per cent. solution of potassium hydroxide. The aqueous layer is acidified with hydrochloric acid and extracted with 10 c.c. of carbon tetrachloride, and part of the extract treated with 2 c.c. of a reagent consisting of crystallised phenol in 2 parts of carbon tetrachloride, and then with 5 drops of hydrobromic acid (sp. gr. 1.19). The porcelain crucible is gently shaken, a bluish-green colour appears almost immediately, the presence of palm oil is indicated. *Second Method:* A solution of the reagent used in the Liebermann test for rosin oil is employed. Ten c.c. of the oil and filtered fat are shaken with an equal quantity of colourless acetic anhydride, after which one drop of sulphuric acid (sp. gr. 1.53) is added, and the mixture again shaken for a few seconds. When palm oil is present, a greenish-blue colour is seen on the lower layers, as they separate. The test was applied to various oils and fats ordinarily used for edible purposes, and it was found that sesame oil, cotton-seed oil, and mustard oil did give colours that could be confused with the colour yielded by palm oil, but their presence could easily be demonstrated by other characteristic tests, the sesame oil by the furfural reaction, the mustard oil by the high refractive index of the acids extracted by the alkali solution. More colouring matter in sesame oil may be revealed by repeated extraction with alcohol, and the palm oil will not give the blue colour in the test for oil. Cotton-seed oil containing 1 per cent. of palm oil acts with the same intensity after extraction with alcohol as before. The following precautions must be observed in making these colour tests for palm oil:—All reagents must be pure and colourless, any tint in the phenol, acetic anhydride or carbon tetrachloride, having an influence on the final coloration. The fat under examination must be freshly and carefully filtered at a temperature not exceeding 70° C. Exposure of the fat to air or light, or the presence of water, alcohol, ether, &c., interferes with the reaction. The bluish-green colour is transient. Any colorations occur after the lapse of several minutes must be disregarded. (5) The test should be corroborated by determining the refractive index of the fatty acids. This must not exceed 1.4615 at 25° C. in the case of oleomargarine prepared from oleo oil, cotton-seed oil and palm oil. If maize oil, mustard oil, &c., be present, this value will be much higher. Bleached palm oil does not give the reactions just described.—C. A. M.

*Hydrates; Some Reactions of* —. R. and O. L. Pflüger's Arch., 1905, 106, 323—328. Chem. Zentr., 1905, 1, 672—673.

*Pentoses.* A mixture of equal parts of glacial acetic acid and aniline is heated to boiling, and a small quantity of the substance under examination introduced, when if pentoses be present, a red colour is produced owing to formation of furfural-aniline acetate. Other aromatic amines may be used in place of aniline. With the toluidines, red furfural-toluidines, and with benzidine, brownish-red

furfural-benzidine, are formed. These compounds are all insoluble in water, but soluble in ether. *Methyl-pentoses* (rhamnose) react in a similar manner to pentoses; with aniline, a yellow coloration is produced. Tollens' tests for *pentoses* with orcinol and phloroglucinol can be carried out in glacial acetic acid solution if a small quantity of hydrochloric acid (one or two drops of a 36 per cent. solution) be added. *Pentoses* and *heptoses* give with orcinol a violet coloration, changing to green on addition of ferric chloride, and to red on addition of caustic soda. *Hexoses* and *hexose-forming di- and tri-saccharides* behave differently. If *dextrose* be heated with glacial acetic acid and aniline, a reddish-brown coloration is produced, changing to green on further heating. Disaccharides give these reactions only if they are previously hydrolysed. *o-* and *m-* Toluidine produce a green, *p*-toluidine a red, and benzidine a reddish-brown coloration with dextrose. The green colouring matter produced when hexoses are heated with aniline and glacial acetic acid is insoluble in water, but easily soluble in ether. Selivanoff's reaction with resorcinol for distinguishing *ketoses* from *aldoses* can be carried out in glacial acetic acid solution with the addition of a little hydrochloric acid. *Ketoses* give a red coloration, but not *aldoses*. Dimethylresorcinol or diresorcinol may be used instead of resorcinol; with the latter, an intense dark red to violet-black coloration is produced.—A. S.

*Papers from Rags; Testing* —. E. L. Sellegger. Paper and Pulp, 1905, 10, 189—191.

RECENTLY ramie fibre has been employed to a slight extent in the manufacture of German rag papers; it closely resembles linen and hemp in appearance, and is in no way inferior to these in strength and durability. The detection of ramie in admixture with rag fibres is very difficult and necessitates the examination of a section. When testing reputed rag papers for adulteration with straw- or wood-cellulose, it is usual to stain the preparation with iodine in conjunction with a reagent such as zinc chloride or calcium nitrate. In such cases, a casual examination may lead to the impression that foreign fibres are present, since fibres and particles are sometimes observed which are stained a pure blue colour by the reagent. These fragments are, however, merely the bleached residues of the "sheavy" or flax-straw, and are very numerous in canvas and coarse Russian lincens. The cell elements are generally quite short, very thin, and marked with fine lines or seams; they have a slight resemblance to straw-cellulose, but the corrugated cells of the latter are absent, and the cells of the parenchyma in the "sheavy" are rarer and smaller, and of a different shape. If the calcium nitrate-iodine reagent be employed, the cells of the "sheavy" are stained a bright blue, whereas those of straw- and pine-cellulose do not acquire such a definite colour. The small proportion of "sheavy" cannot have any deleterious effect on the mechanical qualities of the paper; on the contrary, it is generally found that papers containing bleached "sheavy" are stronger than those free from the same, owing to the fact that they are prepared from coarser stronger rags.

—J. F. B.

*Mercury in Mercury Compounds; Determination of* — [and Reactions of Mercury Succinimide]. E. Rupp and Ph. Nöll. Inorg. Quantitat., page 350.

### ORGANIC—QUANTITATIVE.

*Amino Bases; Separation of Primary and Secondary* —. O. Hinsberg and J. Kessler. Ber., 1905, 38, 906—911.

*Separation of Primary Bases with less than Seven Atoms of Carbon from Secondary Bases.* — The mixture of bases is treated with 4 mol. equivalents of potassium hydroxide in the form of a 12 per cent. solution, 1½ mol. equivalents of benzene-sulphochloride are added in small portions with agitation, and the mixture is warmed to remove excess of the sulphochloride. The liquid is acidified with hydrochloric acid, and the

precipitated benzene-sulphamides are filtered off, or extracted with ether. Any dibenzene-sulphamides present are converted into the mono-compounds by heating the precipitate for 15 minutes under a reflux condenser with sodium ethylate (about 0.8 grm. of sodium in 20 c.c. of 96 per cent. alcohol for each grm. of bases). The liquid is then diluted with water, the alcohol distilled off, and the benzene-sulphamides of the secondary bases, which are insoluble in alkali filtered off. The filtrate is acidified and the separated benzene-sulphamides of the primary bases removed by filtration or extraction with ether. The free bases are obtained from the benzene-sulphamides by heating with hydrochloric or sulphuric acid to 120°—150° C. in the usual manner.

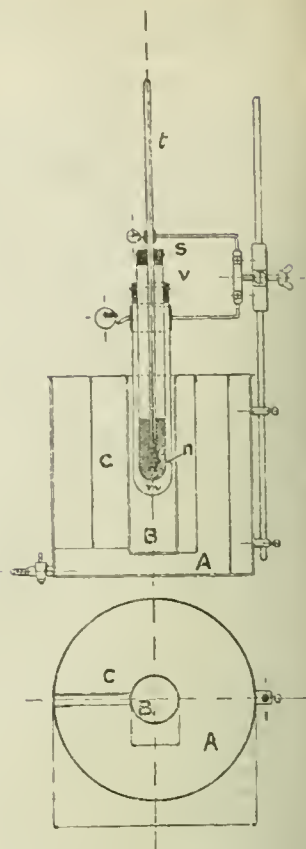
*Separation of Primary Aliphatic and Hydrocyclic Bases with more than Six Atoms of Carbon from Secondary Bases.*—After the treatment with sodium ethylate as described above, the liquid is diluted with water, the alcohol distilled off, the residue acidified, and the mixture of sulphamides filtered off. After drying, the precipitate is dissolved in anhydrous ether, metallic sodium added in small pieces, and the whole gently warmed on the water-bath for six to eight hours. After cooling, the ethereal solution is filtered, the residue in the flask shaken with ether, and the latter poured through the same filter. The insoluble matter when acidified with hydrochloric acid yields the benzene-sulphamides of the primary bases, whilst the evaporation residue of the ethereal solution contains those of the secondary bases.—A. S.

*Oils, Lubricating; Testing the Behaviour of — in the Cold.* R. Hackel. Mitt. kaiserl. königl. Techn. Gewerbe-Museum in Wien. 1905, 15, 38—45.

In the author's opinion the best method of determining the solidification point of lubricating oils is to keep them for at least an hour immersed successively in freezing mixtures of ice and water, containing the following salts in solution:—

To Produce a Temperature of Approximately:	Salt.	Parts by Weight in 100 Parts of Water.
— 3	Potassium nitrate	13.0
— 5	Potassium nitrate and sodium chloride	13.0 and 3.3
— 9	Barium chloride	35.8
— 10	Potassium chloride	22.5
— 15	Ammonium chloride	25.0
— 19	Sodium nitrate	50.0
— 21	Sodium chloride	33.0

The salt solutions and ice must be placed in a vessel of at least 100 mm. in diameter, since otherwise the layer of liquid between the test-tube and wall of the vessel solidifies too rapidly. The results thus obtained differed very greatly from the solidification points determined by the more rapid method of immersing the tube of oil in a mixture of ice and salt. The error in the latter method is shown to differ in amount in each individual case, so that it is impossible to determine any factor of correction, and the author considers that the results cannot be regarded of value as even approximate determinations. The apparatus shown in the figure, however, is recommended as giving results closer to the truth, since it allows the oil to be cooled much more slowly. The vessel A is filled with the mixture of ice and salt, whilst none is placed in the inner chamber B, and the observation slit C. The test-tube, *n* (diameter 20 mm.) is filled with the oil to a depth of 30 mm. and closed by the india-rubber cork, *s*, through which is passed the thermometer, *t*. The tube is then placed in a larger tube, *m* (diameter 30 mm.), and kept in position by means of the cork ring, *v*, so that it is surrounded by a layer of air of about 4 mm. The tube *m* is then lowered into the vessel, B, and clamped in position. The behaviour of the oil can be observed through the slit, C, and the tubes can be raised and shaken without coming in contact with the hand. The results thus obtained with three different oils differed by



at most —1.5° C. from those given by the method of immersion in the different salt solutions, which are taken as standards of comparison.—C. A. M.

*Maltose in Presence of Dextrose; Detection and Determination of Small Quantities of —.* J. L. Baker and W. D. Dick. Analyst. 1905, 30, 79—83.

The authors have critically examined the method proposed by Grimbert (this J., 1903, 382) for the detection of maltose in presence of dextrose, based on the differences in solubilities of their osazones in acetone. They found that benzene is not a suitable solvent for removing the by-products of the osazone reaction, since it dissolves maltosazone. The mixed osazones, however, purified by treatment with a little cold 5 per cent. acetone; when the mixture is subsequently extracted in a Gooch crucible with 10—15 c.c. of cold 20 per cent. acetone, the filtrate deposits crystals of maltosazone mixed with a little dextrosazone. In this manner the presence of maltose can be detected with certainty provided the proportion of this sugar is not less than 15 per cent. in the mixture. The method, however, cannot serve for the quantitative determination of maltose in presence of dextrose.

Small quantities of maltose can be determined in the presence of dextrose, with a fair degree of accuracy, by determining the reducing power of the solution before and after inversion. The inversion is best effected by heating 10 c.c. of a 2 per cent. solution of the sugars with 1 c.c. of strong hydrochloric acid and 10 c.c. of water in a boiling water-bath for 90 minutes. The results so obtained may be confirmed by fermenting the solution of the sugars by *S. Marxiensis*, which removes most of the dextrose, and leaves the maltose unchanged. A fall in the specific rotation and a fall in the reducing power as the result of the fermentation, is additional evidence of the presence of maltose. Finally the fermenting solution may be tested by the osazone method.



above tests cannot be applied in presence of dex-  
and the latter, if present, must first be removed by  
and precipitations with alcohol or mixtures of alcohol  
etone.—J. F. B.

*Cereals; Analysis of* ——. J. L. Baker.  
Brewers J., 1905, 41, 186.

Brewers' extract in flaked cereals is usually deter-  
by mashing a mixture of two-thirds of malt, the  
extract in which is known, and one-third of the  
d cereal. The total extract of the mixture is  
d from the density of the wort, and the proportion  
by the "flakes" is calculated by subtracting that  
of the malt. The author uses a mixture of equal parts  
of "flakes," in order to decrease the error of the  
determination, passing both malt and cereal  
a Sieck mill set at 25. It is shown, however,  
the yield of extract obtained from the "flakes"  
largely according to the diastatic power of the  
and that with the more highly cured malts, the  
n of the proportion of "flakes" to malt is of con-  
siderable importance. The following results are quoted  
sample of flaked maize:—

Power Malt. (tner.)	Extract per 336 lb. of Maize, Mashed in Proportion of 1 : 1.	Extract per 336 lb. of Maize, Mashed in Proportion of 1 : 2.
40	106.50 lb.	106.4 lb.
34	102.40 ..	103.2 ..
25	100.25 ..	103.3 ..
12	97.64 ..	99.17 ..

—J. F. B.

*Acid; Purification and Determination of* ——.  
E. Rupp. Arch. Pharm., 1905, 243, 69—73.

Formic acid prepared from sodium formate,  
is now made in large quantities by the action of  
monoxide on powdered caustic soda under pressure,  
to contain traces of sulphur and chlorine. It may  
ified by shaking with litharge for 24 hours and  
ing, and then precipitating the sulphur by dilution,  
being insoluble in 25 per cent. acid.

The determination of formic acid or formates, oxida-  
th sodium hypobromite is recommended. Carbon  
and water are produced. A measured volume of  
d hypobromite solution is diluted to 70—100 c.c.  
oppered flask and the formic acid added in such  
y that about half the hypobromite remains in

Dilute hydrochloric acid is dropped in from a  
until the yellow colour of bromine becomes per-  
cent. The solution is then allowed to stand for 30  
s in the dark, after which about 1 gm. of potassium  
and 10—20 c.c. of dilute hydrochloric acid are added,  
e liberated iodine titrated with N/10 thiosulphate  
n. The difference between the initial and final  
values gives the amount of hypobromite used.  
of N/10 thiosulphate corresponds to 0.0023 grm.  
ic acid.

Hypobromite solution is made by dissolving 15  
of sodium hydroxide (pure by alcohol) in 450 c.c.  
er and adding 5 c.c. of bromine, after cooling, and  
g up to 500 c.c. In absence of air and light the  
factor remains very constant.—F. SDS.

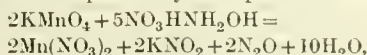
*Hydroxylamine; Volumetric Determination of* ——.  
J. Simon. Comptes rend., 1905, 140, 724—727.

Fixe to the author's method (this J., 1903, 113),  
ylamine is determined by adding an excess of  
oxalate to a neutralised solution of the hydroxyl-  
salt and titrating with permanganate. The theo-  
proportion of oxalate required to give correct  
according to the equation (*loc. cit.*) is 1 mol. of  
im oxalate to 2 mols. of hydroxylamine. If the  
tion of sodium oxalate be lower than the above,  
hole of the oxalate behaves as hydroxylamine  
e, and reduces the permanganate in accordance  
he equation, but the excess of other hydroxylamine  
duces it in another ratio (*loc. cit.*), and the results  
o high. On the other hand, an excess of sodium

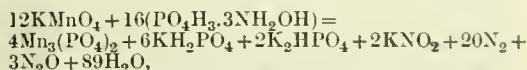
oxalate beyond the theoretical quantity introduces an  
error in the results, which may be as much as 3 per cent.  
too low. The best way is to make a first titration in  
presence of an excess of sodium oxalate, thus obtaining  
a permanganate value slightly too low, and then to make  
a second titration in presence of a volume of N/10 sodium  
oxalate solution equal to double the volume of N/10  
permanganate consumed in the first test. The second  
titration, being made with a deficiency of sodium oxalate  
proportional to the error of the first test, will give a per-  
manganate value correspondingly too high. The mean of  
the two tests may then be taken as the closest approxi-  
mation to the true value that the method is capable of  
affording.—J. F. B.

*Hydroxylamine; Action of Potassium Permanganate on  
Salts of* ——. L. J. Simon. Comptes rend., 1905,  
140, 659—661.

The reaction of potassium permanganate on hydroxyl-  
amine nitrate is expressed by the equation—



so that 1 molecule of hydroxylamine nitrate reduces  
0.4 molecule of permanganate (as with the chloride and  
sulphate, this J., 1903, 113). If the solution be now  
acidified, further permanganate can be decolorised, corres-  
ponding to the nitrite formed—0.16 molecule for each  
molecule of hydroxylamine. This is double the corres-  
ponding quantity in the case of chloride or sulphate.  
With phosphate or arsenate of hydroxylamine the equation  
is—



and the proportion of permanganate to hydroxylamine is  
the same as in the case of the oxalate (*loc. cit.*). The  
additional amount of permanganate decolorised on  
acidifying is only 0.0166 molecule per molecule of  
hydroxylamine.

If the hydroxylamine solution be acidified before adding  
the permanganate, the reaction is much more complex  
and less regular. The reducing power is increased, but  
the amount of permanganate destroyed depends on the  
concentration, the temperature, the rapidity of the opera-  
tion, and other circumstances; so that the reaction of  
permanganate in acid solution cannot be used as a mode  
of determining hydroxylamine.—J. T. D.

*Iodoform; Determination of* ——. Utz. Pharm. Centr.,  
1904, 45, 985—987. Pharm. J., 1905, 74, 405.

0.1 GRM. of the sample is dissolved in 10 c.c. of a mixture  
of ether and methyl alcohol, and the solution is treated  
with a few drops of fuming nitric acid and 10 c.c. of N/10  
silver nitrate solution, and heated gently on the water-  
bath, until an odour of ether or of nitrous acid can no  
longer be detected. The solution is then diluted with  
50—100 c.c. of water, and the excess of silver nitrate  
titrated with ammonium thiocyanate solution. 1 c.c. of  
N/10 silver nitrate solution is equivalent to 0.0131 grm.  
of iodoform. In the case of bandages, &c., 5 grms. of  
the material are extracted with 100 c.c. of a mixture of  
ether and methyl alcohol, and the amount of iodoform in  
20 c.c. of the solution determined.—A. S.

*Hydrosulphites; Analysis of Solutions of* —, and of  
Formaline. E. Orloff. Inorg. Quantitat., page 348.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Radium Bromide; Action of* —, upon the Electric  
Resistance of Metals. B. Sabat. Comptes rend.,  
1905, 140, 644—646.

METALLIC wires were wrapped round a glass tube, in the  
centre of which a tube of pure radium bromide could be  
placed, and the electric resistance was measured before  
and after the introduction of the radium bromide. The  
metals used were iron, steel, copper, platinum, bismuth,

Exposure to radium bromide increased their resistance. Immediately on exposure the resistance rose suddenly, then a further gradual increase occurred, till a maximum was reached. On removing the radium, the resistance slowly fell till the initial value was regained. The variation of resistance was several times too great to be accounted for by the direct communication of heat from the radium to the wire. The author concludes that the metals, absorbing the  $\beta$ -radiation, transform part of its energy into heat, which raises the temperature of the metal and thus increases its resistance. The  $\beta$ -rays thus behave exactly like cathode rays, though with a less intensity, for they are not so readily absorbed as cathode rays.

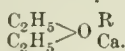
—J. T. D.

*Hydrogen and Chlorine; Cause of the Period of Chemical Induction in the Union of —.* D. L. Chapman and C. H. Burgess. *Proc. Roy. Soc.*, 1905, **74**, 400.

THE retardation of the interaction of hydrogen and chlorine which is observed under certain conditions does not depend on any condition of the hydrogen. Water and aqueous solutions of salts are found to render active chlorine inactive towards hydrogen. On long contact with chlorine in presence of light, or on boiling with chlorine, the solutions lose this property, and do not regain it even on subsequent removal of the chlorine; the only method found to restore to these solutions their power of rendering chlorine inactive was the introduction of substances which react with chlorine; ammonia is the most efficient in this respect; sulphur dioxide acts similarly, but is more easily removed on exposure to light. It was proved that no decay of activity took place when an active mixture of hydrogen and chlorine was kept for some time in the dark. It is conclusively established that the phenomenon in question is due solely to the presence in the gas of substances capable of reacting with chlorine, and not to the formation of an unstable intermediate compound.—T. F. B.

*Calcium; Some Applications of Metallic —.*  
E. Beckmann. *Ber.* 1905, **38**, 904–906.

THE metallic calcium used by the author was in the form of turnings, which keep bright in dry air. Calcium reduces nitrobenzene in alkaline, alcoholic solution to azoxybenzene, in hydrochloric acid solution further to aniline. Oximes yielded amines in alkaline as well as acid solution. Benzenesulphonichloride in alkaline solution was reduced to the sulphinic acid, in acid solution to thiophenol. In alkaline solution some mercury bichloride was always added. Calcium may replace magnesium in Grignard's reaction. The author obtained by heating iodobenzene dissolved in dry ether with finely-divided calcium after one hour, a light brown powder which yielded benzoic acid by passing carbon dioxide into the solution, or diphenyl carbinol by addition of benzaldehyde. Ethyl iodide reacts more readily, yielding calcium-ethyl iodide. The presence of ether is necessary for this reaction, for calcium remains unattacked by ethyl halide in benzene solution. According to Baeyer (see this J., 1902, 607) a combination of calcium ethyl iodide with ether to



is suggested. This would explain why ether adheres so tenaciously to these compounds, and is only split off under reduced pressure at 40° C. By addition of water, ethane is liberated and the smell of ether is perceptible. Several metallic oxides and sulphides are reduced by finely-divided calcium according to Goldschmidt's method (see this J., 1898, 543), e.g., manganese peroxide, cupric oxide, lead oxide and cupric sulphide.—R. L.

*Fermentative Oxidations; Indirect —. Oxidation of Hydroquinone.* L. Marchadier. *J. Pharm. Chim.*, 1905, **21**, 299–302.

UNDER the action of the oxygen of the air or of hydrogen peroxide, hydroquinone undergoes a slight oxidation, but an oxidising enzyme causes vigorous oxidation, quinhydrone and quinone being formed. When the

oxydase acts on hydroquinone in conjunction with gen peroxide, the different stages of the oxidation more clearly manifested, quinone and ordinary hydrone being obtained, together with another hydrone corresponding with a lesser degree of oxidation than the ordinary quinhydrone.—T. H. P.

*Nitrifying Ferment; Influence of Ammonium Salt Nitrification of Sodium Nitrite by the —.* E. langer and L. Massol. *Comptes rend.*, 1905, **687**–689.

THE mineral nutrient medium employed by Winogradsky and Omeliansky for the cultivation of the nitrifying organism contains one gram. of sodium carbonate per litre. The present authors find that this proportion may be reduced to 0.2 gram. per litre without interfering with the nitrifying activity of the organism. With media in which the quantity of sodium carbonate does not exceed 0.25 gram. per litre, the addition of ammonium sulphate (1–2 gram. per litre) in no way retards the oxidation of sodium nitrite by the ferment. Consequently, the inhibitive action of ammonium salts on the activity of the organism, reported by Winogradsky and Omeliansky, is to be ascribed not to the action of those salts themselves, but to the production of free ammonia in quantities sufficient to injure the organism, owing to the excessive proportion of sodium carbonate present in the medium and to the dissociation of the ammonium carbonate present thereby.—J. F. B.

*Nicotine; Antidote to —.* C. Zalackas. *Comptes rend.*, 1905, **140**, 741–742.

THE juice of *Nasturtium officinale* is a definite antidote to nicotine poisoning. This juice is very rich in iodine, especially when the plant is grown near sea coasts, these elements, and the action of the antidote, are ascribed to the revivification of the blood corpuscles by these constituents.—J. F. B.

## New Books.

**MINERAL RESOURCES OF THE UNITED STATES.** Year 1903. (Department of the Interior, United States Geological Survey, Chas. D. Walcott, Director.) DAVID T. DAY, Chief of Division of Mining and Geographical Resources. Washington, U.S.A., Government Printing Office, 1904.

8vo volume, containing "Letter of Transmittal," Preface, and 1178 pages of subject matter with a detailed alphabetical index of subjects. The following are the principal subjects which geographical and industrial details are given: I. Iron Ores. (i) Statistics of the American Iron Trade. 1903. II. Manganese Ore. III. Gold and Silver. IV. Copper. V. Lead. VI. Zinc. VII. Aluminium. VIII. Mercury. IX. Steel-hardening Materials. (Manganese, Nickel and Cobalt, Chromium, Tungsten, Molybdenum, Vanadium, Uranium and Titanium.) X. Platinum. XI. Lithium. XII. Antimony. XIII. Tin. XIV. Coal and Coke. XV. Gas. XVI. Tar, and Ammonia at Gas Works, and in Retorts. XVII. Petroleum. XVIII. Natural Gas. XIX. Asphaltum and Bituminous Rock. XX. Stone. XXI. Clay Working Industries. XXII. Cement. XXIII. Precious Stones. XXIV. Tale and Soapstone. XXV. Abrasive Materials. XXVI. Borax. XXVII. Fluorite and Cryolite. XXVIII. Gypsum and Gypsum Products. XXIX. Phosphate Rock. XXX. Salt. XXXI. Sulphur and Pyrites. XXXII. Barytes. XXXIII. Glass. XXXIV. Asbestos. XXXV. Flint and Quartz. XXXVI. Graphite. XXXVII. Magnesite. XXXVIII. Mineral Waters. XXXIX. Monazite and Zircon. XL. Glass Sand.



## Trade Report.

### I.—GENERAL.

#### CAPE COLONY; TRADE OF — IN 1904.

*Bd. of Trade J., March 16, 1905.*

Following tables show the total value of the imports and exports, including transit trade in both cases, of articles into and from Cape Colony during 1903 and 1904.

#### Imports into Cape Colony.

Article.	Year ended 31st December, 1903.	Year ended 31st December, 1904.
	£	£
Gold metal manufactures	3,863,000	2,510,000
and leather manufactures	1,491,000	877,000
beverages	580,000	385,000
and chemicals	365,000	246,000
candles	231,000	242,000
and patent fuel	295,000	204,000
and oil	136,000	165,000
ammunition (includes te and blasting com- and powder)	216,000	156,000
are manufactures	196,000	123,000
and colours (includes and varnish)	159,000	100,000
ores	85,000	73,000

1.—The figures of imports into Cape Colony are exclusive of those supplied by the Imperial Government, but supplies for the military are still partly contracted for on the spot.

#### Exports from Cape Colony.

Article.	Year ended 31st December, 1903.	Year ended 31st December, 1904.
	£	£
Wool	457,000	514,000
and skins	469,000	476,000

#### TRANSVAAL; TRADE OF THE — IN 1904.

*Bd. of Trade J., March 16, 1905.*

Following tables, showing the value of certain articles imported into and exported from the Transvaal for the year ended 31st December, 1904, as compared with the year 1903, have been compiled from official figures published in the *Transvaal Government Gazette* of February 1905.

#### Imports.

Article.	1903.	1904.
	£	£
and manufactures	3,769,000	2,550,000
and chemicals	500,000	472,000
and manufactures	735,000	468,000
(includes ale, spirits, and mineral waters)	814,000	426,000
ammunition (includes te and other explosives)	130,000	291,000
and oilmen's stores		
and oils and paints)	398,000	289,000
candles	246,000	239,000
and glassware	113,000	74,000
ware and crockery	80,000	42,000
and lime	41,000	41,000
	35,000	30,000
and patent fuel	9,000	23,000
phic material	34,000	21,000

#### Exports.

Article.	1903.	1904.
	£	£
Coal	151,000	144,000
Skins, hides and horns	4,000	40,000

### II.—FUEL, GAS, AND LIGHT.

#### MANTLES FOR INCANDESCENT LIGHT; TARIFF CLASSIFICATION OF — IN RUSSIA.

*Bd. of Trade J., March 23, 1905.*

The Russian Customs Department have notified that annealed mantles for incandescent light are to be dutiable on importation into Russia under Article 169 of the tariff as "physical apparatus for intensifying light," at the rate of 10 rubls. 20 cop. per pound (7½d. per lb.).

Similar mantles, not annealed, of textile materials, even if impregnated with a mineral substance, are to pay duty according to the material of which they are made.

### III.—TAR PRODUCTS, PETROLEUM, Etc.

#### PARAFFIN: U.S. CUSTOMS DECISION.

The United States Circuit Court has decided that both liquid paraffin and paraffinum molle, a product of petroleum and a wax, are free of duty as "paraffin" under paragraph 633 of the free list. The ground taken by the Court was that the enumeration of paraffin by name constitutes a more specific designation than the provisions of paragraph 626, which places a countervailing duty on products of petroleum.—R. W. M.

### VII.—ACIDS, ALKALIS, Etc.

#### ACETIC ACID; EXEMPTION FROM DUTY OF — IN THE NETHERLANDS.

*Bd. of Trade J., March 23, 1905.*

A Dutch Decree, dated December 23rd, 1904, exempts from taxation acetic acid and acetyl oxide (acetic anhydride) for use in the preparation of chemical products.

#### PHOSPHORIC ACID: U.S. CUSTOMS DECISION.

The United States Circuit Court has decided that syrupy phosphoric acid is free of duty as "phosphoric acid" under paragraph 464 of the free list. The assessment of duty as "syrup of phosphoric acid" at 25 per cent. *ad valorem* under paragraph 68, providing for "medicinal preparations," was overruled. The Treasury Department will not appeal from this decision.—R. W. M.

#### STRONTIUM CARBONATE: U.S. CUSTOMS DECISION.

*Feb. 28, 1904.*

Precipitated strontium carbonate was held to be dutiable at 25 per cent. *ad valorem* as a "chemical salt," under paragraph three of the tariff. No evidence was offered to show that it was mineral carbonate of strontia.

—R. W. M.

### IX.—BUILDING MATERIALS, Etc.

#### CEMENT INDUSTRY; ESTABLISHMENT OF — IN CANADA.

*Bd. of Trade J., March 23, 1905.*

The *Monetary Times* (Toronto) states that arrangements have been completed for the building at Sydney,

Cape Breton, of a large plant for making cement from slag, one of the by-products of the Dominion Iron and Steel Company. The plant is to cost about 250,000 dols., and will be the only one of the kind in Canada. The site has been selected close to the steel works. Its capacity will probably be 500 barrels a day, and a coeprage with a capacity of 50,000 barrels a year is also proposed to be built. The plant, which is to be of steel, will probably be finished in July. The city council of Sydney have granted the company a bonus of 10,000 dols., exemption from taxes for 20 years, and low water rates, providing the company manufacture not less than 25,000 barrels of cement a year.

#### X.—METALLURGY.

##### TRANSVAAL; MINERAL PRODUCTION OF —, IN 1903-04.

*Bd. of Trade J., March 2, 1905.*

The following table shows the quantity and value of the mineral production of the Transvaal during the year ended June 30, 1904, with comparative figures for the preceding year:—

		1902-03.		1903-04.	
		Quantity.	Value.	Quantity.	Value.
Gold .....	fine ozs.	2,372,076	£ 10,075,926	3,475,911	£ 14,762,10
Silver .....	"	280,997	29,215	406,677	45,1
Diamonds .....	carats	33,572.57	46,358	497,917.14	685,7
Coal .....	tons	1,969,089	782,906*	2,370,465	895,0

\* Value of coal sold.

The following figures show the value of the output of the various industrial concerns in the Transvaal during the year ended June last, with comparisons for the preceding year:—

	1902-03.	1903-04.
Machine-made bricks (building) .....	£ 59,741	£ 114,698
" " (fire) .....	7,961	8,726
Cement .....	9,880	24,355
Lime (blue) .....	41,129	16,628
" (white) .....	12,727	56,486
Slate .....	6,000	15,500

##### PIG IRON PRODUCTION OF CANADA.

*Eng. and Mining J., March 9, 1905.*

The statistics of the production of all kinds of pig iron in Canada in the calendar year 1904 show an increase of 5524 gross tons, or a little over 2 per cent., as compared with 1903, but a decrease of 48,615 tons as compared with 1902.

The total production in 1904 amounted to 270,942 gross tons, against 265,418 tons in 1903. In the first half of 1904 the production was 120,643 tons, and in the second half it was 150,299 tons. Of the total production in 1904, 251,671 tons were made with coke and 19,271 tons with charcoal. About one-fourth of the total production was basic pig iron, namely, 70,133 tons. The production of bessemer pig iron, all made in the last half of the year, was 26,016 tons. Spiegeleisen and ferromanganese have not been made since 1899.

The unsold stocks of pig iron in Canada at the close of 1904 amounted to 35,119 tons. On December 31, 1904, Canada had 15 completed blast furnaces, of which eight were in blast and seven were idle. Of this total, 10 were equipped to use coke for fuel and five to use charcoal. In addition, three coke furnaces were partly erected on

December 31, but work on the furnaces had been suspended some time ago.

##### OPEN-HEARTH STEEL PRODUCTION OF THE U.S.

*Eng. and Mining J., March 16, 1905.*

The total production of open-hearth steel ingots and castings in the United States in 1904 was 5,907,660 tons, against 5,829,911 tons in 1903, an increase of 1 per cent. In 1902 the total production was 5,687,720 tons, and in 1901 it was 4,656,309 tons. The open-hearth made in 1904 was produced by 115 works. In 1903 there were 111 such works.

The production of open-hearth steel ingots in excluding castings, amounted to 5,605,332 gross tons against 5,429,563 tons in 1903, an increase of 175,769 tons.

In 1903, 4,734,913 tons of open-hearth steel were made by the basic process and 1,094,998 tons were made by the acid process, while in 1904 the production by the basic process amounted to 5,106,367 tons and by the acid process to 801,299 tons.

There was a decrease in the production of acid steel in 1904, as compared with 1903, of 293,699 tons, or

26.8 per cent., but an increase in the production of steel of 371,454 tons, or over 7.8 per cent.

The total production of open-hearth steel castings in 1904, included above, amounted to 302,334 gross tons, of which 98,919 tons were made by the basic process and 203,415 tons were made by the acid process. In 1903 the production of open-hearth steel castings amounted to 400,348 tons, of which 134,879 tons were made by the basic process and 265,469 tons by the acid process.

The total production of steel is given in the table in long tons:—

	1903.	1904.
Bessemer .....	Tons. 8,592,829	Tons. 7,859,
Open-hearth .....	5,829,911	5,907,
Crucible, &c. ....	112,238	110,
Totals .....	14,534,978	3,876,

The net result shown in this statement is that, in 1904, the net production of steel decreased 8.5 per cent. The production of open-hearth steel decreased 2.0 per cent., the open-hearth steel castings increased 1.3 per cent. The reduction in the total production was 4.5 per cent. This decrease is somewhat proportion than that in pig iron. The ratio of steel production to pig iron, which was 80.7 in 1903, was 84.1 last year.

##### TIN EXPORTS FROM THE FEDERATED MALAY STATES IN 1904.

*Bd. of Trade J., March 16, 1905.*

The following statement, showing the weight of tin ore (tin exported in the form of ore having been at 68 per cent.\* of the gross weight of the ore) exported from the Federated Malay States during the year with corresponding figures for the preceding years taken from the *Selangor Government Gazette* of 3rd February:—





According to customs returns, exports of nickel in matte, &c., were as follows, in pounds:—

To Great Britain .....	2,028,908
To United States .....	9,204,961
Total .....	11,233,869

The price of refined nickel in New York remained steady throughout the year at from 40 to 47 cents per pound.

The production of asbestos, divided into crude and mill stock, was as follows:—Crude, 4,239 tons; value 509,001 dols.; mill stock, 31,996 tons; value 58,277 dols.; total, 35,035 tons; value, 1,167,278 dols. The exports of asbestos, according to Customs returns, were 37,272 tons, valued at 1,160,887 dols.

There was a somewhat increased production of natural gas in Ontario, due entirely to operations in the Welland field, production in the Essex field having dropped to very small amounts. The development of the gas field at Medicine Hat, North-West territories, seems to have been continued with much success. The gas commission of the town of Medicine Hat has now six producing wells, one of which has been put down to a depth of nearly 1000 ft., yielding 1,125,000 cub. ft. per 24 hours. The Canadian Pacific Railway Company has just completed drilling a well to a depth of 989 ft. with 4½ in. casing to 941 ft. The pressure per square inch developed in 18 hours was 525 pounds.

The production of natural rock cement shows another large decrease in 1904, the sales being only 56,814 barrels as compared with 92,252 barrels in 1903. Although a much larger quantity of Portland cement was sold in 1904, the total value, owing to the fall in price, is only slightly in excess of that in 1903. In the absence of complete returns, Portland cement statistics have been partially estimated. The following is, however, a close approximation:—Portland cement sold, 900,358 barrels, valued at 1,272,992 dols.; Portland cement manufactured, 908,990 barrels. The imports of Portland cement in 1904 were 2,746,208 cwt. This is equivalent to about 784,630 barrels of 350 lb. each, at an average price per barrel of 1.35 dols. The duty is 12.5 cents per 100 pounds.

#### ZINC SHEETS, NICKEL PLATED: U.S. CUSTOMS DECISION. Feb. 23, 1905.

The United States Circuit Court has decided that nickel plated zinc sheets are not dutiable as "zinc in sheets," under paragraph 192 of the tariff, but at 45 per centum *ad valorem* under paragraph 193 as "articles not specially provided for composed wholly or in part of nickel, zinc or other metals, and whether wholly or partly manufactured."—R.W.M.

### XII.—FATS, FATTY OILS, Etc.

#### OLIVE OIL IN ITALY.

*Chem. and Drug., March 25, 1905.*

The following statistics relating to the importation of olive oil from France, Spain, and Tunis into Italy have been obtained from the Italian Chamber of Commerce:—

	1903.	1904.
	Quintals.	Quintals.
From France .....	20,740	26,732
" Spain .....	102,523	70,572
" Tunis .....	1,260	10,770
	124,523	108,074

The total imports into Italy during 1904 amounted to 125,757 quintals, and the production to 238,579 quintals (1 quintal = 50 kilos.). Of the foregoing amount 2,699,679 kilos. were imported at Leghorn, of which Spain shipped 2,084,740 kilos., France 346,569 kilos., and Tunis 268,370 kilos. The chief interest in the above figures lies in the fact that the imports from Spain during the last three or four

years have developed considerably, and especially regard to the production of fine edible oils. In this connection Spain is now looked upon as the largest producer of the finest cream olive oils, a fact which is not sufficiently known in this country.

#### OLIVE OIL: GERMAN CUSTOMS DECISION.

*Bd. of Trade J., March 23, 1905.*

Pure undenatured olive oil is dutiable under 2 of the German Tariff at 3 or 10 m. per 100 kilos. (even as it is imported in casks or other vessels), even with "lavat oil" or "sulphur oil," it cannot be for table purposes.

#### NIGER SEED OIL: U.S. CUSTOMS DECISION.

*March 2, 1905.*

Niger seed oil was held to be dutiable at 25 per cent *ad valorem* as an "expressed oil," under paragraph 6 of the present tariff. The claim of the importer for free as an "oil commonly used for soap making and fit for such use," was overruled, as the evidence showed it was also used as an edible oil, and for burning and eating.—R. W. M.

#### STEARINE PITCH: U.S. CUSTOMS DECISION.

*March 7, 1905.*

Stearine pitch is dutiable at 20 per cent. *ad valorem* as a "manufactured article unenumerated," under 6 of the tariff. The claims of the importer for free as "Burgundy pitch," "coal tar pitch," "in crude," "crude vegetable substance," or "tar of wood," were all overruled.—R. W. M.

### XV.—MANURES, Etc.

#### GUANO DEPOSITS OF PERU.

*U.S. Cons. Rep. No. 2208, March 17, 1905.*

By a decree of 28th December, 1904, persons engaged in digging guano between the months of February and November, inclusive, of any year shall be fined 1. per ton of the product extracted, regardless of whether or not the vessel shall have been regularly deposited by Peruvian port authorities. A repetition of the will render offenders liable to confiscation of their vessels as prescribed by Article 4 of the law of 17th July, 1904.

The chief guano deposits of Peru are (1) the Islands (Lobos de Afuera and Lobos de Tierra) off the coast of Eten and (2) the Chincha Islands, off the port of Callao. There are numerous minor deposits, such as the promontories, and islets of Islay, near the port of Mollendo, &c. By a contract entered into in January, 1905, the Peruvian corporation, a British syndicate, enjoys the exclusive right of exporting guano from the Peruvian deposits until 3,000,000 tons shall have been exported. Peru may continue to dig guano, but only for the benefit of national agriculture. It is said that one-third of the 3,000,000 tons have already been exported by the Peruvian corporation.

### XVI.—SUGAR, STARCH, Etc.

#### STARCH; SOLUBLE POTATO —: U.S. CUSTOMS DECISION. Feb. 28, 1905.

Soluble starch or thin boiling starch, consisting of starch modified by the action of acid was decided to be dutiable as "starch" under paragraph 283 of the tariff. An analysis of the article showed the following composition:—

Moisture, 10.45 per cent.; dextrin, dextrose and soluble in water, 9.50 per cent.; starch forming an insoluble liquid with water at 70° C., 62.45 per cent.; forming an opalescent liquid with water at 90° C.



; starch insoluble in water at 98° C., 6-15 per cent.; residue, 0-40 per cent. article differed from white dextrin in the per cent. in, and in the large amount of starch present, also bought and sold as soluble starch. The assessment duty at 2 c. per lb. as "dextrin" under paragraph therefore overruled.—R. W. M.

#### ITALY.—BREWING, WINES, SPIRITS, Etc.

##### ALCOHOL TRUST IN SPAIN.

U.S. Cons. Rep. No. 2201, March 9, 1905.

Organisation of an alcohol trust (La Sociedad Alcohólica Española) has just been completed. The office at Madrid, and a capital of 16,000,000

Members bind themselves neither to establish manufactories, nor to deal in alcohol not produced by Spain. The trust is made up of most of the alcohol in Spain, of the members of the Sociedad General de Azúcar (National Sugar Company)—which brings into its manufactories, its molasses or dregs as product and also the alcohol which it produces—and of a number of financiers which has subscribed the 4,000,000 that form the working capital. The basis is the contract entered into with the Sociedad General de Azúcar, which owns most of the sugar mills in Spain. These combine has already acquired the best-situated grain distilleries, and hopes to control also the production of vinic alcohol. In order to enable the trust to completely control the market in times, such as the present year, when the low price of wine prevents industrial alcohols from competing with vinic alcohol, it has been proposed to invite the owners of vinic alcohol to join the combine; but this necessitate a very large increase in capital, and in view of the difficulty of bringing into harmony the interests of the innumerable small distillers throughout the country would prove almost insurmountable. In view of this, considerable time must elapse before the trust is able to be in a position to operate. The president of the company states that there are 54 alcohol factories, and up to the present 31 of them are part of the society, the most modern and best establishments being included. The annual production of industrial alcohol is calculated to be 600,000 litres (15,850,200 gallons).

#### ITALY; TAXATION AND CONSUMPTION OF —.

U.S. Cons. Rep. No. 2203, March 11, 1905.

Taxation imposed in Italy on the manufacture of spirits 190 lire per 100 litres of anhydrous alcohol, at the rate of 15-56° C. Deductions are allowed of 10 per cent. upon manufactures of the first category, those in which starch and starchy substances and residues of the culture and refining of sugar are used, and of 15 per cent. upon manufactures of the second category, distillates of fruits, wines, dregs of pressed grapes, and other products of vines only.

Exemptions on products of factories provided with meters are allowed of 25 per cent. for distillations of fruits, dregs of pressed grapes, and remains of wines, and of 30 per cent. for distillations of wines and small wines. The private societies manufacturing articles of the second category enjoy a deduction of 18 per cent., which may be increased to 28 per cent. if they distil dregs of pressed grapes and residues mentioned, and 34 per cent. if they distil wine only. The last two advantages depend, however, on the condition that the factories are furnished with meters.

Complete exemption from taxation is not granted, however, to spirits derived from wine, dregs of pressed grapes, and residues from wines when properly adulterated and intended only for lighting, heating, motive power, or industrial and determined uses; while for spirits derived from substances not containing wine the taxation

is reduced to 15 lire per 100 litres of pure alcohol if destined for the above-mentioned purposes. During the financial year 1903-4, 17,662 hectolitres of pure alcohol were adulterated for such purposes, of which 15,077 hectolitres were from substances containing wine, and 2,585 hectolitres from other substances.

#### XX.—FINE CHEMICALS, Etc.

##### RESORCINOL: U.S. CUSTOMS DECISION.

March 9, 1905.

Resorcinol fit for medicinal use is dutiable at 25 per cent. *ad valorem* as a "medicinal coal tar preparation," under paragraph 68 of the tariff. The claim of the importer for free entry under paragraph 524 as "resorcin" was overruled.—R. W. M.

##### COUMARIN: U.S. CUSTOMS DECISION.

March 8, 1905.

Coumarin derived from coal tar is dutiable at 20 per cent. *ad valorem* as a "preparation of coal tar, not a colour or dye, and not medicinal," under paragraph 15 of the tariff. The assessment of duty at 25 per cent. *ad valorem*, as a "chemical compound" was overruled.—R. W. M.

##### QUININE SALTS: U.S. CUSTOMS DECISION.

Quinine bromide, quinine sulphate and cinchonidine salicylate were held to be free of duty as "salts of cinchona bark" under paragraph 647 of the present tariff. The assessment of duty as "medicinal preparations" at 25 per cent. *ad valorem* was erroneous.—R. W. M.

##### CODEINE SALTS: U.S. CUSTOMS DECISION.

March 2, 1905.

Codeine muriate, sulphate and phosphate, were held to be dutiable at 1 dol. per oz. as a "salt of opium" under paragraph 43 of the tariff. The claim of the importer for assessment at 25 per cent. *ad valorem*, under paragraphs 67, 68 or 3, was overruled.—R. W. M.

#### XXII.—EXPLOSIVES, MATCHES, Etc.

##### PICRIC ACID.

The following Order in Council, dated March 27, relative to the position of picric acid with regard to the Explosives Act, 1875, came into force on April 1:—

1. Picric acid when in process of manufacture shall (for whatever purpose used or manufactured) be deemed to be an explosive within the meaning of the said Act, subject to the following exception:—

(a.) When the picric acid is mixed with not less than half its own weight of moisture in every process of manufacture, it shall be exempt from being deemed to be an explosive within the meaning of the said Act.

2. Picric acid when kept, conveyed, imported or sold, shall (for whatever purpose used or manufactured) be deemed to be an explosive within the meaning of the said Act, subject to the following exceptions:—

(a.) Picric acid mixed with not less than half its own weight of water shall be exempt from being deemed to be an explosive within the meaning of the said Act.

(b.) Picric acid which does not fall within the exemption (a) when the quantity does not exceed 2,000 lbs. in any one ship, boat, carriage, building or place, shall be exempt from being deemed to be an explosive within the meaning of the said Act; provided that such picric acid is so kept and conveyed

as not to be liable, whether under the action of fire or otherwise, to come in contact with any substance specified in the schedule hereto, or with any fire or light capable of igniting such picric acid.

Provided also that such picric acid when dry is so packed in a substantial barrel or case that the contents cannot escape; and that no metal other than aluminium or an alloy containing not less than 90 per cent. of aluminium, is used in the construction of any package containing such picric acid, and that each barrel or case is legibly marked "Picric acid."

Picric acid when not subject to the above exemptions must be packed and marked as required by the Order of Secretary of State relating to the packing of explosives.

3. Picrates and mixtures of picric acid with any other substance (for whatever purpose used or manufactured), shall be deemed to be explosives within the meaning of the said Act, subject to the following exceptions:—

(a.) A picrate mixed with not less than half its own weight of water, shall be exempt from being deemed to be an explosive within the meaning of the said Act.

4. This Order shall come into force on the 1st April, 1905, and shall be deemed to be in lieu of the Order in Council relating to picric acid and picrates dated the 29th December, 1887, which is hereby repealed.

#### Schedule.

Any of the following metals or metallic oxides, namely, lead, oxide of lead, oxide of iron, potash, baryta, lime, soda, oxide of zinc, oxide of copper; and any compound of such metal or oxide (other than a metallic sulphate); or any chlorate, nitrate, or other oxidising agent; or any other substance declared by an Order of the Secretary of State to be capable of forming with picric acid a dangerous compound.

Provided that this Schedule shall not be deemed to include any metal, or oxide unavoidably formed on any metal, used in the construction of any ship, boat or carriage, or contained in any paint, where the packages containing picric acid are protected from direct contact with such metal or paint.

### Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

#### I.—PLANT, APPARATUS, AND MACHINERY.

- [A.] 5332. Declercq. Continuous precipitation and decantation in the treatment of liquids. March 14.  
 „ 5434. McPhail. Apparatus for evaporating liquids and for drying and oxidising other materials. March 15.

- [A.] 5481. Ifö Kaolin-Och Chamottefabr., and Retort furnaces.\* March 15.  
 „ 5593. Ray. Vacuum evaporating apparatus. March 17.  
 „ 5663. Hinze. Lixiviating and washing apparatus. March 17.  
 „ 5668. Spooner (Cie. pour la Fabr. des Com. et Material d'Usines à Gaz, and Fery). metric telescopes.\* March 17.  
 „ 5721. Parker. Crucible furnaces. March 17.  
 „ 5895. Wojciechowski. Using compressed air for agitating liquids, cyanides, clarifying and separating slimes from sands. &c. March 20.  
 „ 5953. Elmore. Process of separating certain constituents of finely divided material by causing them to rise or float in a liquid. March 21.  
 „ 5988. Schmeisser. Distilling apparatus.\* March 21.  
 „ 6055. Löffler and Weidle. Filtering material. March 22.  
 „ 6075. Bouchand-Praceiq. Process and apparatus for collecting, aspirating, drying, cooling, and recuperating the vapours of volatile substances diluted in air [Fr. Appl., March 26, 1904]. March 22.

[C.S.] 3962 (1904). Evans. See under X.

- „ 7010 (1904). Haack and Sürther Maschinen-fabrik. H. Hammerschmidt. Vacuum distilling apparatus. March 22.  
 „ 8298 (1904). Fell (Bigelow). Centrifugal machine for separating liquids from solids and for filtering the separated liquids. March 22.  
 „ 14,487 (1904). Breyer and von Wehrstedt. Liquefaction apparatus. March 22.  
 „ 14,960 (1904). Prollius. Centrifugal separator. March 29.  
 „ 14,961 (1904). Prollius. Centrifugal separator. March 29.  
 „ 15,351 (1904). Lennox. Drying apparatus. March 29.  
 „ 15,733 (1904). Lennox. Spraying device for evaporating liquids and for other purposes. March 29.  
 „ 28,776 (1904). Lindemann (Gebr. Korting & Co. Ges.). Spraying nozzles. March 22.

#### II.—FUEL, GAS, AND LIGHT.

- [A.] 5216. Kramers. Manufacture of illuminating gas. March 13.  
 „ 5265. Mewes. Process for generating incandescent light.\* March 13.  
 „ 5720. R. Dempster and Sons, Ltd., and R. Gas purifiers. March 18.  
 „ 5761. Holmes. Apparatus for washing and drying gases.\* March 18.  
 „ 5773. Ott. Apparatus for washing and purifying coal-gas and other gases. March 18.  
 „ 5779. Creed. Gas burners. March 18.  
 „ 5810. Blenheim and Williams. Apparatus for the production of gas. March 20.  
 „ 5825. Ellis. Art of making weak gas.\* March 20.  
 „ 6119. Rowbotham, Booth and Osborn. Two producers for gas making. March 23.



6184. Greenwood and Marriott. Production of artificial fuel. March 23.
6274. Pattinson. Manufacture of bricks, briquettes, and other articles which are moulded and fired. March 24.
6297. Cutler. Gas purifiers. March 24.
- 4230 (1904). Pfeifer and Wolz. Complete combustion of solid fuel. March 29.
- 6335 (1904). Thuman. Water gas apparatus. March 22.
- 7298 (1904). Fleming. Arc lamp electrodes. March 29.
- 7299 (1904). Fleming. Arc light electrodes and methods of making same. March 29.
- 8659 (1904). Ashby. Gas making retorts. March 22.
- 10,733 (1904). Hills and Lane. Gas producing apparatus for use with fuels of a bituminous nature. March 29.
- 13,316 (1904). Everitt. Method of extracting tar and other impurities from crude illuminating, heating or power gases. March 29.
- 26,921 (1904). Weedon. Electrodes for arc lamps and method of making same. March 29.

#### 4.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

211. Bingham. Enrichment of hydrocarbons. March 24.

#### 5.—DYEING MATTERS AND DYESTUFFS.

5215. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of 3,4-dichloranilinesulphonic acid. March 13.
5449. Chem. Fabr. vorm. Weiler-ter-Meer. Process for the manufacture of a yellow sulphur dye. [Ger. Appl., March 24, 1904.]\* March 15.
5564. Johnson (Badische Anilin und Soda Fabrik). Manufacture of phenylglycine salts.\* March 16.
5572. Ellis (Chem. Fabr. Sandoz). Manufacture of yellow sulphur dyes. March 16.
5843. Ransford (Cassella and Co.). *See under XIII A.*
5861. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters. March 20.
- 10675 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds suitable for use in the preparation of colouring matters. March 29.
- 0,235 (1904). Shillito (Aniline Colour and Extract Works, formerly J. R. Geigy). Manufacture of 1-diazo-2-oxy and 2-diazo-1-oxynaphthalene mono-, di and trisulphonic acids. March 22.

#### 6.—PREPARING, BLEACHING, DYEING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

209. Baxter. Solution for rendering combustible materials fire-resisting. March 13.

- [A.] 5244. Fletcher. Dyeing machines.\* March 13.
- " 5296. Zeitschner. Process of bleaching textile fibres, yarns and fabrics. March 14.
- " 5842. Bradford Dyers' Association, Ltd., and Rigby. Apparatus for finishing textile fabrics. March 20.
- " 6160. Muntadas y Rovira. Continuous bleaching apparatus. [Fr. Appl., March 23, 1904.]\* March 23.
- " 6215. Textile Fibres, Ltd., and Tickel. Treating rhea, ramie or china glass, flax and other similar fibres. March 24.
- " 6230. Duckworth. Dyeing, colouring and sizing in the manufacture of polished yarns of cotton or other natural or artificial fibre. March 24.
- " 6356. Linkmeyer. Devices for the manufacture of artificial silk threads.\* March 25.
- [C.S.] 9946 (1904). Crosfield and Markel. Lubrication of wool in the manufacture thereof into yarn or cloth. March 29.
- " 10,005 (1904). McNaught. Machinery for scouring and washing wool and other fibrous materials. March 22.

#### VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 5223. Dahl. Manufacture of white lead. March 13.
- " 5882. Candan and Candan. *See under XI.*
- " 5895. Wojciechowski. *See under I.*
- " 6135. Wheelwright and Threlfall. Manufacture of amorphous phosphorus. March 23.
- " 6136. Wheelwright and Threlfall. Means for separating amorphous from white phosphorus. March 23.
- [C.S.] 11,256 (1904). Wood-Smith. Purification of natural salts, such as alkaline carbonates, sulphates, nitrates and chlorides. March 22.
- " 20,952 (1904). Eschellmann, Harmuth, and Tov. Tentelevskago Khimichesk Zavoda. Apparatus for the manufacture of sulphuric anhydride. March 29.

#### VIII.—GLASS, POTTERY, AND ENAMELS.

- [A.] 6330. Fawcett, Ltd., and Fawcett. Means for making saggers for earthenware, porcelain, or like pottery ware. March 25.

#### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 5513. Zellenka. *See under X.*
- " 5528. Bandy. Process of making Portland cement from slag. [Belg. Appl., Feb. 10, 1905.]\* March 16.
- " 5748. Koepff. *See under XIV.*
- " 5763. Associated Portland Cement Manufacturers (1900), Ltd., and Brooks. Manufacture of cement. March 18.
- " 5765. Associated Portland Cement Manufacturers (1900), Ltd., Bamber and Layton. Manufacture of Portland cement.\* March 18.

- [A.] 5912. Stourbridge Glazed Brick and Fireclay Co., Ltd., Hill and Smith. Bricks. March 21.
- .. 6321. Kilby. Kiln particularly adapted for burning cement, lime and plaster. March 25.
- .. 6347. Chalk Power Gas Synd., Ltd., and Stoneham. Manufacture of cement. March 25.
- .. 6362. Condere. Process for treating wood to render it hard and impermeable, and to impart to it a polished surface. March 25.
- [C.S.] 8619 (1904). Goldsmith. Machine for applying colours, glazing matter, &c., on tiles, bricks, and similar articles. March 22.
- .. 11,398 (1904). Hargreaves. *See under XIII B.*

## X.—METALLURGY.

- [A.] 5265. Bondreaux. Antifriction compositions or alloys. [Fr. Appl., March 26, 1904].\* March 13.
- .. 5260. Sulman, Picard and Ballot. Ore concentration. March 13.
- .. 5271. Bernard. Extracting zinc and the like from lead and tin and its alloys. March 14.
- .. 5367. Hudson. Manufacture of charcoal iron and steel. March 14.
- .. 5492. Cowper-Coles. Manufacture of metallic calcium. March 16.
- .. 5513. Zellenka. Soldering and cementing material, and the manufacture of same. March 16.
- .. 5573. St. André. The refining of metals.\* March 16.
- .. 5817. Simpson (Simpson). Direct conversion of iron into steel (a) in the blast furnace, or (b) immediately outside it. March 20.
- .. 5857. Wood and Gittings. Refining iron and other metals. March 20.
- .. 5895. Wojciechowski. *See under I.*
- .. 5970. Thompson (Merrill). Separating the heavier or coarser from the lighter or finer components of the tailings of ores or other material. March 21.
- .. 6001. Anderson. Method of and apparatus for the smelting of ores, iron, sand and the like, and subsequent conversion into steel or other metals or alloys. March 22.
- .. 6255. McIvor and Fradd. Extraction of nickel from ores. March 24.
- .. 6290. Wagner. Alloy and process of manufacturing same. March 24.
- .. 6388. Bergendal. Furnaces for calcining and burning briquettes of ore and for similar purposes. March 25.
- [C.S.] 689 (1904). Ciantar and Ciantar. Extracting gold from solution in water. March 22.
- .. 3962 (1904). Evans. Apparatus for separating liquids from solids particularly applicable to the treatment of gold-bearing slimes. March 29.
- .. 6832 (1904). Webb. *See under XI.*
- .. 7478 (1904). Rouse and Cohn. Manufacture of briquettes from powdered iron ore or iron wastes, or from iron sand or mixtures thereof for reduction in furnaces. March 29.

- [C.S.] 9110 (1904). Talbot. Manufacture of iron steel. March 22.
- .. 10,682 (1904). Heberlein and Hommel. Rotary furnace applicable for use in roasting ores. March 29.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- [A.] 5425. Sulman and Picard. Electric furnace. March 15.
- .. 5648. Ashcroft. Electrolytic cells. March 15.
- .. 5882. Candau and Candau. Manufacture of limes by electrolysis of sulphates or chlorides of soda and consecutive production of calcium soda. March 20.
- .. 5918. Chamberlain and Hookman, Ltd., and Holden. Electric batteries and electrolytic processes and apparatus. March 20.
- .. 5984. Price, Cox and Marshall. Electrodes adapted for use in electric furnaces.\* March 21.
- C.S. 6832 (1904). Webb. Electrolytic extraction of metals from solutions. March 22.
- .. 27,861 (1904). Gardiner. Electric accumulator. March 29.
- .. 27,904 (1904). Gardiner. Secondary battery. March 22.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

- [A.] 5426. Gabler, Gordon and Kennedy. Process of making soap of all kinds. March 15.
- .. 5906. Wilson. Manufacture of soaps or wax compounds. March 21.
- .. 6161. Rivoir. Apparatus for the manufacture of soap. March 23.
- [C.S.] 11,436 (1904). Fischer. Manufacture of soap. March 22.
- .. 1572 (1905). De Hemptinne. Process for converting oleic acid into stearic acid and compounds. March 22.

## XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES, INDIA-RUBBER, Etc.

## (A.)—PIGMENTS, PAINTS.

- [A.] 5223. Dahl. *See under VII.*
- .. 5760. Bowley. Method of coating materials with paint, varnish, &c., and apparatus therefor. March 18.
- .. 5843. Ransford (Cassella and Co.). Manufacture of colour lakes. March 20.
- .. 5872. Dreyfus. Paint.\* March 20.
- .. 5882. Candau and Candau. *See under XI.*
- [C.S.] 11,398 (1904). Hargreaves. *See under XIII B.*



## (B.)—RESINS, VARNISHES.

5760. Bowley. *See under XIII A.*
6371. Smith. Manufacture of linoleum, floor cloths, and the like. March 25.
- 11,398 (1904). Hargreaves. Manufacture of varnishes and paints for waterproofing, disinfecting, &c., also for indurating building materials. March 29.

## (C.)—INDIA-RUBBER.

5965. Sine and Rosenthal. Manufacture of rubber. March 21.
- 6471 (1904). Robinson Bros., Ltd., and Clift. Method of preparing rubber solutions and the utilisation of such means and of subsequent treatment for converting waste into serviceable rubber. March 22.

## —TANNING, LEATHER, GLUE, SIZE, ETC.

5748. Koepff. Apparatus for drying gelatine, glue, paste goods, bricks, woods, &c.\* March 18.

## XV.—MANURES, ETC.

5618. Crone, Taylor and Williams. Manufacture of fertilisers and apparatus therefor. March 17.

## XVII.—BREWING, WINES, SPIRITS, ETC.

5845. Fränkel. Production of pure diastase. March 20.
5930. Pampe. Process of separating bye products of alcoholic fermentation from mash or wort.\* March 21.
6253. Howe. Apparatus for oxygenating wort, beer, and other liquids. March 24.
- 5445 (1904). Frew and Dempster. Fermented beverages. March 29.
- 10,361 (1904). Aspinall and Cannon. Treatment of wort. March 22.

## XVIII.—FOODS, SANITATION, WATER PURIFICATION, &amp; DISINFECTANTS.

## (A.)—FOODS.

6278. Poumay. Alimentary product.\* March 24.
6373. Preston. Nutritive flour.\* March 25.
- 10,211 (1904). Lawson. Preparation of a solution for use in bleaching grain and rice. March 22.
- 13,266 (1904). Craveri. Process of preserving meat. March 22.

- [C.S.] 13,651 (1904). Budde. Sterilisation of food and beverages. March 29.
- „ 1312 (1905). Blogg. Manufacture of culinary essences. March 22.

## (B.)—SANITATION; WATER PURIFICATION.

- [A.] 5200. Guttman. Apparatus for purifying or softening water.\* March 13.
- „ 6055. Löffler and Weidlo. *See under I.*
- „ 6112. Ball. Composition for preventing and removing incrustation and corrosion in steam boilers and the like. March 23.
- [C.S.] 8857 (1904). Wanklyn and Cooper. Treatment of sewage. March 29.
- „ 8944 (1904). Adams. Filter beds for sewage. March 22.
- „ 10,867 (1904). Peschges. Purification of sewage and the like. March 22.

## (C.)—DISINFECTANTS.

- [A.] 5278. Illingworth. Means for disinfecting. March 14.
- [C.S.] 11,398 (1904). Hargreaves. *See under XIII B.*

## XIX.—PAPER, PASTEBOARD, ETC.

- [A.] 5214. Lilienfeld and Tedesko. Method of coating with viscose or mixtures thereof with pigments and the like and apparatus therefor. March 13.
- „ 5766. Topham. Apparatus for filtering and pumping or regulating the flow of solutions of cellulose or the like. March 18.
- „ 6079. Lagneau, Nebel and Vignès. Celluloid and process of manufacturing same. March 22.
- [C.S.] 7885 (1904). Elias. Manufacture of paper for packing and other purposes. March 22.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

- [A.] 5353. Ellis (Merek). Manufacture of dialkylbarbituric acids. March 14.
- [C.S.] 11,747 (1904). Imray (Meister, Lucius und Brüning). Manufacture of new perfumes and of intermediate products therefor. March 22.
- „ 12,091 (1904). Newton (Bayer und Co.). Manufacture of pyrimidine derivatives. March 22.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 5780. Little. Negative plates for photographic printing. [U.S. Appl., March 19, 1904.]\* March 18.
- „ 6276. Smith. Reducing agents or compositions for use in photography.\* March 24.

[A.] 6340. Croft. Photography. March 25.

[C.S.] 5948 (1904). Findlay. Base or support for photographic sensitive emulsions. March 22.

XXII — EXPLOSIVES, MATCHES, Etc.

[A.] 5687. Schultz. Manufacture of a new explosive.\* March 18.

[A.] 5985. D  m  triade, Jonesen and Williams. Explosives. March 21.

.. 6045. Girard. Explosives. [Fr. Appl., A1 1904.]\* March 22.

.. 6361. Wetter (Westf  lisch-Anhaltische Spreng- u. Explosiv-Akt.-Ges.). Explosives. March 22.

[C.S.] 14,480 (1904). Coipek. Explosives. March 22.



# JOURNAL OF THE Society of Chemical Industry.

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### ANNUAL GENERAL MEETING, 1905.

The Annual General Meeting will be held in London early next, and the proceedings will commence on Monday, July 10th.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council members are to retire from their respective offices at the forthcoming Annual Meeting.

Edward Divers, F.R.S., has been nominated to the office of President under Rule 8; Dr. L. Baekeland, J. Carter Bell, Dr. J. Lewkowitsch, and Mr. N. H. S. have been nominated Vice-Presidents under Rule 8; and Mr. Wm. H. Nichols has been nominated a President under Rule 11.

Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices. Members are hereby invited to nominate fit and proper persons to fill four vacancies among the ordinary members of Council. Forms for this purpose can be obtained, on application, from the General Secretary, or from the Local Secretaries of the Canadian, New York, and Sydney Sections.

Extract from Rule 18:—"No such nomination shall be valid unless it be signed by at least ten members of the Society who are not in arrears with their subscriptions, and unless it be received by the General Secretary, at the Society's office, at least one month before the date of the Annual General Meeting, at which the election to which it relates takes place. Nor shall any such nomination be valid if the person nominated be ineligible for election under Rules 12 or 15. No member shall sign more than one nomination form."

### INDUSTRIAL ALCOHOL COMMITTEE.

The report of this Committee, which was appointed by the Council, and of which the Exchequer in September last took possession, is now being printed, and will be sent into the existing facilities for the use, without payment, of spirit in arts and manufactures, and, in particular, into the operation of Section 8 of the Finance Act, 1902, has been published, together with the minutes of the Committee. The report will be found on page 397 of the Journal, together with a full abstract of the Appendix. Such of the Committee's proposals as need legislative sanction will be embodied in a Revenue Bill.

A meeting of the Council, held on April 25th, the following resolutions were passed:—

"That this Council welcomes the Report of the Industrial Alcohol Committee with the Blue Book containing evidence and appendixes upon which the Report is based, and resolves that a letter be sent thanking the Controller of the Exchequer for his action in appointing the Committee, and expressing a trust that he may see fit to give legislative effect to the recommendations of the Committee at an early date."

2. "That this Council also desires to record its appreciation of the persistent efforts of Mr. Thomas Tyrer in the cause of Industrial Alcohol, and hereby tenders him its thanks for his services on the Industrial Alcohol Committee."

### SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

At a meeting of the Organising Committee of the Sixth International Congress of Applied Chemistry, held in Rome on March 2 last, Prof. E. Paternò in the chair, it was decided to divide the Congress into the same number of sections as was the case at Berlin in 1903. At the suggestion of the Presidents of foreign Committees, the date of meeting was fixed for April, 1906, during Easter week.

All communications with respect to the Congress should be addressed to the President, Prof. E. Paternò, Via Panisperna 89, Rome.

## List of Members Elected.

April 25th, 1905.

- Atteaux, F. E., 176, Purchase Street, Boston, Mass., U.S.A., Dyestuff Importer.
- Barnes, Edgar, c/o American Beet Sugar Co., 123, California Street, San Francisco, Cal., U.S.A., Chemical Engineer.
- Berge, Henry vom, c/o Schoellkopf and Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Manager.
- Bond, Josiah, Somerville, N.J., U.S.A., Mining Engineer.
- Brown, Prof. Adrian J., West Heath House, Northfield, near Birmingham, Professor of Brewing.
- Brown, H. J., jnn., Oak Villa, Elton, Bury, Lancashire, Paper Maker.
- Burton, James K., 336, Drexel Building, Philadelphia, Pa., U.S.A., Consulting Chemist.
- Butler, T. H., Charnwood, Cotham Park, Bristol, Chemical Student.
- Byrne, F. A., Seringa Buildings, 2, Ludgate Hill, Birmingham, Director of Chemical Co.
- Cheesman, Frank Page, 92, William Street, New York City, U.S.A., Paint Manufacturer.
- Colley, Alfred, 1, Merridale Road, Wolverhampton, Steel Works Analyst.
- Crean, John F., 25, Abercromby Square, Liverpool, Oil Refiner.
- Davidson, Wm. B., 3, Vernham Road, Plumstead, S.E., Chemist.
- Donnan, Prof. F. G., Physico-Chemical Laboratory, University, Liverpool, Professor of Physical Chemistry.
- Dreyfus, Dr. Isaac, c/o Schoellkopf and Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Chief Chemist.
- Dufus, W. B., Las Minas de Rio Tinto, Provincia de Huelva, Spain, Chemist.
- Dukes Bernhard, I., Great James Street, Bedford Row, London, W.C., Patent Agent.
- Duncan, D. J. Russell, Canadian General Electrical Co., Toronto, Canada, Civil Engineer.
- Eager, Charles E., 124, High Street, Boston, Mass., U.S.A., Merchant.
- Evans, Geo. A., 832, Yonge Street, Toronto, Ontario, Canada, Pharmacist.
- Fairchild, John G., 150, Rodney Street, Brooklyn, N.Y., U.S.A., Chemist.

Findlay, Dr. Alex., The University, Birmingham, Lecturer on Physical Chemistry.  
 Gummere, W., 125, East Hanover Street, Trenton, N.J., U.S.A., Chemist.  
 Hawkins, Henry, Leeming Hall, Todmorden, Yorks., Gas Engineer.  
 Heathcote, Henry L., Messrs. Rudge Whitworth, Ltd., Coventry, Research Chemist.  
 Heymann, Dr. Fritz, 7, Elsworth Terrace, Hampstead, N.W., Analytical Chemist.  
 Hions, A. H., Carleon, Chester Road, Erdington, near Birmingham, Science Teacher.  
 Hodgson, T. R., The Sycamores, Poulton-le-Fylde, Lancashire.  
 Holcroft, Harold, Parkdale, Wolverhampton, Ironfounder.  
 Hudson, O. F., The University, Birmingham, Lecturer on Metallurgy.  
 Hughes, T. Vaughan, 26, Barnsley Road, Edgbaston, Birmingham, Metallurgist and Electrical Engineer.  
 Jennison, James, 90, Blackburn Road, Darwen, Lancashire, Chemist.  
 Johnson, Dion L., 3257A, Texas Avenue, St. Louis, Mo., U.S.A., Analyst.  
 Jones, J. Ernest, 31, Melville Road, Coventry, Analytical Chemist.  
 Kaye, Frederick, Hampden House, Phoenix Street, London, N.W., Research Chemist.  
 Kayser, Edwin Cuno, c/o Messrs. J. Crosfield and Sons, Ltd., Warrington, Chemist.  
 King, Warren C., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemical Salesman.  
 Kneeland, Furman Lawrence, 21, Park Row, New York City, U.S.A., Manufacturer.  
 McKenzie, Dr. Alex., The University, Birmingham, Lecturer on Chemistry.  
 Methley, Bernard, 21, Clifton Mount, Rotherham, Yorks., Engineering Chemist.  
 Moseley, F. A. D. H., Box 1657, Johannesburg, Transvaal, Analytical Chemist.  
 Murray, William Wallace, c/o Acker Process Co., Niagara Falls, N.Y., U.S.A., Chemist.  
 Murrill, Dr. Paul L., 39, Victoria Street, Westminster, S.W., Representative, E. I. du Pont Co.  
 Peakes, Charles E., 176, Purchase Street, Boston, Mass., U.S.A., Treasurer, Mercantile Corporation.  
 Plath, Dr. F., Deutsche Ton- und Steinzeugwerke, A. G., Berlinerstrasse 22B., Charlottenburg, Germany, Managing Director.  
 Price, Dr. T. Slater, The Technical School, Birmingham, Lecturer on Chemistry.  
 Pugh, John V., Rudge Whitworth, Ltd., Coventry, Works Director.  
 Rigby, William T., County Analyst's Laboratory, Temple Street, Birmingham, Analyst.  
 Romanes, J. W., Minas de Rio Tinto, Huelva, Spain, Technical Chemist.  
 Rosenhain, Walter, 443, Gyllott Road, Edgbaston, Birmingham, Chemist and Metallurgist.  
 Ruttan, Prof. R. F., Medical Faculty, McGill University, Montreal, Canada, Professor of Chemistry.  
 Shrewsbury, H. S., 37, King Edward's Road, Moseley, near Birmingham, Analytical Chemist.  
 Stuart, H. E., 176, Purchase Street, Boston, Mass., U.S.A., Vice-President, Mercantile Corporation.  
 Szegő, A. S., 38, Walker Street, Warrington, Chemist.  
 Thomlinson, Wm., Seaton Carew Ironworks, West Hartlepool, Ironmaster.  
 Turner, Prof. T., 355, Bristol Road, Birmingham, Professor of Metallurgy.  
 Tutwiler, Carrington Cabell, 1706, North Broad Street, Philadelphia, Pa., U.S.A., Chemist.  
 Twigg, Geo. F., 70, Abbey Street, Derby, Gasworks Chemist.  
 Waldenberger, Charles A., c/o Independent Baking Powder Co., 322-328, Warren Street, Jersey City, N.J., U.S.A., Chemist.  
 Watson, John D., Tyburn, near Birmingham, Engineer.  
 Weber, Nicholas M., 727, Western Avenue, West Lynn, Mass., U.S.A., Leather Manufacturer.

## Changes of Address.

When notifying new addresses, members are required to write them distinctly, and state whether the temporary or permanent. Multiplication of address also to be avoided as tending to create confusion. In sending subscriptions, the use of the form attached the application helps in the verification of address which the safe delivery of the Journal depends.

Avery, D.: all communications to Working Men's Club, Melbourne, Vic., Australia.  
 Black, W. Geoffrey, 1/o Wandsworth Common; 1 Limes, New Street, Braintree, Essex.  
 Bloxam, W. Popplewell, (communications) c/o Fawdon and Low, 12, Bread Street, London and (Journals) 61, Walpole Road, Boscombe.  
 Brown, Dr. Arthur Lee, 1/o North Street; 213, Court Street, Baltimore, Md., U.S.A.  
 Dewhurst, John A., 1/o Bradford; 13, Highfield Terrace, Nab Wood, Saltaire, Yorks.  
 Diek, W. D., 1/o London; c/o Hugh Baird and Son, West George Street, Glasgow.  
 Eastlake, Arthur W., 1/o Clapham Park; Grosvenor Palace Road, Streatham Hill, S.W.  
 Ekenberg, Dr. M.; Journals to 40, Odengatan, Stockholm, Sweden.  
 Emery, Arthur L., 1/o New Montgomery Street, Smith, Emery and Co., 426-428, Crossley Building, San Francisco, Cal., U.S.A.  
 Feilmann, Dr. E., 1/o Nottingham; 112, Alexandra Road, Wimbledon, S.W.  
 Foster, Jas., Exors. of late; Journal to W. F. Clouston, Teviot Place, Edinburgh.  
 Georghi, Carl, 1/o New York; 12, Wilhelmstrasse, Berlin, Germany.  
 Greaves, Wm., 1/o Aberaman; c/o Powell Duffry & Co., Bye Product Works, Bargoed, near Cardiff, South Wales.  
 Grosvenor, W. M., 1/o New York City; c/o Schorff & Hartford and Hanna Co., Buffalo, N.Y., U.S.A.  
 Gudeman, Dr. Edw., 1/o Vincennes Avenue; 903, Telegraph Building, Chicago, Ill., U.S.A.  
 Henderson, J. A. Russell, 1/o Tientsin; Chihli Provincial College, Paotingfu, North China.  
 Heriot, T. H. P., 1/o Crouch End; 37, Church Croft, Muswell Hill, N.  
 Heslop, O., 1/o Liverpool; Fernsholme, Prescott, St. Helens, Lancs.  
 Macara, Thos., 1/o Paisley; 6, Sutherland Terrace, Dowanhill, Glasgow.  
 McDowell, Stewart H., 1/o South 51st Street; 100, South 47th Street, Philadelphia, Pa., U.S.A., Maker.  
 Merrill, Frank H.; Journals to 2420, Ocean View Avenue, Los Angeles, Cal., U.S.A.  
 Merry, John B., 1/o King's Heath; 54, Earlsbury Gate, Birchfield, Birmingham.  
 Phillips, E. W.; Journals to 800, Gaston Avenue, Mont, W. Va., U.S.A.  
 Pidduck, E. W., 1/o Aberystwyth; 4, Cromwell Street, Spring Bank, Hull.  
 Schlegel, Jno., W., 1/o New York; Cor. Main and 4th Avenues, Elmhurst, Long Island, N.Y., U.S.A.  
 Sewell, B. F. Brooke, 1/o Baltimore; Ferry Lane, Baltimore, Md., U.S.A.  
 Smith, F. Gurney; Journals (temp.) c/o G. J. Rosemount, Pleasington, near Blackburn.  
 Stebbins, J. H., jun., 1/o Madison Avenue; 27, East 42nd Street, New York City, U.S.A.  
 Steel, John S., 1/o Adelaide; Achernat, Blackburn, Melbourne, Vic., Australia.  
 Summers, Bertrand S., 1/o Military Street; c/o The Summers Fiber Co., Port Huron, Mich., U.S.A.  
 Taylor, A. M., 1/o Hudson Heights; c/o General Chemical Co., Syracuse, N.Y., U.S.A.



Frank, l/o 44; 76, Beach Farm Road, Southsea, ants.

n. H. D.; Journals to Laboratory, Gutta Percha and Rubber Manufacturing Co., 47, Yonge Street Toronto, Canada.

n. Herbert J., l/o Mansfield; retain Journals.

house, P. L., l/o Victoria Street; c/o W. H. Keys, all End Works, West Bromwich.

## Death.

ell, John, 75, Hudson Street, New York City, S.A.

## Liverpool Section.

ting held at the University, on March 8th, 1905.

MR. EUSTACE CAREY IN THE CHAIR.

### FIRING WITH COAL-DUST.

BY EUSTACE CAREY.

ort time ago, by the courtesy of the chairman of hwartzkopf Coal-Dust Firing Syndicate, I was ted to see an installation which has been erected m at Haydock, and it occurred to me that as the ing and the use of coal-dust for the production of heat w advanced to what seems to me to be a fairly tory stage, I should be justified in reporting what I saw on that occasion and what ntly can be accomplished in the way of fuel economy l-dust firing.

n dry coal-dust of sufficient fineness, it is probably e, with a strictly regulated supply of air, to burn at the utmost attainable economy of fuel will result, n addition, with the advantage of freedom from

This is how, I take it, the matter presents itself t technical men who have given attention to the t of economy of fuel. But the cost of dry coal-dust icent fineness has been hitherto a great difficulty. I must confess that some years ago, when I first saw xperiments made, and had occasion to think about tter, I was strongly of opinion that the grinding coal to a sufficient degree of fineness would e not by any possibility cost less than one shilling . In this, apparently, I was mistaken, for I am nformed that grinding need not cost more than at amount; that is, not more than sixpence a ton, ng interest and depreciation.

d, by reference to Mr. William M. Barr's "Practical e on the Combustion of Coal," page 234 of the dition, that in 1876, a series of trials were conducted American Government to determine the value of a t of burning powdered fuel patented by Messrs. ley and Storer. The boiler was but a small one, n. diameter and 10 ft. long, and the experiments with that boiler, apparently very carefully, were ry extensive, but went to show that there was no ar advantage in using dust-coal as compared with coal. For instance, in one experiment, with this they burnt 11-113 lb. of fuel per hour per sq. ft. te room, and they evaporated 10-124 lb. of water at 2. per 1 lb. of fuel. In their experiment with st they burnt 11-35 lb. per sq. ft. of grate room, btained an evaporation of 10-192 per 1 lb. of fuel. umber of square feet exposed to the heated gases was y more for the lump, being 442 sq. ft. for the dust, 57 for the lump. The exit gases temperature was or the lump and 382° for the dust. These experi- were, therefore, not very conclusive.

report of the American Government states the

following, with respect to the cost of pulverising:—"The cost of the net horse-power in average practice may be taken at 4 lb. of coal per hour. Now, the mean of experiments gave 1-381 net horse-power developed by the engine in pulverising the coal, and in blowing the dust into the furnace, and in pumping the feed water into the tank, which, at 4 lb. of coal per hour per horse-power, is 5-524 lb. of coal per hour, or, as the total coal consumed per hour was 66 lb., 8-37 per cent. of the total weight of coal burned. Consequently, the pulverised coal was commercially 8-37 per cent. inferior to the lump coal. In another experiment, during which lump coal was burned alone, there was required to drive the fan blowers and to pump the feed water 0-500 net horse-power, which, at 4 lb. of coal per hour per horse-power, required 2-000 lb. of coal per hour to produce it, and as the hourly consumption of coal during that experiment was 66 lb., there were consumed in producing the artificial draught and in pumping the feed water 3-06 per cent. of the total weight of coal burned. Deducting this 3-06 per cent. from the 8-37 per cent., as given in the immediately preceding paragraph, there remains 5-31 per cent. of the total weight of coal consumed, applied to the pulverisation of the coal alone. From this, it will be seen that the use of powdered fuel was more expensive than that of lump coal, about in the ratio of the cost of pulverisation, and so far the scheme was a failure." One cause of the failure, the report goes on to say, was obviously, that the arrangement would not permit of the coal-dust being burned fast enough.

Mr. Barr mentions also Stephenson's experiments, for which no date is given. His showed negative results as to evaporation, but proved that coal dust can be burned with the exact amount of air required for the combustion, without smoke. All the experiments that Mr. Barr records in his very interesting book are of comparatively short duration: 2 hours, 4 hours, 5 hours, and so on—far too short a time, I think, to establish any real knowledge of the subject.

Mr. Brian Donkin, C.E., in his very excellent book, "The Heat Efficiency of Steam Boilers," published in 1898, describes Mr. Crampton's experiments between 1868 and 1873 with powdered coal, which experiments were conducted really for the purpose of the prevention of smoke. In his book, page 180, he refers to the "Wegener" Powdered Fuel Boiler Furnace and Apparatus, and the following details of two experiments without the Wegener apparatus and of two experiments with the Wegener apparatus are reported in the *Engineer*, of May 15th, 1896:—

	Without.	With.
Total coal burnt .....	1600	1415
Coal burnt per hour .....	225	211½
Moisture in coal, per cent. ....	9%	1-2%
Asbes .....	About the same	
Temperature of feedwater entering the boiler, F. ....	63°	48-2°
Lbs. of water evaporated per lb. of wet coal	4-95	7-46
Same calculated out from 212° F. ....	5-9	9-0
Water evaporated per lb. of dry coal with feedwater at 212° .....	6-48	9-11
Thermal efficiency of boiler .....	54	71
Temperature of gases at the base of the chimney .....	438°	412°

The smoke observed, I need not say, was very much less in the dust experiment than in the large coal experiment.

Mr. G. O. Bartlett read a paper, which appears in the Journal of the Association of Engineering Societies, before the Civil Engineers' Club, at Cleveland, in May, 1903. He says, "To burn coal in a powdered form successfully three things are necessary, uniformity of moisture, uniformity in size of grain, and the amount of air required for perfect combustion." He reminds us of what we all know, that coal varies very much in moisture, therefore, uniformity in moisture is necessary for any satisfactory comparative experiments, and that it is impossible to get the best results by burning large pieces of coal together with the dust. He recommends, therefore, that all coal used for firing should be reduced to grains of equal size, and for mechanical dust firing passed through a sieve of

operation. The valve on the top box then closed, and thus prevented the inrush of air referred to. The valve on the bottom box was now opened automatically, and the contents were discharged into a suitable receptacle or elevator, which elevator would load the fine ash into a waggon or truck and thus a battery of boilers would have all the fine ash deposit removed entirely automatically and, consequently, could be run day and night for any period without stoppage for removal of fine ash deposit.

Mr. W. RAMSAY inquired if none of the dust escaped up the chimney. In some experiments which he had conducted some years ago, they experienced the difficulty that they smothered the neighbourhood in fine ashes.

Mr. O. E. WILSON replied that they had never experienced anything of that kind, as a very small portion would be pretty sure to come, but that could be got over by forming an expansion chamber at the foot of the chimney, or in any part of the flue passages, in order to reduce the speed of the gases at that part and thus deposit the fine ash. This was quite a simple matter; really, it was only a case of having an installation to attach it to, but he thought there would be no difficulty whatever on that score.

Mr. STOCKS inquired if there was any difficulty found with the coal-dust which was collected from the chamber. Was it not likely to contain more moisture than that passing from the cylinder?

The CHAIRMAN, in answer to the query, stated that a small percentage of coal-dust, as far as he understood, was carried away by the air which went through.

Mr. WILSON said he supposed Mr. Stocks referred to the dust that was deposited in the chamber. There was a travelling creeper chain at the bottom of that chamber close to the brickwork, and he should say this brickwork was heated to about 300° F. The heat from the combustion chamber constantly played upon this brickwork, so that the fuel coming away from that chain was practically dry; it might contain possibly a half per cent. more fuel than the coal that came out of the dryer.

The CHAIRMAN said that he understood the fuel that went through the cylinder was dried at a temperature of about 120°, but it did not follow that the furnace and the heated gases were as low as 120°; he presumed they were much higher.

Mr. WILSON said that was so; a current of air was constantly going through the drying cylinder, which kept down the temperature. They had not made actual tests of the temperature at the foot of that chamber, but they had never had any difficulty in depositing the fine particles of fuel, or any difficulty in delivering fuel from the chamber. It came out perfectly dry and perfectly ready for grinding. Any members of the Society who cared to see the system in operation at Haydock would be perfectly welcome, and those in charge would give them full particulars and answer any questions that they might like to ask.

*Meeting held at the University, on Wednesday, April 12th, 1905.*

MR. EUSTACE CAREY IN THE CHAIR.

## THE WOOD DISTILLATION INDUSTRY.

BY MAX MUSPRATT.

The principal commercial products from the distillation of wood are charcoal, wood spirit and acetate of lime, each of which has important industrial uses.

Charcoal has its largest outlet in the iron and steel industry, but in copper foundries, sugar refineries, for water filtration, for stoves and household cooking, also in laundries, it is utilised to an extent which in the aggregate is considerable; in addition it is the basis of carbon bisulphide manufacture, the outlet for which is increasing.

Wood spirit is used for the production of varnishes,

perfumery, formaldehyde, &c., also for denaturing alcohol.

Acetate of lime is the principal raw material in the manufacture of acetic acid and acetone, and these in turn are the raw materials for amylac acetate, chloroacetic ether and most commercial acetates.

Thus it is clear that the outlets for the various products is an increasing one, but except perhaps in Germany systematising and perpetuating of the conditions, which production can best take place has been entirely ignored, while the methods have been wasteful and extravagant to a degree.

As in the days of really cheap coal fuel economy was never considered, so has the accessibility of virgin forests tended to postpone the application of scientific methods both in the cultivation of the trees and the carrying out of the process.

At this point it is well to review the principal countries where wood is distilled with recovery of all the products, remembering that the two conditions of success as far as situation is concerned are (1) cheap wood, (2) outlet for charcoal.

In Great Britain wood distillation is at present practically confined to waste wood, especially in conjunction with bobbin works, but the great disadvantage is the quantity of waste wood available is barely sufficient to keep a thoroughly equipped plant in full work. Quantities of wood spirit are not considered worth recovering, and the brown acetate of lime produced becoming more and more difficult to market. In Scotland one, perhaps two, works are well equipped and produce grey acetate of lime of good quality, but very limited quantity. The charcoal is readily marketed.

In Germany the regulation of forestry by the State and the insistence on replanting cleared areas has much to keep the wood distillation industry in a profitable condition; in addition practically all the improvements in process have been carried out in that country, but the demand for the products is so great that at half the total consumption of acetate and wood spirit to be met by importation.

Austro-Hungary, Russia, Bosnia, Norway and Sweden, owing to their wealth in forests, have all for many years been looked upon as most promising fields for the wood industry; they were all exploited more or less by the German Trebertrocknungsgesellschaft of Cassel, and this has individually works have survived the gigantic failure of that firm the fundamental weakness, namely, the lack of a policy in marketing the charcoal in those countries is likely to be a serious handicap until greater all-round industrial development brings larger demand for charcoal.

It is across the Atlantic we must look for the future development of wood distillation. In the United States vast tracts of virgin forest have been felled for this industry, but, unfortunately, replanting has not taken place, as the forest wealth seemed inexhaustible; now it is being gradually realised that the most accessible of the suitable timber has been used up, and every few years the works have to be moved further and further from the centres of consumption. The situation is not yet acute from this point of view (though temporarily it is very acute from another cause), but it is already giving cause for anxiety, and the world is watching keenly for some signs that the wood-distillers are looking ahead and taking steps to deal with the problem. Actual information as to the technical side is not easy to obtain, but it is doubtful if the industry is so well developed as in Germany, and it is to be hoped that, both for the consumers' and producers' sake, some effort will be spared to obtain the maximum output of products for the minimum consumption of timber; and the question of replanting felled areas is one of national and even international importance.

The position in Canada is much more healthy; the virgin forests still stand in accessible localities, and the industry is in capable hands, while the outlet for charcoal has been greatly facilitated by an unprecedented development of domestic consumption, which the United States might with advantage copy. Replanting is a condition insisted upon when the forests are systematically felled, and the outlook for this industry is



la free from anxiety, especially if, as is probable, methods are brought up to date, which at present they r from being.

t new sources of supply must be looked for, and the ability of the founding of a home industry deserves serious attention. Schemes of afforestation are freely discussed from the point of view of national ities, and as relief work in times of depression in the r markets. Little has, however, been said on the trial side, and as to wood distillation nothing. On rostry side the industrial chemist cannot speak with rity, but on the industrial side a *prima facie* case a made out which deserves the very earnest attention erts and public authorities who own large tracts of such as water-sheds. One of the great deterrents estry in this country has been the length of time the r has to wait for a return on his 'capital, and the mental advantage of wood distillation is that the is only about 30 years, which is very much shorter is required for any other industrial application of r. The woods which are the best for wood distil- are birch and beech, but coniferous woods and oak recovery of turpentine and tannin respectively are ood, while all hard woods are more or less suitable. ctual processes it is not the purpose of this paper scribe, as they can readily be found in text-books urrent literature, but for a right understanding of onomical side manufacturing balance-sheets must ren.

following is taken from actual practice in Germany— ce Sheet I. (Year of 300 days):—

Wood used—Beech.

Cost of production—	Mks.
Wood, 15,000 cub. metres .....	67,500
Coal, 1,425 tons at 15 mks. ....	21,375
Lime, 150 tons at 15 mks. ....	2,250
Labour, 13,200 shifts at 2.10 mks. ..	27,720
Repairs .....	4,000
Packages .....	6,000
General (including management) ....	17,300
	<b>Mks. 146,145</b>
<b>Sales—</b>	
Charcoal, 1,650 tons at 45 mks. ....	74,250
Wood spirit, 99,000 kilos. at 0.55 mks. ..	54,450
Acetate of lime, 382 tons, at 160 mks. ....	61,200
Wood tar .....	7,500
	<b>Mks. 197,400</b>

Gross profit ..... Mks. 51,255

Depreciation—	Mks.
1 per cent. on land (15,000 mks.) ..	150
2 per cent. on buildings (75,000 mks.) ..	1,500
12 per cent. on plant (165,000 mks.) ..	19,800
	<b>Mks. 21,450</b>
<b>Nett profit .....</b>	<b>Mks. 29,865</b>

e following is based on recent improvements— ce Sheet II. (Year of 300 days):—

Wood used—Birch.

Cost of production—	Mks.
Wood, 15,000 cub. metres at 4.50 mks. ....	67,500
(about 8,000 tons)	
Coal 900 tons at 15 mks. ....	13,500
Lime, 150 tons at 15 mks. ....	2,250
Labour, 8,400 shifts at 2.10 mks. ....	17,640
Repairs .....	4,000
Packages .....	6,000
General (including management) ....	17,300
	<b>Mks. 128,190</b>
<b>Sales—</b>	
Charcoal, 1,650 tons at 45 mks. ....	74,250
Wood spirit, 99,000 kilos. at 0.55 mks. ..	54,450
Acetate of lime, 382 tons at 160 mks. ....	61,120
Wood tar .....	7,500
	<b>197,320</b>
	<b>128,190</b>
<b>Gross profit .....</b>	<b>Mks. 69,130</b>

Depreciation—	Mks.
1 per cent. on land (9,000 mks.) ....	90
2 per cent. on buildings (50,000 mks.) ..	1,000
12 per cent. on plant (125,000 mks.) ..	15,000
	<b>Mks. 16,090</b>

Nett profit ..... Mks. 53,120 per annum.

The capital involved in the first balance sheet was 265,000 mks., and in the second 184,000 mks.; the returns on capital being 11 per cent. and 35 per cent. respectively. I have also an estimated balance sheet from Canada, where with the use of pinewood a return of over 30 per cent. is expected.

The high estimates have every prospect of realisation, but it is better to confine our attention to the balance sheet from actual working, with the certainty that it will err on the low side. We can now construct a balance sheet for a hypothetical works in England, and as this paper is a suggestion for the use of waste land by afforestation, no charge for the timber is made, but the total profits from the distillation are calculated on the acre, so as to compare with results of other methods of utilisation of waste lands.

In constructing this estimated balance sheet we have to consider the following points:—

Capital (excluding all charges for the timber).—This will, of course, vary with the scale upon which the work is to be carried out. If on too small a scale, the capital charges would swamp the undertaking. The size of the plant in Balance Sheet I. is a normal one, and is, therefore, taken.

Comparing cost of plant, it is safe to reckon the buildings at the same price, the cheaper material of England being counterbalanced by dearer labour; but in the plant, which is chiefly of metal, it is reasonable to reckon 10 per cent. less for England. This gives:—

	£
Buildings .....	3,750
Plant .....	7,500
<b>Total capital .....</b>	<b>£11,250</b>

As to the cost of working, coal is cheaper than in Germany, but a high price is taken owing to the comparative inaccessibility of the areas contemplated. Labour in the German balance sheet is at an extremely low rate, but judging by other products, of which comparative balance sheets have been seen, at any rate in the heavy chemical industry the nett cost per ton on similar work is about the same with low German or high English wages; an increase of about 15 per cent. however is allowed.

Lime, repairs, packages and management are taken at the German figure, though packages would probably be cheaper in England.

We, therefore, have on the debit side for approximately 500,000 cu. ft. of timber per annum:—

Cost of production—	£
Coal, 900 tons at 10s. ....	450
Lime, 100 tons at 15s. ....	75
Labour .....	1,000
Repairs .....	200
Packages .....	300
General (including management) ....	860
<b>Total manufacturing cost .....</b>	<b>£2,835</b>

Depreciation—	£
Buildings, 2 per cent. ....	75
Plant, 12 per cent. ....	900
<b>Total debit per annum .....</b>	<b>£3,860</b>
<b>Say £4,000 per annum.</b>	

Now, taking the credit side, coke is worth in England at least 10s. more per ton than the German balance sheet figure: acetate of lime is at present £2 to £3 higher, but £8 is a fair average over a term of years. Wood spirit is worth about 2s. 6d. per gallon. The revenue, therefore, would be:—

	£	s.	d.
Charcoal, 1,650 tons at 55s. ....	4,537	10	0
Wood spirit, 15,000 galls. at 2s. 6d. ....	1,875	0	0
Acetate of lime, 382 tons at £8 ....	3,056	0	0
Wood tar or creosote .....	400	0	0
<b>Total credit .....</b>	<b>£9,868</b>	<b>10</b>	<b>0</b>

Or a gross profit of about £6000 per annum.

*Area of land.*—This most important item will have to be finally established by forestry experts.

With beech wood, a rotation of 30 years should be sufficient, and on the basis of figures which I have obtained, I give with all reserve the following estimates:—

(a) Source of information, Sellich's Manual of Forestry.

Yield per acre for 100 years 15,230 cb. ft. For 30 years this would be (say) 3000 cb. ft. Therefore, for a yield of 500,000 cb. ft. the areas which would have to be felled per annum would be 168 acres.

N.B.—The above calculation ignores the first ten years' growth.

(b) Source of information—Michigan, U.S.A.

One acre yields 3500 cb. ft.; 500,000 cb. ft. is yielded by 143 acres.

In order to leave a good margin for error 200 acres per annum for 500,000 cb. ft. is taken.

On a 30 years' rotation this would involve a total area of 6000 acres.

Calculating the gross profits of the wood distillation (viz., £6000 per annum) to the acre, this would give a sum of 20s. per acre per annum for the whole estate.

As the actual expenditure on the bulk of the estate during the period of growing would be very slight, the main items of expenditure would fall on only 400 acres each year, viz., 200 acres to be planted at, say, £5 per acre, and 200 acres to be felled at, say, 25s. per acre annually, leaving £4,500 per annum as the net yield of the estate.

Another method of showing the results is profit on the timber. In stating the yield on the actual timber, it must be remembered that the whole of the timber as felled is used, and not the sawn logs only, and that only a 30 years' rotation is involved.

The net profit on 500,000 cb. ft. per annum, as shown above, is £4500, which gives a yield of 2.16d. per cb. ft., which is the value of 40 year-old wood for other purposes.

In case beechwood is not convenient to grow fir may be considered.

*Fir.*—Up to recent years this wood was not considered suitable for distillation, but recent developments have made this snitable for an even more promising industry, as means have been found of separating the turpentine, which gives a large additional profit.

As fir is of more rapid growth than beechwood the return per acre will be considerably greater, and I now give an estimate based on actual figures for fir or other coniferous wood.

Fir (30 years' rotation), annual consumption 500,000 cb. ft.

Capital—	£
Buildings .....	3,750
Plant .....	8,000
	<b>£11,750</b>

Cost of production—	£
Coal, 1,500 tons at 10s. ....	750
Lime, 80 tons at 15s. ....	60
Labour .....	1,500
Repairs .....	250
Packages .....	900
General, including management .....	1,250
	<b>£4,710</b>

Value of products—	£
Charcoal, 1,365 tons at 55s. per ton .....	3,753
Wood spirit, 6,000 gallons at 2s. 6d. ....	750
Acetate of lime, 163 tons at £8 ....	1,224
Turpentine, 120 tons at £25 .....	3,000
Tar oil, 3,000 barrels at £1 .....	3,000
	<b>£11,727</b>
Less cost of production .....	<b>4,710</b>
	<b>£7,017</b>

Depreciation—	£
Buildings, 2 per cent. ....	75
Plant, 12 per cent. ....	960
	<b>£1,035</b>
Total .....	<b>£5,982</b>
Gross profit .....	<b>per annum.</b>

It will be seen that in this case the main profit earning products are turpentine and turpentine tar oil, both

reckoned at a low figure, best turpentine having averaged £40 per ton for some years.

*Area of land.*—30 years' rotation. The rate of felling of fir to that of beechwood is as 24 to 15. To produce 500,000 cb. ft. of fir per annum requires 125 acres on a 30 years rotation, 3750 acres, say, 4000 acres.

The distillation profits are ...	£5,927 per annum
Cost of planting and felling—	
Planting 125 acres at £5 .....	781
Felling 125 acres at 25s. ....	"
Nett yield .....	<b>£5,146</b>

This gives 25s. per annum per acre, or 2.4d. per cb. ft. for 30 years' old fir.

These returns may not seem great, but if the uncultivated lands of Great Britain can be divided up into afforestation areas of from 4000—6000 acres, so as to be by distillation employment to the extent of over 400,000 acres, and revenue of from 20s. to 25s. per acre per annum, a very great new source of national wealth will be tapped.

To accentuate the importance of this industry, the progressive output of the United States in the two principal products, apart from charcoal, is here given:—

Production.	Wood Alcohol.	Acetate of Lime.
	Gallons.	Tons.
1880 .....		2,943
1890 .....	1,000,000	11,000
1900 .....	5,000,000	38,490

The exports are also given herewith:—

Exports.	Wood Alcohol.	Acetate of Lime.
	Gallons.	Tons.
1889 .....	386,000	17,000
1899 .....	727,000	21,800
1900 .....	540,000	21,000

England at present consumes a quarter to one-third of these exports and her consumption is steadily increasing.

The United States has, it is true, virgin forests, but against that there are railway charges and sea-freight, which largely counterbalance the natural advantage. With large tracts of uncultivated land in England, the growing feeling towards afforestation from both an aesthetic and social point of view, there is added stimulus of a profitable industry, which in its turn fosters and increases the industries depending upon these materials. At any rate, the industrial demand for up-to-date wood distillation in this country is certain, and in any public scheme of afforestation should command the most careful consideration.

## London Section.

Meeting held at Burlington House, on Monday, April 10, 1905.

MR. A. GORDON SALAMON IN THE CHAIR.

ON THE FORMATION OF SULPHURIC ESTERS IN THE NITRATION OF CELLULOSE, AND THE INFLUENCE ON STABILITY.

BY C. NAPIER HAKE AND REGINALD J. LEWIS.

The purification of guncotton on a manufacturing scale presents difficulties which can only be appreciated



parts directly engaged in the process, or who, from official position in relation to the supervision of the manufacture of explosives, are constantly brought into contact with the trade.

The first attempt by von Lenke to effect purification of guncotton on a manufacturing scale by a prolonged immersion of pure guncotton in running water, was unsuccessful; after eight weeks' treatment purification was incomplete.

The pulping process suggested by the late Sir Ric. Abel made, for the first time, the production of guncotton possible. In spite, however, of the adoption of all well-known precautions, manufacturers are from time to time suffering severe losses, owing to the official prohibition of explosives, more especially such explosives as contain guncotton in their composition (gelatine bombs), and which are consigned to tropical or sub-tropical countries. The unpleasant duty of condemning whole cargoes in Australia fell to the lot of one of the ships in his official capacity at one time with alarming frequency, and the fact of the exact cause of the changes in the quality of the explosives being unknown, often increased the difficulties and anxieties of arriving at a final decision.

In conjunction with Messrs. Nobel, of Glasgow, and other high manufacturers, experiments were made some years ago with a view of throwing light on the subject; special cartridges were selected from each consignment and divided into two halves; one portion was tested and exploded at the factory, the other portion (specially prepared) was forwarded with consignment. Careful daily observations of air and water temperatures were taken during the voyage between England and Australia, the observations extending over a period of more than two years.

Experience gained in this experiment made it possible to forecast with almost absolute certainty the probable condition of the explosive on arrival by reference to temperature records during the voyage. When the temperature rose to, or above, 80° F. and remained several days, the samples tested in Melbourne showed a considerably lower "heat test" than the corresponding sample originally tested in England.

It is well known that "cordite" stored in hot climates undergoes a change, in so far as the original strength and of purity is lowered.

Numerable experiments made in the laboratory of Explosives Department, Melbourne, as near as possible to the temperature conditions of a voyage through the tropics, confirmed the result recorded above.

It was urged by capable and experienced chemists connected with the factories concerned, that the apparent variation in quality of the explosive was due to the presence of volatile organic substances in the guncotton, which reacted on the iodide-starch paper, but which did not affect the stability of the explosive; in other words, the interpretation of the results were erroneous.

Dupré, F.R.S., at the discussion on Mr. Oscar Reissner's paper, read before this Society in 1897, also pointed out volatile impurities being present in gelatine bombs. No new facts, however, of a character sufficiently convincing to justify a departure from a strict interpretation of the recognised official test were forthcoming.

The investigation into the more exact causes of instability, in the first instance, started by us on the supposition that lower nitrated bodies were formed in the case of cotton, which at ordinary or slightly raised temperatures were liable to decompose.

Cottons of various degrees of nitration were washed by immersion in cold running water for 14 days, known quantities of these guncottons were then transferred to wide-mouthed stoppered bottles, containing known quantities of distilled water, and subjected to the action of a copper couple for various periods of time, both at normal and at raised temperatures, the degree of decomposition being estimated by the amount of ammonia evolved.

By comparing the results of the "heat tests" of these samples so treated, with blank experiments made under identical conditions, apparently stable cottons were obtained on applying the stability test at 130° to 131° C. to one

of the cottons, it exploded violently after 40 minutes, without fuming.

Curves plotted to show the amount of ammonia formed at certain temperatures and within certain time limits of treatment were found to be worthless, owing to the absorption of ammonia by the guncotton. Further investigations showed that guncotton absorbs up to 0.2 per cent. of ammonia, the quantity depending on the degree of nitration of the cotton, and the temperature of the experiment.

This property of guncotton accounted for the misleading indication of stability by the "heat test," the reaction having been simply delayed by the neutralising effect of the ammonia.

In the course of the investigation it was observed:—

1. That the lower nitrated cottons were more easily washed free of acids than the higher nitrated cottons.

2. That water in which the nitrated cotton, previously washed free of acid, had been standing for some time, on re-testing gave, in some instances, a very appreciable reaction with barium chloride, in other instances no reaction; but on evaporating the latter to dryness with a drop of potash solution, igniting, and then making up to the original volume an appreciable sulphate reaction was obtained.

3. All the nitrated samples previously washed free from sulphuric acid when dried at 212° F., and re-washed with cold distilled water, yielded a very appreciable sulphate reaction with barium chloride.

The formation of sulphuric esters of cellulose by treating cellulose with sulphuric acid has long been known. "Cotton cellulose" is rapidly attacked and dissolved by concentrated sulphuric acid. The initial product may perhaps be regarded as cellulose sulphuric acid, but a rapid molecular disintegration arises, and there results a series of sulphates with the general formula  $C_6H_7O_5 \cdot n \cdot x(SO_4)_x$ . The free acids are very soluble in water, but on boiling are hydrolysed quantitatively to glucose and sulphuric acid. (Cross and Bevan, "Cellulose.") A. L. Stern, in his thesis for Doctor of Science, London University, 1894, has further investigated these compounds.

Systematic experiments were now commenced, to see whether sulphuric esters were formed in the nitration of cotton. Two samples of cotton kindly supplied to us by Mr. Lundholm, of Nobel's Explosive Company, Glasgow, for the express purposes of this investigation, were chiefly worked upon, and were described as (A) "Bleached hard waste, used in the manufacture of guncotton"; (B) "Washed cops, used in the manufacture of blasting gelatine." The above samples (A) and (B) were nitrated with acids of strengths 4.3/1, 4.1/1, 9.3/1, 9.1/1, 14.3/1, 14.1/1, 19.3/1, 19.1/1. These strengths are similar to those used by Dr. Will in his interesting investigations on the stability of nitro-cellulose.\*

The nitrations were carried out at the Australian Explosives and Chemical Company's Factory, Braybrook, Victoria, and the acids used were similar to those employed by the Company for the preparation of nitro-glycerine, the ratio of acid to cotton being as 50 to 1. The temperature during nitration was 73° F. Each sample of cotton was left in contact with the acids for one hour with constant stirring, the excess of acid was then squeezed out, and the resulting cellulose nitrate drowned in a large excess of water. The samples (unpulp) were then washed twice daily for 14 days in rain water, and were then transferred, thoroughly saturated with water, to wide-mouthed, stoppered bottles, and brought to the laboratory.

After standing for several days, some of the water was squeezed out of the samples and tested for sulphuric acid with barium chloride. The samples were then re-washed for four hours in a stream of running water, and returned to the bottles in a wet condition, and retested after two days. No sulphuric acid could now be detected. Two months later the test was repeated.

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Capital—	£
Buildings .....	3,750
Plant .....	5,000
	£11,750

Cost of production—	£
Coal, 1,500 tons at 10s. ....	750
Lime, 80 tons at 15s. ....	60
Labour .....	1,500
Repairs .....	250
Packages .....	900
General, including management .....	1,250
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Value of products—	£
Charcoal, 1,365 tons at 55s. per ton .....	3,753
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Portions of various degrees of nitration were washed by immersion in cold running water for 14 days, known quantities of these guncottons were then transferred to wide-mouthed stoppered bottles, containing known quantities of distilled water, and subjected to the action of a copper couple for various periods of time, both at normal and at raised temperatures, the degree of decomposition being estimated by the amount of ammonia evolved.

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In the course of the investigation it was observed:—

1. That the lower nitrated cottons were more easily washed free of acids than the higher nitrated cottons.

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The formation of sulphuric esters of cellulose by treating cellulose with sulphuric acid has long been known. "Cotton cellulose" is rapidly attacked and dissolved by concentrated sulphuric acid. The initial product may perhaps be regarded as cellulose sulphuric acid, but a rapid molecular disintegration arises, and there results a series of sulphates with the general formula  $C_6H_7O_5(SO_3H)_x$ . The free acids are very soluble in water, but on boiling are hydrolysed quantitatively to glucose and sulphuric acid. (Cross and Bevan, "Cellulose.") A. L. Stern, in his thesis for Doctor of Science, London University, 1894, has further investigated these compounds.

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The nitrations were carried out at the Australian Explosives and Chemical Company's Factory, Braybrook, Victoria, and the acids used were similar to those employed by the Company for the preparation of nitro-glycerine, the ratio of acid to cotton being as 50 to 1. The temperature during nitration was 72° F. Each sample of cotton was left in contact with the acids for one hour with constant stirring, the excess of acid was then squeezed out, and the resulting cellulose nitrate drowned in a large excess of water. The samples (unpulp) were then washed twice daily for 14 days in rain water, and were then transferred, thoroughly saturated with water, to wide-mouthed, stoppered bottles, and brought to the laboratory.

After standing for several days, some of the water was squeezed out of the samples and tested for sulphuric acid with barium chloride. The samples were then re-washed for four hours in a stream of running water, and returned to the bottles in a wet condition, and retested after two days. No sulphuric acid could now be detected. Two months later the test was repeated.

\* Investigations as to the stability of Nitro-cellulose, by Professor Dr. W. Will (translated from the German).

The following table gives the result of the tests :—

Sample marked.	1. Tested with Barium Chloride several days after return from factory.	2. Tested with Barium Chloride 2 days after being washed for 4 hours in running water.	3. Tested with Barium Chloride 2 months later than No. 2 test.
4 3/1 A	no reaction	no reaction	no reaction
4 3/1 B	do.	do.	do.
4 1/1 A	reaction	do.	reaction
4 1/1 B	do.	do.	do.
9 3/1 A	do.	do.	do.
9 3/1 B	do.	do.	do.
5 1/1 A	do.	do.	do.
9 1/1 B	do.	do.	do.
14 3/1 A	do.	do.	do.
14 3/1 B	do.	do.	no reaction
14 1/1 A	no reaction	do.	do.
14 1/1 B	do.	do.	do.
19 3/1 A	do.	do.	do.
19 3/1 B	do.	do.	do.
19 1/1 A	do.	do.	do.
19 1/1 B	do.	do.	do.

The weaker nitrating acids had a marked hardening influence on the cotton, especially in the case of sample B. The total sulphuric acid in each sample was then estimated by the following methods:—

3—5 grms. of the cellulose nitrate were saponified in hot alkali, just sufficient to obtain complete solution; carbonate of soda crystals, or, better, the anhydrous salt, were then added (about eight times the weight of the sample), and the whole evaporated to dryness, care being taken to keep well stirred during the operation. The temperature was then gradually raised, the combustion proceeded slowly but completely; when the residue became grey it was fused in a blast (if the process is carefully conducted the addition of nitre is unnecessary) and then taken up with water, acidified with hydrochloric acid, boiled and tested with barium chloride. Blanks run with the same reagents and nitre in the place of gun-cotton, showed no sulphate reaction. The following Table shows the results obtained:—

Samples marked.	Combined Sulphur per cent. calculated as $H_2SO_4$ , in Cellulose Nitrate.
4 3/1 A	0.44
4 3/1 B	0.39
4 1/1 A	0.39
4 1/1 B	0.32
9 3/1 A	0.37
9 3/1 B	0.35
9 1/1 A	0.30
9 1/1 B	0.30
14 3/1 A	0.54
14 3/1 B	0.44
14 1/1 A	0.26
14 1/1 B	0.22
19 3/1 A	0.67
19 3/1 B	0.79
19 1/1 A	0.22
19 1/1 B	0.26

Two possible sources of sulphate naturally suggested themselves:—(1) The presence of lead sulphate in the nitrating acids. (2) Basic sulphates of alumina, &c., in the "ash" of the cotton.

1. The absence of lead sulphate was proved by boiling the gun-cotton in ammonia acetate and testing the solution with hydrogen sulphide; also by fusing the gun-cotton with sodium carbonate and testing the resultant melt for lead.

2. The ash in the original cotton (B) was found to be 0.59 per cent., of which 0.22 per cent. was alumina containing a trace of iron. The percentage of alumina is reduced to about 0.17 on nitration.

Samples of Swedish filter paper containing about 0.1 per cent. total ash were nitrated with acids 9 3/1 under the same conditions as the cotton above, washed with cold distilled water until they showed no sulphate reaction on standing for 24 hours. On igniting some of these papers, they were found to contain 2 per cent. of calculated sulphuric acid. On extracting for three days

in the "soxhlet" with water they lost a little over of this amount; \* but, although no more could be rated by this treatment, yet, on drying at  $212^{\circ}$  submitting to the "heat test," they showed a reaction at once, and on rewashing the dried papers only one cold water, the washings showed a considerable amount of sulphuric acid. Treatment with acetic acid (a method which will be described further on) removed a further 0.4 per cent. On again drying at  $212^{\circ}$  two hours, and almost immediately heat testing, papers only showed a slight reaction in 24 minutes, although nearly 0.6 per cent. combined sulphuric acid still present.

From these experiments (filter paper) it would appear that mineral matter in cotton has very little influence on the formation of sulphur compounds.

A portion of the sample marked 14 1/1 A was taken from the bottle in a wet condition and treated in a "soxhlet" extractor for 10 days, the water being changed three times, the whole of the water was then evaporated to a small volume and tested with barium chloride, almost unappreciable quantity of sulphate separated out. Upon igniting a portion of the sample so treated with alkali and testing with barium chloride, a appreciable precipitate was obtained. Another portion of the sample treated in the "soxhlet" was tested, and showed reaction only after one hour. The same sample was then dried in the water-bath at  $212^{\circ}$  and again "heat tested," when it showed an immediate reaction in a few minutes. The interpretation of results is, that the treatment in the "soxhlet" removed the last trace of free acid and that no further development of free acid takes place even at the temperature of the "heat test" so long as sufficient moisture is present to nitrated cellulose, but on removing the moisture raised temperature, decomposition sets in and sulphuric acid is formed.

Various solvents were tried with a view of removing these sulphur compounds, viz.:—

Dilute nitric acid, hot and cold strong nitric acid, fuming nitric acid (dissolving action on gun-cotton), dilute aqua regia; dilute sulphuric acid, hot and dilute acetic acid, with negative, or only very slight results. Glacial acetic acid seemed, at first, to offer the best hopes of success, but owing to its gelatinising action on cellulose nitrates, it could not be used directly. A method finally adopted, was to expose the nitrated cotton in the ordinary hygrometric state, to the action of acetic acid vapours under bell jars at ordinary temperature for from 24 to 48 hours at a time, washing, and returning to the hygrometric state again and repeating the process until no more sulphuric acid separates. The washing was sometimes conducted with cold water, at other times with hot water in the "soxhlet," but whether hot or cold washing was adopted, it was found that, practically, the liberated sulphuric acid was each time removed by a few hundred c.c. of the wash water.†

For instance "bleached hard waste cotton" nitrated with acids 9 3/1 (9 3/1 A) cold water (unpulped).

Total sulphur compounds determined as sulphuric acid on the dry sample equalled 0.37 (0.375 per cent. 0.38).

20 grms. of the damp sample containing 8.49 per cent. of moisture were divided into two equal portions (each weighing 9.151 grms. of dry nitrated cotton) and one was exposed to the action of acetic acid vapour.

\* The following test was made to observe whether the was originally combined or simply remained from extraneous nitrating acids. If the latter was the case, then nitric acid ought to be present also. Six papers (cold washed) were extracted in soxhlet for 14 days with  $Na_2CO_3$  in the receiver. The soxhlet was exactly neutralised with hydrochloric acid was made up to 100 c.c. and divided into two equal portions; 100 c.c. treated with zinc-copper couple for 24 hours and tested with Nessler solution found to contain less than 0.00005 grm.  $NH_3$  — 0.00018 H. The other 100 c.c. acidified with hydrochloric acid and tested with  $BaCl_2$  gave 0.0185 grm.  $BaSO_4$  = 0.0077 grm.  $H_2SO_4$ . A ratio of over 40 sulphuric acid to 1 of nitric acid, whereas the original ratio was 3:1.

† Acetic anhydride does not appear to act as favourably as glacial acetic vapour, owing probably to its strong gelatinising action and insufficiency of water vapour for hydrolysis.



ary temperatures, from one to two and a half days time, cold washed, and the sulphuric acid determined the washings. After the eighth treatment "heat" were taken and the sample washed in the "soxhlet" addition to the cold washing. The sample was treated the same as *a* with the exception of exposure to acetic acid vapour.

probably offers a truer explanation of the cause of the Stowmarket explosion in 1871, when nearly 15 tons of finished guncotton stored in the factory magazines exploded spontaneously\* than that arrived at on the evidence submitted at the inquiry.

Although this accident occurred many years ago, it will still be within the memory of many here present; the

In hours separate treatment with Acetic Acid pours.	Sulphuric Acid, per cent. extracted on washing with Water calculated on dry nitrated cotton.		"Heat Test," 20 gr. of n/e. (Potassium Iodide paper), at 170° F. in minutes.		Remarks.
	Nitrated cotton treated with Acetic Acid Vapours <i>a</i>	Nitrated cotton run as a Plank <i>β</i>			
48	0.03	undetected	"Heat tests" were not taken in these cases but, from experience know that they would re-act almost at once.	8 7	Not sufficient acetic acid used, and moisture too great in the sample. Sample dried to hygrometric state and fresh acetic acid used.
24	undetected	do.			
48	0.08	do.			
72	0.07	do.			
48	0.04	a trace (unweighable)	Samples dried at 190° F. for 2 hours allowed to stand over night and "heat tested." Extracted 6 hours in soxhlet and percentage of sulphuric acid determined. The high result of the blank is due to decomposition on drying prior to the "heat test." Re-extracted in soxhlet another 6 hours, dried at 212° F. for 2 hours testing almost immediately. Cold washed. Extracted in soxhlet 3 hours (extract tested for sulphuric), dried 212° F. for 1 hour and "heat test" taken. Extracted in soxhlet 3 hours more (extract tested for sulphuric), dried 212° F. for 1 hour and "heat test" taken. Dried at 212° F. for 3 hours longed and tested after standing 1 hour. Fresh acetic used. Extracted in soxhlet 3 hours. Extracted in soxhlet another 3 hours.	45 3½	Fresh acetic acid was used in third of these treatments but did not increase the quantity removed. Precipitates weighed together.
48	0.01	undetected			
	a trace	0.055			
	undetected	undetected			
48	a trace	a trace	17	8	
	undetected	a trace	30	15	
	do.	do.	27	10	
48	a trace	undetected	42	20	
	undetected	a trace			
	do.	undetected			

On submitting to the stability test at 130°—131° C., *β* exploded without appreciable fuming in 45 minutes.

eral samples of commercial cellulose nitrate, cordite 1, and blasting gelatine cotton examined were found to contain considerable quantities of sulphates soluble in water, and sulphur compounds which could not be removed, even after prolonged treatment with water or mineral acids. An estimation of the sulphuric acid remaining after the above treatment by the method described, gave results corresponding to as much as 19 per cent. of sulphuric acid in blasting gelatine 1 and 0.20 per cent. in cordite cotton. The amount of sulphate removable by water was found to be largely in excess of the quantity one would expect to find in finished guncotton. Lime was present in all the samples examined, but mostly in a soluble form, very little being as carbonate, in which form it was, no doubt, usually present. The original "heat tests" were very materially on extracting the samples with water in the "soxhlet" (the treatment being continued in cases up to 48 hours) and drying at 180° F.

The above reactions are in conformity with the results previously mentioned in this paper, and from which it appears that sulphuric acid chemically combines with cellulose during nitration, probably to form esters, which decompose to esters of a more stable character giving less combined sulphur. The decomposition takes place partly during the prolonged purification treatment, and partly during subsequent storage of the finished explosive. The presence of small quantities of lime in the washing waters, from the nitrating acids, and the partial breaking down of sulphuric esters, no doubt, plays an important part in helping this decomposition by hydrolysis.

The difficulty of eliminating the sulphuric esters, their tendency of slowly decomposing to set free sulphuric acid, and the want of homogeneity of distribution of the chemically mixed neutralising agent throughout the samples, explain the frequently observed erratic behaviour of apparently stabilised guncotton, and of explosives of the composition of which guncotton enters, especially when they are exposed to tropical climatic conditions. It is ventured to suggest that this property of cellulose

details of the voluminous evidence will, however, only be remembered by a few. We propose therefore to indicate, as briefly as possible, the points which appear to conflict with the results of our investigations by reference to the evidence of the experts engaged in the enquiry and upon whose evidence mainly the verdict and the conclusions of Captain Majendie, as to the cause of the explosion, were, at the time, based.

At the enquiry, which sat for seven days, the Home Office was advised by Dr. Dupré and the late Mr. Keates; Prof. Abel gave evidence on behalf of the War Office, and Prof. Odling appeared for the Company.

In investigating the chemical causes of the explosion, it was proved that within a fortnight of the accident impure guncotton was, on two separate occasions, found to be present on the works, the cotton commencing to fume while in the process of drying. On examination, the cotton was found to contain "a notable quantity of free sulphuric acid" (up to 0.6 per cent.).

Some of this impure cotton was "present in the magazine at the time of the explosion."

As to the origin of the sulphuric acid, Prof. Abel stated that "there is nothing in guncotton from which sulphuric acid can be devolved or developed." Captain Majendie states "there was a general agreement among the chemists on this point, and we are left therefore with only one possible conclusion, viz.:—that the sulphuric acid was, by accident or design, introduced into the cotton after it had passed the tests for purity." He goes on to say that this conclusion was "found to be materially strengthened" by the evidence of the experts as to the uneven distribution of the sulphuric acid in the cotton, and the quantity of "ash" found in the impure samples, from this it was reasoned that the sulphuric acid must have been added after the pulp had left the "poacher," or in other words, after purification.

\* Report on the explosion of guncotton at Stowmarket on the 11th August, 1871, by Vivian Dering Majendie, Captain, Royal Artillery (the late Sir V. D. Majendie, K.C.B.). Report and proceedings of the special committee on guncotton, addendum 27, minutes of evidence relating to the explosion of guncotton at Stowmarket.

No doubt, cotton containing "notable traces of free sulphuric acid" or sulphuric esters would not have passed the tests applied in the works laboratory without discovery. On the other hand, Captain Majendie states, "It is clear that these arrangements afforded numerous opportunities for mistakes. No one person was responsible for the samples through the various processes of selection, testing, and final passing."

Ulmic acid bodies which are closely related to the higher members of the acetic series, may also influence the stability of a not thoroughly purified cellulose nitrate. Girard states\* than when hydrocellulose is heated above 80°C. it is converted into ulmic bodies, possessing acid properties. A. L. Stern doubts the accuracy of this statement, † and says that when care is taken to remove all traces of acid, no such bodies are formed, but they easily form when even traces of acid are present. From our own observations we are inclined to A. L. Stern's view.

From the constitution of cellulose, it would be reasonable to assume that the  $(\text{HSO}_4)_2$  groups would take the place of the  $(\text{OH})_2$  groups, just as the  $(\text{NO}_3)_2$  groups do, and this, no doubt, occurs in dissolving cellulose in sulphuric acid. The sulphuric acid esters are fairly readily decomposed, whereas the nitric esters are comparatively stable.

It is probable that a cellulose containing  $(\text{HSO}_4)_2$  and  $(\text{NO}_3)_2$  groups would have properties midway between these two. The partial hydrolysis and replacement of some of the  $(\text{HSO}_4)_2$  groups by  $(\text{OH})_2$  groups would naturally give more stable compounds. A. L. Stern has shown this to be the case with cellulose sulphuric acid.‡

We hope in continuation of this research that a closer study of the action of acetic acid on the sulphur compounds in cellulose nitrate will throw more light on the conditions of their formation and of their constitution.

Since writing this paper, we have found that fuming nitric acid vapours act in the same way on hygrometric nitro-cotton as acetic acid, but whereas acetic acid vapours have to be applied many times, one treatment with nitric vapours for 48 hours is sufficient to remove practically the whole of the sulphuric esters. No doubt, any volatile acid will have the same effect, the degree depending on the concentration of the hydrogen ions which are powerful hydrolysing catalysts.

The possible formation of sulphur compounds in the process of parchmentising paper used for wrapping cartridges for blasting, has for some time occupied our attention, the results of which we propose to embody in a future communication.

In communicating to you our results at the present incomplete stage of the investigation, we feel that we are justified by the importance of the subject.

We take this opportunity of expressing our thanks to Mr. Marcus Bell for his assistance in carrying out the work; also to Mr. H. W. Gepp, of the Australian Explosives and Chemical Company, for his valuable aid and courtesy.

#### DISCUSSION.

The CHAIRMAN read the following communication from Dr. Dapré, who wrote as follows:—

"The authors, in the course of an investigation on the drop of the heat test, sometimes observed in cargoes of gelatinised preparations on their arrival in Australia, although they have presumably passed the usual stability tests, have apparently come to the conclusion that this is due to the presence of sulphuric esters. That the presence of such esters in any appreciable quantity would constitute a danger no one, I think, will deny. This possible cause, though previously pointed out, has not, as far as I am aware, received the attention which it apparently deserves. The point has not as yet been proved, but the authors have, at least, gone some way towards proof, and they

are to be congratulated on the ability and care displayed in working at this somewhat difficult subject.

The analyses given in the first table of the paper, however, be accepted as giving a fair picture of what might be expected in the case of a well-manufactured guncotton. In the first place, the one hour's drying followed immediately by washing, cannot, in my opinion, be taken as equivalent to the process usually adopted by manufacturers. The authors' process favours, the production and subsequent retention of an proportion of sulphuric esters.

"I have always been of opinion that the free sulphuric acid was not, as is often assumed, due to its combining with the water formed during the reaction, but also, perhaps mainly, to the formation of sulphuric esters subsequently converted into nitric esters. In the case of nitroglycerine, the double process can be carried out indeed has been, carried out. The longer then, within reasonable limits, the cotton is left in contact with the more complete, probably, will be the conversion of nitric esters.

"In the second place, the guncotton was not so well washed and was but imperfectly washed in cold water, which, as is well known, is incapable of producing a guncotton. This again would tend to leave an proportion of esters in the finished product. In this, the highest proportion of sulphuric acid left in guncotton, presumably in the form of sulphuric acid was only 0.79 per cent., and the amount of free sulphuric acid produced during the subsequent keeping was apparently very small.

"In conclusion, I should like to make a few remarks regarding the Stowmarket explosion which is referred to in this paper. At first sight, the authors' explanation as to the probable cause of the explosion is a cause certainly not thought of at the time, and the light of their experiments not only a very reasonable, but also a very probable one. There are, however, great difficulties in the way of its acceptance.

"In the first place, the guncotton involved was a very recent manufacture, and in the second place, the amount of free sulphuric acid found in one 8 oz. sample of Mr. Keates and myself (nearly 0.6 per cent.) would seem that about 2 per cent. of calcium carbonate first have been neutralised, the production of not less than 1.5 per cent. of sulphuric acid from esters present in guncotton which had passed, as far as the evidence goes, all the then accepted stability tests.§

"Further, even assuming that a guncotton which passed the stability tests could have contained the proportion of esters implied, the slow rate of decomposition observed by the authors during two months, presumably from esters, as shown in the second table of the paper, makes it difficult, if not impossible, to think that so large an amount of free acid could have been produced in the guncotton in question during a month.

I may add that at Stowmarket, the stability of guncotton was tested by three methods. Firstly, the effect produced on iodised starch paper when the guncotton was heated in a tube at a given rate, known as the tube test, similar to but not identical with our present test, secondly, by the temperature at which the guncotton began to give off red fumes under stipulated conditions of heating, the fuming test, and lastly, by the temperature at which it exploded, likewise under given conditions of heating.

Colour test.—No coloration to observed below 170°F.

Fuming test.—No fumes to appear below 325°F.

Exploding test.—Not to explode below 350°F."

Dr. DIVERS said the paper was of great interest from both scientific and technical points of view, and he congratulated the authors of it. His own work had been in other fields, but he might mention that the first

\* "Hydrocellulose and its Derivations," Ann. Chim. Phys. 1831 [V] 24, pp. 337—334, by A. Girard.

† "The So-called Hydrocellulose," Transactions of the Chemical Society, 1904, vol. 85, pp. 336—340, by A. L. Stern, D.Sc.

‡ Cellulose sulphuric acid and the products of its hydrolysis, by A. L. Stern, Journ. Chem. Soc. Trans., 1895, p. 84

§ The free sulphuric acid was present only in patches of a portion only of the whole mass, but was calculated on the weight. It is clear, therefore, that for this acid to have derived from esters a great part of these patches must have consisted of such esters, an incredible condition of things in pulped guncotton which had passed through beating and poaching, unless indeed, the whole mass was of the same composition, but had suffered only local decomposition.



published was on the spontaneous decomposition of guncotton. It was remarkable that a much greater quantity of the sulphuric esters was not found in the guncotton. The explanation given was that these esters were merely transition bodies, which passed on into the products.

HODGKINSON said they all thought they knew a deal about guncotton, but, after all, what they did was very little. The method of manufacture as used with an ordinary chemical process such as that giving picric acid seemed a somewhat crude process. He was convinced that sulphuric esters were generally present in guncotton, especially if the sample was kept and heated up after thoroughly washing. Guncotton made on the manufacturing scale, and then ground and washed, would, in most cases, if not in all, on washing, give a sulphuric acid test. Mention made in the paper about acetic acid apparently on the guncotton, and decomposing these sulphuric esters. He thought some of these sulphuric esters were very difficult substances to hydrolyse, and were not readily enclosed by nitric esters. He thought a means of hydrolysing these esters was by using ammonia. If the gas were passed over moderately moist guncotton it would cause detonation should the temperature rise to between  $75^{\circ}$  and  $90^{\circ}$  C., but if ammonia was passed over moist guncottons there were very few would not afterwards, when washed out with water, give a sulphuric acid test.

GUTTMANN said he regretted that the authors, in common with others, had overlooked the important work which had been carried out by Messrs. Cross and Bevan. These chemists found the presence of sulphuric acid in nitro-cellulose in notable quantities—up to about 1 per cent., and he understood, although they had not noticed it, that they were aware, as others were since, that such nitro-cellulose gave inferior stability tests. He suggested that cellulose had no definite chemical composition, containing so many groups which could be attacked by nitrous acid—indirectly confirming what he was first to point out, namely, that there was no definite stage of nitration of guncotton—but that the whole molecule was an aggregation in which according to the amount of nitric acid introduced higher or lower products were formed. This gave an explanation of the various anomalies, not only in the nitration of cellulose, but also in its behaviour to solvents of different composition, and in the amount of moisture nitro-cellulose could take up. He believed it would be found that the amount of the sulphuric acid in the course of nitration was not in sulphuric esters in the first instance, which were usually replaced by nitric acid, and according to certain conditions of nitro-cellulose, one of which was the capacity for absorbing moisture, the nitric acid could penetrate more or more completely. Prof. Will had recently found that the percentage of nitrogen in nitro-cellulose was the quantity of moisture it could take up was a constant, namely 14.65, so that this constant less the moisture represented the percentage of nitrogen in the cellulose. This shows that the highest nitrated cellulose containing 4.4 per cent. nitrogen could still take up 0.5 per cent. moisture, and this may lead to further investigation. He suggested that if nitro-cellulose could absorb a large quantity of moisture, according to its percentage of nitrogen, there must be some hindering circumstance such as nitration which prevented the nitric acid penetrating promptly. He might take this opportunity of pointing out that the process of pulping guncotton for the use of purification was patented by John Tonkin, jun., of Cornwall, two years previous to the publication of Frederick Abel's process. Messrs. Hake and Lewis had that by extracting their guncotton in a Soxhlet apparatus, the heat test lowered. If that treatment of heating the water up to boiling point and passing it through the nitro-cellulose he did not wonder at it, he did not think any nitro-cellulose would stand that very long time. With reference to the Stowmarket explosion, he agreed with Dr. Dupré, who although saying at the beginning of his communication, that a probable cause of the explosion had been given, disproved later on,

quite convincingly to his mind, that the formation of these small quantities of sulphuric esters could have produced the explosion. He could not believe that the mere fact of a heat test going wrong in the ordinary way, that is to say, giving nine or even six minutes instead of ten, or the presence of 0.4 or 0.6 of sulphuric esters should be the cause of such a serious conflagration. Will, Bergmann and Junck, and others had shown that there were two things going on in nitro-cellulose when submitted to heat. The finished and properly purified nitro-cellulose might contain a very small quantity of what had been referred to as volatile constituents, which owed their presence to the present incomplete means of purification, but these had nothing to do with the stability of the guncotton. They could be readily removed, and Will, in his test of four hours' duration, proved that after a certain length of heating, the decomposition of the guncotton followed a regular curve if it were properly stable. Some authorities had expressed doubt concerning the value of the heat test. Samples of nitro-cellulose had been submitted to comparatively high temperatures for months, and no dangerous decomposition resulted. He therefore did not think the Stowmarket explosion could be due to the cause suggested.

Mr. W. D. BORLAND said the authors had rather led them to the conclusion that they must not lightly neglect the importance of the absence of sulphuric esters of cellulose. Whether they were of the importance suggested, he was not quite sure, that was a matter for further investigation; but there were two or three points which he thought as a matter of commercial practice and manufacture on the large scale seemed to bear out the authors' idea that a certain importance ought to be attached to the presence of the sulphuric esters. First of all, so far as nitration was concerned, it was not found that to obtain a certain definite product the ratio which water bore to the sulphuric acid in the mixed acids had within certain limits more effect on the resulting product than the actual percentage of nitric acid. The preliminary formation of sulphuric esters which were later converted into nitric esters was a matter of importance. Another interesting observation was that in the purification of the nitro-cellulose, previous to pulping, when the washing waters showed no trace of acidity, it was possible by applying heavy pressure upon small pieces of unpulped guncotton resting upon litmus test paper to obtain an acid reaction, which showed there was something of an acid nature still remaining in the guncotton, and it would appear that the presence of some body very slightly soluble in water, such as a sulphuric ester, might be a reasonable explanation. Formerly the impurity of nitro-cellulose was supposed to be due to grease and various encrusting materials in the cellulose before nitration. But as there was difficulty in purifying nitro-cellulose, which had been made from perfectly pure cellulose, it was not reasonable to ascribe that difficulty to the presence of grease or foreign substances, but rather to some cellulose product of lower stability than the nitro-compound.

Mr. W. F. REID said he did not agree with the authors of the paper in attributing the Stowmarket explosion to this hypothetical formation of a sulphuric ester. It was one of the most mysterious things about guncotton that, although the technical operations were carried out uniformly and with apparently the same materials, the finished products were sometimes rejected and condemned. He desired to express his complete agreement with Mr. Guttman in the condemnation of the heat test as carried out in this country. He did not think the authors had absolutely proved the presence of sulphuric esters—they assumed there was a sulphuric ester and attributed to it the reactions which they obtained. Although it was a difficult thing to do, yet if they could have isolated even a very small percentage of the sulphuric ester it would have carried more conviction. Again, the raw material they used was to some extent defective. Although they had used the cotton which was employed generally in factories, yet that cotton was itself the waste product from another industry. Now in carrying out an accurate chemical investigation and discussing traces of almost unknown

esters in a product, they ought at least to start with pure materials. The cotton waste which was used for this purpose being a waste product might be purified to a certain extent, but there were in it impurities, and he attributed to these, in many instances—he would not say in all—the difficulty of passing the heat test as it was carried out in this country. The heat test was obviously an improper one, and was not an indication of stability, for if an explosive was heated under the conditions of the heat test, it became far more stable than it was previously. There was no doubt that the sulphuric acid played some part in the stability of the nitro cellulose produced by the nitration of cellulose with a mixture of sulphuric and nitric acids, for he had made many experiments in nitrating cellulose with nitric acid alone and obtained a purer and more stable product as a rule. And it was recommended in some recipes for manufacturing collodion cotton for photography that sulphuric acid should not be used. To use nitric acid only in the manufacture of guncotton on the large scale would not be profitable. Still, other means might be found, and the use of sulphuric acid might probably be eliminated at some future time. He did not see any evidence that the sulphuric ester should be less stable than the nitric ester, because they had products such as parchment paper in which there were traces of sulphuric acid in some combination or other, which was absolutely stable. Parchment paper could be kept for 30 years and be as good as ever; it would absorb moisture, but did not decompose.

Mr. W. MACNAB said it should not be overlooked that the cotton marked B, used in the experiments, was almost certain to be of very high grade, and would be of much purer character than cotton waste, so that in that case, at any rate, the authors were really working with a pure raw material. He did not know whether he quite correctly followed the paper in listening to it, but it seemed to him that the authors had shown that there were sulphuric esters present, and that the removal of them tended to improve the heat test, so that it might be concluded that these esters had a deleterious effect on the stability of the explosive.

Mr. C. F. CROSS found it necessary to remind the authors of their specific contribution on this subject in 1901 (Cross, Bevan and Jenks, *Ber.*, **34**, 2496; this *J.*, 1901, page 1133), in which the matter was clearly set out and emphasised in the title, viz., "The reaction of cellulose with nitrating acids, and mixed esters of cellulose." Therein they showed the fixation of quantities of sulphuric acid up to 6 per cent., calculated on the original cotton (not on the nitro cotton). Being unable to isolate these nitrosulphuric esters, and therefore to characterise them more definitely, they passed to an acid of less "negative" function than nitric acid, viz., acetic acid. In the later paper to which Mr. Guttman had also referred they gave a general communication in relation to the resulting aceto-sulphates. He was able to submit to the meeting a specimen film of the normal aceto-sulphate with 8.5 per cent. sulphuric acid ( $H_2SO_4$ ) in combination, not as a cellulose sulphuric acid, as was the case with the bodies described by Hoenig and Schubert and Stern, but as a neutral sulphuric ester. It was a body soluble in various solvents, neutral in reaction. The interesting point was that the sulphuric acid could be left in the ester, at the same time that the acetyls were saponified away. That showed how the presence of sulphuric residues in nitro-celluloses might easily come to be overlooked. The reactions of formation of these mixed esters involved general questions of equilibrium between the cellulose OH groups and a mixture of esterifying groups with which they were brought into contact. He did not wish in any sense to discount the value of this paper: it came as a confirmation from the specialist's point of view of the matter which they had published as a contribution to the general scientific question.

Mr. H. DE MOSENTHAL said at present the conclusion did not appear to be very definite, and this was not surprising in view of the difficulty of the subject. He noticed that the authors omitted to state experiments to which he attached considerable importance, namely,

that they constructed near Melbourne an isolated zinc for storing nitroglycerin explosives which did stand the test. They left them there for months, and they found them from time to time, and as they were kept the test steadily improved. Mr. Reid stated that it was antiquated. But was it not retained because had nothing better? He felt convinced that he could submit to the authorities a heat test which more satisfactory it would be readily accepted because the reason why the heat test went wrong at times, especially with goods sent to tropical climates, seemed shown to be due to the temperature, and it might interest to know that explosives could not be shipped in vessels which were insulated. The idea of sending out in ships which brought home frozen meat was obvious, but the Board of Trade would not allow account of the danger of spontaneous combustion charcoal with which the insulation was made.

Dr. R. ROBERTSON said the question of the hydrolysis of the sulphate of cellulose was of considerable importance, for, as was well known to manufacturers, guncotton after one or two boilings, although it was to all appearances neutral, continued to hydrolyse sufficiently to the washing water acid to a considerable degree. A certain number of alkaline boilings the guncotton taken as being stable, and was then sent to be put in water. This method of boiling, which was the Service method for guncotton, seemed to be founded on a rational principle and the method received confirmation from the fact that now put before them, because not only was the elimination of the sulphuric acid ester of cellulose, but this acid when set free hydrolysed other unstable products, and was the means of producing an ultimate nitrate of cellulose fit for storage. This method of stabilising guncotton seemed to him to receive more confirmation as time went on. There might be quoted, for example, the difficulty experienced in obtaining in the same length of time a stable cellulose, when in the initial stages an alkaline liquor was added to the boiling washing water. On making cotton experimentally in which the first boiling was neutralised with soda, one obtained with great difficulty a guncotton of the same stability as when one boiled guncotton in its own water with frequent change of water. As an instance in which the much-calumniated Abel test indicated such an impurity, he might say that they had on mixing a guncotton which had been made up of pure cotton of perfectly good cotton with an imperfectly prepared guncotton, the Abel test would indicate the presence of impurity much more quickly if the sample were with nitroglycerine. For that reason it was customary at Waltham Abbey to apply what was called the "heat test" to guncotton. It consisted in adding to the guncotton nitroglycerine in the proportion employed in making cordite, and testing that mixture at the temperature of the guncotton heat test. They found under these conditions they had been able to point out impurities in guncotton which were objectionable, which, if allowed to remain, would be destructive to the product. One point raised by Mr. Guttman he did not like to mention. He referred to the nitro-cellulose he spoke of on a former occasion in that room. This was a low evolution of nitrogen in the Will test and at the same time a low Abel test. It was not an ordinary unimproved guncotton but a gelatinised sample, and he recognised now that the application of the Will test to gelatinised cotton was impossible. The sample was interesting one since, in spite of the good Will test, proved, when subjected to other tests, in which decomposition products were not removed, to be a very unstable condition, thus confirming the indication afforded by the Abel test.

Mr. GEORGE MACDONALD wrote as follows:—The author's conclusions as to the formation of cellulose sulphuric esters during the nitration of cotton are in agreement with manufacturing experience. The water from the vats in which guncotton is boiled is neutral, at a stage of purification at which all original adherent acids have certainly been removed, and an amount of sulphate is always found, in excess of that nor-



ent in the water, pointing at once to the gradual composition of a cellulose sulphuric ester. At the same time, the fact must not be overlooked that there is also a net attack during purification on the nitric ester itself, since very considerable quantities of nitric oxide can be obtained from the water in which the gun-cotton has been boiled, an amount in the writer's experience equivalent to a by no means negligible decimal percentage of nitrogen on the gun-cotton present. It would appear extremely probable that the stability of nitrocellulose depends on the dual attack on the nitric ester, and the lower nitric esters. The higher ratio of sulphuric acid to nitric acid in the nitrating mixture, the longer the time necessary, and the greater number of changes of water requisite, before the water in the boiling vat is obtained free from acid reaction. The beneficial hydrolysing effect, up to a certain point, on the acidic products of decomposition is undoubted. A more perfect and rapid stabilisation is thus obtained if the acid products of decomposition are kept neutralised by the continuous addition of a neutralising agent. The author's observations on the improvement of the heat test as the sulphuric esters are removed by means of nitric acid vapour are extremely interesting, and it will be of value to know if the stability tests at higher temperatures are also found to be correspondingly improved."

### THE PROOF OF PERCUSSION CAPS.

BY HENRY W. BROWNSDON, B.S.C., M.S.C., PH.D.

the manufacture of small arms ammunition, each component part may vary within small defined limits, the quality of the finished cartridge depends to a great extent on the reduction of these to a minimum. In other words, the perfection of the whole is dependent on the perfection of the component parts. The component parts in a cartridge (I refer here and throughout the paper to 0.303 inch small arms), those of most interest to the chemist are the cordite charge, the percussion cap, and whilst the former has received searching attention, the cap has been more or less neglected. I presume that the argument has been, so long as the cartridge conforms to final tests as regards velocity, range, &c., why bother about the caps. Up to a certain point such a conclusion may be justified, but to an inquiring mind it gives but little satisfaction. Until quite recently, practically the only method of proof on which the quality of a cap was based was by the flash test, made on a piece of paper when fired in a special test at a distance of 8½ in. from the paper. Such a test gives indication of differences—strong and weak caps—but what do the differences indicate? What causes are responsible for such irregularities? In my experience of this method of proving caps, to go no further than to say it gives an indication of imperfectly filled caps or of miss-fires, would be at least open to severe criticism. As a ready, quick, and cheap method of detecting gross defects in manufacture, it is certainly of use. It gives an effect, but of the cause, which is far more important, it tells nothing with certainty, but unfortunately the cause is often deduced from the flash mark. Thus defects attributed to wrong causes. As an example of this point, take the common deduction made in proving caps by this method. A large mark is attributed to a strong cap, i.e., one containing an abnormal heavy charge, whilst a faint mark is attributed to a weak cap, i.e., one containing less than the average charge. Assuming that the percentage of fulminate and other ingredients is the same in both caps, the above may be a wrong deduction to draw, but in a mechanical sense, such as cap composition there is always a possibility of high imperfect mixing or careless filling) of a cap containing a normal charge by volume, but abnormal so that the percentages of the ingredients are concerned. Using therefore a cap to contain high percentages of potassium nitrate and chlorate, and a low percentage of stibnite, the cap would give a weaker flash mark than a normal cap, but instead of being a weaker cap, it is a stronger cap, produced by heat and pressure, and the cap would probably

be blamed for a defect which was absent, viz.: low charge. The photographs on Fig. 1 illustrate this difference, the caps marked D giving a weaker mark than A,

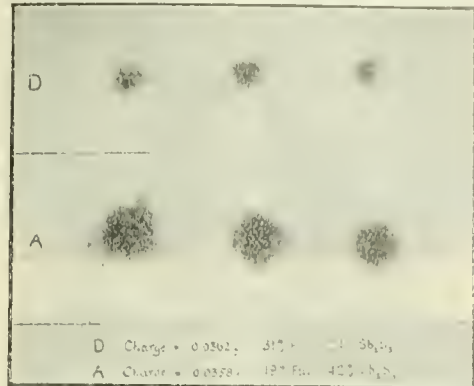


FIG. 1.

although from the nature of their composition they are the stronger cap. The difference in composition of these caps of course is extreme, but variations in the percentage of ingredients in certain caps may be as high as 5 per cent.—a difference quite sufficient to show marked variations in the flash mark.

Other contributory causes to the variations, noted in flashing on paper, are varnish and tin foil, but the effect of these is not so marked. A foiled cap will give a stronger flash than an unfoiled cap, and the colour of the flash mark is browner with a heavily varnished than with a lightly varnished cap.

From these few remarks it will be seen that the causes giving rise to variations in the flash of a cap are so varied that it is impossible to attribute the differences shown on the paper with certainty to any one cause, and unless the cause be known, steps cannot be taken to remedy the defect.

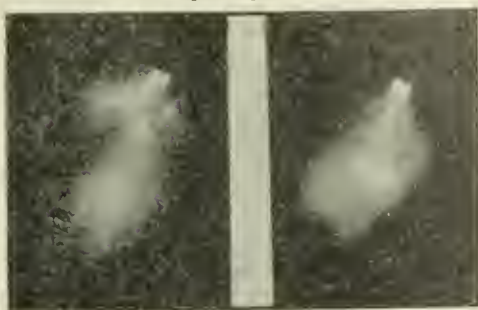
A few years ago a distinct advance was made in the proof of caps by Mr. W. D. Borland, who proposed methods for photographing the flashes. The results obtained with some caps are highly instructive, giving a clear insight to many features of the flash on emerging from the fire holes, but the method is not equally applicable to all makes of caps, some giving good photographs and others images so faint as to be of little use.

Flashes of four different makes of caps.



FIG. 2.

Open Aperture.



Lens Stopped Down.



Fig. 3.

Reference to the photographs on Fig. 2 illustrate this point.

The most interesting features in the flash of a cap giving a good photograph are only brought out on stopping down the lens, and with certain caps this is impossible, since by working at full aperture only an extremely faint image is obtained. In order to obtain a strong photograph of a cap containing a composition such as C, I replaced the covering of tin foil by one of aluminium powder, which was applied by suspending the powder in the varnish with which the cap was varnished, drying and then pressing. A most interesting photograph (Fig. 3) was obtained, one showing especially the need of stopping down the lens in order to see clearly what takes place during the flash of the cap. The projected incandescent solid particles, clearly shown when the lens is stopped down, are masked to a great extent when the flash is photographed working at full aperture.

To the naked eye, there is little difference between the flashes of A and D, and the photograph of a cap such as A reveals but very little of what really takes place. Were the incandescent particles of solid antimony and potassium salts actinic, a cap such as A would undoubtedly reveal as interesting results as those obtained with the aluminium covered cap I have just referred to. With caps, such as A, B and C, giving faint photographs, it is much more instructive to flash them in a dark room and observe with the naked eye than to attempt photographic methods.

Before leaving the optical methods of examination, I should like to refer briefly to a means of approximating to the duration of flash. With a cap giving a weak photograph not much can be done, but with a cap treated with aluminium powder interesting results can be obtained. The cap is flashed at right angles to, and behind a revolving disc pierced with holes of known diameter and revolving at a known speed. By having the disc focussed in a camera in front of the disc, and exposing a plate at the time of flashing the cap, on development, the spots of light appear either circular or elongated, according to the movement through which the disc has rotated during the period of flash. Measurement of the distance through which the circle of light has moved, the speed of the disc and the distance of the spot of light from the centre of the disc, provides all the data necessary for approximating to the duration of the flash. On these lines I have computed

the total duration of flash of such a cap to be  $1/30000$ th of a second.

Both flashing on paper and photographing the flash that definiteness which is only associated with figures. For a satisfactory comparison of the value of figures such as we are considering, figures are required, and not results which are capable of ambiguous interpretation.

If a cap is faulty in any way, what are the existing causes for its defects? It may be due to a bad composition, imperfect mixing of the ingredients in an otherwise good composition, or neglect of other essential points in manufacture.

If it can be shown that the composition used in manufacture is one known to give good results, that the weight and percentage of each ingredient within small unavoidable limits per cap, then definite figures are obtained which go a long way to deciding its quality. These variations being known, it should then be determined what effect they have on the cap as an igniter, to what extent they influence the temperature, pressure and form of flash produced by its percussion.

The causes, due to the composition, giving rise to caps or abnormalities in otherwise good caps, should be determined analytically and the effect of these causes on the cap as an igniter, determined physically and a practical firing on the range.

#### THE ANALYTICAL EXAMINATION OF CAPS.

The quantities most easily and accurately obtainable are:—

- First.—Weight of Charge.
- Second.—Weight of Fulminate.
- Third.—Weight of Stibnite.

From the figures so obtained the percentage of fulminate and stibnite per cap can be determined and of chlorate and other ingredients indirectly by difference. In the determination of such small quantities of fulminate and stibnite as are contained in a cap, special methods must of necessity be used, and on the elaboration of accurate methods for these determinations, the speed and applicability of analytical examination depends. By the use of the methods given in the following, the weight of fulminate and stibnite are obtainable easily within 20 minutes of commencing the analysis and by working on a number of caps, the time is still further curtailed. The methods being volumetric the only weighings required are those from which the weight of charge is obtained.

*First—Determination of weight of charge.*—This is done by difference, first weighing the cap, and after cleaning the composition, weighing the empty shell and tin foil. The difference gives the weight of composition and varnish. The weight of varnish is small, and may be determined in a number of caps, the mean being deducted from the above weight found. If comparative and absolute figures are required, it may be neglected, as it does not affect the weight of fulminate or stibnite.

The extracting of the composition is most convenient and completely done over a porcelain dish of about 2 c.c. capacity by squeezing with pliers and removal of the loosened foil and broken composition by means of a pointed wooden chip. Composition adhering to the shell is loosened by alcohol and washed into the dish by means of alcohol in a small wash bottle. The shell and fragments are put to one side and subsequently weighed when required. It is convenient to extract the composition out of a number of caps at the same time for individual treatment.

*Second—Determination of fulminate.*—The composition in the dish is broken down quite fine with a flat-bottomed glass rod, and the alcohol evaporated on the water bath until the residue is moist, but not quite dry. Twenty-five c.c. of water are then added, and the composition well stirred to the bottom. After the addition of 0.5 gr. of pure sodium thiosulphate, the contents of the dish are well stirred for 2½ minutes. One drop of Methyl Orange is then added and the solution titrated with N/20 sulphuric acid, which has been standardised against weighings of 0.05 c.c. of fulminate to which 25 c.c. of water is added in a porcelain



then 0.5 gr. of thiosulphate, and after stirring for minutes, titrated with the N/20 sulphuric acid. A small amount of antimony sulphide present does not interfere with the recognition of the end point. After titration, the solution is filtered through a small filter paper, which retains the antimony sulphide. *3rd.—Determination of Antimony Sulphide.*—The filter containing the sulphide is well washed and then transferred to a large 6 by 1 test tube. Five c.c. of strong perchloric acid are added, and the contents of the tube gently for a few seconds until the sulphide is dissolved and all the sulphuretted hydrogen driven off or exposed; 2—3 c.c. of a saturated solution of tartaric acid are added, and the contents of the tube washed into a 100 c.c. Erlenmeyer flask. The solution is then nearly neutralised with sodium carbonate, excess of bicarbonate is removed, and after the addition of some starch solution, titrated with N/20 iodine solution.

This is a method for small quantities of stibnite is both accurate and accurate, the error being about  $\pm 0.0003$  gr. at the outside:

0.1 gr. stibnite taken gave 0.0179 gr.  $Sb_2S_3$  found.  
0.3 gr. stibnite taken gave 0.0170 gr.  $Sb_2S_3$  found.

The accuracy is not influenced by the operations which are involved in the analysis of the composition in the cap, as the following test experiments show:—

Fulminate found.	Error.	Stibnite taken.	$Sb_2S_3$ found.	Error.
0.6	0.0083	—	0.0083	—
0.2	0.0081	—	0.0081	—
0.4	0.0071	—	0.0071	—
0.8	0.0066	—	0.0066	—

It will thus be seen that the tendency of this method is to give slightly low figures for the fulminate, but since the results are uniform within a negligible error, it does not detract from the value of the results as a criterion of uniformity. Applying the above methods of analysis to various caps, figures are obtained which permit of a fair estimate being made as to their relative values, as shown by uniformity and proportion of ingredients used in the composition. Figures thus obtained on four different makes of caps are summarised in a table, which I refer to later.

Analysis tells us a great deal, but one can imagine conditions giving rise to a bad cap even though the results given by analysis were excellent. In a mechanical sense, such as cap composition, where the components are considerably in density, there is a tendency for segregation to take place at several stages of the manufacture, and a cap may conceivably contain a correct composition by weight, an average weight of fulminate, of potassium chlorate, and of chlorate, and still be a bad cap if the components were not intimately mixed. Such defects would not be noticed chemically, and are best detected physically. A number of caps when fired under similar conditions give equal amounts of heat and equal gas volumes, and only then can one be certain of their uniformity of quality. A uniform and good cap physically must not only be a good cap analytically, but a good cap must also need not of necessity be a good cap, although the chances are very much in its favour of being so.

#### THE PHYSICAL EXAMINATION OF CAPS.

The physical characteristics most easily measured are the heat and gas volume produced on percussion, and from one may deduce relative values for temperature and pressure. The absolute values of these characteristics are difficult to determine and of more or less theoretical interest, but relative values are of equal importance to the maker and much more easily determined. What is desired is to be able to do so to compare cap against cap by a method which will give definite reliable figures for the characteristics being tabulated which will give their relative values.

With this end in view, I have devised a small apparatus which is essentially a steel cartridge case, adapted so that a thermometer can be inserted in the neck and with means of collecting the gases liberated on percussion. The base containing the cap chamber may be unscrewed to permit of recapping and cleaning. The details of construction will be more readily understood by reference to the accompanying photographs, Figs. 4 and 5. A is of thin steel about  $\frac{1}{8}$  in. thick,  $1\frac{1}{2}$  in. long and  $\frac{3}{4}$  inch internal diameter, thickened at the top and bottom so as to take threads for the collar c, holding the thermometer and the base d holding the cap. c has a  $\frac{1}{4}$  in. hole through the centre, into which the thermometer is sealed; d is an ordinary service cap chamber in steel with an octagonal collar g for a wrench, and with parts of the rim filed away on opposite sides. Through the side collar e is fastened

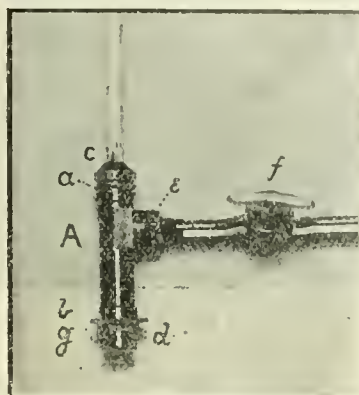


FIG. 4.

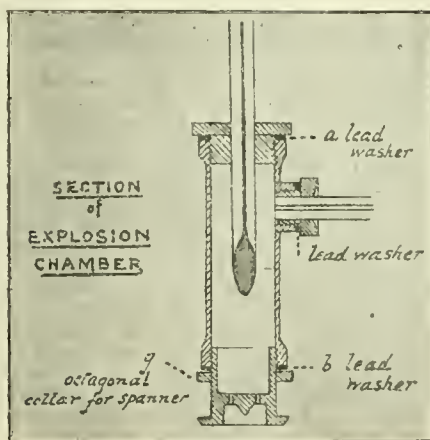


FIG. 5.

a small bore glass tube containing the tap f; a and b are lead washers. The threads are best lubricated by means of a thick paste of silicate of soda and asbestos powder; e is permanently fastened, whilst c and d are best unscrewed and cleaned between each determination. The cubic capacity of A with d screwed in is 3 c.c., about that of a cartridge case. The bulb of the thermometer is adjusted so as to be central, and is protected by a thin piece of copper foil wrapped round and kept in position by means of a sporting cap shell jammed over its end. By gripping the collar c with pliers, and using a spanner on the collar g, the two can be tightened up one against the other. The apparatus is used in conjunction with an ordinary rifle firing mechanism. By filing away slots in the firing

mechanism to correspond with what is left of the rim of *d*, the apparatus can be brought into position for firing by introducing the rim projections into the slots and giving a quarter turn, afterwards locking the bolt.

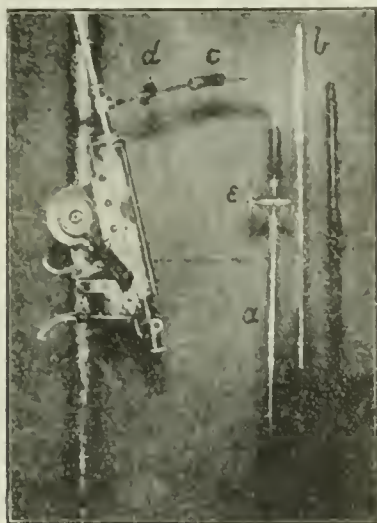


FIG. 6.

For measuring the gas volume a graduated tube *a* with a stopcock *c* at the top is used, along with a connected plain tube *b* for the adjustment of pressure (Fig. 6). The graduations need not be throughout the length of the tube, *S. c. c.* in tenths from the tap being sufficient. The measuring tube is connected to the side tube of the explosion vessel by means of a piece of capillary tubing bent at right angles, rubber pressure tubing being used for the connections.

**Method of Use.**—A cap having been pressed into the steel base piece, the base and thermometer are screwed tightly home. The apparatus is then inserted in the firing mechanism, given a quarter turn, and the bolt closed. After the level of the mercury has been adjusted so as to stand near the tap *e*, the measuring tube is connected up at *c*, *d* and *e* being open. With the enclosed air at atmospheric pressure, *d* is closed and the reading of the mercury is noted; *b* is then lowered to reduce the pressure. The cap is now fired and the rise of temperature noted on the thermometer. As soon as no further rise is noticed *d* is opened, the level of mercury in *a* and *b* adjusted, and *e* closed. The measuring apparatus is then disconnected at *c*, and may be read subsequently, although the volumes of gas measured are so small that variations of a degree or two make no appreciable difference. The steel explosion vessel is removed, thermometer and base unscrewed and cleaned, cap extracted, base reappressed and fitted up again for a second experiment.

The results obtained by use of this apparatus on four different makes of caps are summarised in the appended table, and show clearly its value in determining what might be termed the physical characteristics of a cap. The effect of slight variations in manufacture such as tin foiling can be followed and figures are obtained which give an excellent indication of uniformity and quality.

As regards the uniformity, best shown by the mean differences of the figures found, the physical characteristics agree closely with the analytical, the order of merit remaining the same. A, B and C practically identical caps as regards the percentage of components, show marked differences; C contains only three-quarters of the weight of charge of either A or B, but the heat developed by C is greater or at least equal to that developed by B, and since the charge producing the heat

is smaller by a quarter the temperature must be considerably greater.

A foiled gives an average rise of temperature of 22°; unfoiled this falls to 20·7° C., whilst D gives 3·3° less unfoiled than foiled.

Some of these seemingly contradictory results explained when the mode of manufacture is examined and gone into carefully, different methods producing different results.

It is difficult to obtain thermometers having exactly the same heat capacity, and therefore the rises in temperature observed are only strictly comparative so long as the same thermometer is used, but a thermometer can be standardised against a known cap by making experiments.

The measurement of the gas volume is a secondary consideration compared with that of the heat liberated and will be found in most cases to vary directly with rise in temperature. For ordinary every day comparative testing of caps in the laboratory, therefore, the apparatus may be simplified by doing away with the tube and its appendices.

By dividing the average rise in temperature obtained by the average weight of charge, figures are obtained representing the rise of temperature per gramme of charge. The heat capacity of the apparatus being a constant quantity, the rises of temperature calculated per gram of charge are proportional to the heat liberated per gram of charge.

In estimating the value of a cap as an igniter, factors besides heat are of importance, and must be considered. Heat can be generated in the percussion cap in more than one way, and may be liberated with greater or less speed. A cap dependent on a high percentage of fulminate for its heat, must generate heat more rapidly than one dependent on a slower combustion decomposition than the detonation of fulminate. The production of equal amounts of heat, therefore, have a choice of methods, and the method chosen will depend on the explosive we wish to ignite. In the case of gunpowder little difficulty was experienced, and not till the introduction of modern colloidal explosives that difficulty of ignition evidenced itself. The value of an igniter may be best judged by taking extreme Gunpowder, which liberates a great amount of heat rapidly, but giving wholly gaseous products of combustion, is known to be inferior as an igniter compared with gunpowder, liberating less heat, burning less rapidly, and giving a considerable quantity of solid combustion products. This points to the great value of an igniter giving solid products with a high specific heat, as compared with one giving purely gaseous products. In other words, an igniter liberating its heat on comparatively slow combustion lines appears to be superior to one dependent on explosion for its heat. The only explanation to be given is, that in the one case the solid particles are carried directly on to the surface of the explosive where they stick and give up their heat, whilst the flame from a gaseous explosive becomes cooled at the surface of the explosive and does not last long enough to ensure ignition.

Taking the duration of a cap flash to be some 1/3000th of a second, it is evident the cap must do its work quickly and give the explosive no chance of throwing off its flash.

Whilst I have confined myself in this paper to referring to military caps, the methods suggested are equally applicable to sporting caps, many different types of which I have critically examined with interesting results.

In conclusion, I have much pleasure in acknowledging my indebtedness to the directors of the King's Metal Co., Ltd., in whose interests this work was originally carried out, for permission to bring this paper to the attention of the Society. To Mr. H. Melville belongs the credit of being one of the first to recognise the difficulties with which the problems of ignition are beset, and it is to his initiative that I am indebted for being alighted on such an interesting field for investigation. For part of the analytical work on which my figures are based I have to thank my assistant, Mr. A. J. Green.



Summary of Figures Obtained on Four Different Makes of Caps for 0.303 Ammunition.

	A. Tin Foiled.	B. Not Foiled.	C. Tin Foiled.	D. Tin Foiled.
Weight of charge .....	0.0358 gr.	0.0378 gr.	0.0277 gr.	0.0362 gr.
Mean difference .....	0.0012 gr.	0.0030 gr.	0.0014 gr.	0.0015 gr.
Weight of fulminate .....	0.0070 gr.	0.0077 gr.	0.0051 gr.	0.0114 gr.
Mean difference .....	0.0002 gr.	0.0007 gr.	0.0002 gr.	0.0004 gr.
Weight fulminate .....	19.1	20.1	19.4	31.3
Weight of stibnite .....	0.0155 gr.	0.0163 gr.	0.0117 gr.	0.0087 gr.
Mean difference .....	0.0006 gr.	0.0011 gr.	0.0007 gr.	0.0005 gr.
Weight stibnite .....	41.0	42.9	42.2	23.9
Weight rise in temp. in °C. ....	22.25° C.	19.2° C.	19.75° C.	29.6° C.
Mean difference .....	1.13° C.	1.56° C.	1.33° C.	1.47° C.
Weight rise unfolled .....	20.73° C.	—	—	26.3° C.
Weight gas volume in c.c. at 0° C. and 760 mm. ....	3.73 c.c.	3.73 c.c.	2.89 c.c.	4.46 c.c.
Mean difference .....	0.28 c.c.	0.32 c.c.	0.29 c.c.	0.27 c.c.

# DISCUSSION.

W. F. REID said that in 1881 he found when first experimenting with colloid explosives that all caps were alike, as many people seemed to think they were, or to be. A cap which gave regular results with black powder gave uncertain results with nitro-cellulose powder, he set to work to find the reason. The first instrument he used was a practical one, although not of a high degree of accuracy. It consisted of a brass tube about the length of a gun barrel, the upper half of which was cut off at the cartridge case. Pieces of gun cotton were placed across at distances of about one inch. On flashing in the gun itself, it was found that different caps from the same batch ignited a different number of strands of gun-cotton. Then came Mr. Borland's apparatus which was a useful one. It was pointed out that the flash alone could not give accurate evidence of the actual force, and if the author proposed to carry out other methods, he might as well use one which many years ago he found to give very reliable indications. It was igniting the cap in an apparatus connected with a U-tube filled with mercury. The action of the cap ejected a certain quantity of the mercury which gave a measure of the total gas, and at the same time of the pressure. It did not, of course, indicate the matters in the products of combustion, which were entirely of some use. Dr. Brownson had described an apparatus which would be of great use, and he only wished it could be applied to sporting caps in the same way as he had applied it to military ones, because the method was quite different. The resistance of a sporting cap had to overcome on ignition was variable, whereas with the military cartridge it was uniform.

MR. BORLAND said there was no cap which could not be photographed under suitable conditions of apparatus, such conditions had an important bearing on the interpretation of results. In the second place, the method of timing the duration of the cap was one he described himself in a lecture at the United Service Institution in 1898.

According to the estimation then made, he placed the duration of a cap flame at about 1/4000th of a second, which he agreed very closely with what Dr. Brownson had said. As to the question of the solid incandescent core in the flame, it demanded a great deal more attention than it had received, and was of great importance. It had an effect on the specific heat, and was able to impart its explosive heat in a graduated manner. Probably it was of infinitely more value than a high gas pressure, and exerted a sort of jet action on the explosive. The method described for gauging the temperature was of a really one for gauging heat units; it depended on the mass of the thermometer and the mass of the tube. An apparatus for comparative testing it was valuable, and other similar tests.

DR. BROWNSON, in reply to Mr. Reid, said the question of timing caps presents so much in common with that of for small arms, that similar methods of examination were applicable. Whilst, however, in the case of caps of small arms ammunition, where one is dealing practically with uniform conditions, it is possible to arrive

at some definite conclusion as to the best kind of cap; the problem becomes much more complicated with caps for use with the multitude of sporting powders, each presenting differences which have to be considered in the manufacture of a suitable cap.

He was afraid Mr. Borland had misconstrued his remarks relating to photographic methods of examination. Some caps gave stronger photographs than others; and when he referred to some being so faint as to be of little use, he meant from the point of view of photographically showing projected solid particles. That other inferences might be drawn from a comparison of weak and strong photographs, he did not doubt, but the conditions, especially as regards pressure, and incidentally temperature, under which the flash of a cap is photographed and under which it is fired in service, are so far removed from one another that deductions drawn from a photograph may be misleading. As a guide to the relative temperatures of the flashes, the difference shown by photographs may be of some value, but whilst the actinic rays are most active in producing the photograph, the heat rays influence it but little.

The applicability of any photographic method of approximating to the duration of flash naturally depends to a large extent on the actinic power of the flash, and whilst he did not claim originality in using a revolving disc for the measurement of time, he wished to emphasise the great advantage possessed by a strongly actinic cap over a less actinic one, where photographic methods of examination are applied.

No single method of proof will suffice for determining the quality, uniformity, or suitability of a cap for any special purpose, but a combination and summing up of several is required, and it had been his endeavour to place some further methods at the disposal of the cap maker or buyer, which may prove of value to them in determining the quality and suitability of their caps for any desired purpose.

## THE DETERMINATION OF SMALL QUANTITIES OF IRON.

BY J. W. LEATHER, PH.D., F.I.C.

Some time ago I had occasion to determine the amount of iron in some tank waters. The quantity was too small to admit the use of the usual methods, and I found that Lovibond's tintometer provided the means of measuring small quantities with considerable precision.

The two colour reactions, the ferrocyanide and the thiocyanate, are both applicable to the purpose, but it was necessary to determine the requisite quantities of the reagents, because, as is well-known, the colour of the Prussian blue is materially affected by large excess of ferrocyanide.

(A solution of ferric chloride was employed throughout, but the weight of iron is expressed as ferric oxide as being probably more convenient.) For example, 0.001 gr. ferric oxide + 0.0528 gr. ferrocyanide + 0.0048 gr. hydrochloric acid in 20 c.c. gave a light blue, but when the quantity of hydrochloric acid was increased to

0.048 gr., a deep blue was produced; with 0.528 gr. ferrocyanide the colour was green-yellow. It was obvious therefore that the quantity of reagents employed must fall within certain limits in order to produce a normal colour, and the chief object in view throughout the measurements was to determine these limits. Secondly, it would be a great advantage if the water under examination need not be diluted materially by the added reagents; and similarly, if one quantity of reagents were found suitable for all quantities of iron within the required limits, the procedure would be much simplified.

Since only a few c.c. are required for the cells of the

tintometer, 20 c.c. was adopted as a suitable volume.

It is to be noted also that the solution of ferric chloride employed was not neutral, and doubtless contained free hydrochloric acid apart from that required by salt, but, as becomes evident from Table I., this quantity was too small to affect the resulting colour.

**Ferrocyanide.**—Table I. shows the results obtained with ferrocyanide, and includes (a) the quantities of materials employed, (b) their molecular relation to the cell employed, (d) the colour in terms of Lovibond standard glasses:—

TABLE I.

Grms. in 20 c.c.			Molecular Relation.			Cell.	Degrees on Lovibond's Scale	
Ferric oxide.	Ferrocyanide.	Hydrochloric acid.	$\frac{1}{2}\text{Fe}_2\text{O}_3$ .	$\text{K}_4\text{FeCy}_6$ .	HCl.			
0.001	0.0528	—	1	10	—	—	Light blue.	
0.001	0.528	0.0048	1	100	10	—	Greenish yellow.	
0.001	0.528	0.048	1	100	100	—	Greenish yellow.	
0.001	0.0528	0.06	1	10	2000	$\frac{1}{2}$ in.	Blue.	Yellow.
0.001	0.0528	0.048	1	10	100	$\frac{1}{2}$ in.	8.5	1.0
0.001	0.0528	0.144	1	10	300	$\frac{1}{2}$ in.	9.0	1.0
0.001	0.0264	0.048	1	5	100	$\frac{1}{2}$ in.	9.0	1.0
0.001	0.0264	0.144	1	5	300	$\frac{1}{2}$ in.	9.0	1.0
0.001	0.0105	0.048	1	2	100	$\frac{1}{2}$ in.	8.0	1.0
0.001	0.0105	0.144	1	2	300	$\frac{1}{2}$ in.	9.0	1.0
0.001	0.01056	0.06	1	2	2000	$\frac{1}{2}$ in.	8.0	1.0
0.0004	0.0021	0.0192	1	1	100	$\frac{1}{2}$ in.	3.6	0.4
0.0004	0.0042	0.0576	1	2	300	$\frac{1}{2}$ in.	3.6	0.4
0.0004	0.01055	0.0192	1	5	100	$\frac{1}{2}$ in.	3.6	0.4
0.0004	0.01055	0.0576	1	5	300	$\frac{1}{2}$ in.	3.6	0.4
0.0004	0.02112	0.0192	1	10	100	$\frac{1}{2}$ in.	3.6	0.4
0.0004	0.02112	0.0576	1	10	300	$\frac{1}{2}$ in.	3.6	0.4
0.0004	0.2112	0.0576	1	100	300	$\frac{1}{2}$ in.	3.6	0.4
0.0002	0.00211	0.0096	1	2	100	$\frac{1}{2}$ in.	3.6	0.4
0.0002	0.00211	0.0288	1	2	300	$\frac{1}{2}$ in.	3.4	0.4
0.0002	0.00211	0.192	1	2	2000	$\frac{1}{2}$ in.	3.4	0.4
0.0002	0.00528	0.0096	1	5	100	$\frac{1}{2}$ in.	3.6	0.4
0.0002	0.00528	0.0288	1	5	300	$\frac{1}{2}$ in.	3.4	0.4
0.0002	0.01056	0.0096	1	10	100	$\frac{1}{2}$ in.	3.4	0.4
0.0002	0.01056	0.0288	1	10	300	$\frac{1}{2}$ in.	3.4	0.4
0.0002	0.01056	0.192	1	10	2000	$\frac{1}{2}$ in.	3.4	0.4
0.0002	0.1056	0.0288	1	100	300	$\frac{1}{2}$ in.	3.4	0.4
0.00004	0.00105	0.0019	1	5	100	$\frac{1}{2}$ in.	1.6	0.3
0.00004	0.00528	0.0288	1	25	1500	$\frac{1}{2}$ in.	2.2	0.3
0.00004	0.01056	0.0288	1	50	1500	$\frac{1}{2}$ in.	2.2	0.3
0.00004	0.01056	0.048	1	50	2500	$\frac{1}{2}$ in.	2.2	0.3

It will be seen that if the quantity of hydrochloric acid present is only about sufficient to form ferric chloride, the colour is too light, whilst if that of ferrocyanide is much too great when the amount of iron is comparatively large, the colour is also abnormal. But with 0.001 gr. ferric oxide per 20 cc. about 0.05 gr. ferrocyanide + 0.05 gr. hydrochloric acid will produce a normal colour of Blue 9 + Yellow 1—Red 3 units on Lovibond's scale. Furthermore, these quantities do not interfere with the normal colour if the amount of iron is very much less. These amounts of reagents may be expressed as one drop of concentrated hydrochloric acid plus one drop of 10 per cent. potassium ferrocyanide solution. The necessity for adding red to the

colour of the ferrocyanide was very definite with none of standard glasses; in other words, the blue glass was not as pure a blue as the ferrocyanide.

Assuming the measurements of the largest quantity of iron to be the most correct, the following brief statement of values may be deduced:—

0.001 gr. ferric oxide = 9 blue + 1 yellow — 3 red in  $\frac{1}{2}$  in. cell.  
 0.0001 gr. ferric oxide = 0.9 blue + 0.1 yellow — 0.3 red in  $\frac{1}{2}$  in. cell.  
 or 1.8 blue + 0.2 yellow — 0.6 red in  $\frac{1}{2}$  in. cell.  
 0.00001 gr. ferric oxide = 0.72 blue + 0.08 yellow — 0.24 red in  $\frac{1}{2}$  in. cell.

The following determinations of unknown quantities of iron were made:—One drop of conc. hydrochloric acid plus one drop 10 per cent. ferrocyanide added to 2

TABLE II.

Grms. in 20 c.c.			Molecular Relation.			Cell.	Degrees on Lovibond's Scale	
Ferric oxide.	Thiocyanate.	Hydrochloric acid.	$\frac{1}{2}\text{Fe}_2\text{O}_3$ .	$\text{NH}_4\text{CSN}$ .	HCl.		Red.	Yellow
0.001	0.00475	—	1	5	—	$\frac{1}{2}$ in.	4.8	7.0
0.001	0.00475	0.00228	1	5	5	$\frac{1}{2}$ in.	4.8	8.0
0.001	0.00475	0.0228	1	5	50	$\frac{1}{2}$ in.	4.4	7.0
0.001	0.00475	0.0114	1	50	25	$\frac{1}{2}$ in.	17.5	20.0
0.001	0.0095	0.0114	1	10	25	$\frac{1}{2}$ in.	7.5	14.0
0.001	0.0190	0.0114	1	20	25	$\frac{1}{2}$ in.	11.5	18.0
0.001	0.0285	0.0114	1	30	25	$\frac{1}{2}$ in.	14.0	20.0
0.001	0.0475	0.0114	1	50	25	$\frac{1}{2}$ in.	17.0	20.0
0.001	0.0712	0.0228	1	75	50	$\frac{1}{2}$ in.	20.5	18.0
0.001	0.0950	0.0228	1	100	50	$\frac{1}{2}$ in.	21.0	18.0
0.001	0.0950	—	1	100	—	$\frac{1}{2}$ in.	21.0	18.0
0.0005	0.0950	0.0228	1	200	100	$\frac{1}{2}$ in.	10.5	9.0
0.0001	0.0712	0.0228	1	750	500	$\frac{1}{2}$ in.	4.0	2.5
0.0001	0.0950	0.0228	1	1000	500	$\frac{1}{2}$ in.	4.2	2.0
0.00004	0.0712	0.0228	1	1875	1250	$\frac{1}{2}$ in.	2.7	2.0
0.00001	0.0950	0.0228	1	2500	1250	$\frac{1}{2}$ in.	3.1	0.5
0.00001	0.0712	0.0228	1	7500	5000	$\frac{1}{2}$ in.	0.7	0.5
0.00001	0.0950	0.0228	1	10,000	5000	$\frac{1}{2}$ in.	0.7	0.5



he sol.; found, 7.5B+8Y—2.5 R in  $\frac{1}{2}$  in. cell; 1.8=4.2=0.00042 gr. iron. The actual amount present 0.0004 gr. In another case, after adding the same salts, the reading was, Blue—12.5 degrees in the cell; 12.5/0.9—1.4—0.0014 gr. ferric oxide; amount actually present was 0.0016 gr.

**thiocyanate.**—Measurements made in the same way ammonium plus hydrochloric acid yielded the results recorded in Table II.

From these measurements, it will be seen that the full strength of the colour was not obtained with 0.001 gr. ferric oxide until about 0.69 gr. thiocyanate had been added; and that whilst 0.02 gr. hydrochloric acid does not affect the colour, it is only necessary to have a trace present to form ferric chloride. Since a saturated solution of either ammonium or potassium thiocyanate is more than 50 per cent. strong (100 c.c. water dissolves 1 gr. amm. thiocyanate or 217 gr. pot. thiocyanate at 20° C.), it follows that 0.1 gr. of either salt would be contained in two drops of a saturated solution. In the case of natural waters containing ferric carbonate, one drop of concentrated hydrochloric acid would be sufficient to convert it into chloride.

The table also shows that the colour produced with these quantities of reagents, in the presence of even so little as 0.01 gr. ferric oxide in 20 c.c., is quite normal.

The following measurements may be deduced from Table II:—

0.01 gr. ferric oxide in 20 c.c.=21 red+18 yellow in  $\frac{1}{2}$  in. cell.  
1 gr. ferric oxide in 20 c.c.=2.1 red+1.8 yellow in  $\frac{1}{2}$  in. cell.  
1 gr. ferric oxide in 20 c.c.=4.2 red+3.6 yellow in  $\frac{1}{2}$  in. cell.  
0.01 gr. ferric oxide in 20 c.c.=0.42 red+0.36 yellow in  $\frac{1}{2}$  in. cell.  
or 0.84 red+0.72 yellow in 1 in. cell.

The following determinations were made with unknown quantities of iron in 20 c.c.:—

1. Observed, 3.3 R+3 Y in 1 in. cell. 3.3 0.84=4=0.04 gr. ferric oxide; actual amount present=0.000043 gr.  
2. Observed, 5.3 R+4.2 Y in 1 in. cell. 5.3 0.84=6.3=0.063 gr. ferric oxide; actual amount present=0.00007 gr.  
3. Observed, 15.7 R. in  $\frac{1}{2}$  in. cell. 15.7/2.1=7.5=0.00075 gr. ferric oxide; actual amount present=0.0008 gr.  
4. Observed, 10.3 R. in  $\frac{1}{2}$  in. cell. 10.3/2.1=4.9=0.00049 gr. ferric oxide; actual amount present 0.0005 gr.

In the two reactions, the thiocyanate is perhaps to be preferred. It is distinctly more delicate with small quantities of iron; even so little as 0.00001 gr. may be detected with very considerable accuracy. A further advantage lies in the fact that only two sets of glasses, red and yellow, are required to match the colour of the thiocyanate, whereas with the ferrocyanide all three have to be employed. When employing ferrocyanide five to ten minutes should be given for the full development of the colour; but the reaction with thiocyanate appears to be almost instantaneous.

Incidentally it may be noted that the normal colour of ferrocyanide is produced in the presence of two equivalents of ferrocyanide to one atom of iron that is the theoretical amount, but that some free hydrochloric acid must be present. With the thiocyanate about 100 mols. of one atom of iron is necessary to produce the full strength of colour, whereas only 12 mols. should be added to form  $9\text{NH}_4\text{CSN.Fe}(\text{CSN})_3$ , and points to the necessity of a salt of greater complexity than this one.

## New York Section.

Meeting held at the Chemists' Club, on Friday,  
January 20th, 1905.

DR. RUSSELL W. MOORE IN THE CHAIR.

### TICK PROCESS TANNING OF SOLE LEATHER.

BY ALAN A. CLAFLIN.

Tanning formerly was, and even at the present time is frequently referred to as an industry of conservative tendencies, in which progress is slow, experiments conducted with great caution, and new methods and materials

adopted only after the most patient investigation and serious consideration. To-day this is certainly not the case. No great industry has changed so radically in the last two decades as has the art of leather making, and in none are experiments made on so large a scale or in general with so little preliminary investigation. Two causes have operated to produce this effect:—1st, the successful introduction and development of chrome tanning; 2nd, the diminishing supply of tan bark and consequent necessary introduction of tanning extracts. With an industry in this restless state, all possible ways for improvement are searched for and examined with avidity, and the question of shortening the time required for producing those leathers which from their nature cannot be made by the quick chrome methods, becomes one of paramount interest.

Sole leathers require a firmness and solidity of texture which is not obtainable by the use of mineral tanning agents, or at least by such agents alone. In former times one to three years was the time allowed for tanning good sole leather, and in fact there are records of the hides being permitted to remain in the pits for seven years. To-day I would put seven months as the longest time and four or five months the average time for the production of the best quality of sole leather, and from these periods down to two or three days may be called the limit of variation. For the purpose of my paper I make the arbitrary distinction that a quick process of sole leather tanning is one that is completed, and the leather ready for the market, inside of thirty or forty days.

The value of a successful quick tanning process is perhaps self-evident in the saving of investment and interest which it would effect; but there is another condition of more recent origin which is causing greater urgency for quick returns in leather making, namely, the close control of the hide market by the large packing interests and the attendant speculative fluctuations which are certainly not to the advantage of the old-fashioned tanner, with hundreds of thousands of dollars tied up for months in unfinished leather. Hence, we find to-day a very large amount of money invested in experimental processes of quick tanning. While the majority of these processes are more or less protected by patents, they should to a large extent be classed as secret processes, as the patents usually cover only minor details, and to my mind, may be avoided in general by a little mechanical ingenuity, and with equally good results. Another, and perhaps the most important point is the personal factor. Many men to-day are making merchantable leather by quick processes, while others who are not such keen observers nor as painstaking manufacturers, are making expensive failures with as good if not better processes.

The history of quick tanning dates back not earlier than 1880, and because of its influence on the sole leather manufacturer, I wish to include in my paper a slight account of the light leather quick tannages. The first of these was the Dongola process, or what we call to-day a "combination tannage," that is, salt, alum, and gambier. This is completed in a shorter time than was then employed with vegetable tannage alone, and is important because it brought into general use revolving drums, and paddle vats. Then followed the chrome tanning by the Schultz method, and its successors, the one bath processes of Martin Dennis, Procter, and many others. Two points may be noticed here: 1st, that with the chrome process the development of mechanical agitation begun by the Dongola process was rapidly increased; 2nd, that the direction of progress in chrome tanning has been from light to heavy leathers. At first goat and kid skins only were successfully chrome tanned, then followed chrome sheep and calf leather. Less than five years ago chrome side leather became an article of commerce, and within the last year or two chrome tanned belt leather has been produced and used in steadily increasing quantity.

True quick tanning of sole leather begins with the Velocitan process of Fratri Durio,\* which swept Europe

\* Canadian Patent, 42,770, April 27th, 1892. English Patent, 8,469, May 4th, 1892. United States Patent, 536,019, March 19th, 1895 (see this J., 1892, 625).

and the United States (and I am not reflecting on the great contribution it was to the leather industry when I say it) like a South Sea Bubble. The Durio process is simply a tannage in a revolving drum fed through a hollow trudgeon with a strong extract liquor, or an extract liquor weak at first and increasing to high concentration as the tanning continues. While the litigation about this process shows, in general, that its essential principles had been locally anticipated, and while I believe that it was founded on certain wrong principles, yet it marks an epoch, in that it showed, in a large public way, that sole leather could be made in a few hours. The leather of the Durio process was generally not good enough to be a commercial success, although in some instances a tolerably good result was obtained by exceptionally able tanners. Following this process are the many patented modifications and gradual improvements that have led up to the fairly successful processes of to-day.

In tracing this development we must first consider the reasons for the failure of the Durio process. The leather as I have seen it was objectionable because it was flat and the percentage yield small, because of its very coarse grain and bad colour, and also because of a frequent, although not consistently occurring brittleness. These faults I believe to be inherent in this process and all similar processes, because the vital and fundamental principle is not recognised that raw hide differs in physical properties from leather. An explanation may make this clearer. To a considerable degree a piece of raw hide is like a sheet of gelatine, although it has an organised structure, and from a physiological point of view has fibres, yet from a chemical standpoint the fibres, that is the vast majority of them, are identical with the surrounding cementing substance. While from their organised nature they are somewhat less soluble than the unorganised substance, they must be delicately treated until their structure is fixed more permanently. For sole leather it is necessary for thickness and solidity that the fibres be swollen and fixed in that condition before any of the harsh mechanical treatments are applied. This was not done in the Durio process, and a flat leather resulted, and one in which the yield was small, as in the flat condition the proper ratio between hide substance and tanning and filling material cannot be obtained. The grain was harshened by mechanical treatment, and by the fact that the acids, when employed to obtain some plumping, were not the proper acids. The colour was bad partly because the extracts then obtainable were not clarified, and, more important, because of the heat generated by the motion of the drum. This same heat probably accounted for the brittleness, and I imagine that in the samples of leather I have examined, made by this process which were not brittle, it was because resort had been made to some method for cooling, not described in the patent.

The recognition of the causes of these faults and their elimination has been the task of the developers of the recent more successful quick tannages. At the same time they have been aided by new and more scientific preparatory methods and by new tanning materials, with quicker penetrating properties, among which I emphasise the wood extracts, chestnut and quebracho. The cheap production of lactic acid has made available an acid that will plump without raising the grain. The mechanical improvements have been on the line of gentler treatment, and greater opportunity for the dissipation of the heat generated. In my account of an up-to-date method of quick tanning, I will endeavour to avoid detailed descriptions of unpatented mechanical contrivances in justice to their devisers, who have permitted me to examine them.

In the quick process tannery where I have had most extended opportunity to observe, packer hides are used, and, after a few hours' soaking, are ready for the limes. They remain in the limes beginning with the oldest five to seven days. As is general among the quick tanners, the limes are not sharpened with sodium sulphide or soda ash. From the limes the hides are un-haired and worked out, rinsed in a large drum with a free supply of cold water, and then put in a large octagonal slat cage with a capacity of fifty whole hides, which is

floating in a large vat containing a dilute solution of lactic acid. The weight of the hides semi-immersed in the cage, which is agitated occasionally by a workman wading on it, in a sense after the principle of a tread mill, solution is slightly warmed in winter so as to stand about 70° F.

The hides are kept in the deliming solution a six or eight hours, and in that time the cage makes the four complete revolutions. After the deliming solution the hides are ready for the handler liquors. The handler liquors are eight in number and deep enough to accommodate the whole hide suspended on the usual rocker frame operated by an eccentric with a throw of about 12 inches and making 25 full strokes to the minute. The handlers are operated on a continuous press system, that is, the liquor flowing into the bottom of the first handler vat and then flowing from the top of that vat into the bottom of the second, and so continued through the series. The circulation is maintained by a small pump and the overflows are arranged so that each vat in turn be the eldest or head handler, and thus no handling of hides after the first tacking on the slats is necessary; they are struck through, when they are taken from handlers. The handler liquors are bleached liquors, hemlock bark, which are made uniform by mixing and storing in large vats, when they are allowed to ferment the amount of acid calculated as acetic is over 1.25 per cent. The percentage of tannin is 3 or 4 per cent, corresponding to an 18° liquor. In the course of the handling this is lowered to from less than 2° to 5° barkon. Below 2° the tail liquors are run away, above that they are run back to the leaches or used for diluting in storage tanks. Besides the saving in tannin, the reason for the running back of the tail liquors to the leaches is that a more highly nitrogenous liquor is obtained and one which is better adapted for lactic fermentation and having the mellow effect of an old liquor.

The hides should be struck through in eight or although ten may be allowed. The rockers are kept in motion 24 hours; in fact the whole tannery is open day and night. When taken from the handlers, the hides are allowed to drain on a horse, and then put in drums mounted on bearings, and operated by power and half immersed in a 25° quebracho liquor. The drums have a capacity of 25 sides, and make fifteen to twenty revolutions per minute, with occasional stops to allow for cooling. In 36 to 40 hours, the sides may be said to be tanned; they are then taken from the slat drum for the operation of filling; this is done in the regular vat of tanning drum. Fifty sides are put in with 1½ to 2 per side of full strength chestnut wood or chestnut wood extract, and milled for three or four hours. They are then taken out, allowed to hang 24 hours in a very strong liquor made from the residual extracts from the drums, and then bleached with a sulphuric acid and soda solution. The sides are then oiled, dried in a drying chamber ventilated by mechanical draft, and rolled for the market. These operations take four or five days. Thus, we find the time required for this process to sum up as follows: Soaking, 1 day; liming, 6 days; unhairing, fleshing, and bating, 1 day; handling, 9 days; tanning and liming, 3 days; bleaching, oiling, drying and rolling, 5 days; total 25 days.

Variations of this process are as many as there are tanners making, or experimenting with quick process tannage. Naturally, the variations are of two classes, the different tanning materials are used, and, secondly, different mechanical contrivances are employed. So, I know quebracho is always a component of a quick tannage liquor. Much has been done with it alone, but its lack of filling properties necessitates the use of oak and grape sugar or some other extract to give the leather weight. The combination of oak bark, quebracho, and chestnut wood is very common, and a lighter colour leather is obtained than with hemlock bark. With a combination of quebracho and oak bark are used in quick handlers, and more acidifying done with lactic acid than lactic and acetic acids than is necessary with the tanned hemlock liquor. Acetic acid alone has a tendency to raise the grain if used in sufficient quantity to bring the necessary plumpness. Sulphuric acid



used for plumping to some extent, after the method of old-fashioned acid tanning. The objection to its quick tanning is that in handler liquors, in which strength is increased so rapidly, a falling is caused in grain, while the interior of the hide remains plump. It makes a leather with a brittle grain, also one hard to work. With quebracho and oak bark I have no record of experimentation; doubtless they have been used together, but the cheapness of chestnut wood or chestnut oak wood by now brings it into combination, even though it is only used for filling. There is a great variation in quality of the chestnut extracts on the market, and election of one best adapted for the purpose is of importance. Unless it is to be used in the handlers, this is seldom the case as too much colour is so obtained. Recommendation is for an extract with at least 30 per cent of tannin, and not over 10 or 11 per cent. non-tannin, as clarified as possible. A colour test on sheepskin always accompany the analysis of an extract, the tanner may know exactly what to expect. Among the mechanical arrangements, I may mention following patents:—Dupin (1), in 1897, for a tanning with automatic feed; Galbien (2) and E. H. Dewson the same year for drums of special construction; Easton (4) in 1898, covering the circulation of strong acids, and Mario (5), in 1899, for attaching hides to driving and moving rolls; Bona Allen's patents in (6), protecting arrangements for fastening the hides on revolving shaft, and suspending them radially therefrom, is noteworthy as giving excellent practical results. The patent is that of Koenitzer (7) for the suspension of hides from the inner periphery of a drum. In order to determine how near the quick process leathers are in quality the standard leathers made by the old methods, I have made some analytical and physical examinations, which I believe give a fair statement of conditions as they are to-day:—

Sample.	Altrition Test.	Tensile Strength.	Moisture 105°.	Nitrogen.	Hide Substance.	Extract.	Tannin.	Non-tannin.	Sulphates.	Sugars.
	Min.		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.		
120 days hemlock .....	82	940	11.35	7.44	41.81	19.54	7.05	12.49	present	present
120 days oak .....	87	—	—	7.06	39.68	—	—	—	present	present
30 days hemlock and quebracho .....	92	910	8.89	6.98	39.22	20.83	6.68	14.15	present	present
30 days oak .....	—	—	—	6.97	39.16	—	—	—	present	present
30 days quebracho .....	—	—	—	6.79	38.16	—	—	—	present	present
60 days union .....	100	620	8.84	6.39	36.75	19.89	7.63	12.24	present	present
120 days union .....	67	840	9.98	7.23	40.62	13.32	4.58	8.74	present	present
30 days oak and quebracho .....	88	710	10.40	6.73	37.99	22.16	6.94	15.22	present	present
120 days non-acid hemlock dried hide .....	75	270	—	—	—	—	—	—	—	—
120 days acid hemlock .....	73	320	—	—	—	—	—	—	—	—

- (1) United States Patent, June 1st, 1897—583,792.
- (2) French Patent, November 11th, 1895—251,592.
- (3) United States Patent, September 14th, 1897—590,061.
- (4) United States Patent, September 21st, 1897—590,390.
- (5) United States Patent, May 31st, 1898—604,739.
- (6) United States Patent, May 30th, 1899—664,907.
- (7) United States Patent, December 23rd, 1902—716,358.
- (8) United States Patents, April 5th, 1904—756,553, 756,554.
- (9) United States Patent, February 3rd, 1903—719,713.
- (10) United States Patent, November 1st, 1904—773,873.

From these results I think we may well consider that the best of the quick tanned leather is nearly, or is equal to the average leather made by the slower processes. It should be borne in mind, however, that pieces of this quick tanned leather, that is, the best, are perhaps more carefully selected than those used by the slower processes, although care was taken each should come from the same part of the hide. Chemical analyses show that nearly as much tannin has been fixed in one case as in the other. It is not how much quick tanned leather is now being produced is a different question, as many tanneries are producing both kinds, and are not over willing to give estimates. My estimate is that about 600 sides per day are now being tanned, and in the present condition of the leather market, are being sold as rapidly as produced; yet, most of the tanneries making this class of leather are well sold ahead. This is a conservative estimate, if rumour is correct, 1200 sides is nearer the amount. I have chosen the smaller figure as I know of that

amount. The selling price of this leather is usually 1 or 2 cents per lb. less than the standard price, but this is variable, and the prejudice against quick tanned leather is so nearly worn away that to a large degree, such leather sells on its merits.

We may now consider on what lines and to what extent the present processes may be improved. Without hesitation, I think I may say that time can be saved in the liming, by sharpening the limes with sulphide of sodium, soda ash, or sulphate of ammonia, or by use of warm water, according to the so-called Buffalo method, instead of 5 to 7 days, 48 to 72 hours should be sufficient for depilating. Many tanners making leather in the old way avail themselves of these processes, and so far as my observations go, there is no reason why they cannot be combined with the quick methods. The Pullman process of calcium chloride and caustic soda also could be developed with advantage.

The possible use of formaldehyde, for fixing the plumpness obtained by acids, suggests a material shortening of the handler period. This product may be truly called a tanning agent, in that it fixes the fibres in an insoluble condition, and thus, by its use, it seems that in a few hours the grain and fibres might be fixed so that the delicate and graduated treatment of the handlers could be quickened or, perhaps, entirely obviated. My experiments with formaldehyde on a small scale have, however, made me a little sceptical of its value, because when it is used in sufficient quantity the fibres appear to be rendered non-absorptive, and the tannin that is worked in can be nearly all washed out again. If some method could be devised whereby the formaldehyde could be generated in small quantity in the hide itself, I believe a very practical gain would be made. My experiments with bisulphite-aldehyde compounds have not been successful. On the other hand dilute chrome solutions have seemed to be beneficial in the direction of partially tanning without

destroying the absorbent properties of the fibres. The objection to their use is that the colour of the leather is injuriously affected by the mordanting properties of the chromium.

Another question is the more general use of chestnut wood extract as a substitute for quebracho. The former is now much the cheaper, but lacks the quick penetrating power of the latter.

Eitner has stated that wood extracts have properties of quicker penetration than bark extracts, and such seems in general to be the case, but quebracho excels chestnut wood in this respect to a greater extent than chestnut wood does oak-bark extracts. I have made many experiments, and without success, to determine to what this property of quick penetration is due. A moderately pure tannin, prepared by alcohol extraction and ether precipitation, gives equally bad results whether its source be quebracho or chestnut oak. A bisulphited chestnut oak wood extract has been reported as giving quicker penetration than the ordinary extracts, yet while the bisulphited quebracho extracts are quite widely used, they are not markedly superior to the other extracts in penetrating properties. If a chestnut extract can be purified or treated so as to give quick penetrating power, it is probable that it would lose the filling properties which now recommend its use, thus making necessary the employment of two kinds of chestnut extract, one for the tanning, and the other for the filling.

One of the most important present problems in the

manufacture of quick process leather is the avoidance of loss in the bleaching process. This leather (dilled as it is with tannin extract, of which a considerable amount is uncombined at the time of bleaching, however much it may combine later), on keeping, yields an expensive proportion of this tannin to the soda bleach liquor. Delay before bleaching somewhat decreases the loss, and is always more or less resorted to, but loss in time is to an extent as objectionable as loss in weight. One method, of course, is to make up for loss in weight by loading with grape sugar and Epsom salts, which, to a limited extent, say  $1\frac{1}{2}$  to 2 lb. to the side, is admitted in the trade as legitimate. From the wearers' standpoint loading certainly does not improve the leather, as it makes it absorb water more readily. The natural remedy is not to bleach the leather. Bleaching was adopted because it disguised leather containing considerable proportion of chestnut or hemlock and let it pass for oak, or as containing more oak than it really did. To-day no one is deceived by bleached leather, and as it is practically painted when it reaches the consumer there is no further excuse for the custom, except the theory, and it is more theory than fact, that the shoe manufacturer will pay for the light colour. If however, bleaching must be done, a material which has strong decolorising properties should be employed and not those which depend on their tannin removing properties for their efficiency. I have had fairly successful results with permanganate of potash followed by bisulphite of soda or oxalic acid. The peroxides also give good results, but are more expensive.

In conclusion we may summarise the results of quick process tanning as follows:—Good average sole leather is now made in 30 days; this time can be shortened 2 or 3 days in the liming. Further quickening may be effected by the use of a combination process with aldehydes or inorganic compounds. Cheapening is perhaps possibly accomplished by the use of pure chestnut extracts. The mechanical arrangements are fairly good, but arrangements for cooling liquors are not yet perfected. Any great radical change is not to be expected aside from lines laid down, and business men should avoid too hasty investment in processes which will effect revolutionary changes. Great emphasis should be placed on the personal factor. With so complicated a material to deal with, keen and scientific observation, accompanied by wide practical experience, are absolute essentials to success.

That in time all sole leather will be tanned by quick processes, is to me unquestionable.

*Meeting held at New York, on Friday,  
March 24th, 1905.*

DR. RUSSELL W. MOORE IN THE CHAIR.

## CONSTANTS OF PERSIMMON SEED OIL.

BY NATHANIEL J. LANE.

### *Constants of Persimmon Seed Oil.*

Specific gravity at 15° .....	0.92437
Solidifying point .....	-11° C.
Melting point .....	-6° C.
Coefficient of expansion .....	0.000049
Saponification value .....	188.0
Iodine value, Hübl .....	115.6
" Hanus .....	114.5
" Wijs .....	116.8
Reichert-Meißl value .....	0.0
Hehner value .....	95.9
Acetyl value (Lewkowitsch method) ..	7.15
<b>Fatty Acids—</b>	
Specific gravity at 15° .....	0.9033
Melting point .....	23.8° C.
Dalican titer (Titer test) .....	20.2° C.
Coefficient of expansion .....	0.000663
Neutralisation value .....	192.7
Molecular weight .....	291.5
Solid acids .....	9.11 per cent.
" Neutralisation value ..	188.4
" Molecular weight .....	298.0

### Liquid acids—

Volumetric determination (N/10 NaOH × 0.0282) .....	85.00 per cent.
Gravimetric .....	85.50 per cent.
Neutralisation value .....	196.7
Molecular weight .....	285.0
Iodine value, calculated on vol. det.	
Hübl .....	135.2
Iodine value, calculated on vol. det.	
Hanus $\frac{1}{2}$ hr. ....	130.4; 2 hrs. 133.
Iodine value, calculated on vol. det.	
Wijs 1 hr. ....	134.6; 2 hrs. 135.
Iodine value, calculated on grav. det.	
Hübl .....	134.2
Iodine value, calculated on grav. det.	
Hanus $\frac{1}{2}$ hr. ....	129.6; 2 hrs. 132.
Iodine value, calculated on grav. det.	
Wijs $\frac{1}{2}$ hr. ....	133.5; 2 hrs. 134.

The oil is semi-drying, brownish yellow in colour, and smells like peanut oil produced by heat, and contains no arachidic acid.

## Nottingham Section.

*Meeting held at Nottingham, on Wednesday, March  
1905.*

MR. J. T. WOOD IN THE CHAIR.

## STANDARD METHODS OF ANALYSIS.

BY JOHN WHITE, F.I.C.

By standard methods of analysis, I understand implied methods officially prescribed and recommended by some body, duly appointed for the purpose. A chemist possesses full liberty to adopt these methods, vary them, or improve them as he pleases. By thoughtful such processes will be received with gratitude they represent the collective wisdom of their origin and are thus stamped as reliable. They are upon from the moment of their publication, and are subject to revision. No such method is intended to replace a finality.

I would emphasise this liberty of action and freedom of trial possessed by individual chemists, because it lies a reply to the argument, in my opinion, falls that the adoption of standard methods must transform intelligent workers into mere animated machines for repeating analytical figures, stifle originality and hinder research. I have not yet heard any proof of this assertion. I have found that a standard method is subjected to less criticism than that received by a process suggested by an individual.

For an ultimate analysis of, say, starch or sugar, a standard process is wanted; the manipulative skill and chemical knowledge of the operator are the factors of importance. But, in the examination of butter, the opinion of the sample has to be based upon the results of certain empirical tests.

Again, the methods involved in the determination of the iodine value of a fat or oil, the "fineness" of a slag, the flash point of a petroleum, or the viscosity of an oil, must of necessity be standardised, otherwise the figures obtained may be meaningless. As an example of a method in every-day use requiring the standardised, that for the determination of indigestible fibre in an oilcake or feeding meal may be quoted. In this particular estimation, the exact truth may be regarded as practically unattainable, and thus a process is required wherein the risk of error shall be reduced to a minimum.

In all such determinations, where either a constant is to be found, or where the proportion of some constituent, which does not allow of exact estimation, has to be attained as nearly as possible, it is idle to condemn standard methods of working. Surely it is desirable that concordant results should be arrived at in different laboratories, and that error of experiment should be eliminated where practicable. If the whole truth be not discovered,



s, at least, get as near to it as we may, and a od which is the result of the deliberations of a well ed committee is likely to be nearer the truth than volved by an individual.

e opponents of standard methods also urge that the t of the chemist when conducting an analysis is to at the exact truth to the best of his ability, and he can, better accomplish this by the adoption of than one analytical process, arranged so that one check the other, than by any number of repetitions a standard method. I do not see any great strength a argument; the careful and intelligent chemist will e satisfied merely by the agreement of duplicated s unless he also knows that his method is reliable; thers will continue to perpetrate their errors in any

spite of the protests of their opponents, standard ods are spreading. The International Association ather Trades' Chemists has adopted such processes hese are subject to revision at intervals. Standard ods have been formulated by a sub-committee of ew York Section for the analysis of cement and aterials. Official methods for the analysis of sers were issued by the German Manure Manufacturers iation as long ago as 1895. Methods for the estima- of arsenic in foodstuffs and brewing materials have ublished, both by a Joint Committee of the Society emical Industry and the Society of Public Analysts, a Departmental Committee appointed by the Board land Revenue, and a process for the determination e Reichert figure for butter and margarine has been lly prescribed. The Adams' process for the esti- od of fat in milk may be regarded as a standard od, and for many years the analysis of water for ury purposes has been conducted on standard lines. e analysis of food and drugs. I welcome standard ods, and hope to see them extended.

the case of food and drugs, the selection of methods t be assigned to the Board of Reference recommended eated in the Report of the Select Committee on oducts Adulteration, published in 1896. In other es of technical and commercial analysis committees emists concerned in these respective branches might ointed, and here the Society of Chemical Industry t well act as the controlling force, to examine, discuss eport upon the various methods of importance used ch branch. If upon inquiry it were decided to ardise a method, no better and more fitting place ublication could be found than the columns of our al. The methods should in all cases be subject to eal revision.

#### DISCUSSION.

. J. GOLDING declared himself as distinctly opposed tandard methods. We were suffering at present too much authority, and the evil was infecting science. ally on the Continent and in the United States. mber of men in authority meeting together seldom d, and the result was frequently a poor compromise.

. S. F. BURFORD said it considerably influenced the de public when they saw reports of analyses on any cular subject which differed considerably from one er. To obtain fixed data they must use uniform ods.

Mr. S. R. TROTMAN agreed with Mr. White's conclusion, and thought it was particularly desirable that standardised methods should always be adopted where the figures had to be given on which an opinion was based. It frequently happened that two chemists would arrive at the same opinion, but that their figures would differ according to the method used in the analysis. This, though quite intelligible to the chemists themselves, was not a desirable thing from the point of view of the public.

Mr. JOHN WHITE pointed out that his paper was not a plea for the introduction to this country of methods standardised in Germany. Analysis would not be so frequently discredited if standard methods were adopted, nor would it then be necessary to attach to the analytical results a description of the process by which they were obtained.

*Meeting held at Nottingham, on Wednesday, March 22nd, 1905.*

MR. J. T. WOOD IN THE CHAIR.

#### COMMERCIAL AMYL ALCOHOL.

BY S. F. BURFORD.

Since the introduction of the Leffman Beam method of estimating fat in milk, I have tested many samples of amylie alcohol, and compared with standard processes have obtained results, not differing by more than 0.3 per cent. as fat.

A recent sample purchased as amylie alcohol has presented such abnormal results as to indicate the necessity of standardising each batch of alcohol.

The sample mixed with an equal volume of hydrochloric acid, soon separated, and did not become darker on keeping.

Milks tested with ordinary amylie alcohol gave:—

4.4 per cent. fat but 7.1 per cent. with the abnormal alcohol.					
3.4	"	"	6.1	"	"
3.9	"	"	6.7	"	"

showing a constant excess of 2.7.

In a blank experiment without any milk 3 c.c. of a mixture of equal parts of the alcohol and hydrochloric acid diluted with sulphuric acid 1 in 4, and 9 c.c. strong sulphuric acid after rotating gave 3.7 c.c. of a straw-coloured liquid.

Three c.c. of hydrochloric acid and alcohol and 15 c.c. sulphuric acid strong, and bottle filled up sulphuric acid. 1 in 4, gave 6.5 c.c. separated liquid, 5.5 c.c. yellowish upper portion, 1 c.c. colourless lower portion.

Fifty c.c. of the alcohol mixed with 50 c.c. of sulphuric acid 1 in 4 and 50 c.c. strong sulphuric acid added, gave no oily layer, but after standing 24 hours separated into two layers—an upper dark blackish-brown portion and a lower portion about 70 c.c. of sherry-coloured liquor smelling of amylie alcohol.

The abnormal sample presented the following characters:—

Temperature.	Volume of Distillate.	Sp. Gr. of Distillate at 60° F.	No. of c.c. of Normal Alcoholic NaHO required to neutralise 5 c.c. of Distillate.	
Up to 120° C.	6.0 c.c.	—	0.55 e.c.	Strong amyl odour.
130	5.5	—	1.7	Strong amyl odour.
145	3.5	0.831	0.8	Faint pear odour.
155	12.0	0.836	3.5	Sweetish pear odour.
170	8.7	0.851	6.3	Heavy odour, inducing flushing rush of blood to head.
180	8.0	0.870	10.5 e.c.	Cheesy odour.
190	16.0	0.8796	11.2 c.c.	Stuffy odour.
200	4.3	0.874	5.45 c.c.	Oily cheesy odour.
in retort 4.0		—	2.6 c.c.	Rancid oily odour.
of original sample of alcohol			4.8 e.c.	

The later distillates had an extremely persistent and disagreeable putrid cheesy odour.

Mixtures of 1.5 c.c. of the various distillates and 1.5 c.c. of hydrochloric acid were used to estimate the fat in milk containing 2.0 per cent. fat.

Distillate obtained :—

Above 130 up to 145° C. gave	4.2 per cent. of fat-like liquid.
"    155    "    5.3    "	"    "
"    170    "    6.8    "	"    "
After rotating in Leffman Beam bottles.	
Above 130 up to 180 C. gave	10.6 per cent. 6.3 clear white liquid ;
	4.3 milky liquid.
{ 0.75 c.c. distillate obtained between 170° C. and 180° C. gave	5.3 c.c. 2.8 c.c. clear.
and	5.3 c.c. 1.2 straw colour.
{ 0.75 c.c. hydrochloric acid	1.3 pinkish colour.
0.75 c.c. distillate from 180 C. up to 190 C. gave	
and	6.0 c.c. 13.0 c.c. clear.
{ 0.75 c.c. hydrochloric acid	3.0 c.c. milky white.

Beyond the fact that the amyl alcohol had been in store for some time the vendors could furnish no clue.

## Yorkshire Section.

Meeting held at Bradford, on Monday, March 20th, 1905.

MR. G. W. SLATTER IN THE CHAIR.

### "NOTES ON WATER SOFTENING."

BY WALTER M. GARDNER AND L. L. LLOYD, PH.D.

(A Contribution from the Department of Chemistry and Dyeing of the Bradford Technical College.)

The advantages to be gained by the use of soft water in steam raising and for most manufacturing operations, are now generally recognised. The point of most importance in connection with a water supply for household purposes is its freedom from organic impurity. For works purposes this is of very minor importance, but in many works the town supply is used, under the impression that it is the best procurable. This is by no means necessarily the case, either as regards quality or price. The cost of towns' water to manufacturers varies between 4d. and 1s. per 1000 gallons, and usually the latter figure is far above the interest on the cost of sinking a well and pumping, even if a subsequent softening process is necessary. Probably the recognition of this fact is the main cause of the recent great extension in the number of private water supplies in certain districts. Curiously enough, those towns' supplies which are the least suitable for works' purposes are often the most costly, and in such cases, a double advantage is possible by using private sources.

No hard and fast rule can be laid down with regard to the desirability of softening a water. From the point of view of steam raising, this will depend not only on the nature of the water, but upon the type of boiler used, the working pressure, circulation, &c. It should be clearly recognised that the cost of the water before it enters the boiler is in any case small compared with the cost of converting it into steam. Taking as a basis that 1 lb. of coal at 8s. per ton burnt in the furnace of the boiler, will convert 9 lb. of water into steam, the cost of evaporating 1000 galls. of water would be 4s., whereas the cost of the water, even including softening, should not exceed 6d. per 1000 galls. As an average statement, it is also probably well within the mark to say that the use of a water of 20° hardness will cause a loss of 15 to 20 per cent. in fuel, that is to say, the decrease in the efficiency of the boiler due to scale formation, more frequent blowing off, increased repairs, &c., will be about 20 per cent. This means an increase in the cost of evaporation of about 1s. per 1000 galls., whereas the cost of softening including interest on plant, should not, in an extreme case, exceed 3d. per 1000 galls. From the point of view of steam raising, the softening of water is thus well worth consider-

ation, to all interested in power production of any magnitude.

In the case of processes in which soap is used, soft water is very essential. One thousand gallons of a water of 20° hardness will destroy at least 12 lb. of ordinary soap. Thus, apart from the inferiority of the result due to the presence of calcium and magnesium soaps, the increased cost of the process incurred by the hardness of the water would, in the supposed case, be 2s. 6d. for each 1000 galls. of water used; and this is still out of proportion to the cost of softening than in the case of steam raising. Soft water is thus essential for laundries, for wool washing, and wherever large quantities of soap are used.

For general dyeing purposes, the permanent hardness of a water is of small importance compared with temporary hardness. The removal of any considerable amount of permanent hardness, moreover, always in a certain degree of alkalinity—a very objectionable feature in water used in a dyehouse. Taking into account the requirements of the dyer only, it is, therefore, preferable to confine the softening process to the removal of temporary hardness, but since steam raising, and usually washing, are also carried on in the same work, regard must of course be paid to the general requirements in advising as to the best softening process to employ in any particular case.

The use to which the water is to be put should influence the decision as to whether a water can advantage be softened, and should determine the method of the softening process recommended.

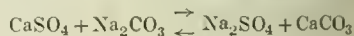
The actual results obtained by the softening process depend upon a complex set of conditions, the chief of which are probably the following :—

1. The degree of hardness of the water.
2. The amount of magnesium salts present.
3. The amount of neutral salts present.
4. The method and apparatus used in carrying out the process.

A good deal of attention has latterly been paid to the influence of magnesium salts in water softening, to the effect of the presence of neutral salts and the influence of the apparatus employed in softening, have hardly received the due recognition by chemists.

### Effect of Neutral Salts.

Examination of a large number of water samples from all parts of the country, has led us to the conclusion that, on an average, six waters in ten may be expected to contain a fairly large quantity of neutral salts, chiefly calcium sulphate. Far too little attention is paid to the influence of these bodies, not only in water softening, but in the action of the water in subsequent use, and we have been led to attribute many irregularities in results to their presence. The presence of neutral salts in considerable quantity, is indicated by a great difference between the amount of total inorganic solids, and the total hardness, and in such cases we have found time after time, that the softening process cannot be pushed so far without the alkalinity as is possible in the absence of neutral salts. This is, of course, not surprising if the equation—



is partially reversible, and this we have found to be the case.

The removal of calcium permanent hardness by means of sodium carbonate or magnesium permanent hardness by means of lime and soda, results of course in an increase in the amount of mineral solids in the water, since 142 parts of sodium sulphate are produced by the removal of 136 parts of calcium sulphate or 120 parts of magnesium sulphate. The softening of a water of 10° permanent hardness, will thus generally result in the presence in the soft water of about 11 grains of sodium sulphate per gallon. This amount is quite sufficient to exert a deleterious effect in such processes as washing off after dyeing acid colours; and we have known this more than once to be the cause of serious trouble in the use of a soft water. It may here be pointed out that the use of bi-



xide as a precipitating agent does not result in the action of soluble sulphates, and this is perhaps its advantage. We have further experiments in progress regard to the influence of neutral salts in water softening and water softening.

#### *Influence of the Apparatus.*

Influence of the method and of the apparatus used, degree of softening attainable, is largely concerned with variables, viz., the time during which the reaction is allowed to proceed before removal of the precipitate, the temperature at which the process is conducted, the use of a suitable apparatus it is frequently practicable to utilise waste steam, and thus raise the temperature of the reacting chamber. Another plan which may be adopted, is to run the water through a condenser before giving it to the softening plant. In any case, raising the temperature greatly facilitates the reaction.

As regards the time factor it is not to be expected that reactions carried out in such dilute solutions as in water softening, will be completed very rapidly, other things being equal, that apparatus will give the best result which allows of the longest time of contact before the deposit is removed. This, of course, largely influences the output of a plant of a given size, and it is frequently the case that with a view to economy of installation, an apparatus of too small a size is put up, in order to obtain the necessary amount of water, the apparatus is then worked at such a rate of flow that the time of contact is not given, with the result, that the necessary amount of further deposit is produced in the orange tank or in the boiler.

Another point having an important influence on the rate and rapid reaction, is to ensure a sufficient degree of agitation of the water after mixing with the reagent. In experiments we have carried out on a large scale, we end to show that the reactions are more complete when the apparatus is under pressure.

In the technical softening of water the treatment is sometimes confined to the removal of temporary hardness by action with lime. This case is perfectly simple if the water contains calcium salts only, the amount of lime in hydroxide required being of course equivalent to calcium bicarbonate, plus the free carbon dioxide.

The reaction is also quantitative in the case of solutions of magnesium bicarbonate as shown in Table I., but in this case a double quantity of calcium hydroxide is necessary, as the magnesium should be precipitated as hydroxide and not as carbonate. If magnesium chloride or sulphate is present, the total magnesium must be taken into account. In this case Pfeifer and Wartha (Zeits. angew. Chemie, 1902, 198) as stated by H. R. Procter (this J. 1904, 8) gives the lime required as  $11t + 11m - 11p$ , when  $t$  = temporary hardness,  $p$  = permanent hardness, and  $m$  = magnesium hardness. This formula is, however, incorrect for the case in question, as when lime is added to mixtures of calcium bicarbonate and magnesium sulphate, the temporary hardness is not completely removed until sufficient lime is added to react with the total magnesium salts as well as with the calcium bicarbonate. This is shown in Table II.

Considerable experience in the use of the Pfeifer and Wartha formula for determining the amounts of reagents to use in water softening has led us to the conclusion that although they give approximate results in many cases, they cannot be relied on when dealing with waters containing much neutral salts. It is indeed, not to be expected that the results of reactions carried out in such great dilution, and with such complex bodies as occur in water softening, can be readily calculated by means of a simple formula; and we have been led to support the view of those chemists who prefer to determine the amount of lime and soda by direct experiment. We proceed as follows:—

#### *Determination of Lime Factor.*

210 c.c. of the sample is transferred to a stoppered cylinder, and lime water of a known strength is added in considerable excess. The cylinder is kept stoppered and shaken during two hours, the precipitate being then allowed to settle, or being removed by filtration in the case of magnesium waters which do not readily settle. Seventy c.c. is pipetted off and titrated with N/10 hydrochloric acid, using first phenol phthalein, and then methyl orange as indicator. The difference between the two titrations is probably a measure of the calcium, and magnesium carbonates still in solution and this is deducted from the figure obtained in the phenolphthalein titration. The result then gives the amount

TABLE I.

#### *Action of Lime on Magnesium Waters.*

Expt.	Composition of Water.		* Amount of Lime used (Grs. per Gall.).	Analysis of Treated Water.		
	T. and Mg. Hardness. Mag. bicarb.	P. Hardness.		T. Hardness.	P. Hardness.	Excess of Lime.
1	30	nil	16.8	22.8	nil	—
2	do.	do.	33.6	2.0	do.	—
3	do.	do.	35.0	2.0	do.	1.25
4	do.	do.	33.75	2.0	do.	—

- \* 1. Amt. of Lime necessary to ppt. Mg. as  $MgCO_3$ .
- 2. Amt. of Lime necessary to ppt. Mg. as  $Mg(OH)_2$ .
- 3. Experiment for the Determination of Lime Factor.
- 4. Experiment in which the Lime Factor is used.

TABLE II.

#### *Action of Lime on Magnesium Waters.*

Expt.	Composition of Water.			Analysis of Treated Water.				Excess of lime.	Analysis of Ppt.	
	Temp. Hard. Calc. bicarb.	P. and Mg. Hardness. Mag. sulph.	* Amount of lime used (Grs. per Gall.).	Temp. Hard.	Perm. Hard.	Calc. carb.	Mg. as Calc. carb.		Calc. carb.	Mg. as Calc. carb.
1	53.5	10	5.6	45	10	46	8.5	—	16.5	trace
2	do.	do.	31.7	12	10	15.9	5.8	—	87.9	3.2
3	do.	do.	43.7	—	—	—	—	1.45	—	—
4	do.	do.	42.2	3	not determined	—	nil	—	—	—

- \* 1. Lime necessary for Permanent Hardness.
  - 2. Lime necessary for Temporary Hardness.
  - 3. Experiment for the Determination of Lime Factor.
  - 4. Experiment in which the Lime Factor is used.
- The Ca and Mg Estimations were gravimetric.

of lime in excess, and the figure thus obtained is more accurate than by a simple titration. We have found in practice that the amount of lime determined in this manner works out quite satisfactorily when applied on a large scale, and in the case of several installations of softening plants, practically no subsequent adjustment has been necessary.

#### Determination of Soda Factor.

70 c.c. of the sample is placed in a platinum dish, and an excess of N/10 sodium carbonate is added. The solution is evaporated nearly to dryness, and then somewhat diluted, and the precipitate washed with air free

water. The excess of sodium carbonate in the is then found by titration with N/10 sulphuric acid.

This also gives the permanent hardness of the water in the absence of sodium carbonate in the original sample. If this is present, as is not infrequently the case, it is determined as follows:—70 c.c. of the water is evaporated to dryness in a platinum dish on the water bath. The residue is treated with a small quantity of water from carbon dioxide, filtered, and the filtrate treated with N/50 sulphuric acid. The amount of acid required to neutralise the alkalinity thus found is reduced to N/10 acid and is then deducted in estimating permanent hardness.

TABLE IIIA.

#### Action of Lime and Soda on Artificial Waters.

Composition of Waters.				Amount of Lime used (Grs. per Gall.).	Amount of Sodium carb. used (Grs. per Gall.).	Analysis of Treated Waters.			
Expt.	Temp. Hard.	Perm. Hard.	Mag. Hard.			Temp. Hard.	Perm. Hard.	Alkalinity as Sodium carb.	Mag. Hard.
1	10	10	10	11.2	10.6	5	0.5	nil	—
2	do.	do.	do.	12.6	10.6	3.5	—	0.75	—
3	17.5	5	15	18.2	5.3	4.75	1.25	nil	—
4	do.	do.	do.	19.4	5.3	4.25	—	0.5	—
5	10	20	17.5	15.4	21.2	4.5	0.75	nil	—
6	do.	do.	do.	10.0	21.2	3.75	—	0.25	—

In Nos. 1, 3 and 5, the amount of Lime added has been calculated from Pfeifer's Formula  $5.0(T.H. + MgH.)$ . In Nos. 2, 4 and 6, the amount of Lime added was the "Lime Factor" found by experiment.

The results of experiments carried out on these lines are shown in Tables I., II., IIIA., and IIIB., compared in some cases with results obtained by Pfeifer's formula. It is found that in some waters the lime factor obtained by direct experiment is less, and in other cases is greater than the amount calculated by Pfeifer's formula. All the softening experiments were carried out with 210 c.c. of

water shaken in cylinders with the reagents during 24 hours, then filtered and analysed. The filtered water did not further precipitate on standing 24 hours. In some cases better results were obtained by adding the lime and soda in two separate operations, this being in accordance with the results in Table IIIB.

TABLE IIIB.

#### Action of Lime and Soda on Natural Waters.

Composition of Waters.					Amount of Lime used (Grs. per Gall.).	Amount of sodium carb. used (Grs. per Gall.).	Analysis of Waters.		
Sample.	Expt.	Temp. Hard.	Perm. Hard.	Mag. Hard.			Temp. Hard.	Perm. Hard.	Alk. Hard.
1	A	14.4	10	4.1	10.3	1.06	6	0.25	—
	B	do.	do.	do.	9.6	1.06	4.6	—	—
	C	do.	do.	do.	9.6	1.06	4.9	—	—
	D	do.	do.	do.	9.6	—	4.5	1.25	—
2	A	5.5	14.5	3.9	5.3	17.5	5.75	—	—
	B	do.	do.	do.	5.0	17.5	4.25	—	—
	C	do.	do.	do.	5.0	17.5	4.75	—	—
3	A	15.5	4.5	4.5	11.2	4.77	6	—	—
	B	do.	do.	do.	10.7	4.77	4.25	—	—
	C	do.	do.	do.	10.7	4.77	3.75	—	—
4	A	4.6	16.3	14.2	10.5	17.3	7.25	—	—
	B	do.	do.	do.	9.2	17.3	3.64	2.52	—
	C	do.	do.	do.	9.2	17.3	2.47	1.96	—
5	A	28	52	21.4	27.7	55	7.0	4.0	—
	B	do.	do.	do.	29.7	55	4.5	—	—
	C	do.	do.	do.	29.7	55	5.0	—	—

In analyses A the amount of Lime has been calculated by Pfeifer's formula.

In analyses B the amount of Lime has been found experimentally, as in Tables I. and II. and Lime and Soda being added to the water simultaneously.

In analyses C, the Lime has been added as in B, the liquid shaken 2 hours, filtered and the soda then added.

In analyses D, the water has been treated with lime only as in B.

When the above method is adopted, the analysis necessary in connection with water softening is extremely simple, comprising merely the determination of the lime and soda required. When a direct determination of hardness is required, we employ the ordinary Hefner process for the temporary hardness, preferring methyl orange or lacmoid as indicator to alizarin, as recommended by Pfeifer, because in the latter case it is necessary to boil, and this introduces errors due to secondary reactions.

In the estimation of permanent hardness we have found no advantage in the use of a mixture of sodium

carbonate and sodium hydroxide as proposed by Pfeifer, since the magnesium carbonate is totally insoluble in excess of sodium carbonate. For the estimation of magnesium salts, Pfeifer's method as described by Pfeifer has been adopted.

Reference may finally be made to the use of barium hydroxide as a reagent in water softening. This has recently been placed on the market as a solid product containing about 60 per cent. of barium oxide. Experiments with this substance have not been exhaustive, but we have come to the conclusion that at its present price it can only be used in very small



The amount employed must never exceed the amount of the temporary hardness due to calcium carbonate or half the temporary hardness due to magnesium carbonate. In the case of magnesium sulphate barium hydroxide may be added until the whole precipitated, as both products, barium sulphate and sodium hydroxide are insoluble. Addition of lime in this case required for removal of temporary hardness shown in Table IV., No. 6). In the presence of sodium sulphate, sodium hydroxide is of course formed, or this reason baryta cannot be used to diminish solid in water so far as they are due to sodium carbonate. The solubility of barium carbonate is variously given in books as 1 part in 4000, 12,000, 14,000, 47,000, 64,000 of cold water. One experimental results

any experience of softening water where calcium sulphate was the chief cause of trouble, and where it was difficult to bring about deposition of precipitate. He did not agree with Mr. Richardson that carbonate of soda was the best thing to recommend, but would use in addition caustic soda and seaweed or starch, and possibly sugar or gummy matters, which caused a softer scale to be formed.

Mr. W. M. GARDNER said he had not found people disinclined to adopt water softening apparatus. He thought some tanning material (e.g., catechu) mixed with soda ash of use in the treatment of hard waters in steam boilers. Plentiful agitation was necessary in cases where sulphate of lime had to be dealt with, as this caused more

TABLE IV.

*Action of Baryta on Artificial Waters.*

Composition of Waters.			Amount of barium oxide used (Grs. per Gall.).	Amount of lime used (Grs. per Gall.).	Treated Water Temp. Hard.	Qualitative Tests for Metals.		
Temp. Hard.	Perm. Hard.	Mag. Hard.				Barium.	Calcium.	Magnesium.
10-75	10	—	15-2	—	3-2	absent	present	absent
do.	do.	—	16-3	—	6-2	present	present	absent
7-75	10	10	15-2	—	7-4	trace	present	—
do.	do.	do.	11-7	—	7-5	absent	present	present
do.	do.	do.	27	—	5-4	present	present	absent
do.	do.	do.	15-2	4-3	2-8	absent	present	absent
12-3	10	12-3	15-2	—	9-9	absent	present	present

Nos. 1, 3 and 7, the amount of barium oxide added is that required to combine with the sulphate present.

No. 2, barium oxide added as in 1, but with an additional quantity of barium oxide to remove Temp. Hard not removed by liberated lime.

No. 4, barium oxide added for Temp. Hard.

No. 5, barium oxide added for Temp. Hard and Perm. Hard.

No. 6, barium oxide has been added for Perm. and lime for Temp. Hard.

that it possesses considerable solubility, probably 1 in 12,000, and as the barium compounds are said to be poisonous, barium hydroxide must be used with great caution in the treatment of drinking water. The amount used is carefully regulated, however, to avoid the possibility of the presence of barium carbonate, trace of barium remains in solution.

## DISCUSSION.

G. W. SLATTER said temperature and the length of action were important in water softening, 6 to 12 hours being usually required in a continuous form apparatus. The Archbutt-Deely apparatus took only 10 minutes. Caustic baryta was not a suitable softening agent owing to its poisonous properties and its cost.

T. FAIRLEY thought barium hydrate was of doubtful merit when used to soften water. The Archbutt process saved time and expense as the blowing in and the mixing of the old precipitate with the new and the latter to deposit more quickly. For the reason deep tanks were preferable, because the precipitate from the upper layers rapidly carried the lower layers, and thus produced a much more uniform settling.

F. W. RICHARDSON said manufacturers would not go to the expense of softening water outside the boiler, previous to use. He had found best soda ash the useful reagent to advise to put in boilers.

W. McD. MACKAY understood that good results were obtained when water was softened under pressure. Barium hydrate was suitable for bad waters containing amounts of sodium sulphate, but he had always tried to recommend its use.

F. W. BRANSON said that discrepancies mentioned by Mr. Gardner as to the solubility of barium carbonate were no doubt due to the varying amounts of carbonic acid gas present in the waters used for the experiments.

W. RUSHBY said he believed in softening the water outside the boilers. He asked if Mr. Gardner had

rapid deposition of the carbonate of lime precipitate. He warned manufacturers against using sesquicarbonate of soda in the softening of water in mistake for the ordinary carbonate (or soda ash).

*Meeting held at Bradford, on Monday, March 20th, 1905.*

MR. G. W. SLATTER IN THE CHAIR.

## THE PREPARATION OF STANDARD SOLUTIONS OF SULPHURIC ACID.

BY B. NORTH, A.R.C.S.C. (LOND.), F.C.S., AND W. BLAKEY.

(A Communication from the Department of Chemistry and Dyeing of the Bradford Technical College.)

A process in frequent use in laboratories for the preparation of a standard acid, and the one generally recommended in text-books, is the method of standardising with sodium carbonate, prepared by igniting the bicarbonate.

During the last 12 years many other methods have been suggested. In 1892, Bornträger (Z. angew. Chem., 1892, 294) proposed the use of potassium hydrogen tartrate, which by ignition is converted into the carbonate. In 1893, Rimbach (Ber., 26, 171) suggested the use of borax as an agent for obtaining a standard acid, and this has been supported by Salzer (Zeits. anal. Chem., 1894, 32, 529), Buchanan (this J., 1894, 1093), Perman and John (Chem. News, 1895, 71, 296). Moody (Jour. Chem. Soc., 1898, 658) described a method of obtaining a standard acid by weighing the amount of hydrochloric acid gas absorbed in water, but the arrangement of apparatus is hardly suitable for technical work. A similar method was suggested by Higgins in 1900 (this J., 1900, 958). Sørensen, in 1899 (Revue de Chim. Industr., 9, 107, 304), suggested the use of sodium oxalate, which gives, he says, pure sodium carbonate by ignition. Marshall, in 1899, and again in 1902, (this J., 1900, 4 and 1902, 1508), published tables of specific gravities of sulphuric acid. Recently (this J.,

1905, 178) Worden and Motion have given tables of specific gravities of sulphuric and hydrochloric acids between the limits of N 10 and N 1 solutions, and Kuster and Münch (Ber., 1905, 38, 150—152) have also recently published a table of specific gravities of hydrochloric acid. Kohn, in 1900 (this J., 1900, 962) suggested the electrolysis of pure copper sulphate as a means of making standard sulphuric acid, the amount of acid in the electrolysed solution being found from the weight of copper deposited. This method has, however, been criticised by Dauvé (Jour. Pharm. Chim., 1902, 16 [2], 65), who maintained that the deposited copper is always mixed with cuprous oxide.

Substances such as borax containing several molecules of water are hardly reliable, especially when these bodies have to be dried in the air, and all methods which depend on the ignition of salts for the production of dry sodium carbonate must fail in the preparation of an accurate acid, owing to the formation of hydroxide. Rimbaud, in 1893 (Ber., 26, 171), seems to have first noticed this fact, and states that ignited sodium bicarbonate is liable to contain hydroxide, though Higgins (this J., 1900, 958) first definitely stated that sodium hydroxide was formed by the ignition of bicarbonate even at temperatures as low as 170° C. Gardner, however, in 1899, definitely proved the formation of hydroxide under these conditions, and early in that year wrote to some of the chief manufacturers of pure chemicals asking to be supplied with a specimen of dry sodium carbonate, free from hydroxide; these firms replying that to their surprise they had found that they were unable to accede to his request. Some two years ago, we independently observed the formation of sodium hydroxide. Supposed pure sodium carbonate had been prepared by the ignition of bicarbonate, but when a solution was titrated with acid, using phenolphthalein and Methyl Orange, the results always indicated the presence of hydroxide, and by the silver nitrate test this observation was confirmed. We have obtained similar results by the ignition of potassium bicarbonate and bitartrate, and with sodium bicarbonate have noticed the formation of hydroxide at temperatures as low as 120° C. At lower temperatures, the bicarbonate is not completely decomposed. (One of us, in conjunction with Prof. Gardner, is continuing the work on the amounts of hydroxide formed at various temperatures.)

As it was found impossible to obtain pure, dry sodium carbonate, an attempt was made to prepare pure bicarbonate for the purpose of standardising acid. A sample of bicarbonate was carefully tested and found to contain a small quantity of sodium chloride as an impurity, but this was easily removed by washing with water. The washed bicarbonate, when tested with phenolphthalein, always showed a purple coloration, indicating the presence of the normal carbonate. Sodium carbonate is soluble in a saturated solution of common salt, whereas the bicarbonate is insoluble, and in this way the whole of the normal carbonate was removed, but in the subsequent washing, to free the bicarbonate from salt, it was found that the bicarbonate was slowly dissociating and again forming the normal carbonate. This is in accordance with results which we have observed that sodium bicarbonate in solution slowly dissociates with the formation of normal carbonate when the solution is freely exposed to the air. Various methods were employed with the object of removing the normal carbonate or of converting it into bicarbonate, and we ultimately succeeded in obtaining the perfectly pure and dry bicarbonate in the following manner:—

About 400 grms. of bicarbonate are washed in a large funnel with distilled water using a filter pump, until the wash water gives no reaction for chloride, and until the bicarbonate, when tested qualitatively, is found to be pure with the exception of the presence of the normal carbonate. The bicarbonate is then dried in the air on porous plates, afterwards powdered, and placed in a moist atmosphere of carbon dioxide for several hours, until it gives no reaction with phenolphthalein. It is preferable to expose only a thin layer of bicarbonate to the action of the gas, the method we adopt being to place the bicarbonate in a shallow dish over a second containing water, the two being placed in a Hempel's desiccator, or in a

bell-jar standing on a glass plate. The desiccator exhausted by means of a water pump, and carbon dioxide washed with water, is allowed to slowly enter the desiccator, the atmosphere of moist gas being maintained in connection with a Kipp's apparatus during the absence of gas. When free from the normal carbonate, the bicarbonate is transferred to a desiccator containing sulphuric acid, though with a large quantity it is preferable to transfer the substance in a vacuum desiccator containing phosphoric anhydride. Several different specimens prepared in this way have given identical results when against the same acid, and one specimen had been for six months *in vacuo* over phosphoric anhydride, proof that the dry bicarbonate is perfectly stable in the absence of moisture. We have observed that the bicarbonate is not stable in presence of moisture, but bicarbonate is saturated with carbon dioxide and immediately, it is impossible to detect the formation of any normal carbonate. To ascertain whether a specimen is free from carbonate, a small quantity is moistened with phenolphthalein, and a few drops of water added; the smallest trace of carbonate is detected in this way. Every specimen of commercial bicarbonate, although sold as "pure," which we have tested, has yielded the reaction for carbonate, and is inclined to think that the pure and dry bicarbonate we have obtained has never before been prepared in a state of purity.

The pure bicarbonate may be used as a means of preparing an accurate standard acid; a quantity is weighed out, dissolved in water, and titrated with acid. A standard solution of bicarbonate may be prepared to make several titrations, the indicator used being Methyl Orange.\* Dissociation during solution formation of the normal carbonate, is of no consequence. Making use of the bicarbonate, the results given in Table I show that the factors of different specimens of

TABLE I.  
Standardisation of Sulphuric Acid.  
Factors of Acids obtained by the Following Method.

Acid.	Gravimetric Method.	Pure and Dry Bicarbonate.	Carbonate prepared by Ignition of Bicarb.	Sp. Gr. of Acid Marshall's Method.	Sp. Gr. of Acid W. N. S.
I.	1.053 1.053	1.050 1.052	1.041	1.031	
II.	1.096 1.096	1.094 1.094	1.084	1.069	
III.	1.011 1.007	1.010 1.010	1.003	1.007	
IV.	—	1.057	—	1.037	
V.	—	1.038	—	1.013	

acid are in close agreement with those obtained by the gravimetric method of standardising sulphuric acid. As first we failed to obtain gravimetric results which were in perfect agreement, the factors being invariably low, and this was found to be due to the formation of barium sulphide by the partial reduction of the sulphuric acid. Even when the precipitate and ash are ignited separately, our results show the necessity of moistening the precipitate and ash with one or two drops of hydrochloric acid and sulphuric acid, in order to convert any barium sulphide, formed by the ignition, into barium sulphate. We draw attention to this point, as, although it is mentioned in one or two text-books, it is omitted in the majority of analytical works.

The various specimens of normal acid were prepared

\*The strength of the Methyl Orange solution is 1 g. in 100 ml. of the solvent being methylated spirit and water. When using this indicator, it is important to use only the smallest quantity of the indicator so as to give a very pale yellow coloration, and to continue the addition of acid till the tint changes to orange and not to pink. At the end of the reaction, the addition of another drop of acid should produce a pink colour.



all's method, the specific gravity of strong sulphuric acid diluted with about half its bulk of water being first found, and a known weight was then diluted to 100 cc. The factors as obtained by this method are generally low. We have made no systematic examination of this method, the acid used being the ordinary sulphuric acid, but our results show that under these conditions the method cannot be considered a reliable one. Sutton, in his work on volumetric analysis, states that he has shown the method to be an extremely accurate one by comparison with ignited sodium bicarbonate, the latter cannot be made to yield accurate results unless that one error has merely been tested against it. By taking the specific gravities of the normal acid recommended by Worden and Motion in a recent issue of this Journal, lower factors still were obtained than in Table I.

The usual method of standardising acid, using carbonate of sodium obtained from the purified bicarbonate by ignition, has been tested against this method of standardising ignited bicarbonate. The ignition was performed in a tinned dish at a dull red heat so as not to fuse the dish which was heated until constant in weight. The residue to be pure sodium carbonate, the factors of the acids were obtained, but in all cases these were 1 per cent. too low as shown in Table I., and indicate the presence of hydroxide. Other factors in the absorption of moisture by the residue raise the factor. Similar results were obtained using pure bicarbonate in porcelain dishes, but the results were more variable and in all cases it was observed that the glaze of the porcelain was attacked by the alkali. In weight when purified bicarbonate is ignited in a tinned dish is always greater than one would expect on theoretical considerations, though the errors of weight should be on the other side. By using carefully dehydrated with lime and sodium, we have been able to extract caustic soda from ignited carbonate.

Table II. shows the factors obtained with so-called pure bicarbonate, as sold, the different specimens being

TABLE II.

Factors of Bicarbonate, as sold, Compared with Pure Bicarbonate.

Bicarb. No. 1.	Bicarb. No. 2.	Bicarb. No. 3.	Bicarb. No. 4.	Pure Bicarb.
1.039	1.036	1.042	1.043	1.051
1.084	1.082	1.092	1.088	1.094

obtained from widely different sources, and these factors compared with those obtained from purified bicarbonate.

The specimens on the market, it has been found, are very dry, and the errors in the factors, 1 per cent. on the average, are due to the presence of normal carbonate. Other impurities would give a different factor.

Purified bicarbonate, as sold, has also been compared with ignited bicarbonate subsequently dried in a vacuum or with phosphoric anhydride, and also with the bicarbonate after saturating with moisture and carbon dioxide, the specimen being afterwards dried in a vacuum desiccator with phosphoric anhydride. In all cases the bicarbonate increased in weight about 1 per cent. by saturating with moisture and carbon dioxide, and this method may therefore be made use of in determining the percentage of normal carbonate in samples of bicarbonate. The results are shown in the following table:—

TABLE III.

Ordinary "Pure" Bicarbonate.	Washed and Dried Bicarbonate.	Purified and Dried Bicarbonate.
1.039	1.032	1.051
1.084	1.077	1.095

The decrease in the factor by washing is accounted for by the increase in the amount of carbonate, produced by dissociation of the bicarbonate.

The use of dry purified bicarbonate possesses many advantages over other substances for preparing a standard acid. It is easily got in a state of purity, is perfectly stable in a dry atmosphere or in a closely-stoppered bottle, is non-hygroscopic, and, as the atomic weights of the constituent elements have been determined with great accuracy, it therefore readily lends itself to the production of an extremely accurate standard acid.

For technical work it is quite as accurate to standardise with the commercial bicarbonate as with ignited bicarbonate, and the tedious process of ignition may thus be avoided, but, if a correction of +0.01 be made in the factor obtained with commercial bicarbonate in standardising an approximately normal acid, a value will be obtained which is sufficiently near for all commercial purposes. It is advisable, however, in such a case to allow a weighed quantity to remain overnight in a sulphuric acid desiccator, in order to ascertain whether the sample is dry.

As it is possible, by the method which we have described, to prepare 100 or 200 grms. of the purified bicarbonate in a few days with little attention to the process, we recommend the preparation of the pure compound, or, in any case, the preparation of a small quantity from which the alkalinity of a larger specimen of ordinary bicarbonate may be determined, the latter being then kept specially for the standardisation of acid.

#### DISCUSSION.

Mr. T. FAIRLEY said Fresenius' method of igniting filter papers in a platinum wire coil separately from the precipitate would prevent reduction of barium sulphate. He could not see how this took place if the platinum vessel used was in an oxidising atmosphere during the ignition. A disadvantage of the gravimetric standardisation was the tendency barium sulphate had to carry down other salts with it. Assuming barium chloride to be used as the precipitant the minimum quantity necessary to precipitate the sulphuric acid should be used. After weighing, the precipitated sulphate should be boiled with dilute nitric acid, dried and reweighed, the solution being tested for chlorides.

Mr. W. McD. MACKEY advised the use of sodium bicarbonate as the standard for very accurate work. The barium chloride precipitation was so handy that technical chemists generally employed it, but it should be remembered that in sulphuric acid containing hydrochloric acid the barium chloride method of standardising would be inaccurate.

## Industrial Alcohol.

REPORT OF THE DEPARTMENTAL COMMITTEE ON INDUSTRIAL ALCOHOL TO THE CHANCELLOR OF THE EXCHEQUER.

Presented to Parliament, 11th April, 1905; issued 15th April, 1905.

By permission of the Controller of His Majesty's Stationery Office.

#### TERMS OF REFERENCE.

To inquire into the existing facilities for the use, without payment of duty, of spirits in arts and manufactures, and to participate into the operation of Section 8 of the Finance Act, 1902, and to report whether the powers conferred upon the Commissioners of Inland Revenue by this section permit of adequate facilities being given for the use of spirits in manufactures and in the production of motive power, or whether further facilities are required; and if it should appear to the Committee that the present facilities are inadequate, to advise the further measures to be adopted, without prejudice to the safety of the revenue derived from spirits, and with due regard to the interests of the producers of spirits in the United Kingdom.

*Report.*

1. We have the honour to submit to you the following report of our proceedings and conclusions in connection with the inquiry, which, in August last, you invited us to undertake into the question of facilities for the use of spirit in arts and manufactures.

## INTRODUCTORY REMARKS.

2. In interpreting the terms of reference, we have considered that the main objects of our inquiry were to ascertain the extent to which alcohol is, or might be, employed in arts and manufactures, or in the production of heat, light, or motive power; and to determine conditions of greatest freedom that could be accorded to its use for those purposes, consistently with adequate safety to the revenue derived from spirit as an article of human consumption.

3. We have, therefore, confined our attention almost exclusively to these points: and have not attempted to deal fully with allied questions, such as possible changes in the methods of producing spirit, or in the materials from which it may be obtained, or such as the actual or possible sources of supply. These questions, important as they are in themselves, seemed to us somewhat remote from the purpose immediately in view; and their investigation would have unduly enlarged and prolonged our labours.

4. We did, however, for special reasons, take some evidence on the question of the production of spirit from potatoes: enough to satisfy us that in the present agricultural conditions of this country it would not be possible to found a profitable industry on the employment of potatoes as a material for distillation.

5. In order to obtain evidence, we addressed ourselves to the Association of Chambers of Commerce of the United Kingdom, and to the Chambers of Commerce of London, Liverpool, Manchester and Birmingham; and the majority of witnesses examined by us were gentlemen selected for us by those bodies, as representatives competent to speak on behalf of the several industries in which alcohol is, or might be, employed. Of the rest, some came at their own request, while others came on our direct invitation. In addition to oral evidence, much information was laid before us in the form of memoranda prepared for us by the Board of Inland Revenue, in regard to the regulations in this and other countries governing the use of spirit for industrial purposes, as to the quantities of spirit so used, and as to the Rules and Regulations laid down by the Board of Inland Revenue under the Act of 1902. These memoranda are printed as appendices to the evidence. Lastly, as in the evidence of certain of the witnesses who came before us much stress was laid upon the system and regulations established in Germany in connection with the industrial use of alcohol, we felt it was very desirable to procure information at first hand upon that subject; and we accordingly obtained your authority to send a deputation to Germany for that purpose. The report of this sub-committee is annexed in immediate continuation of this report.

## CONDITIONS GOVERNING THE USE OF SPIRIT FOR INDUSTRIAL PURPOSES.

6. The use of methylated (denatured) spirit duty-free was first authorised in 1855 by the Act, 18 & 19 Vict., c. 38. The present law on the subject is contained in the Spirits Act, 1880, as amended by the Customs and Inland Revenue Act, 1890, and Section 8 of the Finance Act, 1902.

7. The practice resulting from the law has been as follows:—

Up to the year 1855, spirit could not be used duty free by the public under any circumstances. From 1855 to 1861 it could be used duty free for manufacturing purposes only, if methylated according to the prescribed process.

From 1861 to 1891 spirit could be used duty-free for any purpose other than consumption directly or indirectly as a beverage, or internally as a medicine, provided it was mixed with wood-naphtha, to the extent of one-ninth of its volume. But, if used in large quantities, as for manufacturing purposes, it

could not be purchased from a retailer of medicinal spirit, but only from a methylator, and the subject to Excise supervision.

From 1891 to 1902, the use of this kind of methylated spirit (which came to be described as "ordinary" or "methylated spirit") was confined to manufacturing purposes, subject to the same conditions as while for general purposes a spirit, consisting of pure spirit with an addition of 0.375 per cent. of mineral naphtha (petroleum), and known as "mineralised" methylated spirit, was brought into use. It is only in this spirit that retailers are permitted to deal.

Since 1902, the two kinds of methylated spirit continued to be used as before. But an alteration to their use has been opened to manufacturers, which spirits may be employed after being subjected to some special process of denaturing, applicable to that particular industry, or possibly even to other state, should circumstances be held by the Inland Revenue so to require.

8. Advantage has been taken of the Act of 1902 by a certain number of manufacturers. But, in examining witnesses who have come before us, we have been unable to find in some quarters a very inadequate acquaintance with its provisions, and much failure to appreciate its significance; and we are disposed to think that the beneficial effects of the Act have, on this account, been less widely diffused than they might have been. It is reasonably to be expected that, as a result of this inquiry, enterprising traders will more largely avail themselves of the provisions of this Act.

## HINDRANCES TO THE USE OF SPIRIT FOR INDUSTRIAL PURPOSES IN THE UNITED KINGDOM.

9. The "ordinary" methylated spirit is open to many objections as a material or instrument of manufacture. In a few cases it is unsuitable by reason either of its chemical properties or of the smell of the wood-naphtha it contains. But even where its character is not objectionable, it is still always open to this disadvantage, that it is somewhat heavily enhanced in cost as compared with pure spirit. For not only does the wood-naphtha added to it must be present to the extent of 10 per cent., but it also tends to make the spirit less efficient for the purpose in view than it would be if it were pure.

10. It was to meet these objections that legislation was undertaken in 1902; and, so far as they are concerned, we consider that Section 8 of the Finance Act of 1902 does all that is possible in respect of the character of the spirit. For it has entirely removed all difficulty in the procuring a spirit suitable in character for any industrial purpose. It has also to some extent mitigated the objection on the score of cost, inasmuch as the processes of denaturing authorised by the Board of Inland Revenue are commonly less expensive to the manufacturer than is the case with "ordinary" methylated spirit. On the other hand, the cost of these processes is added to the charges for Excise supervision.

11. But the cost of denaturing touches a part of the question of the price of the spirit used for industrial purposes. An influence on price, even more important than at an earlier stage of production of the spirit, is the conditions under which spirit can alone be manufactured in this country. The duty on spirit used as a beverage in the United Kingdom is very heavy, and imposing this duty it is essential to the protection of the revenue to impose on the manufacture of spirit such restraints as may be necessary to prevent any spirit escaping payment of duty; and a consequence of these restraints must be to cause an appreciable enhancement in the cost of manufacture. What the measure of this enhancement may be is not susceptible of precise determination; and even an approximation to it can only be reached by persons with a minute and practical knowledge of all the details of manufacture and of trade on the one hand, and of what is required for the protection of the revenue on the other. We have, therefore, not attempted to investigate all the elements that enter into the



but have accepted the figures that have been established by law and practice as applicable to the present on. These figures will be found in Appendix No. 1, or with a full explanation of the manner in which have been reached. For our purpose it is sufficient that they may be taken as representing an enhancement of the cost of producing plain British spirits by 2d. per proof gallon, or an increase of about 50 per cent. cost that would otherwise prevail in the production of industrial alcohol. It is patent that producers thus red could not hope to compete successfully, either at home or in foreign markets, against rivals not hampered, unless some counterpoise were added to the burdens that fiscal restrictions impose on them. Accordingly, the law does provide such a poise—in the case of the home market, by making the duty on imported spirits exceed the duty on British spirits by an amount equivalent to the burdens on the home market—this is called the “surtax”—and in the case of foreign markets, by granting to the home producer a rebate calculated on the same basis. These export rebates are at the rates of 2d. per proof gallon on plain spirits and 5d. per proof gallon on compounded spirits, which is the higher of these two allowances that is taken as determining the measure of the “surtax” on all other spirits other than rum or brandy, on which the “surtax” is 4d. per proof gallon. The final result is that the price of industrial spirit of all the measures taken to protect the revenue may be stated as follows. Spirit of manufacture is commonly about 64 overproof (93 per cent. on the continental standard of pure spirit), and is plain spirit. Therefore, the price of a bulk of the spirit is about 5d. more than it would have been but for Excise restrictions. The cost of methylated spirit may be put at between 3d. and 4d. per bulk gallon, of the price eventually paid by the manufacturer, at present may be taken at from 20d. to 22d. per bulk for large quantities at wholesale price, about 8½d. butable to precautions on behalf of the revenue. The two considerations (a) of the conditions in which spirit must be used, and (b) of the price at which it may be procured, affect different industries in very different degrees. Either consideration may be of vital importance to a particular industry. But, speaking generally, we have no hesitation in saying, on the evidence at hand, that, taking the whole range of industrial enterprises employing alcohol, the question of price is infinitely more important of the two. The number of cases in which it has been conclusively shown that ordinary spirit is seriously detrimental by reason of its use, are remarkably few, whereas the cases are numerous in which a difference of, say, 6d. per bulk gallon in the price of alcohol might make all the difference in profit or loss in the carrying on of an enterprise. To illustrate this, we will briefly review the evidence before us in respect of some of the more important industries employing alcohol, and in doing so will include general observations as occur to us.

#### COAL TAR COLOUR INDUSTRY.

We take this first because it has figured very prominently in the discussions which have led up to the inquiry. In the course of these discussions, it has frequently been asserted that the coal tar colour industry, which originated in this country, and at one time flourished in this country, has been lost to us very largely, mainly, by reason of the obstacles in the way of a prompt and untrammelled supply of alcohol. In view of the prominence given to this assertion, we thought it well, even at the risk of travelling somewhat beyond the immediate purpose of our inquiry, to procure authentic information upon the subject. With that object we invited our learned friend, Dr. W. H. Perkin, the discoverer of the first coal tar colour, Mr. R. J. Friswell, who was engaged in the manufacture of aniline dyes from 1889, and Professor Meldola, who was similarly engaged from 1870 to 1885, and to whose memorandum we led to his evidence we desire to call special attention. We also before us, as a witness nominated by the Chamber of Commerce, Professor A. G. Green,

whose name is associated with a well-known work on organic colouring matters. Further, our Sub-Committee that visited Germany had an opportunity of learning the views of many persons connected with the colour industry in that country.

15. On a review of all the evidence, pro and con, we are satisfied that, regarded as a statement of historical fact, the assertion that the coal tar colour industry has been lost to this country on account of obstacles to the use of alcohol is destitute of substantial foundation.

16. In the earlier days of the industry alcohol was used almost wholly as a solvent, and for that purpose methylated spirit is suitable. Moreover, when alcohol first began to be used as a constituent of dyes, and until some time after the decadence of the industry in this country had become marked, the margin of profit on the manufacture was so great that the difference in price even between duty-free and duty-paid alcohol was a matter that could practically be left out of consideration.

17. It would take us too far afield to examine at length into the causes that did, in fact, contribute to the decadence of the industry in this country and to its rapid development in Germany. But much information on the subject will be found in the evidence, and here we will confine ourselves to saying that, in our opinion, the cause which predominated over all others was the failure of those responsible for the management and for the finance of the industry here, during the years 1860—1880, to realise the vital importance of its scientific side, and their consequent omission to provide adequately for its development on that side.

18. But while we say this in the interest of historical accuracy, it by no means follows that either we, or the authorities we have quoted, think that what was true of the period 1860—1880, is true of the present time. On the contrary, it is unquestionable that, in some branches of the colour industry, with alcohol playing a considerable part as a constituent of certain dyes, and with profits cut down by competition to a narrow margin, the circumstances under which, in respect of condition and of price, alcohol can be used, have become of importance. But here too, it is necessary to guard against exaggeration. Large classes of the coal tar colours—alizarin, indigo, and by far the greater number of the azo dyes—require no alcohol for their manufacture either directly or indirectly, and these represent by far the larger proportion of all the colours produced. We have had varying estimates given to us of the proportion of the whole output that demands alcohol, and they range from the 10 per cent. of the German authorities to the 20 per cent. to 25 per cent. of Professor Green. Therefore, for at least 75 per cent. of the whole industry, alcohol does not enter into account even now, and these branches could be prosecuted in this country, as indeed they now are, whatever the conditions in regard to the use of alcohol might be.

19. Nevertheless, even where alcohol is not immediately required for the manufacture of a dyestuff, the utilisation of waste products and the development of new methods may be hampered by a want of alcohol; while, for those dyestuffs for which alcohol is essential, its price and the conditions of its use are matters of great moment. We are of opinion, therefore, that, if the hope is to be entertained of recovering any considerable portion of this trade, more favourable conditions must be established in respect of the use of alcohol.

20. We may observe that in the manufacture of dyestuffs, or of the intermediate products for their manufacture the part played by methyl alcohol is far more important than is that of ethylic alcohol. Methyl alcohol is not produced by fermentation and it was not until the process of its manufacture was so far perfected as to bring it into possible competition with ethyl alcohol that it was thought necessary to subject it to the charge of the spirit duties. This was done by an Act of 1865; and in 1898 its use was prohibited in the preparation of beverages or of medicines for internal use. (28 & 29 Vict. c. 96, ss. 27, 28.) Its chemical character differs so much from that of ethyl alcohol that its presence in any product can readily be detected by analysis. In view of these facts, we think that exceptional treatment may be accorded to methyl alcohol, in the manner described later.

## SMOKELESS POWDERS.

21. On the question whether in this industry ordinary methylated spirit is unsuitable or detrimental in character the evidence laid before the Committee appears to us conflicting and inconclusive. We are inclined to think that the true position is that the question has never been thoroughly sifted. As Sir W. Crookes put it to us, it is known that very slight chemical variations in the materials employed may produce very marked variations in the quality of the powder produced, more especially as regards its stability; to determine whether the chemical composition of ordinary methylated spirit (or of methylated ether) would or would not affect the stability or other properties of a powder, would demand costly experiments extending over many years; and there has not been any sufficient inducement to undertake such experiments. The Act of 1902 still further diminishes the inducement, and all the more so because there is probably no single industry in which exceptional advantages as regards the use of spirit could be accorded with less risk to the revenue. The workmen employed are of necessity men of steady and trustworthy character; they are subject to the strictest supervision; and the manner in which spirit enters into the process of manufacture gives but little opening for speculation.

22. But the question of the price of spirit and ether is one of vital importance to the manufacturer of smokeless powder of which nitro-cellulose is a constituent.\* The quantity of alcohol used, either directly in the form of spirit, or indirectly in the form of ether, for the production of one pound of this powder is very large. What the exact amount may be it is difficult to determine, because so much depends upon the amount of spirit that may be recovered from any operation, and this varies as between one operation and another, and as between one factory and another. But one witness gave us to understand that a difference of 6d. per gall. in the price of spirit would make a difference of 7d. per lb. in the cost of the powder produced; and it is manifest that even a much smaller difference than that would turn the scale between profit and loss.

## PHARMACEUTICAL PRODUCTS—FINE CHEMICALS.

23. In this branch of industry alcohol plays a very important part. In Section 4 of our Sub-Committee's report, the subject is very fully treated, and we will not here repeat what is there stated. We will merely observe that for a large, and probably increasing, number of substances, such as the synthetic perfumes, antipyrine, phenacetin, sulphonal, and so on, alcohol at a price not in excess of that at which it stands in competing countries, and usable under conditions not inimical to the quality and character of the compounds produced, is essential to the existence of the industry. The industry presents certain features of difficulty because, in the first place, there are large numbers of pharmaceutical preparations in which the alcohol remains as free spirit, and which must continue to be made from duty-paid spirit; and because, in the second place, the preparations are so numerous and so various in character that there are difficulties in making a single process of denaturing applicable to them all. But these difficulties have been satisfactorily overcome in Germany, and we see no reason why they should not be overcome here. We are, however, of opinion that the manufacture of synthetical chemical products with duty-free alcohol would have to be completely and effectually separated from the manufacture of preparations (as, for example, tinctures) in which the alcohol remains as such, and which, therefore, must be made with duty-paid spirit.

## ETHER.

24. The production of ether has become a most important industry, large quantities being required for manufacturing purposes (e.g., smokeless powder, artificial silk, &c.) and for refrigerating purposes. For most,

if not for all of these purposes, ether made from methylated spirit is quite suitable. But, inasmuch as it requires much more than a gallon of strong spirit to produce a gallon of ether, the price of spirit is now a consideration of primary moment to this industry. Incidentally we may mention that, in the course of the evidence, the question was raised whether the rates of import duty on ethers are the correct equivalent of the duty payable on the spirit necessary to them.

## ARTIFICIAL SILK.

25. This industry is not at present prosecuted in this country, although it employs many thousands of people on the Continent. Some five or six years ago an attempt was made to introduce it, and a factory was established at Wolston, near Coventry, but after being nearly two years (1899—1900), it was closed. At that time the Excise authorities had no power to allow the use of spirit in any other form than that of ordinary methylated spirit, and in the opinion of Mr. C. J. Fox, who was chairman of the company from its formation until some six months before it was wound up, and who attended as a witness before us, the obligation to use methylated spirit was one of the causes of the failure of the enterprise. The evidence on this point is not conclusive. But it is unquestionable that the operation of manufacture in this industry are extremely costly, and that the difficulties to be overcome are in a great measure inevitable. To add to the difficulties, the use of methylated spirit is most undesirable; and, therefore, if using methylated spirit creates a fresh difficulty, it should by all means be avoided. For the manufacture of artificial silk, the use of alcohol is a consideration of vital importance combined with ether and spirit required to produce one of the finished articles represents nearly a gallon of spirit.

## LACQUERS, VARNISHES, ETC.

26. These are usually made with the ordinary methylated spirit, where spirit enters into the manufacture (spirit is not required for lacquers that are applied to wood). In a few rare cases pure duty-paid spirit is employed for the finest kinds of lacquer. On the question whether the use of methylated spirit is detrimental to the character of the product, the evidence submitted to us was conflicting, some witnesses insisting that it is detrimental, and others representing a considerable section of the trade insisting that it is not. Specimens of goods treated with lacquer made with pure spirit, with ordinary methylated spirit, and with wood naphtha respectively, were shown to us; and we are bound to say that any difference between them was scarcely perceptible to the untrained eye.

27. However this may be, we consider that the use of methylated spirit for lacquers, under the existing conditions, creates a serious hindrance, and perhaps, for goods exported. For in the home market the trade enjoys a considerable measure of protection, owing to the fact that imported lacquers and varnishes containing spirit are charged full spirit duty on the quantity of spirit contained.

## MOTOR VEHICLES.

28. Spirit is not used at present in this country as fuel for motor vehicles. Nor is it so used to an extent either in Germany or in France, in spite of the fact that both these countries are most desirous of encouraging the use of a material that is indigenous, in preference to a material like petrol that has to be imported. In France spirit is used for motor or other engines in those cases where it is almost entirely for agricultural engines. For motor cars, spirit presents certain special difficulties, which require to be overcome, the principal being the brittleness of alcohol in very cold weather, and the tendency of acids generated by its combustion to cause corrosion of the metal surfaces with which they come in contact.

29. For the moment, therefore, the question of the use of spirit for motor cars is not ripe for consideration. The point of view of our inquiry. Should it be

\* It is an open question amongst the authorities whether the powder of the future will be one requiring alcohol for its preparation.



so, it is manifest that alcohol used for this purpose is denatured in the most effectual and most permanent manner. Happily this will not present any difficulty, as there is no evidence to suggest that the use of methylated spirit in common use in this country is in any way unsuitable or detrimental for this purpose. Any question, therefore, of the use of spirit for industrial purposes will be one of price, and as at present the price of petrol is about half the price of methylated spirit, it is clear that close investigation of the matter may be required until such time as there may be an approximation of the prices of petrol and spirit sufficient to make a practical alternative of choice between the two.

#### GENERAL CONCLUSIONS.

In all the facts before us we have arrived at the following general conclusions:—

i.) That where spirit is used for general and various purposes, such as heating or lighting, the use of "mineralised" methylated spirit is perfectly satisfactory, both to the revenue and to the public, in respect of character, and that at present no better method of denaturing is available. In respect of price, the cost of mineralised methylated spirit is enhanced by some 40 per cent. by reason of measures necessary for the protection of the revenue. But to intervene such enhancement would be merely to place the whole community of a burden in one direction by putting upon it an equivalent burden in another, seeing that the cost of relief would necessarily have to be made up to the Exchequer from some other source of taxation. Thus there would be no real increase of gain to the community as a whole from arrangements that would of necessity be somewhat complex, and would entail a certain cost in their execution. We think, however, that, having regard to the practical security that is provided for the revenue by the process of denaturing adopted in the case of this spirit, the regulations in regard to taxation might be appreciably relaxed in respect of the quantities that retailers may keep in stock, or may sell at any one time to a customer. We recommend that the regulations should be left to be prescribed from time to time by the Board of Inland Revenue, instead of being stereotyped in the Statutes.

ii.) That where spirit is used for industrial purposes, the Finance Act of 1902 provides adequate and entirely satisfactory machinery for securing that the spirit may be used in a condition that is suitable and appropriate to each particular purpose of manufacture. The machinery is elastic—much more so than is the corresponding machinery in Germany—but it permits of every reasonable process of denaturing, or even, in the last resort, of the use of spirit in a pure state. For more than this it would be impossible to ask.

iii.) That something more is required in order to secure spirit used as an instrument or a material of manufacture on a footing satisfactory in the matter of cost. Anything in the nature of a bounty is desirable. But seeing that on the price of spirit the very existence of certain industries may depend, and that for all industries using alcohol the price of spirit is an important factor for that portion of trade that is outside the home market, we are strongly of opinion that it is desirable to make such arrangements which will free the price of industrial spirit from the enhancement due to the indirect influence of the spirit duties. It would surely be disastrous if, to the chief that the drinking of alcohol causes by diminution in the efficiency of labour, the taxation of alcohol should be allowed to add the further mischief of narrowing the openings for the employment of our

In our opinion, there is only one way in which the price of the spirit duties can be satisfactorily counterbalanced in favour of industrial alcohol. To diminish the restrictions on the manufacture of alcohol might be to increase the influence, but probably not to any great extent. For with a duty of over 1000 per cent. on the

prime cost of an article, revenue control must of necessity be strict. Moreover, the gain to industry would be made at the risk of the revenue, and a duty that yields over 20,000,000*l.* per annum to the Exchequer is a public interest that cannot be trifled with. To relieve imported spirit from the surtax which is needed to counterbalance the burden imposed on production in this country by the Excise regulations would be manifestly unfair; and its effect would be to give to the State-aided spirits from Germany or Russia a practical monopoly of the market in this country for industrial spirit. The only adequate course, it seems to us, is to neutralise, for industrial spirit, the enhanced cost of production due to Excise control, in the same way as the enhanced cost is neutralised for exports, *viz.*, by granting an allowance on such spirit at such rate as may from time to time be taken as the equivalent of the increase in cost of production due to revenue restrictions. At the present time, the rate is taken at 3*d.* per proof gall. for plain spirits, and the allowance would accordingly be at this rate, and should be paid equally on all industrial spirit whether it be of British or of foreign origin.

33. We do not suggest that the cost of methylation should be borne by the State, although a strictly logical application of the principle of attempting to put industrial alcohol on the footing that it would occupy, if there were no duties on spirit, might seem to require this further concession. For we hold that the manufacturer using alcohol has so strong an interest in rendering it unpotable for his own protection that he may fairly be asked to accept denaturing as a necessary incident of use, the cost of which he should bear.

34. At the same time we think that the charge on the manufacturer might reasonably be limited to paying the cost of the denaturing agents and of the mixing of them with the spirit; and that he should not be required to pay the cost of regular attendance of the Excise officers, which is given wholly in the interests of the revenue. Attendances at irregular times, at the special request and for the special convenience of the manufacturer, might, if necessary, continue to be charged against him.

35. We think that for ordinary methylated spirit (which will continue to be used for many industrial purposes for which it is not, in the words of the Act of 1902, "unsuitable or detrimental") the formula of methylation may safely be modified, and the proportion of wood naphtha reduced, so that the mixture may consist of ninety-five volumes of spirit to five of wood naphtha. This will at once somewhat cheapen the methylated spirit, and will also diminish any prejudicial effect that the chemical properties of wood naphtha may have for certain manufactures; while it will continue to "carmark" the spirit sufficiently to allow of detection by analysis, should the methylated spirit be used for any improper purpose. It must be remembered that this kind of methylated spirit can only be used by persons holding an authority from, and under heavy bond to, the Commissioners of Inland Revenue (whereby its employment is subject to control and supervision, which can be graduated according to circumstances), and that consequently the risk of fraud is limited.

36. We have mentioned that we think that methylic alcohol used for industrial purposes, might be accorded special treatment. We understand that the Board of Inland Revenue do not consider that it would be safe to revert to the position obtaining before 1866, when methylic alcohol was regarded as wholly outside the scope of the spirit duties; and their opinion receives support from the fact that in France the law has recently been altered so as to define more precisely the degree of purity which shall render methylic alcohol liable to duty. The object we have in view can, however, be sufficiently met without taking methylic alcohol out of the charge for duty. It would meet all requirements in respect of methylic alcohol, if it were exempted from the condition of the proviso to Section 8 of the Act of 1902, which requires payment of the surtax on all imported spirit used for manufacture, and if the Board of Inland Revenue should exercise their discretion under the section in the matter of denaturing in such a way as to permit the use of methylic alcohol practically pure. This, we under-

stand, they would be willing to do; and exemption from the surtax would be fully justified, inasmuch as the manufacture of methyllic alcohol in the United Kingdom is not, in fact, subjected to any restrictions that enhance the cost of its production.

37. While making the concessions above described, we think it would be right, in the interests of the revenue, that special denaturing agents authorised for use in particular industries, should be subject to official test; and further that manufacturers who are authorised to employ specially denatured alcohol should be required to keep such books as may be prescribed, showing the receipts and issues of spirit, the manner in which it has been distributed to the several branches or departments of the factory, and the quantities produced of the articles manufactured with it.

38. We believe that the recommendations we have made, if adopted, will place the manufacturers of this country in respect of the use of alcohol in industry on a footing of equality, in some respects of advantage, as compared with their competitors abroad. Amongst the witnesses who appeared before us, we found a very general impression that, in Germany at any rate—and Germany is our most formidable competitor in this field—spirit could be used in manufacture duty-free and pure, with scarcely any restraint. This is very far from being the case, as the report of our Sub-Committee shows. As regards price, the grant of the export allowance would, we believe, make the average price of industrial spirit in the United Kingdom even lower than the average price in Germany. The price, exclusive of the cost of any denaturing, would, under present conditions, be about 7d. the proof gall., or about 11½d. the bulk gall., at 64 over proof—the strength common in industrial spirit. That is as low as the minimum price paid by users in Germany in the year 1902, when spirit was abnormally low, and is much below the figures of 1s. 3½d. per proof gall., and of 2s. 1½d. per bulk gall. prevailing in Germany at the present time. Further, the price of spirit in this country, where all materials may be freely used, and where none of general use are subject to taxation, is a stable price. In Germany the conditions of production tend to wide and rapid fluctuations in price.

39. At the same time, it would be a mistake to suppose that any facilities given for the use of spirit in this country are likely to create such an increased demand for spirit as to produce any shortage of supply, and so to lead to a rise in price. This point is fully discussed in Section 9 of our Sub-Committee's Report, and we see no reason to dissent from the conclusion that any increase in the demand for industrial spirit must for a long time to come lie well within the limit of 3½ millions of proof galls. This estimate serves also to assign a limit within which the charge to the Exchequer, resulting from the proposed allowance of 2d. per proof gall. on industrial spirit, will be confined. The present consumption of such spirit is about 3½ million proof galls., on which the allowance would aggregate 40,000l. The utmost expansion that can be regarded as attainable within a measurable distance of time would double that sum, and it may safely be assumed that any immediate expansion will be moderate and gradual.

40. For convenience of reference we summarise our several recommendations:—

(i.) That an allowance be granted to all industrial spirit, whether of British or foreign origin, at the rate from time to time prevailing for the allowance to British plain spirits on export.

(ii.) That imported methyllic alcohol be relieved from the obligation to pay the surtax imposed by the proviso to Section 8 of the Finance Act, 1902; and that methyllic alcohol be accorded favourable treatment in the matter of denaturing.

(iii.) That "ordinary" methylated spirit should contain only 5 per cent. of wood naphtha, instead of 10 per cent.

(iv.) That no charge should be made on manufacturers for the regular attendance of Excise officers to supervise denaturing operations or the use of denatured spirit, in factories taking the benefit of Section 8 of the Finance Act, 1902.

(v.) That where spirit is allowed to be dealt with special agents such agents should be subject to official test and approval; and that accounts be kept by the user showing receipts of spirit from store, the issues thereof from store in detail, and the quantities of goods produced.

(vi.) That in the manufacture of fine chemical and pharmaceutical products, spirit specially denatured should be allowed only where the manufacture is kept entirely separate from the manufacture of tinctures and other preparations in which spirit remains as spirit in the finished product.

(vii.) That the regulations governing the retail of mineralised methylated spirit should be made less stringent and more elastic.

Any special cases, such as that of smokeless powder, not touched by the above recommendations, can be met under the powers conferred by Section 8 of the Finance Act of 1902.

41. In concluding our report, we desire to express our indebtedness to our Secretary, Mr. E. C. Cunningham, whose service in that capacity has been of great value to the Committee.

We have the honour to be, Sir,  
Your obedient servants,

H. W. PRIMROSE,  
WILLIAM CROOKES,  
W. H. HOLLAND,  
JOHN SCOTT MONTAGU,  
WM. SOMERVILLE,  
T. E. THORPE,  
THOMAS TYRER,  
E. C. CUNNINGHAM (Secretary).

March 23, 1905.

#### ABSTRACT OF THE REPORT OF SUB-COMMITTEE ON VISIT TO GERMANY.

The Sub-Committee consisted of Sir H. W. Primrose, K.C.B., Chairman of the Board of Inland Revenue, Dr. T. E. Thorpe, C.B., F.R.S., Head of the Government Laboratory.

We have the honour to report that we left London on the morning of January 14th, returning on the 26th.

We spent six days in Berlin, and while there, we received the most cordial and unremitting attention from the German authorities. Through the kindness of the German Consuls-General in London, Mr. von Buchka, and through our Ambassador, we had been referred to the Imperial Treasury, and we were able to record our sense of the very great obligation which we feel to those gentlemen.

From Berlin we went on to Heidelberg and Darmstadt, returning through Cologne.

We give the result of our inquiries in full detail in our report, sections relating to the several heads. The outline of the main results may be briefly summarised as follows:—

(1.) That the German system, in regard to the use of spirit for industrial purposes, is correctly stated in Appendix No. III., as laid before the Committee.

(2.) That this system, while designed on liberal and comprehensive lines, is rigidly enforced, and allows of few exceptions in practice to the rules as laid down. The only exception is in the case of smokeless powder, which can be manufactured in Germany with duty-free spirit, unless it be subjected before use to some process of denaturing.

(3.) That the rules can only be varied by authority of the Bundesrath, or Federal Council of the Empire, and that procedure that demands considerable time.

(4.) That the price of spirit in Germany for industrial purposes fluctuates very widely; that at the present time it is considerably higher than the price of similar spirit in this country; and that in normal years its price is not as much below the price in this country as the Committee have been led to suppose.

(5.) That the consumption of spirit in Germany for domestic and industrial purposes affords no standard.



to measure the possible consumption for similar cases in the United Kingdom.

## SECTION 1.

### Official Regulations.

whole of our first day in Berlin we spent in going through the published official regulations as of spirit duty-free for industrial and other purposes. Dr. von Buchka, the head of the chemical branch of the department.

result we were enabled to state that the abstract of regulations as given in Appendix No. III. is perfectly correct, and that practice conforms exactly to the regulations.

Accordingly the rules and practice of the German law may be briefly described as follows:—

Spirit may be used duty-free in a pure, undenatured state in a very limited number of cases, *viz.*:—

- (a.) In public, *i.e.*, State, or municipal, hospitals;
- (b.) In similar scientific institutions;
- (c.) For making smokeless powder, fuses and fulminates.

For all other purposes, without exception, duty-free spirit must be used, *unless* the spirit be subjected to the authorised process of denaturing prior to use.

The authorised processes of denaturing fall into two classes, according as they result in:—

- A. Complete Denaturing.
- B. Incomplete Denaturing.

The processes authorised for "Complete Denaturing" are two, *viz.*:—

- (a.) An admixture with every 100 litres of spirit  $2\frac{1}{2}$  litres of a mixture containing 4 parts of wood naphtha and 1 part of pyridine bases. (To this mixture 50 grms. of lavender or rosemary oil may be added optionally, to counteract the smell of the pyridine bases. But the addition is seldom made.) Spirit thus denatured is what is used for domestic purposes—heating, lighting, and cooking. It is also used for industrial purposes. The only purpose of that kind for which its employment is considerable is the manufacture of cheap varnish.
- (b.) An admixture with the spirit of half the quantity (*viz.*,  $1\frac{1}{2}$  litres per 100 litres of spirit) of the above denaturing mixture, together with an addition of  $\frac{1}{2}$  litre of a solution of methyl violet dye and of benzol in quantities that may range from 2 to 20 litres every 100 litres of spirit.

Though spirit thus treated is classed as completely denatured, its use is limited to agricultural and motor purposes, and the process would seem to fall more properly under B.

Spirit thus denatured is used in practice almost exclusively for agricultural engines, as no satisfactory solution has yet been found of certain difficulties which beset the use of spirit for motor cars.

The processes authorised for "Incomplete Denaturing" are numerous. They consist—

- (a.) Of two alternative processes of general application, *viz.*:—The addition to every 100 litres of spirit of either 5 litres of wood naphtha, or  $\frac{1}{2}$  litre of pyridine bases.
- (b.) Of numerous processes of special application.

These are fully set out in an Appendix. But the processes applicable to the most numerous and most important purposes, including coal tar colours and chemical preparations, are the four alternatives of—

An addition to every 100 litres of spirit of 10 litres of sulphuric ether, or 1 litre of benzol, or  $\frac{1}{2}$  litre of turpentine, or 0.025 litre of animal oil.

We may observe that the above regulations are applicable only to ethyl alcohol. Methyl alcohol does not fall within the charge to spirit duty in Germany, and is used freely for industrial purposes, without control by the revenue authorities.

(7.) The schedule of authorised denaturing agents cannot be varied by the Executive. Any amendment of it, or addition to it, must be sanctioned by the Bundesrath, or Federal Council of the Empire; and the procedure for obtaining such sanction occupies many months, probably never less than six.

We add from our notes a few general observations and others bearing upon points referred to by witnesses who have given evidence before the Committee.

(i.) The rules are strictly enforced and no exceptions to them are allowed.

(ii.) The revenue authorities regard them as being as little stringent as is compatible with the safety of the spirit revenue, even with the present low duty on spirit. They considered that, if the duties were ever to be raised, it would be necessary to revise the regulations, and to make them less lenient in certain directions.

(iii.) The revenue authorities regard as a valuable safeguard to the revenue the obligation on manufacturers to keep "stock accounts" and "control books." They do not consider that it causes to manufacturers any serious difficulty or inconvenience.

(iv.) For lacquer-making a considerable quantity of wood naphtha denatured spirit is used in Nuremberg, Baden and Bavaria. Elsewhere turpentine is almost universally employed as the denaturing agent. No lacquers, polishes or varnishes can be made in Germany with pure duty-free spirit, or with admixture only of shellac.

(v.) *Photographic Collodion*.—It is the common opinion in Germany that the British-made collodion is better than the German.

(vi.) *Edible Oils*.—No special process of denaturing is prescribed for these. Therefore the general incomplete denaturing agents must be used, *i.e.*, wood naphtha, or pyridine bases—see above 5 (a.)

(vii.) All alcohol-containing medicines must now be made with duty-paid spirit, even veterinary medicines. The privilege of using pure undenatured duty-free alcohol for such purpose was taken away in October, 1903.

(viii.) Tinctures are not allowed drawback on exportation, unless manufactured under Excise supervision (in bond).

No drawback, or allowance in the nature of drawback, is given under any circumstances in respect of articles manufactured with denatured spirit.

## SECTION 2.

It was our desire to see the working of the system in factories typical of as many of the principal industries using alcohol as it might be possible for us to visit without unduly extending the period or the circuit of our tour. We failed, however, to accomplish this object in respect of factories for the production of synthetic perfumes, of varnish, and of coal tar colours. for the following reasons:

### Synthetic Perfumes.

Dr. von Buchka very kindly addressed, on our behalf, the firm of Messrs. Schimmel, of Leipzig, the principal manufacturers in Germany of synthetic perfumes. But those gentlemen informed him that it was against the rule of their establishment to admit visitors, and that they regretted that to this rule they could make no exception.

### Varnish.

This industry is not carried on to any great extent in Berlin. But Dr. Wittelschöfer, managing director of the Centrale für Spiritus Verwerthung, kindly made efforts, on our behalf, to obtain admission to the one important establishment of the kind in the city. Owing, however, to the absence of the principal partners, there was no one who possessed the requisite authority to give permission for our visit during the days we were in Berlin, and we did not think it worth while to prolong our stay for the purpose of obtaining an opportunity, as the facts and position in regard to lacquer and varnish are so clear as not to demand any further special elucidation.

### Coal Tar Colours.

Before leaving England, Dr. Thorpe had addressed to Dr. Glaser—a personal friend of his, and a former director (now a member of the Advisory Committee) of the *Badische Anilin und Soda Fabrik* of Ludwigslagen—a request that we might be permitted to visit that establishment. The directors felt some difficulty in acceding to this request. They, however, deputed Dr. Ehrhardt, one of their chemists, to wait upon us at Heidelberg with Dr. Glaser, in order to explain their position, and to give us such information as he properly could in regard to the special subject of our inquiry. We, accordingly, had the advantage of a conversation of some two hours' duration with him and Dr. Glaser together, and from our notes of it we abstract the following items.

Dr. Ehrhardt felt great difficulty in offering an opinion as to the proportion of coal tar dyes, whether by way of value or of quantity, which require the use of alcohol in their manufacture, but was inclined to accept as probably correct an estimate which had been given to us in Berlin by a very competent authority, and which placed the proportion at 10 per cent. of the whole. He observed that indigo and alizarine, neither of which requires the use of alcohol, would account for at least one-half of the production of the *Badische Fabrik*. In addition there was the large class of azo colours which made up a large proportion of the rest of the colouring matters made by the company, and of which only a very few individuals require alcohol.

Asked whether, in these circumstances, it might not be possible to engage profitably in the manufacture of the 90 per cent. of dye stuffs that need no alcohol, while neglecting those that required alcohol, Dr. Ehrhardt remarked that such an enterprise would be at a disadvantage as regards the by-products, for the profitable utilisation of which research, demanding alcohol, was necessary.

On the question of the proportion that the cost of alcohol bore to the total cost of production of coal tar colours, Dr. Ehrhardt felt unable to offer an opinion; but he regarded as quite possible an estimate of  $\frac{1}{2}$  per cent. which had been given to us in Berlin by the authority previously mentioned.

Duty-free alcohol in a pure state is not allowed under any circumstances, not even in the laboratory.

The denaturants employed by the *Badische Fabrik* are animal oil, pyridine, and sometimes the colour to be manufactured.

The importation into Germany of English-made colours or intermediate products is small and is confined to a few specialities.

The total number of persons employed in the *Fabrik* is between 7,000 and 8,000, of whom a large number are boys; no women. Of these only a very few could ever have access to the spirit used, at a stage at which it might conceivably be drunk, and these few would always be under supervision.

There is no particular tendency at the *Fabrik* to avoid the use of alcohol, the restrictions not being found seriously burdensome.

On the general question of the causes which have led to the great development of the coal-tar industry in Germany and its decline, or at any rate, its stagnation in Great Britain, we had much interesting talk with Dr. Glaser and Dr. Ehrhardt, and also on the following day at Mannheim with Dr. Caro, who may be regarded as one of the principal founders of the industry in Germany. They all agreed that, as an historical fact, the question of alcohol had little or nothing to do with the matter. Dr. Caro pointed out that the movement had begun, and had reached a point of considerable advancement, before the time at which the use of alcohol otherwise than as a solvent—a purpose for which methylated spirit is perfectly suitable—had been appreciably developed, and before the time at which reduction in the selling price of dyestuffs through competition had rendered economy in production of serious importance.

In Germany the rise of the industry coincided with an immense development of activity in the study of organic chemistry and in its application to industry, stimulated

largely by the influence of Kekulé, his coadjutors and immediate followers. Dr. Glaser gave it as his opinion that Kekulé's conception of the chemical structure of benzol was the germ out of which has grown the colour industry. The output of chemists by the German Universities was relatively enormous, and has continued to be so for the past forty years, and the services of competent chemists became obtainable at salaries of more than £100 per annum. Consequently, they were able to be employed by hundreds to act practically as foremen in the industry, and the whole of the subordinate supervision was in the hands of scientifically trained men. This was of great advantage to the business of manufacture, and at the same time it provided a large field from which to select more competent men for the work of research and invention; and those thus advanced were a leading part in the management and in the profitable business.

Nothing of the kind was possible in England at that time.

At the same time, these gentlemen all recognised that as things are at the present day, when alcohol so largely enters into the composition of colouring matters, when the profits on the manufacture of coal tar dye intermediate products have been cut down by competition to a narrow margin, the question of alcohol, of the extent to which it can be procured, and of the facilities for its employment—has become a matter of great and of cardinal importance.

[SECTION 3 is devoted to a description of the process of complete denaturing.]

## SECTION 4.

### Pharmaceutical Products—Fine Chemicals.

As is well known, Germany has long enjoyed an eminence in the manufacture of the products generically as "fine" chemicals, in contradistinction to "heavy" chemicals such as the mineral acids, bleaching powder, alum, &c., mainly inorganic substances which hitherto have been the chief staple chemical products of this country. Germany too has made almost exclusively the now numerous pharmaceutical products, which are definite organic compounds, often of complex chemical constitution, largely obtained by synthetic processes and which may be said to depend upon the industrial application of the laboratory processes and methods of modern organic research.

As it is frequently alleged in this country that the eminence is largely, if not entirely, due to the comparative cheapness with which ordinary alcohol pure and suitably denatured, is obtained by chemical manufacturers in Germany, it was of great importance to our inquiry to obtain trustworthy first-hand information on the subject.

We accordingly solicited permission to visit the establishments of E. Merck, in Darmstadt, and of the *Chemische Fabrik Auf Actien* (vorm. E. Schering) at Berlin—being these as among the most representative and most comprehensive manufacturing establishments of these particular classes of products, and to have the opportunity of conferring with those responsible for their direction and management. Both factories have a world-wide reputation and branch houses or agencies in almost every country in the world.

Permission was readily granted in each case, and facility was afforded to us to acquire information on a special subject of our inquiry, and to see operation involving the use of alcohol, its custody and control, methods of denaturing, processes of recovery, revenue checks. We cannot too gratefully acknowledge the courtesy which we were received, the readiness with which information as we could reasonably ask for was given, the freedom with which illustrative or typical processes of some of them unique, were exhibited and explained.

Whilst at Berlin, we were invited by Dr. Botting of the well-known Bayer Company, to visit the large factory at Leverkusen, but as we were at the



informed that they do not use or denature any spirit verkusen, we were reluctantly obliged on account of short time at our disposal, to decline the opportunity of seeing what Professor Witt described as the best denatured works of the kind in Germany.

We visited the Charlottenburg branch of the Chemische Fabrik Actien (vorm. E. Schering), which we visited first, and received by Dr. O. Antriek. By arrangement with the company, we so timed our visit as to be able to witness a denaturing operation on the large scale, having been informed by Dr. Antriek that such an operation had been arranged for prior to our application.

The denaturant mainly in use in this factory is animal charcoal which is mixed under the direction of the revenue officers, in the proportion required by the regulations. A sample of the bone-oil used must be of the character actually prescribed. It is received at the works under a seal, accompanied by a certificate of its validity from a sworn chemist, recognised by the revenue officers. The only other denaturant employed in the works is ether which is admitted under the direction of the revenue officers to the extent of 10 per cent. The employee must be certified to be of the official character before addition.

The expenses of methylation, not only the cost of the denaturants themselves, but the fee for the chemists' analyses and certificates, as well as the charges for the licence of the officer, the cost of handling, mixing, weighing, &c., are borne by the manufacturers, who are obliged to furnish the gauge glasses, standardised hydrometers, weighing machines, mixing machines, mixing rods, furniture, in fact everything needed to carry out the process, as prescribed, without charge to the State. 100 hectolitres of alcohol are employed in the course of a year. The proportion of ether alcohol to bone-oil alcohol used is roughly as 2 to 7. No duty-free pure alcohol is allowed.

The amount of clerical work needed, and the system of supervision and control in force, struck us as greater and more detailed than English users of alcohol under the regulations have hitherto been subjected to. Dr. Antriek considered, however, that in a works of the magnitude and character of Schering's, the system was not too onerous, and they had little difficulty in complying with official requirements, although he admitted that in other works there were occasional complaints of the complexity of the system. We had further an opportunity of seeing operations in which the denatured spirit was recovered and partially recovered, and we saw the method of recovery and rectification of the alcohol in actual use. We were also shown how the recovered alcohol was stored, brought to account, and how the necessary re-denaturing effected.

A new factory of E. Merck, of Darmstadt, is now being erected in premises in the Frankfurter Strasse, some miles outside the town.

The denaturants allowed by the regulations, including special ones used in the manufacture of iodoform, chloroform and ethyl bromide, are employed. The official denatured alcohol, containing wood naphthalene and pyridine bases is used, but not for many purposes, and in small quantities. In all about 100,000 kilos. of alcohol are denatured annually, in addition to which large quantities of duty-paid spirit are used, over which there is no official control. The use of pure alcohol without duty is not allowed. No precise estimate could be given, at the time, of the number of the 3000 products which need denaturation, but two of the partners, including the head of the factory management, agreed that it could not exceed 1 per cent. The value of the alcohol used, as compared with the value of the finished products could not at once be ascertained; it, of course, varies largely with the nature of the products, but was probably not more than from 1 to 20 per cent. Special methods are employed for recovering the last traces of the denaturants from the denatured products, some of which were described to us. As regards the number of denaturants allowed no particular difficulty seems to occur in this respect, although in some cases duty-paid alcohol must be employed. It may be stated that the principle of *ad hoc* denaturation is regarded with favour by the German revenue

officials, and in many cases the privilege of employing it has been withdrawn.

We inspected the spirit stores and inquired into the methods of custody, control and distribution of the duty-free alcohol, and we had also the opportunity of witnessing a denaturing operation. The method, in principle, was precisely similar to that we had seen at Charlottenburg, although the arrangements for the convenience of the revenue officials were slightly different. These officers are required to attend for denaturing about twice a week. The cost of attendance is about 6 marks per officer per day—say, 24 marks a week. Sometimes, however, a third officer is required. The cost of this attendance is considered of less consequence than the trouble it involves. We were informed that the present price of Prima spirit is 67 marks per 100 kilos. (= 2s. 2d. per bulk gall.), which does not include the vat tax, but includes the distillery tax, which amounts to 7-16 marks per 100 kilos. For purposes of rebate, a running account is kept, and the payments are made about every three months. No export business involving drawbacks on exportation is done at Darmstadt.

We inspected some of the control books relating to alcohol in the separate factories. The superintending chemist in charge of each department is personally responsible for the accuracy of the control book, and for the proper use of the spirit served out to him.

As regards ether, we were informed that this article may not be retailed, except when made from duty-paid spirit. A pharmacist may only receive it under permit, and may not sell it for medicinal purposes, unless prescribed by a physician. This procedure is adopted with a view of stopping the practice of drinking ether as an intoxicant.

In hospitals, ether may, by special permission, be used duty-free for anaesthetic purposes, and its use is also permitted, duty-free, in the laboratories of those educational institutions which are allowed to use duty-free alcohol.

## SECTION 5.

### *Agricultural Distilleries; Marienfelde.*

Finding that there was in the neighbourhood of Berlin an example of an agricultural distillery, we took advantage of the opportunity and paid a visit to it.

It was situated at Marienfelde, some ten miles to the south of Berlin, on a large and apparently very flourishing farm. The distillery was at work, and we were enabled therefore to study the system in operation.

The procedure is as follows:—

The potatoes (which must be produced on the land of the proprietor) are first washed by machinery. They are then steamed and pulped, and driven through a strainer into the mash-tun where they are mixed with a small percentage of malt. The wort is then passed into the fermenting vats. Each vat is gauged, and its content marked on the outside, together with the number of the vat. The wash is left to ferment for thirty hours, and is then conveyed to the still, which is of the patent-still type. On issuing from the condenser the spirit passes first through a domed glass case in which is a cup. In this cup, into which the spirit flows and from which it overflows, there float a thermometer and a hydrometer, to indicate the strength of the spirit passing. From this apparatus the spirit flows into a (Siemens) meter, fitted with an indicator which records the quantity, reduced to the standard of pure alcohol, of spirit transmitted, and from the meter the spirit passes on to the receiver.

The system of control does not require the continuous attendance of Exeise officers, but is compounded of—

- (1) Mechanical contrivances,
- (2) Book entries,
- (3) Liability to visitation at any time.

#### *(1.) Mechanical Contrivances.*

Up to the point at which the wash passes into the still, these are limited to the gauging of the vats and to the plumbing under revenue seal of all joints of the pipes leading from the vats to the still. From that point onwards to the receiver every vessel is locked and sealed,

and no access to the spirit can be obtained by the distiller. As the manager expressed it to us, "Up to this point I am treated as an honest man. Afterwards I am no longer trusted."

In the smaller distilleries the meter, which no doubt is an expensive apparatus, is dispensed with, and the quantity of spirit distilled is ascertained by the Excise officer from the receiver. Whether there be a meter or not, the receiver is of course under lock, and is not accessible to the distiller.

### (2.) Book Entries.

The regulations require entry of the quantity of materials used. But we understood that this was regarded as of little practical value, and that little attention was paid to such records. It is manifest that they cannot be susceptible of any real check.

The important entries are those of the times of charging and discharging the several fermenting vats, and of the quantities of wash in each. These entries can of course be checked against the spirit found in the receiver, and on them is computed the vat-tax and the distillery tax, which have to be paid by the distiller.

### (3.) Liability to Visitation.

It will be seen that the control under (1) and (2) provides no security against abstraction of wash from the fermenting vats. Visitation at frequent and uncertain intervals would seem to be an essential feature of the system, and we gathered that at Marienfelde the visits of Excise officers were even unpleasantly frequent. Whether they are so in more remote distilleries may be open to doubt.

In any case we are of opinion that the system of control rests so heavily upon confidence that, while it may be satisfactory with a low duty on spirits and with a system of rebates of duty that makes the Excise a source of profit to the smaller distiller, it could not safely be adopted where the duty is as high as it is in the United Kingdom and invariable in its incidence.

The distillery at Marienfelde is one of the best and largest type of agricultural distillery. Its "contingent" is 600 hectolitres per annum, or about 23,000 proof galls. of spirit. Out of the total number of agricultural distilleries in the German Empire there are not more than some 2000 or 3000 of similar size and character.

The vast majority of the agricultural distilleries are to be found in the eastern provinces of Prussia and Saxony, where the soil is poor, and the cost of conveying agricultural produce to a remunerative market is high; and it is not quite clear to us how it can be commercially profitable on a fertile farm close to Berlin to convert potatoes into spirit. The manager informed us that in the present year, even with the abnormally high price of spirit, he would realise on his potatoes used for distillation no more than from 2*l.* to 2*l.* 5*s.* per ton, whereas if sold for consumption as potatoes, they would realise some 4*l.* per ton. He was, however, compelled to use them in the distillery, in order to maintain his "contingent," which might be reduced if he should fail in any season to reach his prescribed production of 600 hectolitres. Moreover we doubt whether the above figure of return on the potatoes included the bonus of 20 marks (1*l.*) per hectolitre on the amount of the contingent. This would be equal to more than another 1*l.* per ton for the potatoes used.

We think the explanation of the maintenance of this distillery is that it is kept up to some extent as a convenient object-lesson in the neighbourhood of Berlin, for the instruction of Excise officers, and to illustrate the teaching at the Institut für Gährungs-gewerbe und Stärke-fabrikation in Berlin, an institution established by the trades, with assistance from the Government for the purpose of giving instruction in brewing, distilling, and other processes in which fermentation is employed.

We were informed that in normal years the return from potatoes used in the agricultural distilleries does not exceed some 25*s.* per ton (exclusive presumably of

bonuses), and in many cases is less. The average is 120*s.* per ton.

The yield of alcohol from a ton of potatoes may be taken at about 25 galls. of pure alcohol, or about 44 galls.

## SECTION 6.

### *Vinegar Factory.*

We visited a large establishment in Berlin for the manufacture of vinegar from alcohol, one of several worked by the same proprietors (Messrs. Kühne) in different parts of the Empire.

The process is exceedingly simple. The spirit, the account has been taken in the usual way by the Excise officers, is poured, together with the prescribed quantity of vinegar and water, through a scupper in the pavement of the receiving floor into tanks in the basement. These the mixture is pumped up to the topmost floor of a high building, whence it percolates down through a series of vats, floor by floor, filled with wood shavings, maintaining the food for the organisms which effect the fermentation, and arranged so as to secure the maximum exposure of the liquid to the air. The liquid then returns to the basement in the form of the finished product (vinegar), the whole circuit occupying not more than three or four hours.

The quantity of vinegar produced of the strength of 7 per cent. of acetic acid is about 10 times the quantity of alcohol used.

There is a loss of some 30 per cent. of the alcohol by evaporation.

In this industry the control over the spirit employed is less exacting than in the case of any other industry in Germany. From the time when the spirit is denatured no further control is exercised over it. No books are kept to show how it has been disposed of, or the yield of vinegar has been; nor is there any restriction of the visitation of the manufacturing premises by the Excise officers. The one and only regulation imposing the protection of the revenue is a prohibition against keeping a still on the premises. It is true that the denaturation of the spirit is such that there is no apprehension of its being drunk on the premises without purification. But even so, the system of control seems dangerously confiding, and the authorities of the Treasury frankly admitted that it could not be justified in principle.

The Government, however, have been reluctant to alter this; partly because it is of long standing, and partly because it is believed to lead to abuse in practice, but principally because this process of vinegar making can even now with difficulty hold its own against the process of manufacture from pyroligneous acid, and because it is feared that the curtailment of the present privileges of the industry seriously endanger its very existence.

It is, however, felt that if at any time the duty on spirit should be raised in Germany it would be hardly possible to maintain the present system of control without modification.

In these circumstances it seems highly improbable that the process, which is at present not practised in the United Kingdom, could with advantage be introduced into this country.

The quantity of spirit used for the manufacture of vinegar in the German Empire was, for the year 1903, 6,000,000 proof galls.

The quantity used in the factory we visited is about 150,000 proof galls.

## SECTION 7.

### *A German Methylating Factory: Fürsteneufeld.*

Much, if not the greater portion, of the pure denatured spirit used by the German manufacturers is denatured in the works in which it is actually employed, and this is invariably the case where the volume of spirit handled is large. Owing, however, to the fact that the freight-charges on pure alcohol are higher than on denatured spirit—a difference which the German che-



facturers are struggling to remove—and to other instances, arrangements are made whereby manufacturers requiring only a relatively small quantity of tured spirit, either complete or partial, may obtain m professed methylators, working under revenue vision.

The suggestion of Dr. Koreuber and Dr. von Buchka, were kind enough to accompany us, we visited such an ishment at Fürstenwalde, a town on the Spree, t 30 miles south-east of Berlin, and within easy ay communication of the district of Posen where of the agricultural spirit is made.

we were received by the proprietors of the establishment, B. Hecker and W. Zeidler, one of whom made up s, in turn, every form of denatured alcohol which egulations permitted the firm to prepare. The origin, ater and sources of supply of each denaturant were iled to us, and samples of the various articles, ily certified to be in conformity with the prescribed e, were shown to us.

e wood naphtha used for denaturing contains much nethyl alcohol than is customary in this country; rule, the quantity does not exceed 55 per cent. On other hand, the regulations prescribe that it must in at least 25 per cent. of acetone—a relatively iverse substance, probably not so useful as an indica- or "car-marking" material as methyl alcohol, and, as e given to understand, somewhat prejudicial to the f wood naphtha and of methylated spirit in certain facturing operations.

e "pyridine bases" employed come largely from and, although other sources of supply are available, price, owing to the increasing demand for these ances as the raw material for the manufacture of mber of special products, has risen considerably of and although used in only relatively small quantity, or the most part in connection with the completely tured spirit intended for heating, lighting and power, ncrease in price is beginning to be felt. Considering comparatively high prices of spirit in Germany at resent time, and the consequent restriction in the nd for general or household purposes, which is by e largest outlet for industrial spirit in that country, cheapening of the cost of denaturing becomes a r for serious consideration.

e addition of lavender or rosemary oil, which is nal, and to the extent of 0.125 per cent., to the com- ly denatured spirit is seldom made, except for special es, as in soap-making. This addition was original- ysted to meet a possible popular prejudice against the f denatured spirit in households, owing to the pungent of the pyridine bases. The prejudice, if it ever ed, apparently no longer obtains, although it must ated the German nethylated spirit is far more reable, as regards smell, than that in common use ngland.

e Fürstenwalde Works mix considerable quantities e general denaturant—that is the mixture of four parts ood naphtha and one part of pyridine bases—and h as already stated is added to the spirit in the pro- on of 2½ litres to every 100 litres of alcohol. The ne of the mixed denaturant made per annum is at nt 800,000 litres—which is about one-third of the e made in Germany.

e saw the operation of preparing the mixture. The l naphtha was received in iron drums, the tare of which own. It is examined and certified as to character, weight of the wood spirit having been ascertained he arrangements and in the manner already described requisite proportion of authenticated pyridine base aced in carboys is calculated, and that amount ighed out. The wood naphtha is then poured into ak, and forced by air pressure into the receiver, after h the "pyridine base" is added.

ne denaturing solution is distributed in drums, sealed he revenue authorities and bearing labels certifying he mixture is in accordance with law. The drums a received by the consignee can only be unsealed by eue officer. A running account is then kept on an ched label on each drum of the successive quantities drawn for denaturing purposes.

## SECTION 8.

### *Artificial Silk Factory.*

By the courtesy of Dr. Bottler, whom we met in Berlin, and who is managing director of an artificial silk factory at Jillich, near Cologne, we were enabled to pay a visit to that establishment.

In the process followed in this case alcohol plays a very important part, seeing that something like a gallon and a half of proof spirit is required, either in the form of ether or of spirit, to produce 1 lb. of the finished product.

The process is as follows:—

Nitro-cellulose is dissolved in a mixture of ether and alcohol, consisting of sixty parts of ether and forty of alcohol, and the solution thus obtained, which is in effect collodion, is after filtration driven under pressure until it finally emerges, through a number of fine glass tubes. On contact with the air the solution solidifies and the threads thus formed are picked up on bobbins, sixteen of the primary threads being immediately twisted into a single thread which becomes the unit for further operations.

The ether used in the factory is purchased from outside, not manufactured on the spot.

The alcohol comes in under Excise seal in the usual way, and is denatured in accordance with the regulations by being mixed with 10 per cent. of ether. The denaturing is carried out in the presence of the revenue officers and under their supervision. The denatured spirit is stored in a metal tank, under revenue lock and fitted with an indicator outside showing the quantity present in it.

Copper-zinc vessels are used, in preference to iron, to avoid injury to the ethered alcohol from corrosion.

From the tank the denatured spirit, when required for use, passes through closed pipes to the vessel in which the nitro-cellulose is dissolved—the additional ether required being added at this point. While in the dissolving chamber the spirit is not accessible to the workmen employed in the factory; and speaking generally we should say that the conditions of this manufacture lend themselves to the establishment, without much cost or difficulty, of an effective control over the spirit employed.

We may mention that Dr. Bottler informed us that very great difficulties had been met with in perfecting the process of manufacture, and that although the factory had been in operation for over two years, it was only within the ten days preceding our visit that he was able to feel confident that all the difficulties had been overcome. Into those difficulties the obligations in respect of denaturing did not enter, and the experience of this factory is sufficient to show that the embarrassments which attended a similar experiment made some years ago at Coventry, and which were there attributed to the character of the methylated spirit that the promoters were compelled to use, may arise from more causes than one.

## SECTION 9.

### *Production and Price of Spirit in Germany.*

The production of spirit in Germany is a state-aided enterprise, of which the primary purpose is not so much the production of spirit on economic lines as the encouragement of agriculture in the less fertile provinces of the Empire, which lie on its Eastern frontiers, and in which the conditions of soil and climate are so unfavourable that without some such encouragement the country would be in serious danger of depopulation.

To enter into the history and details of the system, interesting though they be, would be to go beyond the province of our inquiry. We shall, therefore, confine our attention as closely as we can to the two points which are of interest to our Committee, viz.: the effect of the system on the price of spirit for industrial purposes and its effect upon the price of spirit for export.

The system is essentially communistic in character, and its effects can be better seen by studying its results broadly and as a whole, rather than by attempting to trace its influence upon the interests of individuals.

Looking at it from this point of view, it may be said that the fundamental principle of the scheme is to make those interested in the production of alcohol sharers with

the State in the revenue collected on spirit used for potable purposes.

Thus in the year ended on 30th September, 1903, there was collected from the taxes on spirit a total sum of 10,000,000*l.*, out of which a sum of 3,100,000*l.* was given back to persons interested in the trade. But of this sum of 3,100,000*l.*, apparently some 700,000*l.* had been already levied as tax on the producers, so that their net subvention would be 2,400,000*l.* In the same year the total production of spirit in Germany was in round figures 132,000,000 proof galls., and accordingly the State subvention in that year represented a bonus of nearly 4*½*d. per proof gall. on all the spirit produced. The figures must, of course, vary from year to year, according to the circumstances of production and consumption; but probably not very widely.

The question for us is whether this bounty, be it 4*½*d. per gall. or more or less, is retained by the producers or distributors, or whether it goes, in whole or in part, to cheapen spirit to the consumers.

Our conclusion is that as a rule it is retained by the producers in respect of all spirit consumed in Germany, and that only under certain circumstances do the German users of spirit secure a share in it.

We will endeavour shortly to give the grounds on which we form this conclusion.

The system of subvention, as established in Germany, stimulates production, but at the same time it provides within itself an arrest of the stimulus after a certain measure of production has been reached. For the *maximum* bounty that can be secured in respect of any spirit, and which may be put at about 11*d.* per proof gall., is obtainable only in respect of a certain limited output, called the contingent. The total of such output is the equivalent of the amount of spirit estimated to be required for consumption as drink;—and therefore of the amount of spirit on which alone tax will be ultimately levied; and the contingent of each distiller is the share annually allotted to him of such amount. On that share it is possible, in favourable circumstances, for a distiller to obtain the maximum bounty of 11*d.* the proof gall. But as soon as his production exceeds this allotted contingent, one portion of the bounty, representing about 6*d.* per proof gall., automatically ceases, and on the excess production the distiller can at most obtain 5*d.* per proof gall. Only the smallest distilleries can obtain the maximum bounty of this kind; and as a distillery increases in size and output the bounty diminishes until with the larger distilleries it becomes non-existent. Thus the system of subvention gradually ceases to operate as a stimulant to production, and it may perhaps be said that the system gives no encouragement to produce more than such an amount of spirit as is sufficient to satisfy the demand for consumption for all purposes within the protected German market, and to provide a moderate margin for stock.

The distribution of spirit produced in the German Empire is practically a monopoly of an association called the Centrale für Spiritus Verwertung, which is representative of the producers of spirit, and which acts as intermediary between them and the consumers, for 90 per cent. of all the spirit produced. The policy of this association coincides with the Governmental policy in tending to restriction of production within the limits above indicated, and in so far as this policy is successful it is clear that, with practically prohibitive duties on the importation of spirit, the user of spirit in Germany is not likely to be able to secure for himself any portion of the benefit of the State bounties. He may only do so to a limited extent, when the general policy of the State and of the association is defeated by unforeseen variations either in the supply or in the demand of any period.

With the spirit exported the case is somewhat different. For this must frequently represent a surplus, of which the association desires to relieve the home market; and it may be assumed with some confidence that, in order to get rid of such surplus, a price is in the circumstances usually accepted which represents a transfer to the purchaser of a part, or even of the whole, of the State bounty.

Another feature of the system in its bearing upon the price of spirit to German users is this, that it tends to great

fluctuations of price. For the general principle of the system being to limit production relatively to consumption, no safeguard is provided against the contingency that has arisen this year of a shortage in production due to a failure of that which provides four-fifths of the material used in distilling, viz.: the potato crop.

Thus our conclusion is that the German user of spirit is not generally benefited by the state-aid given to production of spirit, and at times is injured by it.

The evidence of facts seems to support these theoretical deductions. At the present moment, as we were informed by a large user of spirit, the price charged for spirit of first quality, such as is necessary for the finer purposes which spirit is used, is, free of all duty, 50 marks per hectolitre—at the German standard of pure alcohol. A British standard of proof spirit this is approximately to 50*s.* per 38 proof galls., or a little over 1*s.* 3*½*d. per proof gall. The price of similar spirit of British manufacture in the United Kingdom is about 10*d.* per proof gall. Three years ago the minimum price for spirit was in Germany, 7*d.* per proof gall., and the average price for the year 1902 was 8*½*d. In the United Kingdom the price of British spirit was the same as now. The year 1902 was, however, altogether an exceptional year in Germany, and manufacturers have little expectation of seeing similar prices recur, unless, as one gentleman told us, the Centrale Association should be dissolved and competition between producers introduced.

Moreover, in 1902 the Centrale was pursuing the policy of endeavouring to cheapen spirit for industrial purposes by charging higher prices for spirit used for consumption as drink, and lower for industrial spirit. This policy, however, broken down, in consequence, we surmise, of a tendency noticeable in Germany, as it is in this country, to a decrease in consumption of spirituous liquors. The consequence of contracts made for long terms of years, the policy is still in operation in respect of spirit used in industrial locomotives and other engines. But as the contracts expire, it is anticipated that the policy will be modified, if not abandoned, even in this category of consumption.

It will be seen from the above figures that at the present time the price of industrial spirit in Germany is substantially higher than it is in the United Kingdom; that the price is subject to violent fluctuations; and that although at times it has been and probably will again be appreciably below the British price, it is doubtful whether its normal level in future will show any very material advantage to the German user.

As regards the cost of denaturing by special agents it is hardly possible to name an average figure. It includes the cost of manipulation, of attendance of Excise officers, of vessels and instruments, has to be borne by the manufacturer, and one manufacturer estimated for us as at least 2 marks per hectolitre, or about 10*d.* per bulk gall. of strong spirit. In addition there is the cost of the denaturing agent, which varies very much, according to the substance used. Our informant estimated that in this case the average of the whole cost of denaturing might be taken at 7 marks per hectolitre of strong spirit, or about 4*d.* per bulk gall. We are inclined to think this a high estimate seeing that the cost of "complete" denaturing is definitely known to be only a little more than 1*d.* the bulk gall. In that case, however, there is the economy that results from simplicity, regularity and magnitude in the operations.

A question that pressed itself strongly upon our attention during our visit to Germany, was how far the constitution of spirit for domestic and industrial purposes in this country could be taken as a measure of the possible consumption for similar purposes in the United Kingdom, and we think it may be useful that we should offer to the Committee some observations upon it.

In the year to 30th September, 1903, the consumption in Germany was—

	proof galls
For domestic use .....	33,900,000 (about)
For motor and other engines .....	1,100,000
For industrial purposes .....	14,000,000
<b>Total</b>	<b>49,000,000</b>



the year to 31st March, 1903, the consumption in United Kingdom for similar purposes was—

for domestic use .....	(about)	proof galls.
or industrial use .....	"	2,200,000
		3,300,000
<b>Total</b>		<b>5,500,000</b>

At first sight these figures suggest somewhat startling possibilities. But, if the facts be examined, it will be seen that the possibilities of extended use of spirit in Germany are not so great, and that the demand will tend to shrink to very moderate dimensions.

In the first place the large consumption of spirit in Germany is for domestic purposes, for heating, cooking, and so on, and is due not to the absolute cheapness of spirit, or to any special advantage that it possesses as an agent for heating and light, but it is due solely to its cheapness compared with other agents, coal, gas, or oil. In these cases oil is the agent that most directly competes with spirit, and in Germany oil, in the interests of alcohol, is subjected to a duty of 3 marks per extl., or nearly 2½d. all. In the United Kingdom its importation is consequently the comparison stands thus:

	Price of Methylated Spirit per bulk gall.	Petroleum per gall.
Germany .....	1s. 0d. (normal)	10½d.
	1s. 9½d. (present)	
United Kingdom	2s. to 2s. 6d.	5d. to 7d.

The price given above for petroleum in Germany is for oil in Berlin, and there it is cheaper than spirit. Frequently in Berlin spirit, which has to compete with oil as well as with coal, is very little used for domestic purposes; probably not more so than in this country. In rural districts oil is probably dearer than in Berlin, more difficult to procure, whereas methylated spirit is of universal distribution—it enjoys preferential rail-rates—and of uniform price, and it is therefore in rural regions that the main consumption takes place.

In the United Kingdom with cheap gas and cheap oil, no doubt a reduction in the price of methylated spirit would make spirit able to compete with them in price, but rice must always be the determining motive of choice on the part of the people. For though spirit has certain advantages in directions other than price, they are not of marked significance in themselves, nor are they of a character to appeal very powerfully to the masses.

Accordingly we may dismiss almost entirely the use of spirit for domestic purposes as offering an opening for expansion in the demand for spirit in the United Kingdom.

As regards spirit for industrial purposes the case is different. Even here a large abatement must be made from the figures before they can be taken as a possible measure of British consumption. Of the 14,000,000 proof gallons used in 1902—3, 6,350,000 galls. were employed for vinegar-making, which, as we show elsewhere, is not present, or likely to be present in the United Kingdom. Another 2,650,000 galls. is used for polishes, shes, &c., an industry which in this country enjoys special advantages and which may be supposed to have reached a pretty full measure of development, which it employs some 1,800,000 galls. of spirit. This leaves some 5,000,000 proof galls. used in Germany for miscellaneous industrial purposes, for which this country we use some 1,500,000 proof galls.

These figures one may say that the increased demand might arise for spirit in this country, in consequence of extension in its use for industrial purposes, may be placed at less than 3,500,000 proof galls.

#### Outline of German Spirit Taxes and Rebates.

Alcohol manufactured in the German Customs Union is subject to the following taxes:—

1. *Consumption Tax* (Verbrauchsabgabe).—A certain amount of alcohol (about 4.5 litres) per head was allowed, and this was with certain modifications divided amongst distillers in proportion to the make for previous years. The distillers are allowed to sell the quantity allotted to them subject to a charge of 50 M per hecto-

litre. Anything over their fixed quantity is subject to a charge of 70 M per hectolitre.

(2) (a) *Tax on Wash* (Mischbottelsteuer).—Paid by agricultural distillers. This amounts to 1.31 marks for each hectolitre content of their washbacks. If the distiller gets about 8.2 per cent. alcohol from his wash this would correspond to a tax of 16 marks per hectolitre, and this is the amount of the drawback allowed on exportation, denaturation, or for manufacturers' use for this tax. As a fact the distiller gets far more alcohol from his wash than this, and the average yield in 1900-1 was 10.8 per cent., so that if the average distiller paid 1.31 M per hectolitre of washback content, he only paid 12.13 M per hectolitre of alcohol and was reimbursed 16 M on export, which shows a bonus on export of 3.87 marks per hectolitre. In the case of a great number of distillers, the tax is modified very much, and some only pay six-tenths of the tax, i.e., 7.27 marks showing a bounty of 8.7 marks per hectolitre, and if his yield is above the average the bounty will be still higher. The "Zeitschrift für Spiritusindustrie," the official Journal of the German Distillers' Association, describes a yield of 11.21 per cent. of spirit from the wash as a good but not brilliant yield, and taking this as a basis it corresponds to a tax of 11.68 marks per hectolitre of alcohol, and six-tenths of this is equal to 7.008 M per hectolitre paid, as against 16 M repaid on denaturation or exportation, corresponding to a bounty of about 9 M per hectolitre.

(b) *Taxation Materials* (Brauntweinmaterialsteuer).—Paid by distillers on certain materials (such as fruit, wine, beer, etc.) and varies with the material instead of the tax on wash. This tax varies with the materials. In the case of certain distillers only four-tenths of the full tax is charged.

(c) *Addition to Consumption Tax* (Zuschlag zur Verbrauchsabgabe).—In all manufacturing distilleries and also in some agricultural distilleries and material distilleries instead of the wash tax or material tax, a tax of 20 marks per hectolitre is charged, but this is reduced in some cases to 8 marks per hectolitre.

(3) *A Distillation Tax* (Brennststeuer).—This varies from nothing to 6.5 marks per hectolitre according to the distillery, but on export, denaturation, or manufacturers' use, the full 6 marks is allowed, and so constitutes an additional bounty.

The bounty obtainable from the tax on wash amounts to	d.
9 M per hectolitre .. ..	2.7 per proof gall.
And the bounty obtainable from the distillation tax amounts to 6 M per hectolitre .. ..	1.8 ..
Or together to .. ..	4.5 ..

In addition the fact that a distiller is allowed to make a certain amount of alcohol at 20 marks per hectolitre less than the normal duty, constitutes a further benefit; and the distiller may, if he wishes, actually receive this amount of 20 marks per hectolitre allotted quantity in the shape of Government Bills or Warrants. This is equivalent to a benefit of 6d. per proof gall. on spirit made up to the allotted quantity.

The possible benefits are:—

	d.
(1) Bounty from tax on wash ..	2.7 per proof gall.
(2) Bounty from distillation tax .. ..	1.8 ..
(3) Benefit from being allowed to make at less than the normal duty .. ..	6.0 ..
	<b>10.5</b>

This is probably about the maximum that a distiller can obtain, and it is not maintained that all distillers get such large benefits; but the statements published in their own recognised Journals show that the benefits they get are very considerable—in fact, without very large advantages in taxation, it is difficult to see how

the small agricultural distillers could exist at all. The German Spirit Syndicate buy up nearly the whole of the alcohol made, and in order to keep up the price of alcohol

for consumption as a beverage, they sell for export after denaturation, and use in arts and manufactures at a price at which they admit they make a heavy loss.

*Statement of German Spirit Duties taken from the "Kalender für die Landwirthschaftlichen Gewerbe,"*  
1902-03.

	Marks.	£	s.	d.
A.—Receipts.				
I. Tax on wash .....	32,521,240	1,592,185	14	2
II. Consumption tax at 50 M. ....	11,957,453	585,416	19	4
Consumption tax at 70 M. ....	146,601,154	7,177,348	3	8
	158,558,007	7,762,765	2	8
III. Addition to consumption tax .....	5,574,591	272,922	13	8
	164,133,198	8,035,687	10	4
IV. Brennsteuer .....	8,128,546	397,960	1	3
Total receipts I—IV. ....	204,782,984	£10,025,833	11	10

1902-03.

	Marks.	£	s.	d.
B.—Rebates.				
I. Refund of tax on wash and material .....	22,179,114	1,085,852	9	10
II. Refund of consumption tax .....	483,308	23,661	10	1
III. Warrants for duty allowances .....	36,923,610	1,807,718	8	1
IV. Brennsteuer refund .....	4,117,705	201,595	19	5
Total of repayments and allowances I—IV. ....	63,703,737	3,118,828	15	9
C. Alcohol from Luxemburg .....	15	0	14	8
A—B+C .....	141,079,862	£6,907,031	18	2

These figures show that, out of a total taxation of over £10,000,000, over £3,100,000 are expended in bounties and relief from duties.

APPENDIX No. I.

DUTIES AND ALLOWANCES ON BRITISH SPIRITS AND  
DUTIES ON FOREIGN SPIRITS.

The duty (Excise) on British spirits is at present 11s. per gall. at proof.

When British spirits are exported (or used for certain operations in bond), not only is the duty of 11s. remitted, but an allowance also is paid by the Inland Revenue at the rate of 3d. per proof gall. on plain spirits, and of 5d. per proof gall. on compounded spirits.

These allowances are commonly spoken of as the "allowances on British spirits."

The duty (Customs) on Foreign spirit is at present—

On brandy and rum 11s. 4d. per proof gall.

On other sorts 11s. 5d. per proof gall.

(with certain special rates for liqueurs and perfumed spirits and for spirits imported in bottle).

The difference (4d. or 5d. as the case may be) between the duty on British spirits and that on foreign spirits is commonly spoken of as "the surtax on foreign spirits," or more briefly as "the surtax."

Both the allowances and the surtax which date from 1860 (when the old protective duties were done away with), aim at the same purpose, which is, not to put the British producer of spirits in a position of advantage as compared with his foreign or colonial competitor, but to save him from being placed in a position of disadvantage.

In imposing a heavy duty on British spirits, it is necessary at the same time to impose on their manufacture restraints designed to prevent any spirit from escaping the duty. These restraints have the effect of appreciably increasing the cost of manufacture; and in consequence the burden of the duty on the British producer of spirit is not adequately measured by the figure of the duty alone, but must be measured by that figure *plus* the figure by which the cost of manufacture is increased by the Excise restrictions.

Accordingly if we take x pence per proof gall. for this latter figure, and 11s. per proof gall. as the duty on British spirit, the full burden of the tax on the producer of British spirit per proof gall. is represented by the expression (11s. + x d.).

It follows that, when the producer of British spirit sends out his goods to compete in neutral markets, he is entitled to relief to the extent of 11s. + x d. and not of

11s. only, per proof gall.; and conversely that goods should not be admitted to the home market at a less charge than 11s. + x d. per proof gall.

The values of x have varied from time to time according to the following table:—

	Surtax.			Allowance
	Rum.	Brandy.	Other Sorts.	Plain Spirits
From 1860 ....	2d.	5d.	5d.	2d.
" 1881 ..	4d.	4d.	4d.	2d.
" 1902 ....	4d.	4d.	5d.	3d.

The determination of values for x is a matter of extreme difficulty. To arrive at it, it is necessary to take into account—

(a) The tax, if any, on materials of manufacture.

(b) The effect of Excise restrictions on the cost of manufacture.

At the present time (a) is a negligible quantity, although there is a tax on sugar and glucose, these materials enter into distillation of spirits to so small an extent that the tax may be left out of account. Molasses used in distilling is duty free.

As regards (b), the Excise restrictions that do, or affect the cost of manufacture are numerous, but the principal among them are the following:—

(1) The prohibition against brewing or distilling simultaneously:

(2) The prohibition against mixing worts or fermentations:

(3) Compulsory stoppage of work between Saturday and Monday:

(4) Restrictions on the manufacture of yeast:

(5) Separation of distillery and rectifying processes and loss of duty on spirits rectified.

(No. 5 hardly affects the cost of manufacture of "plain spirits.")

From this enumeration of the factors which have



	1866. Amount claimed by		Amount allowed in 1866.	1866. Considered admissible by this Department.	
	Scotch Distillers.	English Distillers.		For Un- coloured Spirits.	For Coloured Spirits.
Compensation for duty on foreign grain .....	d. 0½	d. 0½	d. 0½	d. 0½	d. 0½
Prohibition against brewing and distilling at same time .....	1½	1½	1	1	1
Against distillers mixing wort in separate vessels while in process of maltation .....	0½	0½	0½	0½	0½
Loss of duty on rectification and flavouring spirits in separate premises .....	2	3	1	2½	2½
Colouring matter in foreign spirits .....	2	2	2	nil	2½
Increased expense in making malt consequent on Excise restrictions .....	0½	0½	nil	nil	nil
Difference in mode of charging duty in favour of foreign spirits ..	1 ½				
Duty evaded upon foreign spirits, and by samples drawn in bond ..	0½	1½	nil	nil	nil
	9	9½	5	4½	6½

ten into account, it will be obvious that anything like accuracy in fixing values for *x* is unattainable. The manner in which the rates of surtax were originally fixed in 1860 is shown in the following table, which was first published in the Board of Inland Revenue's Tenth Report (1870), and which in the literature of the subject has since been frequently reproduced.

The period that has elapsed since 1860, appreciable changes have taken place in the conditions of manufacture and in the rate of duty on spirit, and a computation of the figures at which the rates of surtax should be based on items and on values that would materially from those shown in the original table. The composition of the rates as they now stand there accepted or authoritative analysis, and all that is said of them is that they represent the outcome, by compromise, of prolonged controversy renewed at intervals, as occasion for question presented during a period extending over more than forty

years, however, be convenient to say a few words as to the increase by 1d. of the allowances and of the duty on spirits other than rum and brandy, which was imposed in 1902 at the time when the duty on corn was repealed. For the retention of the increase, notwithstanding the repeal of the corn duties in 1903, has been a frequent subject of criticism.

The imposition of the corn duties was the occasion rather than the cause of the addition to the allowances of the surtax.

As, taken by themselves, it was calculated that the increase, as first proposed, would not have warranted an addition than six-tenths of a penny, nor, as finally decided, with a reduced duty on maize, a larger addition than three-tenths of a penny.

For some years prior to 1902 the distillers had been urging on the Treasury and the Board of Inland Revenue that the old rates of allowance and of surtax were insufficient—(notably on the occasion when in March, 1898, a deputation representing the whole trade led on the then Chancellor of the Exchequer)—and the expert officers of the Excise had admitted that could not dispute the arguments in favour of some increase in the rates.

That the amount of increase should be was a matter difficult to determine, and it was still in question when the revival of the corn duties took place.

At the event made action imperative, and an additional duty was agreed to—the addition, however, not to be added to brandy or rum, which are not made from

wheat when the duties were repealed in 1903 the question was as to an adjustment of the rates of allowance and duty. But as the adjustment could not have exceeded six-tenths of a penny, and as the composition of the duties under the new rates was far from precise, it was decided that no change should be made.

## APPENDIX II.

### REGULATIONS AS REGARDS USE OF SPIRIT FOR INDUSTRIAL, &c., PURPOSES.

(See also this Journal, 1402, 1301 and 1562, and 1903, 270-271.)

#### UNITED KINGDOM.

The Customs and Excise Taxes on Spirits are :—

Customs—11s. 4d. per proof gall. on rum and brandy; 11s. 5d. per proof gall. on other spirits.

Excise—11s. per proof gall.

#### DUTY FREE SPIRIT.

##### ABSTRACT OF THE BRITISH REGULATIONS.

##### I.—METHYLATED SPIRIT.

There are two kinds of methylated spirit.

A.—“*Ordinary*” Methylated Spirit for use in manufacturing operations.

This consists of a mixture of 90 parts of ordinary ethylic alcohol of a strength of 60 to 65 o.p. (i.e., containing from 91 to 95 per cent. of real alcohol) and 10 parts of wood naphtha of an approved type.

The official regulations do not require the British or foreign spirit used to be of a greater strength than 50 o.p. (86 per cent. alcohol), and Colonial rum of a strength of only 20 o.p. (69 per cent. alcohol) may be used; but in practice rum is now never methylated, and the spirit is always over 60 o.p. (91 per cent. alcohol).

No duty is paid on British spirits used for making methylated spirit, and foreign and Colonial spirits are exempt from the ordinary spirit tax of 11s. per proof gall.; but foreign spirits have to pay a Customs surtax of 5d. per proof gall., equivalent to about 8d. per gallon on the spirits as actually methylated. The surtax on Colonial rum is 4d. per proof gall., equivalent to about 6½d. per gall., at 60 o.p., or less than 5d. per gall., if rum of 20 o.p. were used for methylating.

Methylated spirit can only be made by :—

1. Distillers.

2. Rectifiers, i.e., persons who redistil duty-paid spirit.

3. Licensed methylators.

In practice methylated spirit is, as a rule, made by methylators, who pay an annual licence of 10l. 10s.

All methylators have to provide suitable mixing rooms, vats, locks, fastenings, and appliances for weighing, measuring, and mixing the spirits and wood naphtha, and the necessary desks for the convenience of the revenue officials who supervise the operations. Mixing vats must be of a capacity of 550 galls., and wood naphtha vats of 100 galls.

Spirits for methylation come from Customs or Excise duty-free warehouse accompanied by official permits, and are received by a supervisor and officer of Inland Revenue, who examine and check the strength and quantity, and see the spirits run into the mixing vats.

To the spirits in the vats is then added one-ninth of its bulk of approved wood naphtha. The contents of the vat have to be thoroughly mixed, and the total quantity and strength again measured by the officials. An official entry of these particulars is made, and the vat and its contents are then handed over to the methylator for disposal in accordance with prescribed regulations. Not less than 500 galls. of methylated spirit must be made at each mixing.

The wood naphtha used for mixing with the spirit must be approved by the Board of Inland Revenue before it is used. For this purpose a sample is drawn from the naphtha vat and sent to the Government Laboratory for examination, the vat itself being locked up by the revenue officer until the principal of the Government Laboratory has certified that the naphtha is fit for methylating purposes. The nature of the examination to which the naphtha is submitted is described in the annexed paper "A," and from this the character of the wood naphtha used for methylating purposes in this country can be gathered.

"Ordinary" or manufacturing methylated spirit can be sold by methylators only to persons authorised by the Board of Inland Revenue to receive this kind of spirit.

A user of this spirit must send to the methylator an official requisition signed by himself, and on which there is a certificate signed by the local supervisor of Inland Revenue that the applicant is authorised to receive such spirit. Less quantities than five galls. cannot be supplied. The methylator has to enter the particulars of every consignment in an official permit taken from a book supplied to him by the supervisor, and this permit must accompany the spirit to the premises of the user, and be delivered to the officer of Inland Revenue when he visits the premises.

When any person wishes to use methylated spirit in any manufacturing process, or for making embrocations, lotions, medicaments or other preparations, written application has to be made to the Board of Inland Revenue. The particular purpose for which the spirit is intended to be used, with some general description of any manufacturing process involved, has to be given, and also a statement of the situation of the premises and of the quantity of spirit likely to be used annually.

After inquiry by the local officials the board issue their authority for the use of the spirit, and instruct their officers to supply the applicant with a book of requisition forms, in order to enable him to obtain a supply of the spirit from a methylator.

Where the quantity of methylated spirit used exceeds 50 galls. per annum, a bond, with one or more sureties in sums of 200*l.* to 1000*l.*, for the due observance of any conditions that may be imposed and the proper use of the spirit, is required. Hospitals, infirmaries, colleges and other public institutions are not usually required to give a bond.

Methylated spirit is not allowed to be used for manufacturing purposes on any premises where ordinary alcoholic beverages are made or sold, nor for the preparation of any article of food or drink, or to be mixed with any medicine capable of being taken internally. With these exceptions methylated spirit may be used in almost any art or manufacture, and is, as a fact, used for a very great variety of manufacturing and technical purposes. For medicinal and pharmaceutical purposes, for instance, the use of methylated spirit has been sanctioned for the extraction, crystallisation and purification of nearly 500 resins, oils, alkaloids, synthetical perfumes and other substances where the finished products contain none of the spirit; for making several hundred embrocations, lotions, liniments and other medicines for outward application; for most veterinary medicines; and for making collodion, flexible collodion, surgical bandages, iodoform, ethyl and methyl chloride and bromide, and other articles used in surgery and medicine.

As a rule the conditions imposed on the users of methylated spirit are very simple, and interfere very little, if at all, with the manufacturing operations. It must not be removed from the premises where its use has been allowed, and the manufacturing operations have to be carried on substantially in the method described in the

application. Any material alteration of the process, those portions of it where the spirit is used, has to be notified to the revenue officials, and the board's sanction obtained for the change, but this is merely for the information of the inspecting officers, and permission for desired alteration is rarely or never refused.

In a great many cases the methylated spirit used in manufacturing operations is wholly or partially recovered and used over and over again. Where this recovery includes redistillation the revenue permission has to be obtained, and in some cases, where the manufacturing operation and the redistillation might so portions of the spirit as to render it capable of being fit for potable purposes, special conditions are imposed, such as the collection of the whole of the distillate in receiver and not in fractions, or the immediate mixing of the recovered spirit with fresh methylated spirit, or some other substance.

As a whole, however, there is very little interference by the revenue officers. Except for periodical inspections, and the occasional sampling of the recovered spirit and of the intermediate and finished products of operations, manufacturers are left to carry out their operations in any way they please, provided they supply the revenue authorities with sufficient information to enable the officers to see where and how the spirit is used.

Neither the methylators nor the manufacturers have to pay anything towards the cost incurred by the revenue authorities in supervising the making, or the use of methylated spirit.

#### *B.—"Mineralised" Methylated Spirit.*

This is the methylated spirit which is sold by retail to the general public for use for burning in spirit lamps, cleaning and domestic purposes generally, and also some extent for mixing with paints, stains, varnishes, and for polishing purposes by cabinet makers, &c.

In making "mineralised" methylated spirit the alcohol is first mixed with the wood naphtha as in making "ordinary" methylated spirit. After mixing with wood naphtha, the whole contents of the vat of "ordinary" methylated spirit, or a portion of the spirit, less than 100 galls., removed to another vat, is farmixed with three-eighths of 1 per cent. (0.375 per cent.) of an approved "mineral naphtha." This mineral naphtha is an ordinary light mineral oil having a gravity of from 0.800 to 0.830. The addition of mineral oil does not interfere with the purposes for which this kind of spirit is mainly used, *viz.*: burning in spirit lamps, &c. Its use was introduced some 15 years ago in order to prevent the drinking of the "ordinary" methylated spirit which was found to be going on to a limited extent among certain classes in the poorer districts of Glasgow and other large cities.

Persons who wish to retail "mineralised" methylated spirit must obtain a licence costing 10*s.* annually. A body except distillers and publicans may obtain a licence. Retailers of "mineralised" methylated spirit are furnished with a book of requisition forms to enable them to obtain their supplies of such spirit from methylators.

Methylators are not allowed to sell the spirit to retail in greater quantities than 50 galls., or in less quantities than five galls., but the smaller retailers are allowed to purchase it in quantities not exceeding a gallon at a time from any other retailer. The stock of "mineralised" methylated spirit which a retailer may keep is limited to 50 galls., and he is not allowed to sell to any person a greater quantity of such spirit than 1 gall. at a time.

Retailers are also prohibited from selling the spirit between ten o'clock on Saturday evening and eight o'clock on the following Monday morning; and, in exceptional cases, they have to keep a stock account of all spirit received and sold, and the names of the persons to whom it is sold. These regulations are for the purpose of preventing the illicit drinking of the spirit which still occasionally occurs in some localities, and are required more for police than revenue purposes.

Anyone may buy "mineralised" methylated spirit from a retailer, and may use it for any purpose except



preparation of beverages or of medicines capable of being taken internally. All attempts to purify or to use the spirit for use for these purposes are also prohibited; and anyone who sells, for use as a beverage or as medicine, or has in his possession any methylated spirit, or derivative thereof, prepared or purified for such use, is liable to a penalty of 100%.

#### SPIRITS DENATURED WITH OTHER SUBSTANCES THAN WOOD NAPHTHA.

Under the powers conferred on them by the Spirits Act, 1880, and Section 8 of the Finance Act of 1902, the Commissioners of Inland Revenue have authorised the use of ethyl and methyl alcohol denatured with substances other than wood naphtha to be used in the ordinary manufacturing operations:—

##### *making Coal Tar Dyes.*

- a.) Methyl alcohol, mixed with 0.05 per cent. of wood naphtha.
- b.) Ethyl alcohol, mixed with 2.0 per cent. of wood naphtha, or 2.0 per cent. of nitrobenzol.

##### *for the manufacture of Xylonite and similar articles.*

alcohol mixed with—

- a.) One pound of camphor and 1 pint of coal tar naphtha (toluol) per gall.
- b.) One pint of toluol per gall.
- c.) One pound of camphor per gall.
- d.) 0.05 per cent. of bone oil.
- e.) 0.5 per cent. of petroleum ether.

##### *for the manufacture of Fulminates.*

Methyl alcohol mixed with 10 per cent. of the spirit of denaturation from a previous operation, and 0.025 per cent. of bone oil.

##### *for Coconut Oil Refining.* (Temporary sanction.)

Methyl alcohol mixed with an equal volume of ethyl methylated spirit.

##### *for use in making Electric Lamps.*

Methyl alcohol mixed with one pound of red phosphorus per gall.

The denaturing substance is, as a rule, one used in the ordinary distilling operations involved, and there are special provisions as to the mode of working and supervision by revenue officials, including in some cases the constant presence of one or more Excise officers on the premises when open for work. Traders using these specially denatured spirits have to pay the cost of the Revenue duties.

UNDENATURED ALCOHOL is allowed to be used by universities, colleges, and other public institutions for teaching and research under certain conditions.

#### THE EXAMINATION OF WOOD NAPHTHAS.

Wood naphtha must be sufficiently impure to be used for the methylated spirits, prepared by mixing one part of the wood naphtha with nine parts of spirits of denaturation of an amount of nauseousness as will, in the opinion of the Principal of the Government Laboratory, be such mixture incapable of being used as a beverage, and not mixed with potable spirits of any kind without being unfit for human consumption.

Wood naphtha submitted for approval should conform with the following tests:—

- a.) Not more than 30 c.c. of the naphtha should be required to decolorise a solution containing 0.5 gm. of potassium dichromate.
- b.) The naphtha, which must be neutral or only slightly alkaline to litmus, should require at least 10 c.c. of deci-normal acid to neutralise 25 c.c. of the naphtha when methyl orange is used as the indicator.

It should contain:—

- a.) Not less than 72 per cent. by volume of methyl alcohol.

(b.) Not more than 12 grms. per 100 c.c. of acetone, aldehydes, and higher ketones, estimated as "acetone" by the formation of iodoform according to Messinger's method.

(c.) Not more than 3 grms. per 100 c.c. of esters, estimated as methyl acetate by hydrolysis.

The following details of the manner in which the above tests are conducted in the Government Laboratory are published for the information of the trade:—

##### *Bromine Decolorisation.*

A standard bromine solution is made by dissolving 12.406 grms. of potassium bromide and 3.841 grms. of potassium bromate in a litre of recently boiled distilled water.

50 c.c. of this standard solution (=0.5 gm. bromine) are placed in a flask of about 200 c.c. capacity, having a well-ground stopper. To this is added 10 c.c. of dilute sulphuric acid (1 in 4), and the whole shaken gently. After standing for a few minutes the wood naphtha is slowly run from a burette into the clear brown solution of bromine until the latter is completely decolorised. Not more than 30 c.c. of the wood naphtha should be required for this purpose.

##### *Methyl Orange Alkalinity Test.*

The naphtha should be faintly acid to phenolphthalein, slightly alkaline or neutral, rarely acid to litmus, and always alkaline to methyl orange. 25 c.c. of the wood naphtha are placed in each of two beakers, and titrated with deci-normal acid, using in the one case a few drops of litmus solution, and in the other of a solution of methyl orange, as indicator. With litmus usually 0.1 to 0.2 c.c. of deci-normal acid is required to neutralise. With methyl orange the total alkalinity should be greater—at least 5 or 6 c.c. of deci-normal acid being required for neutralisation.

The total alkalinity, less that given with litmus, is the "methyl orange alkalinity," and, for the 25 c.c. of wood spirit, should not be less than is required to neutralise 5 c.c. of deci-normal acid.

##### *Estimation of Methyl Alcohol.*

Twenty-two grms. of coarsely powdered iodine and 5 c.c. of distilled water are placed in a small flask and cooled by immersion in ice-cold water. Then 5 c.c. of the wood spirit (60.0 o.p.) are added, the flask corked, the contents gently shaken, and allowed to remain in the ice-cold bath for 10–15 minutes.

When well cooled, 2 grms. of red phosphorus are added to the mixture of spirit and iodine in the flask, and the latter is immediately attached to a reflux condenser.

The reaction soon commences, and must be moderated by dipping the flask into a cold water bath. (Spirit may be lost if the reaction is too violent.) After about 15–20 minutes, when all action appears to have ceased, the water bath under the flask is gradually heated to a temperature of about 75° C. (167° F.), and the flask being occasionally shaken is allowed to remain at this temperature for 15–20 minutes. The source of heat is then removed, and the apparatus left for an hour till it has cooled, when the condenser is reversed, and the methyl iodide slowly distilled off—first at a low temperature—the bath being allowed to boil towards the end of the operation only. The end of the condenser dips into water in a measuring tube, and the iodide is collected under water and measured at a temperature of 15.5° C. (60° F.)

The percentage (by volume) is found from the formula:—

$$\frac{\text{c.c. methyl iodide found} \times 0.647 \times 100}{\text{c.c. wood spirit taken} \times \text{vol. of methyl alcohol}} = \text{Percentage}$$

Or when 5 c.c. of spirit are taken:—

$$\frac{\text{c.c. methyl iodide} \times 12.94}{\text{percentage (by vol.)}} = \text{percentage (by vol.)}$$

Esters, acetals, &c., also yield methyl iodide by this process, and from the percentage of methyl alcohol calculated as above, an amount equivalent to the percentage of these substances present must be deducted. Practically, however, methyl acetate is the only com-

pound usually found in quantity sufficient to materially affect the result. The grms. of methyl acetate per 100 c.c. of spirit multiplied by 0.5405 give the equivalent of methyl alcohol to be deducted from the total percentage by volume calculated from the methyl iodide found.

#### The Acetone Reaction.

Twenty-five c.c. of normal soda are placed in a flask similar to those used in the bromine reaction. To this is added 0.5 c.c. of the naphtha. The mixture is well shaken, and allowed to stand 5—10 minutes. Into it from a burette  $n/5$  iodine solution is run slowly, drop by drop, vigorously shaking all the time till the upper portion of the solution, on standing a minute, becomes quite clear. A few c.c. more of  $n/5$  iodine solution are added, as to get concordant results an excess of at least 25 per cent. of the iodine required must be added. After shaking the mixture is allowed to stand for 10—15 minutes, and then 25 c.c. normal sulphuric acid are added. The excess of iodine is liberated, titrated with  $n/10$  sodium thiosulphate solution and starch, and half the number of c.c. of thiosulphate solution used are deducted from the total number of c.c. of iodine solution used. The difference gives the amount of acetone by weight in the naphtha by the formula :—

c.c.  $n/5$  iodine solution required  $\times 0.3876$  = grms. of acetone per 100 c.c. of wood naphtha.

This includes as acetone any aldehydes, &c., capable of yielding iodoform by this reaction.

If the quantity of "acetone" is excessive, a less quantity of the spirit is taken, or 10 c.c. are diluted with 10 c.c.

of methyl alcohol free from acetone, and 0.5 c.c. of mixture is used.

#### Estimation of Esters.

Five c.c. of the wood naphtha are run into a silver flask of about 150 c.c. capacity, together with 20 c.c. of recently boiled distilled water. Ten c.c. of normal solution are added, the flask securely closed and distilled for at least two hours in a water bath at  $100^{\circ}\text{C}$ . (21) The contents are then washed into a beaker, and titrated with normal acid and phenolphthalein. The difference between the number of c.c. of soda taken and of that required for neutralisation may be calculated as methyl acetate (weight in vol.) from the formula :—

$$\frac{0.074 \times \text{c.c. soda required} \times 100}{\text{c.c. naphtha taken}} = \text{grms. per 100 c.c.}$$

Or if 5 c.c. of spirit are taken as above :—

$$1.48 \times \text{c.c. soda required} = \text{grms. of methyl acetate per 100 c.c. of spirit.}$$

#### APPENDIX No. II.

B.—ABSTRACT OF THE APPROXIMATE QUANTITIES OF UNMINERALISED METHYLATED SPIRITS USED IN MANUFACTURING OPERATIONS AND FOR OTHER PURPOSES IN THE UNITED KINGDOM DURING THE YEAR ENDED 31ST MARCH, 1901.

(Prepared from information supplied by Supervisors of Inland Revenue to the Government Laboratory in May, 1901.)

Nature of manufacturing operations or other purposes for which the Spirit was used.		Number of Gallons.
1	Making "finish," varnishes, lacquers, stains, paints, enamels, &c. ....	1,221.
2	Soap manufacture .....	144.
3	Hat making .....	121.
4	Celluloid, xylonite, &c. ....	106.
5	Ether, chloroform and iodoform .....	97.
6	Fulminates, smokeless powder, and other explosives (including War Office and Admiralty) .....	48.
7	Preparation of solid medicinal extracts, medicaments, fine chemicals, &c. ....	39.
8	Dissolving dyes and colours, and for dyeing and cleaning operations, &c. ....	28.
9	Making photographic plates, emulsions, films, &c. ....	24.
10	Making linoleum, pegamoid, lincrusta walton, and similar goods .....	21.
11	Making embrocations, lotions, liniments, cattle and other medicines .....	15.
12	Making filaments, &c., in the incandescent electric lamp manufacture .....	14.
13	In piano making .....	7.
14	In silk, crape and embroidery manufactures, mainly for stiffening .....	6.
15	In the manufacture of aniline and other dyes and colours .....	8.
16	In making fireworks .....	2.
17	Plant washes, insecticides, &c. ....	1.
18	In the manufacture of rubber .....	1.
19	For cleaning paint .....	1.
20	In the manufacture of steel pens .....	1.
21	Making blacking and leather dressings .....	1.
22	In "silvering" mirrors, &c. ....	4.
23	In corset making .....	
24	Making sheep dips .....	
25	Preparing surgical dressings .....	
26	Adjusting hydrometers, and in making compasses, thermometers, and other instruments .....	1.
27	In oil refining .....	
28	Electrotyping .....	
29	Making iaks .....	
30	Various miscellaneous manufactures, &c., engraving, brass founding, watchmaking, china making, printers' rollers, black lead, candle making, artificial silk, artificial flowers, calico printing, cotton yarn, ropes, oil gas generators, &c. ....	1.
31	Preserving specimens in museums, hospitals, infirmaries, &c., for burning in lamps, washes, lotions, and other purposes in hospitals, infirmaries, and similar institutions, and also for laboratories and educational purposes .....	33.
32	For the War Office and Admiralty requirements, chiefly at Woolwich and dockyards .....	30.
Total .....		1,987.

#### OBSERVATIONS.

The returns from which the abstract has been prepared are in a very condensed form, and do not give in detail the various purposes for which the spirit is used nor the quantities used for each purpose when there are several. In some cases, therefore, it has been necessary to estimate the probable quantities assigned to each head, and the figures must, therefore, be taken as approximate only. In the case of the largest users, however, there is no difficulty. The "ether," "solid medicinal extracts," and "lotions" are the most doubtful, as most makers use the spirit for all three purposes.

On the whole, however, the figures given are pretty nearly correct.

The "quantities" are the quantities received in the year by the users.

The total, 1,987,665 galls., compares with 2,000,000 galls., the estimated quantity of unmineralised methylated spirit made during the year, showing a deficiency of 87,849, or a little over 4 per cent., due partly to wastage, partly probably to the imperfections in the returns.

It is not possible to make any separation between "finish" and "varnishes," etc., properly so called, but as "finish" is itself almost entirely used for varnishes, or for thinning or manipulating those



and for polishing purposes, any distinction would be of much value.  
*mineralised or retail methylated spirit* is used for burning in spirit lamps, for cleansing and other purposes generally, and also to some extent for use with paints, stains, varnishes, &c., and for polishing by cabinet makers, &c.

## APPENDIX No. II.

COMPARISON OF THE QUANTITY OF SPIRITS, ETC., USED IN MAKING METHYLATED SPIRITS, AND OF THE METHYLATED SPIRITS PRODUCED, FOR THE FIVE YEARS ENDING 31ST MARCH, 1904.

Proof Galls. of Spirits delivered for Methylation.		Total.	Average Strength.	Quantity in bulk of Spirits Methylated.	Wood Naphtha used.	Ordinary (Unmineralised) Methylated Spirit for Manufacturing Purposes.	Mineral Naphtha.	Mineralised Methylated Spirit for Retail Sale.	Total.
British.	Foreign.								
4,978,027	6,245	4,984,272	63.7	3,043,485	338,165	2,058,450	4,962	1,328,162	3,386,612
5,070,713	120,332	5,191,045	64.3	3,158,442	350,938	2,075,514	5,377	1,439,243	3,514,757
4,640,770	627,410	5,268,180	64.3	3,206,214	356,246	2,157,127	5,270	1,410,603	3,567,730
4,230,688	1,210,001	5,451,689	64.9	3,305,502	367,278	2,213,580	5,472	1,464,672	3,678,252
5,054,586	334,140	5,388,726*	63.5	3,295,485	366,165	2,139,784*	6,707	1,527,573	3,667,357

The decrease in 1903-4 is mainly due to the fact that certain firms, e.g., the British Xylonite Company, Nobels, and Leitch and Co., have been allowed the use of duty-free alcohol denatured by other substances than wood naphtha. The total quantity so allowed in 1903-4 was 206,452 proof galls., which would be 125,885 bulk galls. at 64° o.p. (93.5 per cent. alcohol).

## APPENDIX No. III.

REGULATIONS AS REGARDS USE OF SPIRIT FOR INDUSTRIAL ETC., PURPOSES IN GERMANY.

### TAXES ON SPIRITS.

Spirit taxes in Germany are levied in so many different ways that it is difficult to arrive at any very accurate estimate of the average rate.

Imported spirits of all kinds, including arrack, rum, brandy, and mixed spirits:—

Liqueurs .. .. .	240 marks
All other Spirits—	
(a) In casks .. .. .	160 "
(b) In bottles, flasks, and other vessels	
240 marks for every 100 kilos.	
(220 lbs.), i.e., from about 7½ d.	
to 1s. 1d. per lb.	

The tax has apparently to be paid on the gross weight and contents, and no satisfactory comparison with the British system can, therefore, be made. From 10s. per proof gall. may be taken as an approximate estimate according to the character of the spirit and the vessels containing it.

Burg, Cuxhaven, Bremerhaven, and Gestemünde and other places, are not included in the Spirit Tax and spirits coming from these "free cities" into other parts of the German Empire have to pay the same taxes.

A distillery is allowed to produce a certain fixed quantity of spirit annually, called "the contingent," which is paid a "consumption tax" ("verbrauchsteuer") of 50 marks per hectolitre of pure alcohol. On excess production over the "contingent" 70 marks per hectolitre is charged.

The "contingent" may be increased or decreased for various reasons at any time, and there is a general revision every five years.

Various other taxes are also levied. For these, German spirits are divided into three classes:—

1. *Industrial Distilleries* ("Gewerbliche Brennereien") on by individuals or companies solely for manu-

facturing purposes. These distilleries have to pay per hectolitre of pure alcohol in addition to the "consumption tax"

(a) an "addition" (Zuschlag) of from 16 to 20 marks.

(b) a "distilling tax" (Brennsteuer) of from 2 to 6½ marks.

Distilleries producing not more than 200 hectolitres of pure alcohol annually (7,700 proof galls.) are exempt from the "distilling tax," and the smaller distilleries pay the lower rates according to the fixed scales.

2. *"Agricultural Distilleries"* (Landwirtschaftliche Brennereien) are those using as raw materials potatoes

or grain grown on the owners' farms, or on the farms of one or more of the owners, if the distillery belongs to a society or company. These pay modified "additions" of from 10 to 20 marks per hectolitre of pure alcohol and are exempt from the "distilling tax," or pay only from 1 to 3 marks per hectolitre; or instead of these taxes they may elect to pay a "fermenting vat tax" (Maischbottichsteuer), of from 0.786 mark to 1.31 mark per hectolitre on the fermenting vat capacity for each fermentation.

3. *"Material Distilleries"* (Materialbrennereien) are those using berries, fruits, wine lees, grape pressings, etc.

These appear to be all very small, many of them making no more than 11 to 22 galls. of alcohol annually. In addition to the "consumption tax" of 50 marks, they pay from 0.10 to 0.85 mark per hectolitre of material used.

The total average tax on spirits produced in "Industrial Distilleries" is estimated at not more than 70 marks per hectolitre of pure alcohol, equivalent to about 1s. 9d. per proof gall., and in the "Agricultural Distilleries" at somewhat less—60 to 65 marks per hectolitre—or about 1s. 7d. to 1s. 5d. per proof gall. By far the greater proportion of the spirit made in Germany is produced by the "Agricultural Distilleries."

### DUTY FREE ALCOHOL.

#### ABSTRACT OF THE GERMAN REGULATIONS.

Spirit for employment in industrial operations, vinegar making, cleaning, heating, cooking or lighting, as well as for educational or scientific purposes, may, after having been denatured according to the regulations, or in special cases without denaturing, on proof of the spirit having been so used, be granted freedom from the spirit taxes on the following conditions:—

The freedom from duty includes—

(a.) The release from the "consumption" tax and its "additions."

(b.) The refunding of the "fermenting vat" tax at the rate of 0.16 marks per litre of pure alcohol so far as the spirit has been subjected to it.

(c.) The return of the "distilling" tax at the rate of 0.06 marks per litre of pure alcohol.

Duty paid spirit and spirit containing more than 1 per cent. of fusel oil are not admitted for denaturing.

The denaturing is either *complete*, i.e., such as is deemed sufficient to make the spirit undrinkable, or *incomplete*, i.e., such as requires the employment of other means for the prevention of the improper employment of such spirit.

*General denaturing agent for complete denaturing :—*

4 parts of wood naphtha, and  
1 part pyridine bases,

to each litre of which may be added 50 grms. of lavender oil or rosemary oil.

Of this mixture 2½ litres are added to each hectolitre of alcohol.

(German methylated spirit therefore contains 2 per cent. wood naphtha, and 0.5 per cent. pyridine bases, with optionally 0.125 per cent. of a lavender or rosemary oil.)

The mixing of the general denaturing substance can only be carried out by persons who have obtained special authority for the purpose from the chief Inland Revenue Office of the district where the mixing establishments are situated. Authorised methylators have to provide rooms and vessels for storing and mixing the denaturing agents, all materials and implements necessary, and to give the officials the requisite assistance in sampling the denaturing substances and in the mixing them with the spirit. They have also to provide books of an official pattern for entering the particulars of the mixings and of the sale and transport of the denatured spirit.

The denaturing may take place in special vats erected for the purpose, or in the casks or other vessels used to transport the alcohol. Not less than a hectolitre (22 galls.) of alcohol can be denatured at a time. Before denaturing the alcoholic strength and quantity of spirit in each vessel is checked by the Excise officer, unless such spirit has been sent in vessels under special revenue seals, and which are found intact on examination. The wood naphtha and pyridine bases used for denaturing must first be examined and approved by official chemists, samples being taken for this purpose from the vessels used for storing these materials, which remain under revenue control from the time the sample is taken until mixed with the spirit. The store vessels must contain not less than 100 litres (22 galls.) of the denaturing agents when sampled. The Excise officers are directed to see that the denaturing materials are thoroughly mixed with the spirit.

The nature of the official examination of the wood naphtha is described in the official directions printed on page 256 from which the character of the substance used can be gathered. As compared with the British type of denaturing wood naphtha the German wood naphtha is of a more impure character, i.e., it contains a much larger proportion of acetone, and other substances, and less methyl alcohol.

The pyridine bases are used mainly to increase the nauseous character of the methylated spirit, and serve practically the same purpose as the mineral naphtha used in the United Kingdom and in France.

For use in motor-cars and other internal combustion engines, etc., alcohol may also be completely denatured by the addition of 1½ litres of the "general" denaturing agent and ½ litre of a solution of Methyl Violet dye, together with from 2 to 20 litres of benzol to every 100 litres of alcohol.

The ordinary completely denatured spirit and the motor-car spirit may be sold by persons who are authorised to do so by the Administration. Written application for a licence has to be made to the superior Excise official, who may exercise his discretion as to whether a licence should be given, and the licence may be withdrawn at any time if it appears advisable to disallow the sale in any particular shop. Before obtaining a licence notification must be given to the police.

The ordinary completely denatured spirit is intended for sale by retail, and may be used for any industrial purpose; for cleansing, heating, lighting, and cooking, as well as for educational and medicinal purposes; but must not be present in any substance intended for human

consumption, and no attempt must be made to use such spirit, or to add anything to it to disguise its taste or smell, nor must it be diluted under 85° (49° F.). Heavy penalties are imposed for any contravention of the regulations.

The general control of the retail sale of the denatured spirit is very similar to that imposed in this country where the police appear to be more directly concerned in preventing irregularities than with us.

For general use on a large scale for industrial manufacturing processes of all kinds, what is called "wood spirit denatured" alcohol is allowed to be sold and sold under special conditions. This denatured consists of a mixture of 100 litres of alcohol of not less than 90° (58 a.p.) with 5 litres of wood naphtha.

The denaturing of this spirit may take place either at the works where it is to be used, or on the premises of authorised methylators. In the latter case the regulations as to mixing, storing, etc., are the same as in the case of the completely denatured spirit. Permission to sell this "wood spirit denatured" alcohol can only be granted by the chief office, and makers who sell "wood spirit denatured" alcohol have to keep an official "Control Book" in which has to be entered particulars of all spirit denatured, and of every sale of such spirit. A balance is struck annually and duty is charged on the material loss or deficiency that may be shown; satisfactory explanations can be given. Such spirit can only be sold to factories which can show a licence to buy "wood spirit denatured" alcohol. Any person wishing to obtain a "buying licence" must apply to the chief office of the province in which the factory where such spirit is to be used is situated. Full particulars of the purposes for which the spirit is required must be given. No person engaged in the spirit trade, or who sells denatured or undenatured spirit can obtain a licence; a licence may be refused if any facts are known which render the use of denatured spirit in any factory undesirable. A licence is only given for one year, and the maximum quantity allowed cannot be exceeded without special authority. The "buying licence" must be renewed each time any methylated spirit is purchased. The seller must enter on the licence the quantity sold, adding his name and the date, and must also enter the sale in an official "Control Book." Not less than 2½ (½ gall.) may be sold at a time, and the seller must enter that the maximum annual quantity shown on the "buying licence" has not already been supplied to the buyer.

The buyer must enter every purchase in a "Control Book" kept at the works. From these entries in the "Control Books" the buying and selling accounts are checked and the annual quantities allowed at each factory are fixed.

The denatured spirit must be stored in a special compartment at the factory, and on each occasion that it is removed for use in the works an entry of the quantity and particular purpose for which it is to be used must be made in the "Control Book" and a note must also be entered of the pages of the factory work books and official business books in which particulars are to be entered of the production, storage, and sale of the article. Substances in the manufacture of which the methylated spirit has been used.

On the demand of the superior officers of the Administration these books and business books must be produced for their inspection.

Where this "wood naphtha denatured" alcohol or the "completely denatured" alcohol is unsuitable for any particular manufacture, special denaturing may be allowed. Denaturing with special reagents can only be made at the factories where the alcohol is produced, and permission must first be obtained from the chief office of the province for the use of such spirit.

All the special substances sanctioned for denaturing purposes have to be tested by an official chemist according to officially described methods, and the users of denatured spirit have to pay for the analyses as well as to provide the denaturing substances, and proper vessels, etc., for keeping and mixing the approved reagents with the alcohol.

The mixing takes place in the presence of officials



quantities of each kind of specially denatured alcohol to be entered in a separate opening of the "Control Book" kept in separate vessels or compartments at the place, and used under conditions applicable to the "naphtha denatured" alcohol already described. A check account of the amount of all denatured spirit on the premises of the users of such spirit is to be taken at least once a year. The entries in the "Control Book" of spirit received and used are to be checked, and a copy of the comparison submitted to the chief office. No duty on any loss of spirit shown by the account is to be imposed, but only when there is reason to believe that spirit has been used in illegal ways.

Denatured spirit may be recovered in any manufacturing process, but permission must first be obtained. The denatured spirit may be used again for the same purpose for which it was previously used. If used for other purposes, or if it is purified, it has to be again denatured, and treated as fresh denatured spirit. If used from repeated denaturing samples are to be examined, at the cost of the user, by an official in order to determine whether it remains unfit for consumption. Recovered spirit may have to be stored in specially sealed vessels till again denatured. Incompletely denatured spirit must not be removed from the premises.

Incomplete denaturing the following substances (denaturing agents) may be used. They are to be used for denaturing purposes in the undernoted quantities per 100 litres of the spirit.

a.) For industrial uses of all kinds:—  
5 litres of wood spirit,  
or 0.5 " pyridine bases.

b.) For the production of brewers' varnish and similar substances:—

20 litres of a shellac solution, which is made by adding 1 part by weight of shellac in 2 parts by weight of spirit of at least 90° (58 o.p.), are added to the spirit.

In this case the alcohol in the shellac solution if made under official supervision is also allowed exemption from duty.

c.) For the production of cellaloid and pegamoid:—  
1 kilo. of camphor,  
or 2 litres of turpentine,  
or  $\frac{1}{2}$  " benzol.

d.) For the production of the following substances:—  
1. Ether, ordinary (with certain limitations and regulations as to sale and use).

2. Ethyl sulphuric salts.

3. Agaricio, Podophyllin, Scammony, Guaiacum and Jalap resins, as well as other resins and gum resins.

4. Aldehyde and paraldehyde.

5. White lead and acetate of lead.

6. Ethyl chloride, bromide and iodide.

7. Photographic paper and dry plates, and emulsions of chloride, bromide and iodide of silver and gelatin, and similar preparations.

8. Chloral hydrate.

9. Electrodes for electric storage batteries.

10. Acetic ether (with certain limitations as to sale and use).

11. Glucosides.

12. Rubber preparations.

13. Collodion and bromide, chloride and iodide of silver emulsions of collodion.

14. Pancreatin, alkaloids, santonin, tannin, and salicylic acid and its salts.

15. Coal tar colours, including substances used in obtaining them, and intermediate products.

16. Chemical preparations (not otherwise named) which do not retain any spirit when finished (except formic ether, valerianic ether and butyric ether):—

10 litres of sulphuric ether,  
or 1 litre of benzol,  
or  $\frac{1}{2}$  " turpentine,  
or 0.025 " animal oil.

Collodion for sale must contain at least 1/100th of its weight of gun-cotton.

(e) For the preparation of chloroform.  
300 grms. of chloroform.

(f.) For the production of vinegar.

200 litres vinegar containing 3 per cent. acetic acid,  
or 150 " " " 4 " " "  
or 100 " " " 6 " " "  
and 100 litres of water.

and so on,

or 50 litres vinegar containing 12 per cent. acetic acid  
and 100 litres of water.

or 30 " " " 6 per cent. acetic acid  
and 70 litres of water,  
and 100 " " "

Any excess of the quantity of acetic acid in the vinegar mixture or of the spirit are to be allowed for, and the water may be replaced entirely or in part by an equal quantity of beer, glattwasser, or natural wine.

(g.) For making inks, sealing wax, and stamping inks:—

0.5 litre of turpentine,  
or 0.025 litre of animal oil.

(h.) For making bedstead enamels, and brewers' varnish, as well as for use in incandescent lamps, for finishing silk ribbons, and for cleansing jewellery, etc.  
0.5 litre of turpentine.

(i.) For making iodoform.  
200 grms. iodoform.

The iodoform may be dissolved in part of the spirit, and the solution then added to the remainder of the spirit.

(k.) For varnishes and polishes of all kinds:—  
2 litres of wood spirit and 2 litres petroleum  
benzin,  
0.5 litre of turpentine.

Polishes and varnishes not for use in the works of the makers, but for sale, must contain at least 1/10th part of their weight of shellac or other resin.

(l.) For preparing medical, botanical and zoological preparations for educational purposes:—  
1 litre (commercially pure) methyl alcohol  
and 1 litre petroleum benzin.

(m.) Soap-making.

1 kilo. of castor oil and 400 c.c. of soda solution.

The denaturing materials may be dissolved by heating in part of the spirit, and the solution then added to the remainder of the spirit.

(n.) For the production of wool fat (lanoline):—  
5 litres of petroleum benzin.

Spirit is only allowed duty free for the production of ether and acetic ether under the proviso that they are (under official control) either exported; or else used at home for industrial uses; or for the purpose of testing in scientific and technical trades or professions; or for the production of materials for surgical bandages, but not for ether-containing medicines; or for making fulminates, smokeless powders, and other munitions of war; or for use in certain public institutions. So far as the ether and

acetic ether are not used by the maker, but are sent to other workshops, or to the named institutions and factories, the regulations as to obtaining a licence for buying, selling and using, as well as to the keeping of a control book by the sellers, are the same as in the case of "wood naphtha denatured" spirit.

It will be required also that the buyers, by means of their business and manufacturing books, or by special books, shall enter the particulars of the use of the ether and acetic ether.

A buyer's licence for ether made from duty free spirit can also be given if the ether is to be exported by the buyer, or is to be sent to an authorised industrial user, institution or factory. The intermediate merchant in these cases is under the same control as the maker of ether for sale. The superintending officers can permit ether makers to change ether, which has been made from duty free spirit into taxed ether, so that it may be used or sold for the uses excepted in paragraph 1.

In this case the ether is to be notified for taxing, its weight officially taken, and the proper duty, on the basis of 1.6 litre of alcohol for each kilo. of ether, is to be assessed. If the spirit used is subject to any other charges the highest charge is to be taken.

More particular regulations are made by the chief office.

The denaturing of spirit with 0.5 litre of turpentine for cleaning bijouterie, and for making polishes and lacquer varnishes which are to be used for lead pencils, toys, and clock-making can also be permitted in the existing districts of the Chief Imperial Finance Ministry even when the spirit is not to be used in the factory of the applicant, but is to be sent to other factories. The regulations as to the sale and use of "turpentine denatured spirit" are the same as for "wood naphtha denatured" spirit.

#### PURE DUTY FREE ALCOHOL

Pure alcohol without denaturing may be delivered duty free—

(a) To certain Hospitals, Lying-in Hospitals, and Lunatic Asylums, as well as to Public Scientific Institutions.

Permission has first to be obtained from the chief office of the province, and an application must be made in writing stating the purposes for which the spirit is to be used, and the extreme annual quantity required. The quantities allowed are fixed by the chief office and revised every three years. Not less than 25 litres (5½ galls.) can be received at a time. A stock book has to be kept by some specially designated official of the institution, in which is to be entered particulars of the receipt and use of the spirit. The spirit may be used only inside these institutions for general scientific and heating purposes, and it makes no difference whether the spirit is directly used for the specified purposes or only indirectly so used, e.g., to clean instruments, to disinfect the operators or operating tables, or for heating inhalation apparatus, etc.

Otherwise, the spirit can only be used for the purposes stated. It is specially forbidden to give the spirit to other persons, or to take it outside the institutions except by special permission of the chief office. Duty free ether and acetic ether are allowed in the institutions under similar regulations.

(b.) For making smokeless powders, fuses, and fulminates, as well as for making the varnishes used in finishing these substances.

Permission has to be obtained and the same regulations as are applicable to the buying, storage, and use of "wood naphtha denatured" spirit, and the keeping of "control books" and other accounts are enforced. At large works stock is taken at frequent intervals, and there is generally a somewhat more stringent supervision by the Excise officers. Permission may be granted for recovery of any spirit used in the manufacturing operations. The spirit must only be used inside the factories and must not under any circumstances be removed from the works. Duty may be charged on any unexplained loss or deficiency

shown at the stock takings. Duty free ether and other are allowed in these factories under similar regulations.

Pure undenatured alcohol was formerly allowed used by apothecaries, medicine makers, druggists, and veterinary surgeons for the preparation of 80 tinctures, spirits and liquors according to the formulae of the German pharmacopœia and other authentic formulae, and also for doctors' prescriptions for making bandages, etc. This privilege was withdrawn in October, 1902, and all medicines have now to be prepared with duty paid spirit.

No foreign spirit of any kind, nor any mixture containing spirit, or substances made from spirit, appear allowed to be used duty free in Germany. All imported alcohol, alcoholic mixtures and derivatives have to pay the Customs duties before being delivered for use.

#### INSTRUCTIONS FOR TESTING WOOD NAPHTHA

1. *Colour.* This shall not be darker than that of a solution made by dissolving 2 c.c. of n/10 iodine in 10 c.c. of distilled water.

2. *Boiling Point.* 100 c.c. placed in a short-necked copper flask of about 180–200 c.c. capacity is placed on an asbestos plate having a circular hole of 30 mm. diameter. Into the neck of this flask is placed a fractionating tube 12 mm. wide, and 170 mm. long, with a tube connected to a Liebig's condenser at least 400 mm. long. In the fractionating tube, which is provided with a bulb about a centimetre below the side tube, is placed an officially tested thermometer with a scale from 0° C. to 200° C., so that its mercury bulb is in the middle of the bulb. The flask is heated so that the distillation proceeds at about the rate of 5 c.c. per minute. The distillate is collected in a cylinder graduated in c.c. at 75° C. with a normal barometric pressure of 760 mm. at least 90 c.c. shall be collected. If the barometer is not at 760 mm. during the distillation 1° C. shall be added for every variation of 30 mm., e.g., at 770 mm. 90 c.c. shall distill at 75.3° C.; and at 750 mm. 90 c.c. at 74.7° C.

3. *Miscibility with water.* 20 c.c. wood spirit shall with 40 c.c. water shall give a clear, or only slightly opalescent solution.

4. *Acetone Content.*

(a.) *Separation on mixing with soda solution.*

20 c.c. of wood spirit are shaken with 40 c.c. of a soda solution of S.G. 1.300. At least 5 c.c. of the spirit must separate after standing for half an hour.

(b.) *Titration.*

1 c.c. of a mixture of 10 c.c. of wood spirit and 90 c.c. of water, is mixed with 10 c.c. of double strength soda solution. Then 50 c.c. of n/10 iodine solution is added with continual shaking, and the mixture allowed to remain at least for three minutes. Then excess of sulphuric acid is added, and the excess of iodine titrated with n/10 hypo and starch solution. At least 22 c.c. of n/10 iodine solution shall be required for the acetone.

5. *Bromine Absorption.* 100 c.c. of a solution of KBrO<sub>3</sub> and KBr (made up as under) are acidified by the addition of 20 c.c. of dilute H<sub>2</sub>SO<sub>4</sub> (S.G. 1.290). To this mixture the spirit is added drop by drop from a burette so long as any colour remains on shaking. The addition shall be so arranged that in one minute 10 c.c. of the spirit shall be added. Not more than 30 c.c. shall be required for decoloration, and not less than 20 c.c. This test shall be done in full daylight, and the temperature shall not exceed 20° C.

#### Bromine Solution.

After at least two hours' drying at 100° C., and cooling in an exsiccator, 2.447 grms. of KBrO<sub>3</sub> and 8.719 grms. of KBr of tested purity are dissolved in water, and the solution made up to 1 litre.

The subjoined tables show, for the three years ending 30th September, 1903, (a) the quantities of duty free spirits issued for use in Germany, (b) the quantities of spirit denatured of the several methods allowed, and (c) the quantities used for particular manufactures, etc.



## (A) Quantities of Duty-free Spirit issued during

	Completely Denatured.	Incompletely Denatured.	Undenatured.	Total.	Completely Denatured.	Incompletely Denatured.	Undenatured.	Total.
Year ending 30th Sept.	Hectolitres of Pure Alcohol.				Equivalent bulk Galls. of Pure Alcohol.			
1901	782,295	339,754	33,820	1,155,869	17,210,490	7,474,588	744,040	25,429,118
1902	704,729	345,894	59,427	1,110,050	15,504,038	7,609,668	1,307,394*	24,421,100
1903	960,190	360,730	17,792	1,278,712	19,804,180	7,936,060	391,424*	28,131,664

The use of undenatured duty-free spirit in the preparation of medicinal tinctures and prescriptions was formerly allowed in any. This privilege was withdrawn after the 30th September, 1902. Undenatured alcohol is now only allowed to be used duty-free in certain hospitals, asylums, and public scientific institutions, for making smokeless powders, &c., mainly in Government factories. The sudden increase from 33,820 hectolitres in 1901 to 59,427 hectolitres in 1902 was probably connected with the publication of an order by the Government to disallow the use of pure duty-free spirits for medicinal purposes, this intention being published in advance of the time that it was to take effect.

Methods of denaturing and quantities of Alcohol denatured in the years ending 30th September, 1901, 1902 and 1903.

Denaturing Substance used per 100 litres of Alcohol.	1901.	1902.	1903.	1901.	1902.	1903.
	Hectolitres of Pure Alcohol.			Equivalent bulk Galls. of Pure Alcohol.		
<b>Completely denatured.</b>						
Official mixture—						
parts wood naphtha.						
part Pyridin bases.						
<b>General use—</b>						
litres of official mixture .....	782,295	704,729	870,735	17,210,490	15,504,038	19,156,170
motor engines, &c.—						
litres of official mixture and 2 to 20 litres of Benzol, coloured with Methyl Violet	—	—	29,455	—	—	648,010
Total "completely denatured" .....	782,295	704,729	900,190	17,210,490	15,504,038	19,804,180
<b>Incompletely denatured.</b>						
<b>For sale—</b>						
litres wood naphtha .....	18,689	18,164	20,338	411,158	399,608	447,436
litre turpentine .....	607	607	639	13,354	13,354	14,058
<b>Use only in the factories, &amp;c., where denatured—</b>						
negar (various proportions) .....	166,329	160,287	155,838	3,659,238	3,526,314	3,428,436
225 litre animal oil .....	66,748	75,831	79,836	1,468,456	1,668,282	1,756,392
litre turpentine .....	50,334	61,733	54,460	1,107,348	1,188,126	1,198,120
litres wood naphtha .....	2,803	2,240	2,379	61,666	49,280	52,338
litres ether .....	11,495	11,210	14,473	252,890	246,620	318,406
kilo. camphor .....	9,396	9,604	11,510	206,712	211,288	253,220
litres turpentine .....	5,001	4,935	7,403	110,022	108,570	162,866
litre benzol .....	1,879	3,051	4,105	41,338	67,122	90,310
litre benzol .....	1,144	2,356	3,525	25,168	51,832	77,550
kilo. castor oil .....	1,737	1,710	1,808	38,214	37,620	39,776
4 kilo. soda solution } .....	1,684	1,586	1,795	37,048	34,892	30,490
litres shellac solution .....	993	1,052	992	21,846	23,144	21,824
litres petroleum benzene .....	296	671	586	6,512	14,762	12,892
10 grms. chloroform .....	210	509	539	4,620	11,198	11,858
litre Pyridin bases .....	356	324	322	7,832	7,128	7,084
10 grms. iodoform .....	—	—	132	—	—	2,904
10 grms. ethyl bromide .....	—	—	43	132	—	946
litre commercially pure methyl alcohol } .....	6	—	—	—	—	—
litre petroleum benzene .....	—	—	—	—	—	—
litres wood naphtha } .....	47	24	7	1,034	528	154
litres petroleum benzene } .....	—	—	—	—	—	—
Total incompletely denatured .....	339,754	345,894	360,730	7,474,588	7,609,668	7,936,060

) Manufactures, etc., in which "Incompletely Denatured" Alcohol was used in the years ending 30th September, 1901, 1902, and 1903.

Manufacture, &c.	Hectolitres of Pure Alcohol.			Equivalent bulk Galls. of Pure Alcohol.		
	1901.	1902.	1903.	1901.	1902.	1903.
var	171,264	164,062	164,754	3,767,808	3,609,364	3,624,588
res, lacquers and varnishes .....	66,672	65,116	68,095	1,466,784	1,432,552	1,498,090
res, lacquers and varnishes .....	48,265	53,747	51,609	1,061,830	1,226,434	1,135,398
final extracts, alkaloids, coal tar colours, &c. ....	28,070	32,610	38,637	617,540	717,420	850,014
oid .....	15,797	16,684	22,438	347,534	367,048	493,636
paints and colours .....	2,741	3,460	5,397	60,302	76,120	118,734
inates, percussion caps, &c. ....	1,737	1,710	1,808	38,214	37,620	39,776
ners' glazes .....	700	1,650	1,651	15,400	36,300	36,322
line extraction .....	1,447	1,328	1,421	31,834	29,216	31,262
form .....	1,143	1,052	992	25,146	23,144	21,824
orm .....	296	760	586	6,512	16,720	12,892
c ether .....	369	324	322	8,118	7,128	7,084
t bromide .....	245	415	464	5,390	9,130	10,208
cal dressings .....	—	—	132	—	—	2,904
macetrical remedies and preparations .....	425	425	435	9,350	9,350	9,570
ographic emulsions, papers, plates, &c. ....	—	—	631	—	—	13,882
hing rubber goods .....	235	258	374	5,170	5,676	8,228
aneous .....	112	30	217	2,464	660	4,774
	236	263	422	5,192	5,786	9,284
	339,754	345,894	360,730	7,474,588	7,609,668	7,936,060

## APPENDIX No. IV.

## REGULATIONS AS REGARDS USE OF SPIRIT FOR INDUSTRIAL &amp;c. PURPOSES IN FRANCE.

The Customs and Excise taxes on alcohol in France are:—

Customs (Importation)—70 francs per hectolitre (equivalent to about 1s. 5d. per proof gallon, and 90 centimes per hectolitre (equivalent to about 1s. 7d. per 100 proof gallons) for neutral &c.

These duties are in addition to the Excise duty.

Excise (Internal)—220 francs per hectolitre of pure alcohol (equivalent to about 4s. 6d. per proof gallon).

## DUTY FREE SPIRIT.

## ABSTRACT OF FRENCH REGULATIONS.

Spirits for industrial and domestic use are freed from all taxes on condition that they are denatured, but all medicaments which contain any spirit after their manufacture pay the ordinary spirit duty. Denatured alcohol pays a statistical tax of 0.25 franc per hectolitre of pure alcohol (about 7d. per 100 proof gallons) and also 0.80 franc per hectolitre (about 1s. 10d. per 100 proof gallons) to cover the expense of the examination of the samples and the supervision of the denaturing operations.

Any person who desires to denature spirit must submit a plan of his premises and supply details as to the vats, vessels, &c., and the materials to be used for denaturing.

Denaturing takes place in presence of the Excise officials. The alcohol must be of at least 90° (58° a.p.) and contain not more than 1 per cent. of "fusel oil."

Samples of both the alcohol and of the denaturing substances to be used have to be submitted to analysis as directed by the Ministry of Finance, and all operations are supervised by the Excise officers.

Spirits may be denatured by the "general process" or by "special processes."

Denaturing by the "special" processes is usually carried out at the factories where the spirit is to be used.

## General Denaturing Process.

Ten litres of wood spirit of at least 90° (58° a.p.) and containing 25 per cent. acetone and 2.5 per cent. of "impurities pyrogenées" for 100 litres of spirit.

Spirit denatured by this reagent is divided into two classes:—

1. *For lighting and heating and for making "finish."*—This spirit must contain, in addition to the general denaturing agent, 0.5 per cent. of heavy benzine, distilling between 150° and 200° C., when used for heating and lighting, and 4 per cent. gum resin for "finish."

These spirits are allowed to be sold, under strict regulations and police and Excise supervision, both wholesale and by retail to the general public, and correspond to our mineralised methylated spirit and "finish." Since 1st January, 1902, there is allotted to the makers of denatured alcohol for heating, lighting, and motive power a sum of 9 francs per hectolitre of pure alcohol (about 21d. per proof gallon). This is to reduce the cost of denaturing for the various uses to which this alcohol is applied in competition with petrol.

2. *For Manufacturing purposes*, such as varnishes, solid extracts, colloid spirits, plating solutions, alkalis, fulminate of mercury, transparent soap, insecticides, &c.

Manufacturers wishing to use this spirit must obtain permission. They have to keep an account of spirits received and used, and of the nature and quantity of the products manufactured by its aid.

Excise officers frequently visit the works in order to assure themselves that the products made correspond to the spirit produced.

If the products contain any alcohol they come under the same regulations as to sale, &c., as methylated spirits.

This spirit corresponds to our "ordinary unmineralised

methylated spirit," and the regulations in France are not less but more stringent than in this country.

3. Certain industries cannot use methylated mixed with wood spirit, and the Ministry have sanctioned the employment of other processes of denaturing specially adapted to the particular necessities of each manufacturer. These are either *special* for each product, have to be approved by the Minister, or *general* for all or classes of products already approved on the report of the Consultative Committee.

Of the latter are:—

1. *Ethers, simple and compound.*

Alcohol is mixed with 10 per cent. of the ether (of a fixed type) of a previous operation, and 1 per cent. sulphuric acid at 66° B., or 20 per cent. anhydrous. The mixture is heated to a temperature of 80° for some time (prolonge) in presence of the Excise officials.

2. *Ethyl Bromide.*

Seven litres of spirit at 93° with 8½ litres of sulphuric acid at 66° and 15 grms. bromine.

3. *Ethyl Iodide.*

6 litres of alcohol at 96°, 4 kilos. iodine, and 4 grms. amorphous phosphorus.

4. *Ethylate of Soda.*

8 litres absolute alcohol and 500 grms. soda.

5. *Nitric Ether.*

1 part nitric acid at 36° and 4 parts alcohol at 96°.

6. *Ethyl Chloride.*

1 part hydrochloric acid at 21° and 1 part alcohol at 96°.

7. *Aldehyde.*

Mix alcohol with 10 per cent. sulphuric acid at 66° or 20 per cent. at 54° B., and heat the mixture to a temperature of 80° C. Cool and then pour the mixture on to bichromate of potash.

8. *Chloroform.*

Mix the alcohol with 5 or 6 kilos. of chloroform in solution.

9. *Collodion.*

Equal volumes of ether and alcohol, and add cotton. The mixture should represent 2 litres for 1 litre of alcohol, and should contain 6 grms. pyroxyl.

10. *Chloral and Chloral Hydrate.*

A current of chlorine gas is passed through alcohol. Each litre of alcohol of 95° ought to produce 1.500 of chloral hydrate.

In all these cases, as well as in those in which the manufacturer is permitted to employ other special processes, the denaturing has to be done in the presence of an Excise Officer (Agent d'Administration), and the manufacturer has to keep registers of the alcohol used, and of the products made, and to submit to visits from the Excise officials in the case of those who use the common methylated spirits.

The Administration furnishes the denaturing spirit, etc., at the expense of the makers.

The minimum quantity of spirit that can be denatured by the general formula is 20 hectolitres (440 gallons) or by any special formula 10 hectolitres (220 gallons).

In all the "special cases" the French regulations appear to involve the presence of an official during the initial stages of every manufacturing operation, in addition a detailed return from the manufacturer of the quantity of the products he obtains and of the spirit used, and the officials have to be satisfied that correspondence between the spirit used and the products obtained is satisfactory. Manufacturers are charged with duty on any deficiency of spirit shown by their accounts or inspections.

There appears to be no provision in France for remission of the Import (Customs) duty on spirit of no foreign spirit is denatured.



*Showing the Quantities of Denatured Spirit used in France for various Manufacturing Purposes during the years 1900-1-2-3.*

Manufacture, &c., for which used.	1900.	1901.	1902.	1903.
Galls. of pure Alcohol.				
ng, heating, motor engines, &c. ....	2,764,256	3,366,110	4,999,560	5,764,792*
hes, lacquers and polishes .....	385,264	360,426	312,136	317,834*
.....	3,432	16,346	902	11,704*
ld, &c. ....	158,350	111,518	87,186	101,090*
and chemical preparations .....	100,408	60,852	149,886	613,162
and explosives .....	1,427,206	1,530,848	1,530,912	1,405,338
fic purposes .....	8,492	9,438	8,932	11,418
.....	10,204	78,892	88,000	15,818
Total .....	4,866,708	5,534,430	7,180,520	8,241,156

These spirits, as well as a large proportion of that classed under "chemical preparations" and "explosives," contain 10 per cent of wood naphtha.

From January 1st, 1902, a drawback of 9 francs per hectolitre (about 2½d. per proof gall.) has been allowed on alcohol used for heating and for distilling, and to enable this spirit to compete with petrol in motor cars, &c.

There was some alteration of the classification of "drugs," "ether," &c., in 1903.

#### APPENDIX No. V.

##### REGULATIONS AS REGARDS USE OF SPIRIT FOR INDUSTRIAL PURPOSES IN SWITZERLAND.

###### *Customs and Excise Duties.*

In Switzerland, the manufacture, importation, and primary sale of alcohol is a monopoly of the Federal Government.

Distillers are permitted to distill small quantities of alcohol from grapes, wine, wine-lees, wine yeast, fruits, &c., grown on their own lands; but, with this exception, all kinds of distilleries have to work under the supervision of the officials of the Federal Alcohol Department, and all the spirit produced is taken over by this department at prices fixed by agreement made between distillers and the Federal Finance Minister.

*Import Taxes.* Brandy, liqueurs, essences, tinctures, and other special alcoholic liquors are imported by private persons on payment of an import duty of 80 francs per 100 kilos, gross weight in casks and vessels, where the strength does not exceed 16° a.p., and 80 centimes for each degree over that (equivalent to about 2s. 6d. to 3s. 6d. per proof

gallon). All ordinary alcohol, and substances containing alcohol, come under the monopoly, and can only be imported into Switzerland by the Federal Alcohol Department.

*(Monopoly) Taxes.*—All imported alcohol, and all manufactured alcohol, has to be sent to the Customs of the Alcohol Department of the Federal Government.

Anyone who wishes to buy spirit must order it from the department in quantities of not less than 150 litres. The prices charged are fixed by law at not less than 120 francs or more than 150 francs per hectolitre of alcohol.

The present ordinary "monopoly" prices are as follows:—

(a.) Wein Spirit, mark A.V.W., or Kahlbaum spirit (Fein Spirit from Kahlbaum, Berlin). 142.60 francs per hectolitre at 95° (5s. 2d. per all, at 66° o.p., 3s. 1½d. per proof gall.).

(b.) Prima Spirit, mark A.V.P. 110.97 francs per hectolitre at 95° (5s. 1d. per all, at 66° o.p., 3s. 1d. per proof gall.).

(c.) Fein Spirit, mark A.V.F. 138.53 francs per hectolitre at 95° (5s. per gall, at 66° o.p., 3s. per proof gall.).

(d.) Raw Potato Spirit, mark A.V.P. 131.24 francs per hectolitre at 90° (4s. 9d. per all, at 55° o.p., 3s. per proof gall.).

From these prices the Government profit or tax is equivalent to about 2s. to 2s. 3d. per proof gall.

Wholesale dealing in spirit or spirituous liquors is not subject to any further licences or taxes, but the retail sale and the regulation of public houses, &c., is under the control of the Cantonal Authorities, who may impose further taxes or licences.

#### DUTY FREE SPIRIT.

##### *Abstract of the Swiss Regulations.*

The Alcohol Department are authorised to sell denatured spirits in quantities of not less than 150 litres (33 galls.) at cost price for the following purposes:—

(a.) For cleansing, heating, cooking, lighting, and also for use in motor engines.

(b.) For industrial purposes generally, except the preparation of beverages, or of liquid perfumes and cosmetics.

(c.) For making vinegar.

(d.) For scientific purposes.

(e.) For preparing pharmaceutical products which do not contain any alcohol in their finished condition, and are not mixed with alcohol when used.

The denaturing is either "absolute," i.e., such as is considered sufficient of itself to render the spirit unfit for consumption as a beverage; or it is "relative," i.e., such as requires official supervision in order to prevent such relatively denatured spirit being used for other purposes than those for which it is allowed.

"Absolutely" Denatured Spirit. The preparation of "absolutely" denatured spirit is exclusively reserved for the Alcohol Department, who prepare it and sell it to users and retailers in quantities of not less than 150 litres at a time, at a price of 50 francs per 100 kilos, at 93° (about 1s. 6d. per gall. at 63° o.p.). On quantities of 10,000 kilos, sent out at one time in boiler tanks a discount of 2 per cent. is allowed off this price, and from 1½ to 1 per cent. when quantities of 10,000 kilos, and 5,000 kilos, are so sent out in large and small casks.

The methods of denaturing and the substances used are regulated by the Alcohol Department.

The "absolutely" denatured spirit is used for cleansing, heating, cooking, lighting, and motor engines, and for sale, by retail. The retail sale is under the control of the Cantonal Authorities.

For "absolutely" denatured spirit the composition of the denaturing mixture, is not kept constant, but for various reasons it is changed two or three times per annum. At present (November, 1901) the Department employ a mixture having the following composition:—

Acetone Oil .. ..	700 parts.
Pyridine Bases .. ..	100 ..
Solvent Naphtha .. ..	90 ..
Crude Wood Naphtha .. ..	110 ..
	1,000 parts.

2.7 kilos. of this mixture are added to any 100 kilos. of alcohol at 95° (about 2.7 galls. to 100 galls. of alcohol at 66 a.p.).

This proportion has been kept constant for some time, but cannot be considered as unalterable.

"Relatively" denatured spirit. For all manufacturing purposes, "relatively" denatured spirit is allowed to be used.

Whoever wishes to use this kind of spirit in his business must make application to the Alcohol Department on a special form.

Persons whose names are not registered in the "Trade List" have to obtain an official certificate as to the character of their establishments, and the kind of business carried on by them. The discretion as to the granting of permission is vested in the director of the Alcohol Department, who also determines what bonds or guarantees are sufficient to prevent the improper use of such spirit.

Persons who have been allowed to use this spirit must commence operations within three months of the date of their obtaining the permission, otherwise a fresh application has to be made.

Denaturing may take place either in the warehouses of the Alcohol Department or at the premises of the users of such spirit. In the latter case the users of "relatively" denatured spirit have to obtain the pure spirit from the Alcohol Department, and have then to provide the denaturing materials at their own cost and also premises for mixing the denaturing substances with the spirit in the presence of the officials of the Department.

The officials decide whether the denaturing substances provided comply with the regulations, and if they are not satisfied samples are taken and sent for examination by the technical chemists of the department at Berne. Traders have also to provide the denaturing substances used at a warehouse.

The following substances have been sanctioned for "relative" denaturing in the undernoted proportions for every 100 litres of alcohol for use for the purposes specified :

(a.) For making *Vinagar*.

Five litres of absolute acetic acid dissolved in at least 200 litres of water. The water may be replaced by an equal quantity of beer, wine, yeast, yeast pressings, or similar liquids.

(b.) For preparing *Lacquers, Varnishes, and Polishes*.

2 litres of wood spirit and 2 litres of petroleum benzol,  
or,  $\frac{1}{2}$  litre of turpentine,  
or,  $\frac{1}{2}$  litres of wood spirit,  
or, 2 kilos. of shellac,  
or, 2 kilos. of copal or resin,  
or,  $\frac{1}{2}$  kilo. of camphor.

The denaturing with camphor will only be allowed to authorised users, who mix varnishes or polishes exclusively for use in their own workshops.

(c.) For preparing *Dye Substances*.

10 litres sulphuric ether,  
or, 1 litre benzol,  
or, 1 litre coal tar oil,  
or,  $\frac{1}{2}$  litre turpentine,  
or, 25 grms. animal oil, and  
or, 25 grms. aniline blue or eosin, violet or fluorescein.  
or, 100 grms. naphthalene,  
or, 2 kilos. commercially pure methyl alcohol,  
or,  $\frac{1}{2}$  kilo. camphor.

For the use of other denaturing substances for purposes special permission has to be obtained from the Federal Council.

In the case of (b.) varnishes, etc., and (c.) dye Alcohol Department determines, in each case in permission is granted for the use of "relatively" natured spirit, which of the different denaturing stances given in the list shall be used.

The authorised users of "relatively" denatured are required (so far as may not be in whole or part dispensed with) to keep prescribed books in which to be entered the receipt and use of the spirit; the production and disposal of the products made with it; and particulars of any sale of the spirit which may be allowed.

They have also to send to the Alcohol Department immediately after the close of every quarter, extracts of these books, giving full particulars of business done during the preceding quarter, and verified by signature for the accuracy of these reports.

Officials of the department may at any time inspect works, the stock of denatured spirit, and the quantity used, and of the products made with it; and may take samples, and inspect any of the business books belonging to the factory.

The trader and his servants must assist the officials of the department and of the customs in carrying out denaturing, and generally in the exercise of their supervision.

Information must also be immediately given to the officials when there has been any unusual disturbance in the manufacturing operations, or any occurrence which has caused an unusually loss of "relatively" denatured spirit, or of the products made from it.

If more than 10,000 kilos. of relatively denatured spirit are used annually at any factory, iron or other with gauge glasses and scales or floats, and means of official locking must be provided for storing the spirit.

Manufacturers who use both "relatively" and "absolutely" denatured spirit, and also undenatured spirit in their works, have to keep separate the processes in each kind of spirit is used.

No distilling or rectifying apparatus must be used without the special permission of the department in the rooms in which "relatively" denatured spirit is being used, or in any adjoining room belonging to the authorised user.

If permission has been given to recover the spirit it must be used again for the same purpose, and the quantities recovered must be entered in the stock books. The permission for the use of the spirit may be withdrawn at any time, and the withdrawal gives no person any right for compensation. If by death or any other change in the firm occurs, a renewal of the permission must be obtained from the department by the successor.

When for more than a year no "relatively" denatured spirit has been used, the user must resign his permit and sell or give over to some other authorised user the unused spirit, or return it to the Alcohol Department who will pay the market price for it.

The owner of the "relatively" denatured spirit may not sell it, or allow it to leave his manufacturing premises. Permission is given to sell such spirit denatured with-

- (a.) 5 litres of wood naphtha,
- or (b.) 3 litres of acetone oils,
- or (c.) 2 kilos. of shellac, per hectolitre.

Such spirit cannot, however, be sold or given to any person who means to sell it again, but only to users in their own workshops. Not less than 5 kilos. of spirit can be sold at a time, and if the person to whom it is sold does not hold a special permission for it, the total quantity he can receive annually must not exceed 150 litres (33 galls.).

Denatured spirit must not be used for any other purposes than those for which permission is given, and particularly it must not be used in any way for beverages, and no attempt must be made to re-distill wholly or partially from such spirit any of the denaturing substances, or to add other substances which would



the taste or smell of the denaturing substances, must users of "relatively" denatured spirit in preference with it articles for sale make so slight a change in spirit that it practically remains only denatured. In particular all varnishes, etc., must contain at least 1 per cent. of their weight of shellac or similar resin. The sale of lacquers, varnishes, and polishes containing 6 per cent. of shellac is free. Dealers in all other articles containing denatured spirit must obtain permission from the Alcohol Department. Heavy penalties may be imposed for any breach of laws or regulations.

prices at which authorised users of "relatively" denatured alcohol can obtain their spirit from the Alcohol Department are fixed for periods of five years, according to average prices paid by the department for spirit during the preceding five years.

present prices per 100 kilos. net at 95° are as follows:—

(a.) Sekunda-Sprit .. .. .	47.0 francs.
about 1s. 4½d. per gall. at 66 o.p.)	
(b.) Fein-Sprit or Rohspiritus .. .. .	48.5 „
about 1s. 5d. per gall. at 66 o.p.)	
(c.) Prima-Sprit .. .. .	51.5 „
about 1s. 6d. per gall. at 66 o.p.)	
(d.) Kahlbaum-Sprit or Wein-Sprit .. .. .	53.5 „
about 1s. 7d. per gall. at 66 o.p.)	

the same discounts are given for large orders as in the case of "absolutely" denatured spirit.

authorised user has to bear the cost of the carriage, of the denaturing substances in addition. Until authorised users were permitted to buy their own spirit from abroad and to import it through the Department on payment of an import duty of 8 francs per 100 kilos (about 2½d. per gall.). In future all alcohol must be bought from the Federal Alcohol Department, and the prices for the year 1905 have been fixed as follows:—

(a.) Sekunda-Sprit at 41.0 francs per 100 kilos.	t 95°.
(1s. 2½d. per gall. at 66 o.p.=8½d. per proof gall.)	
(b.) Fein Spirit or Rohspiritus at 42.50 francs per 100 kilos.	t 95°.
(1s. 3d. per gall. at 66 o.p.=9d. per proof gall.)	
(c.) Prima-Sprit at 45.50 francs per 100 kilos.	t 95°.
(1s. 4d. per gall. at 66 o.p.=9½d. per proof gall.)	
(d.) Wein-Sprit at 47.50 francs per 100 kilos.	t 95°.
(1s. 5d. per gall. at 66 o.p.=10½d. per proof gall.)	

authorised users who order at one time one or more orders of about 10,000 kilos. net content (2,700 galls.) are granted a discount of 5 per cent. off these prices if they give the Alcohol Department a period of 30 days for execution of their order when foreign kinds of spirit are required.

For all other large orders of over 5,000 kilos. gross the usual official discount will be given.

The annexed tables give the quantities of the "absolutely" denatured spirit, and of the different kinds of "relatively" denatured spirit used in 1903, and also the quantities for which the latter spirit was used.

Quantity of Denatured Spirit of all kinds sold in 1903.

	Kilos. at 93° to 95°.	Equivalent Galls. at 63 to 66 o.p.
"absolutely" denatured .. .. .	4,758,003	1,284,660
"relatively" denatured:		
on monopoly .. .. .	110,980	—
"importations" .. .. .	1,567,602	—
	1,678,582	453,217
Total .. .. .	6,436,585	1,737,877

Quantity of "Relatively" Denatured Spirit used in Switzerland in 1903.

Nature of the Manufacture, &c., in which the Spirit is used.	Number of Factories or Users.	Quantities of Alcohol used.	
		Kilos. at 95°.	Equivalent Galls. at 66 o.p.
Vinegar making .. .. .	10	225,849	60,980
For lacquers and varnishes .. .. .	154	169,767	45,837
Manufacture of dyes .. .. .	8	311,581	84,127
For dissolving dyes for cotton factories .. .. .	6	9,150	2,470
For soaps and perfumery .. .. .	11	8,376	2,262
For scientific purposes .. .. .	18	4,048	1,093
Chemical products .. .. .	27	133,231	35,972
Surgical dressings .. .. .	3	782	211
Gummed tissues .. .. .	3	6,049	1,633
Tobacco manufacture .. .. .	1	17	5
Artificial silk .. .. .	2	603,731	163,007
Celluloid .. .. .	1	8,758	2,365
Smokeless powder .. .. .	1	2,952	797
Fulminate of mercury .. .. .	1	10,932	2,952
Acetic ether .. .. .	1	91,759	24,775
Grafting wax .. .. .	1	258	70
Electrotyping .. .. .	1	280	76
Preparing cotton goods .. .. .	1	16,069	4,339
Making mixture to prevent freezing of gaspipes .. .. .	1	2,536	685
Preserving natural history specimens .. .. .	1	252	68
Preserving botanical specimens .. .. .	3	438	118
In photo-chemical works .. .. .	2	850	230
		1,607,665	434,072

Denaturing Substances used for "Relative" Denaturing, and Quantity of Alcohol Denatured with each.

Denaturing Substances.	Quantity of Alcohol denatured.	
	Kilos. at 95°.	Equivalent Galls. at 66 o.p.
1. Shellac, with or without the addition of camphor, turpentine, wood naphtha, &c. ....	52,340	14,132
2. Colophony resin .. .. .	3,974	1,073
3. Copal resin .. .. .	2,455	663
4. Camphor .. .. .	22,551	6,089
5. Turpentine .. .. .	98,210	26,517
6. Acetic acid .. .. .	257,186	69,440
7. Nitric acid .. .. .	1,241	335
8. Acetic ether .. .. .	3,532	953
9. Ethylic ether .. .. .	628,566	169,713
10. Wood naphtha .. .. .	15,751	4,253
11. Pure methyl alcohol .. .. .	11,419	3,083
12. Wood naphtha and pyridine .. .. .	352	95
13. Acetone oil .. .. .	1,748	472
14. Methyl violet (dye) .. .. .	132,350	35,734
15. Methylene blue (dye) .. .. .	524	141
16. Aniline blue (dye) .. .. .	10,711	2,892
17. Eosin (dye) .. .. .	133,552	36,059
18. Furorescin (dye) .. .. .	87,038	23,500
19. Naphthalene .. .. .	9,463	2,555
20. Soap and castor oil solution .. .. .	4,367	1,179
21. Coal tar oil .. .. .	12,670	3,421
22. Benzol .. .. .	3,100	837
23. Nitrobenzol .. .. .	513	138
24. Phenol .. .. .	739	200
25. Pyridin .. .. .	87,817	23,710
26. Caustic soda .. .. .	15,244	4,116
27. Piperonal .. .. .	2,423	654
28. Musk .. .. .	8,275	2,234
29. Animal oil .. .. .	54,780	14,790
30. Ethyl chloride .. .. .	1,243	336
31. Chloroform .. .. .	128	34
32. Formalin .. .. .	220	59
33. Undenatured (for manufacture of munitions of war) .. .. .	13,609	3,674
	1,678,091	453,081

## APPENDIX No. VI.

## REGULATIONS AS REGARDS USE OF SPIRIT FOR INDUSTRIAL, ETC., PURPOSES IN AUSTRO-HUNGARY, RUSSIA, HOLLAND, UNITED STATES, BELGIUM.

## AUSTRO-HUNGARY.

The Spirit taxes in Austria and Hungary are:—

## Customs (Import)—

On liqueurs, punch essence, sweetened spirits, arrack, rum, French brandy and cognac:—150 kronen (fl.) per 100 kilos, equivalent to about 4s. per bulk gall.

On all other spirits:—110 kronen (4l. 8s.) per 100 kilos, equivalent to about 3s. 3d. per bulk gall.

These duties are in addition to the highest Excise duty payable in the country on spirits of the same description.

## Excise.—

Austria.—90 kronen (75s.) per 100 litres pure alcohol, equivalent to 1s. 11d. per proof gall.

Hungary.—100 kronen (83s. 4d.) per 100 litres of pure alcohol, equivalent to 2s. 2d. per proof gall.

## DUTY FREE SPIRIT.

Ordinary Methylated Spirit is made by mixing with alcohol of at least 90° (58 o.p.)

2 per cent. wood naphtha,

$\frac{1}{2}$  per cent. pyridine bases, and a trace of phenolphthalein.

A tax equivalent to about one-third of a penny per gall. is charged for denaturing.

For Varnishes, fulminate of mercury, hat-making, etc.,  $\frac{1}{2}$  per cent. of turpentine is the denaturing agent.

For Vinegar the spirit is mixed with "anhydride."

Very small quantities of pure alcohol are used for scientific purposes under certain conditions free of duty.

## RUSSIA.

## CUSTOMS AND EXCISE DUTIES ON ALCOHOL.

Customs (Import)—16 roubles 20 copecks per pound, equivalent to 34s. 6d. per 36 lbs. As in Germany, probably the weight of the vessels is included, and no very exact comparison can be made with the British standard. Approximately, the tax may be taken at 10s. to 12s. per proof gall.

Excise.—The sale of alcohol is a monopoly in Russia, and distillers have to hand over their produce at fixed rates.

## DUTY FREE SPIRIT.

## Abstract of Russian Regulations.

Persons wishing to use spirit duty free must apply to the Minister of Finance. Permission is generally limited to one year. Security for the duty (bond) must be given.

The quantity of spirit allowed is determined each year, and "depends on the productive power of the manufactory, conditions for disposal of manufactured article, scale of annual consumption of spirit," etc. The spirit is issued from distilleries, rectifying works, etc., on production of the order of the Finance Minister. It is received and examined at the factories by Excise officers, and after having been denatured, is placed under revenue seal in a special store and is only issued as required by an Excise officer. Accounts of receipt and issue are strictly kept, and sent to auditing authorities at the end of each year.

As a general rule a special Excise controller is attached to each works for constant supervision of the proper use of the duty free spirit, and the proprietor of the works is bound to provide him with proper dwelling accommodation and with furniture and fuel.

Foreign spirits cannot be imported duty free.

## Denaturing processes employed:—

## 1. For Varnishes and Polishes.

100 parts spirit are mixed with 5 parts wood naphtha and 1 part of turpentine, or instead of turpentine shellac, tar, etc., may be used in the proportion of  $\frac{1}{2}$  lb. to one vedro (2.7 galls. of spirit).

## 2. For the preparation of Wine Vinegar.

The spirit is diluted with water and vinegar, it shall be of a strength of 12° tralles (79 u.p.) contain 1 per cent. of acetic acid.

## 3. For the preparation of Ether, Chloroform, Hydrate and Iodine.

20 "lots" of animal oil to 100 vedros (270 of spirit.

## 4. For the preparation of Tannin and Collodion.

To 100 parts of spirit 10 parts of sulphuric acid are added.

## 5. For the preparation of Santonine.

Fresh spirit is mixed with spirit that has already been used in the proportion of 4 parts of fresh spirit to 1 of used spirit, or 36 lbs. (1 pound) of crude santonine mixed with (10 vedros) 27 galls. of spirit.

## 6. For the preparation of Phenacetin, Salol, Salipyrin, Salicitine-Nitro Salts.

5 per cent. of benzol is added to the spirit.

## 7. For the preparation of Aniline Dyes.

5 parts of wood naphtha to 100 parts of spirit the spirit is mixed with animal oil in the proportion of 20 lots of oil to one vedro of spirit (2.7 galls.

## 8. For the preparation of Artificial Silk.

10 per cent. of sulphuric ether is added to the

## 9. For the preparation of Resinite or Ksylite.

7 per cent. of ether or acetone.

## 10. For Smokeless Powder Manufacture.

Spirit is not denatured, but there is strict regulation and personal supervision of the Excise officer.

## 11. For Fulminate of Mercury.

$\frac{1}{40}$ th of 1 per cent. of animal oil (0.025 per cent.) and 5 per cent. of the crude recovered spirit is added to the process.

## 12. For the Emulsic process, i.e., Extraction of from Treacle.

Fresh spirit is mixed with the spirit that has already been used, in the proportion of 1 part of fresh spirit to 1 part of used spirit.

## 13. For preventing Freezing of Gas Pipes.

5 parts of wood naphtha and 1 part of pyridine to 100 of spirits.

## 14. For Street Lighting in Towns.

20 parts of turpentine to 100 parts of spirit; issued to contractors to town councils, etc.

## HOLLAND.

## The Spirit Taxes in Holland are:—

Excise—63 florins per hectolitre of alcohol equivalent to about 5s. 6d. per proof gall.

Customs (import)—A surtax of 3.50 florins per hectolitre of alcohol at 50°, and in addition Excise tax of 63 florins = total 66.50 florins, equivalent to about 5s. 9d. per proof gall.

## DUTY FREE ALCOHOL.

## ABSTRACT OF THE DUTCH REGULATIONS.

## Ordinary Methylated Spirits.

1 litre wood spirit.

8 litres alcohol of at least 85° (49 o.p.).

This spirit is free to all who like to use it, on condition that it is not used in articles of human consumption and that no attempt is made to purify it from methyl alcohol.



*r Making.*

1 hectolitre of alcohol at 50° is denatured with  
1 hectolitre vinegar of 4 per cent. strength.  
2 hectolitres water.

20 litres vinegar of 4 per cent.  
20 litres dried raisin juice.

20 litres vinegar alone if Excise officers see the  
stare added to acidifying vessels.

mission to receive methylated spirits must be  
every year.

1 spirit provided by Government at a fixed price  
r cost of methylating.

e keep accounts of quantity used. Vinegar  
furnish returns of vinegar made.

mens in spirit for teaching natural history may be  
duty free, and no Excise duty is charged.

gn-made varnishes containing wood naphtha  
home-made may be imported duty free.

Duties on	il.
oral hydrate .....	1.30 per kilo.
ier sulphurie .....	2.20 " "
ier acetic .....	1.20 " "
lodion .....	1.90 " "
oroform .....	1.50 " "
rous ether .....	1.30 " "
od spirit .....	1.15 " litre.

exempt when required for use in making smokeless  
and glazing porcelain.

exempt when required for use in making smokeless  
and glazing porcelain.

exempt when required for incandescent mantles.

similar products pay the same surtax and Excise  
res of alcohol at 50°.

## UNITED STATES.

Customs and Excise duties on Alcohol in the  
States are :—

Customs—1.75 dol. (minimum reciprocity tariff).  
5 dols. (general tariff).

Per American proof gall.; equivalent to 10s.  
to 12s. 10d. per British proof gall.

Excise—1.10 dol. per American proof gall.;  
equivalent to 6s. 3d. per British proof gall.

## DUTY FREE ALCOHOL.

There appears to be nothing equivalent to British  
methylated spirit or denatured spirit of any kind in the  
United States.

The only duty free alcohol of any kind is that which  
is supplied in very small quantities to certain schools  
and colleges for use in education and research.

## BELGIUM.

The Customs and Excise taxes on Alcohol in Belgium  
are :—

## Customs (importation)—

175 francs per hectolitre at 50°, and 3.50 francs  
for each degree over 50 for ordinary spirits in bulk  
(equivalent to 7s. per proof gall.).

In bottles 350 francs per hectolitre. Other  
alcoholic liquors at 350 francs per hectolitre.

Food preparations preserved in alcohol, 175 francs  
per 100 kilos.

Wood spirit, methyl and amylic alcohol, and all  
homologues pay customs duty.

## Excise (internal)—

Excise on home-made spirits is 150 francs per  
hectolitre at 50° (equivalent to 6s. per proof gall.).

Agricultural distilleries obtain a rebate of the  
Excise duty, equal to 8 to 10 francs per hectolitre  
at 50° (equivalent to 4d. to 5d. per proof gall.).

## DUTY FREE ALCOHOL.

## ABSTRACT OF THE BELGIAN REGULATIONS.

Since 1896, alcohol has been allowed duty free in a few  
manufactures, and in a number of others a proportion of  
the duty is returned after the alcohol has been mixed  
with certain denaturing agents.

Manufacture, &c.	Denaturing Agent used per hectolitre of Alcohol at 94° or over (64 o.p.).	Duty remitted per hectolitre at 50°. (Excise Duty 150 francs.)
		Francs.
	300 litres of water, and 100 litres of vinegar containing 8 per cent. acetic acid <i>For use in workshops where made.</i> —8 litres methyl alcohol (wood spirit) containing 5 per cent. acetone and 25 litres of varnish containing 30 per cent. gum resin	120
	<i>For sale.</i> —10 litres wood spirit containing 5 per cent. acetone, and 25 litres varnish containing 30 per cent. gum resin	114
colours	10 litres wood spirit containing 5 per cent. acetone, and 25 grms. fuchsine or other aniline colour	140
	10 litres wood spirit containing 5 per cent. acetone, and 25 litres varnish con- taining 30 per cent. gum resin	140
flowers	10 litres wood spirit containing 5 per cent. acetone, and 15 grms. aniline colours	140
gliding	20 litres wood spirit containing 5 per cent. acetone, or 3 litres ethyl methyl ketone	114
materials	10 litres wood spirit and 5 kilos. gum acerride	140
and washing raw oils	10 litres sulphuric acid at 66° B	140
rent soap	5 litres ess. of lavender, aspic of citronella	140
fulminate	10 litres of crude ethers, recovered in process	140
n for use in workshop		
re made	50 litres common ether	140
ds, &c.	50 litres common ether	140
ss powder	5 litres acetone, or 2 litres ethyl methyl ketone, or 25 litres ether	140
s from brewing yeasts	3 litres ethyl methyl ketone	140
line, a disinfectant	3 litres ethyl methyl ketone	140
ics and medicaments	3 litres ethyl methyl ketone	140
ne yellow	3 litres acetone oil	140
de fleelles	4 litres acetone oil	140
g silk	150 litres common ether	140
g metals	3 litres of mixture of equal parts of ethyl methyl ketone and acetone oil	140
ether	15 litres of acetic ether residues	140
ic or common ether	10 litres of sulphuric ether residues	140
ical, &c., preparations in		
erior schools	500 grms. nitrobenzol, 500 grms. camphor, or 1½ litres ethyl methyl ketone	140





# PLANT, APPARATUS, AND MACHINERY.

## ENGLISH PATENTS.

*Drying Apparatus; Vacuum*.—R. Haack, Godesburg, and Sürth, Maschinen-Fabrik vorm. H. Hammerhmidt, Sürth, Germany. Eng. Pat. 7010, March 23, 1904.

See Fr. Pat. 341,672 of 1904; this J., 1904, 858.—T. F. B.

*Drying Apparatus; Impts. in*.—W. J. Wells, Decatur, Ill. Eng. Pat. 23,183, Oct. 27, 1904.

The apparatus provided with double walls is mounted on hollow trunnions so that it can be rotated. Steam is introduced through one of the trunnions into the space between the walls of the drum and from thence into closed pipes, controlled by valves, projecting into and across the interior of the drum. Drip pipes are arranged to collect and carry off the condensed water. Steam can be sprayed directly into the drum, which is provided with a charging door, having a flanged cover, and with a flange for the escape of vapour passing through one of the trunnions. The apparatus is designed more especially for drying material from which oil has been extracted. The material to be extracted, is placed in the drum, the solvent is added and the drum is rotated. When the solvent has taken up the matter to be extracted, the rotation of the drum is stopped, and the solution run off. The drum is then again rotated and steam admitted to the hollow walls of the drum and cross pipes, volatilizing the solvent adhering to the material, which passes off by the escape pipe. The last traces of solvent are removed from the material by means of hot steam.

—W. H. C.

*Refugal Machines for Separating Liquids from Solids, such as Water from Ground Ore, and for Filtering the Separated Liquids; Impts. in*.—J. C. Fell, London. Eng. Pat. 8298, April 11, 1904.

A vertical spindle A running in the footstep A<sup>1</sup>, guided by a bearing A<sup>2</sup> attached to the standard bracket B,

and driven by the pulley E has a "feeding drum" C loosely fitted on, but prevented from revolving on it by the "feathers" A<sup>3</sup>. Webs C<sup>2</sup> preferably in the form of helices are attached to the casing C and support the outer casing C<sup>3</sup> which carries a drum C<sup>4</sup>, having the screw surface D formed on its outer face. A spiral groove D<sup>1</sup>, in the same direction as the screw D and having perforations D<sup>2</sup>, is formed on the inner surface of the drum, to the top of which the flat ring D<sup>3</sup> is attached. A second "hub" E<sup>1</sup> carrying the flange E<sup>2</sup> and the perforated drum E<sup>3</sup>, on which the filtering fabric is placed, and provided with the flanges E<sup>4</sup> and E<sup>5</sup>, is fitted so as to revolve on the spindle A. This drum is driven at a different speed to the drum C by means of the pulley E<sup>6</sup> which has a different diameter to that of the pulley E.

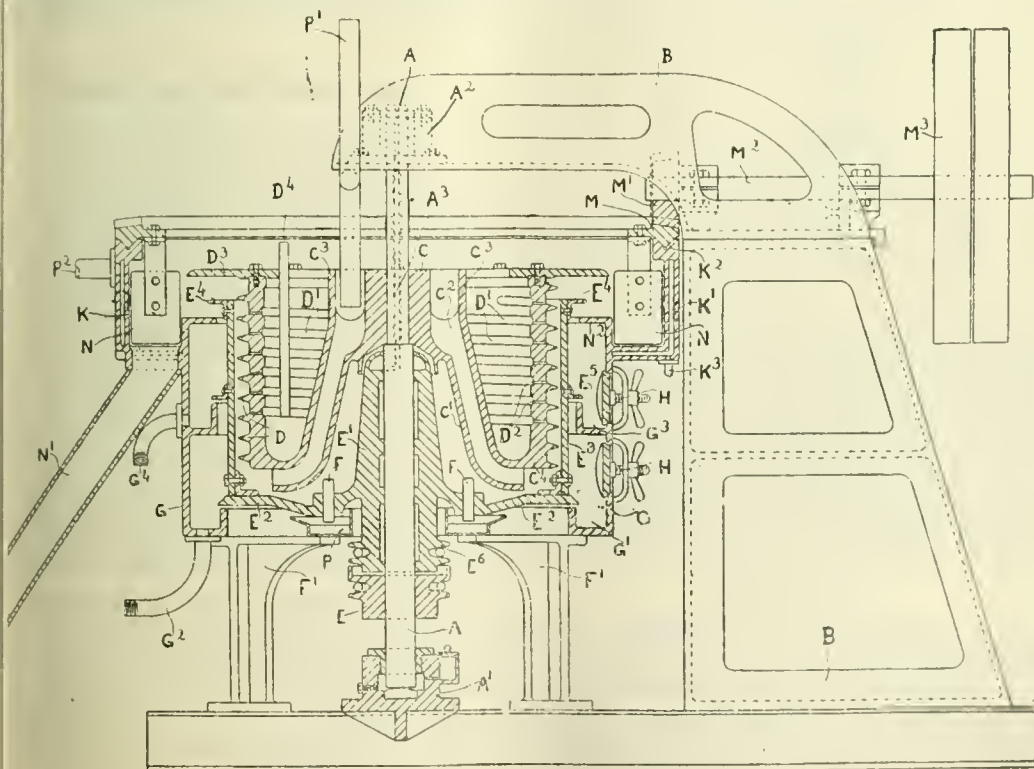
The outer casing G, carried on the framework F<sup>1</sup> is provided with an annular trough G<sup>1</sup> and outlet pipe G<sup>2</sup>, with one or more intermediate troughs and outlets G<sup>3</sup> and G<sup>4</sup>, with "hand-hole doors" H and with the flange N<sup>2</sup>. An exterior annular trough K, with a hollow outer wall K<sup>1</sup> forming a steam jacket, supplied with steam by the pipe P<sup>2</sup> and having a drain pipe K<sup>3</sup> and an outlet shoot N<sup>1</sup>, is attached to the upper part of the casing G. A bevel spur wheel M driven by the pinion M<sup>1</sup>, shaft M<sup>2</sup>, and pulleys M<sup>3</sup>, runs in the V-shaped groove K<sup>2</sup>, and carries the scrapers N.

Pulp is fed into the machine by the pipe P<sup>1</sup>, passes down through the webs C<sup>2</sup>, and is forced upwards by the screw D, the rate of rotation of which is different from that of the drum E<sup>3</sup>. The liquid passes away through the casing E<sup>3</sup> to the trough G and the outlet G<sup>2</sup>, any excess of pulp escaping through FF and the trough P. Washing water enters by the pipe D<sup>4</sup>, passes through the perforations D<sup>2</sup>, washes the pulp and runs off through G<sup>3</sup> and G<sup>4</sup>. The dried pulp passes over the flange E<sup>4</sup> into the trough K, where it is further dried by the steam jacket K<sup>1</sup>, and is then discharged by the scrapers N through the outlet N<sup>1</sup>.

—W. H. C.

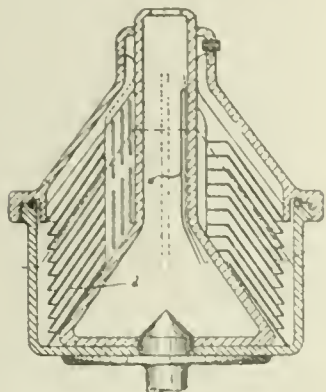
*Filters; Impts. in*.—H. Breyer, Kogel, and A. R. Jurnitschek von Wehrstedt, Puchberg, Austria. Eng. Pat. 14,487, June 27, 1904.

See Fr. Pat. 344,351 of 1904; this J., 1904, 1080.—T. F. B.



## UNITED STATES PATENTS.

*Centrifugal Separating Apparatus.* E. G. N. Salenius  
Stockholm. U.S. Pat. 784,231, March 7, 1905.



The claim is for a central feed inlet, having upright distributing chambers leading into the spaces between the inclined division plates of the basket or bowl of the centrifugal separator (see figure).—W. H. C.

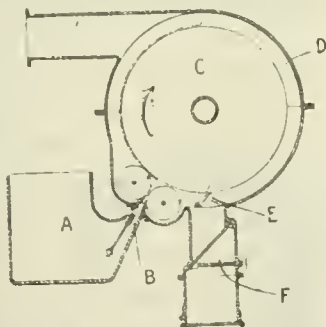
*Evaporating Apparatus: Vacuum* —. T. Suzuki,  
Sunamura, Japan. U. S. Pat. 785,238, March 21, 1905.

SEE Eng. Pat. 19,186 of 1904; this J., 1904, 1202.—T. F. B.

*Liquids; Apparatus for Raising* —. G. Hantke,  
Warsaw, Russia. U.S. Pat. 785,307, March 21, 1905.

SEE Fr. Pat. 345,204 of 1904; this J., 1904, 1203.—T. F. B.

*Drying Pasty Substances; Method of* —. M. Ekenberg,  
Assignor to M. Ekenberg's Aktiebolag, Stockholm.  
U.S. Pat. 785,600, March 21, 1905.

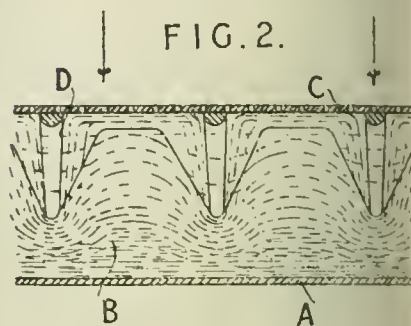
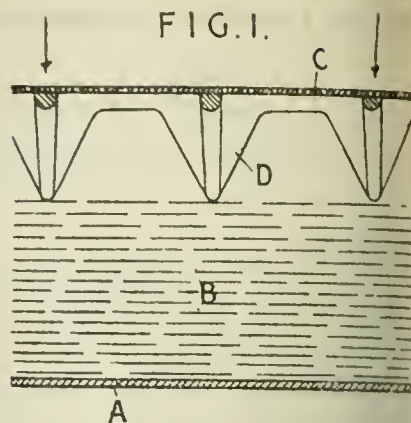


The substance to be dried is forced in an upward direction from the container A through the passage B, on to the surface of the heated cylinder C, which is rotated in the direction of the arrow within the vacuum chamber D. The substance is thus spread in a thin layer upon the surface of the cylinder C, and is carried round and dried by the combined influence of the heat and vacuum, being finally removed by the scraper E and collected in the receiver F. The substance itself serves to prevent the air from entering the vacuum chamber through the opening B.—W. H. C.

## FRENCH PATENT.

*Filter formed of Fibrous Materials arranged in Layers of Increasing Compactness.* W. Stavenhagen. Fr. Pat. 347,740, Nov. 8, 1904.

The fibrous material B is placed on a flat surface A, and is pressed down, in the direction shown by the arrows, by the perforated plate C, which is furnished with projections D. Fig. 1 shows the arrangement at the first contact of the plate C with the material, and Fig. 2 the



operation completed. The increasing density of compressed filtering medium is shown in Fig. 2 by shading lines. The process may also be reversed, i.e. to say, the material may be placed on the perforated plate C and pressed down by the flat surface A.

—W. H.

## II.—FUEL, GAS, AND LIGHT.

*Suction-Gas Plants.* F. H. Bowman,  
Electrician, 1905, 54, 1005—1007.

THE author summarises the advantages of suction producers as follows:—They are reasonable in cost, yield a cheap and regular supply of gas; they are perfectly safe from explosion, occupy a small space (a brake-horse-power plant will stand in a space 6 ft. by 10 ft.); they are simple in design and in operation, and need no skilled labour. There is no escape of poisonous gas, as gas production ceases when the engine stops. The producers are always ready for work, and require no holder. It is pointed out that while with an average steam plant there is a loss of 28 per cent. of the available heat energy of the fuel before the steam reaches the engine, with a producer plant this loss is only 13 per cent. Further, the gas is not liable to losses by condensation as is the case with steam.

The composition of the gas from a gas producer of the Dynamic Gas Co., is given as: carbon monoxide, 12.5; hydrogen, 20.3; oxygen, 0.2; carbon dioxide, 7.8; nitrogen, 49.9 per cent.; the average thermal value is 150 B.Th.U.

The comparative cost of power is given below:—With a 12 h.p. gas plant 0.51d. per b.h.p. or 0.704d. per Board of Trade unit.

With a similar-sized steam plant 1.415d. per Board of Trade unit.

With a larger steam plant 270 kw., at 80 per cent. efficiency, 0.51d. per kilowatt hour.

With a 130 h.p. gas plant, at 80 per cent. efficiency, 0.45d. per kilowatt hour.



author states that the efficiency of a gas engine does not fall off in the same ratio as that of a steam engine in decreasing load, and that for installations up to 100 h.p. a suction producer using anthracite is best, or installations larger than 1000 h.p., a pressure producer using bituminous coal, with recovery of residuals to produce on full load a brake horse power for 1000 h.p. per hour.—W. H. C.

#### ENGLISH PATENTS.

*Carbons and the like; Method of Enriching — Denaturing Alcohol.* E. Phillips, Coventry. Eng. Pat. 7793, April 2, 1904.

For to lower the specific gravity of a liquid hydrocarbon rendering it more suitable for power purposes, the hydrocarbon is dissolved in it. Petroleum is stated to be improved in quality by passing a mixture of acetylene or methane through it. The passage of gas may be continued after the liquid is saturated, whereby an enriched gas is also obtained. This is also applicable to the denaturing of alcohol.

—T. F. B.

*Gas [Generating] Apparatus.* F. Thuman, London. Eng. Pat. 6335, March 15, 1904.

Pat. 342,578 of 1904; this J., 1904, 930.—T. F. B.

*Enriching Machines; Impts. in —.* C. S. Kline, Jr., Col., U.S.A. Eng. Pat. 28,152, Dec. 22, 1904.

A metal tank, with insulating coatings of tar inside, is divided into two unequal compartments by a partition. The smaller compartment is for the hydrocarbon used in enriching the gas, and is fitted with a stirrer, &c., whilst the larger compartment, or mixer, is divided by a number of partitions, so as to compel the gas to take a zig-zag course. The intermediate space between these partitions is packed with strips of redwood, sponge and vegetable fibre, preferably loofah. The gas does not reach to the bottom of the mixing chamber, but leave a certain free space for the liquid carbon, which is drawn up thence by the capillary action of the redwood bark and brought into contact with the gas.—C. S.

*Scent Mantle.* E. Crossley, Liverpool. Eng. Pat. 9622, April 27, 1904.

The mantle is made in the ordinary way are dipped into hydrochloric acid, "to purify the rare earths and destroy any impurities," and are then dried for 24 hours. The mantles are then dipped in a solution of platinum bichloride, to which a dyestuff, as ehrysoidine, has been added.—L. F. G.

*Lamps for Arc Lamps.* W. R. Whitney, Boston, U.S.A. Eng. Pat. 26,917, Dec. 9, 1904. Under Internat. Conv., Dec. 10, 1903.

The electrodes are composed of pure metals, such as zirconium, molybdenum, tungsten, chromium, uranium, and vanadium, or of alloys containing more of these metals.—L. F. G.

*Light Electrodes; Impts. in —.* W. S. Weedon,bury, N.J., U.S.A. Eng. Pat. 26,922, Dec. 9, 1904. Under Internat. Conv., Dec. 10, 1903.

The electrodes are made of an alloy containing about 10 per cent. of titanium and 65 per cent. of iron, formed into a plastic mass with glycerin or other binding material, rolled or pressed, dried, and fired at 1000°—1200° C. Blocks of ferro-titanium may be used.—C. S.

*Rotating Retorts; Impts. in [Inclined] —.* C. J. Bradley, Bradford. Eng. Pat. 8639, April 15, 1904.

A conical hollow pyramid is mounted on the rails across the top of the hopper, by which the inclined retorts are charged. Within this pyramid is mounted a smaller pyramid supported by the same rails, and having of approximately the same area as the opening of the hopper hollow truncated pyramid. The coal is fed above the device by any suitable means, and as

it falls, slides down the space between the two pyramids, and is thrown into the hopper in an inclined direction, being thus evenly distributed.—W. H. C.

#### UNITED STATES PATENTS.

*[Fuel] Bricks; Process of Manufacturing — from Refuse Coal or Coke.* J. Hammerschlag, Strassburg, and H. S. Gerdes and O. Droste, Bremen, Germany. U.S. Pat. 786,028, March 28, 1905.

SEE FR. PAT. 344,225 OF 1904; this J., 1904, 1141.—T. F. B.

*Gas; Apparatus for Manufacturing —.* B. Loomis, Hartford, Conn., and H. Pettibone, New Rochelle, Assignors to Power and Mining Machinery Company, New York. U.S. Pat. 781,576, March 14, 1905.

THE claims refer to a gas-generating and power plant consisting of three (or a pair) of cupola generators, the tops of which are connected by valved pipes, and also the bottoms, and a gas outlet pipe from one of the bottom connecting pipes, so that one of the generators can be cut out of the series for cleaning and repairing. The gas outlet pipe is connected with a scrubber and governor, and the gas engine, the exhaust pipe of which connects with branches to the bottoms of each of the generators, whereby the spent gases are utilised and the fires kept open and clean.—W. C. H.

*Gas; Method of Making and Delivering —.* B. Loomis, Hartford, Conn., and H. Pettibone, New Rochelle, Assignors to Power and Mining Machinery Company, New York. U.S. Pat. 784,870, March 14, 1905.

THE combustible gas generated in a body of incandescent fuel is supplied to a gas engine, and the gaseous products of combustion in the engine are returned by the impulse of the engine to the body of fuel, whereby the ashes are removed from the interstices of the fuel and the mass is kept open. The products of combustion may be discharged into a second body of incandescent fuel, thereby converting the water-vapour and carbon dioxide into hydrogen and carbon monoxide by passing them through both bodies of fuel.—W. C. H.

*Gas Producer.* A. B. Duff, Pittsburg. U.S. Pat. 786,200, March 28, 1905.

SEE FR. PAT. 337,122 OF 1903; this J., 1904, 436.—T. F. B.

*Gas-Washer.* P. Meehan, Lowellville, Ohio. U.S. Pat. 784,748, March 14, 1905.

THE washer consists essentially of two vertical chambers connected at the bottom by a horizontal chamber. Gas enters the top of one vertical chamber and passes down over a series of conical and basin-shaped baffles, on to which water is sprayed—the gas being thus alternately expanded and contracted. Vertical scrubber plates are arranged in the horizontal vessel, and water is sprayed on to them. The gas then passes up through a number of spirally arranged baffle-plates in the second chamber, in the upper part of which is arranged a series of heated pipes for drying the gas before it reaches the outlet. These pipes are arranged between two heads extending across the chamber, and are heated by steam. The horizontal chamber is provided with an overflow opening, controlled by a gate, at one end, and through the other end a series of jets are applied to the surface of the water and are directed towards the overflow. A trough or hopper bottom is provided at the bottom of the collecting chamber, together with cleaning valves.—W. C. H.

#### FRENCH PATENTS.

*Alcohols [and Hydrocarbons]; Solidified —.* L. Denayrouze. First Addition, dated Nov. 19, 1904, to Fr. Pat. 296,132, Jan. 13, 1900. (See Eng. Pat. 17,687 of 1900; this J., 1901, 976.)

ALCOHOLS and liquid hydrocarbons may be solidified by the addition of 5 to 15 per cent. of vegetable wax, stearin, or paraffin wax. The solid product may be used for lighting purposes, particularly for incandescent lighting,

by gently heating it in a receptacle connected with the burner; it is also suitable for heating purposes.—T. F. B.

**Gas; System of Utilising Blast-Furnace**—P. L. Hulin. Fr. Pat. 348,177, Jan. 30, 1904.

THE efficient use of blast-furnace gas in steel furnaces or gas engines is rendered difficult owing to the low thermal value of the gas and the large quantity of dust contained in it. It is proposed to overcome the difficulty by combining the coke ovens with a blast-furnace. The waste gas from the latter is used to heat the coke ovens, thus producing coke for the blast-furnaces, and a gas of much higher calorific value which can be easily purified. This gas is then used either for gas engines, steel-melting furnaces, under steam boilers or in any other way. It is claimed that great economy is thus effected.—W. H. C.

**Gas; Process of Manufacturing and Using a Portable Illuminating**—, by means of Distilled Gas. H. Blau. Fr. Pat. 347,508, Oct. 28, 1904.

THE gas obtained by distillation is cooled by water, and compressed to such an extent that all the liquefiable gaseous components are liquefied, and the liquid thus obtained is transferred to vessels, capable of withstanding a considerable pressure, from which the liquid is drawn off by means of an arrangement for reducing the pressure.—W. C. H.

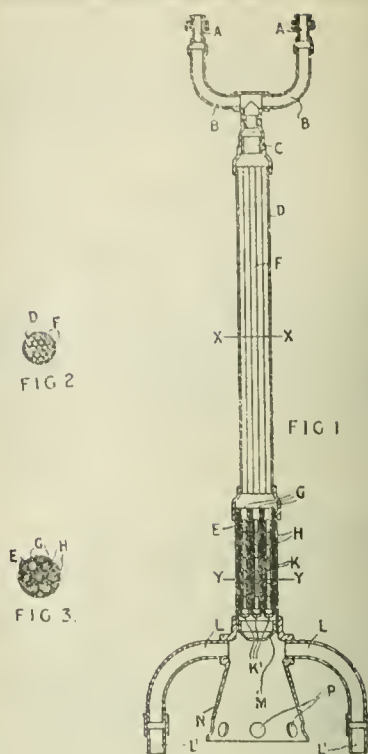
**Gas for Motive Power and other Applications; System and Apparatus for the Production and Use of Inflammable**—W. H. and G. E. Russell. Fr. Pat. 347,554, Oct. 29, 1904.

THE apparatus consists of a vessel provided with an air-inlet and a gas-outlet, and containing, between these, a mass of absorbent material, which can be charged with a volatile combustible liquid. Through the wall of this main vessel is inserted a narrow deep vessel, containing a rod of zinc, surrounded by some absorbent material impregnated with a dilute acid, for the production of hydrogen, which escapes through openings into the main vessel. The air-inlet of the main vessel is connected with a perforated distributing pipe which supplies air to the absorbent material in the vessel. Within the main receptacle, a vessel is arranged to contain a suitable volatile liquid, and provided with an outlet, controlled by a cock, opening on the exterior for the supply of the liquid direct to the motor and also having another valved outlet, communicating with the interior of the main receptacle. The engine can thus be supplied with either the volatile liquid direct, or an explosive mixture of gas and air, and the valves provided allow the ratio of the gas and air, and also the quantity of the explosive mixture supplied to the engine to be controlled. The claims also include the use of turpentine as the volatile liquid.

—W. C. H.

**Gas Jet to Burn under Water or other Liquid; Impts. in**—The Smethurst Furnace and Ore Treatment Syndicate, Ltd. Fr. Pat. 347,791, Nov. 11, 1904.

THE jet or burner is shown in Fig. 1, in vertical section and in Figs. 2 and 3, which are transverse sections on the lines X—X, and Y—Y respectively. The mixture of air and gas arrives by the pipes A, A, which have a diameter of 25 mm., increasing to 31 mm. at the points B, B, to 50 mm. at C to 75 mm. at D, and to 100 mm. at E. The tube D is filled with smaller tubes F, 12.5 mm. diameter and about 900 mm. long. The tube E is also filled with smaller tubes G, which have an internal diameter of 25 mm., the spaces between the tubes G being filled with pieces of tubing H of a smaller diameter and with wire gauze K, having 30 meshes in 25 mm. The lower ends of the tubes G are contracted in order to increase the velocity at this point, and are protected by wire gauze caps K'. These dimensions are important to prevent the gaseous mixture firing back. A cone M is adjusted around the orifices of the tubes G to further concentrate the flame, and to induce a current of liquid (in which the burner is immersed) through the pipes L, L, which have adjustable ends L', L', below the termination of the bell N, which is provided with lateral openings P. The burning jet induces a current of the liquid, through the pipes L, L, which is heated by the flame and passes out of the openings P. In this way, a continual



circulation is produced, which it is claimed prevents shock caused by the return of the liquid against the burner, and also prevents the deposition of solid matter at the burner.—W. H. C.

**Gas Producer**—G. Brandtstetter, R. Freund, and Ulrich. Fr. Pat. 347,908, Nov. 14, 1904.

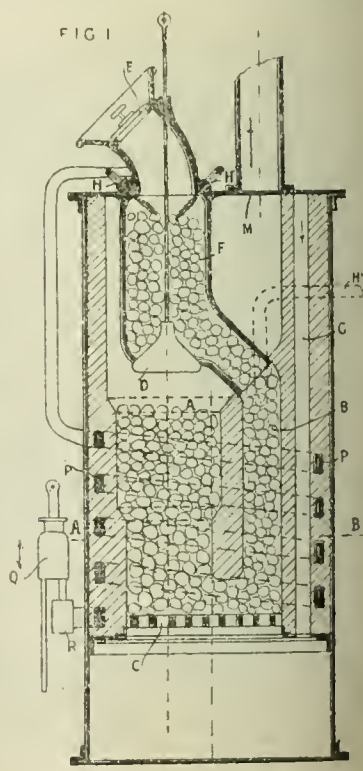
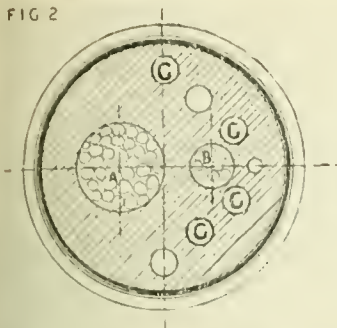




FIG 2



producer is shown in vertical section in Fig. 1, and in section on the line A B in Fig. 2. The chief producer is charged through the valve D, from the hopper F, where it undergoes a partial preliminary distillation by the action of the gas; B is an auxiliary producer communicating with F and A. Water is injected by the pump Q, through the valve R, into the vaporiser P, embedded in the brickwork and heated by transmission through the wall of the producer. The steam formed in the coil is injected into the chamber A or at H<sup>1</sup> and draws the gas and tar formed in the gas hopper through the auxiliary producer B, to the main grate C, the tar being gasified or burnt. The air enters through the pipes G and is heated before it reaches the space beneath the grate C. The gas produced passes through the outlet pipe M. The steam may be condensed by the exhaust gas from the engines. Two modifications of the apparatus are described and illustrated.—W. H. C.

*Generator for Heavy Oils.* A. A. Evens. Fr. Pat. 348,233, Nov. 24, 1904.

A mixture of heavy oil and oxygen is passed through a retort made of grey cast iron containing a large percentage of graphite. The interior of the retort is coated with a layer of graphite, and the retort is heated by passing the hot gas from the motor through a jacket surrounding the retort. It is stated that in the presence of the plumbago the gas is entirely split up by the heat into gas and free carbon. The latter is burnt into its oxides by the oxygen mixed with the oil.—W. H. C.

*Incandescence Mantles; Process for the Manufacture of Mantles with Rare or Other Earths.* J. Moeller, E. Schreier, and E. de Valeriola. Fr. Pat. 347,654, Nov. 4, 1904.

Threads used for making the mantles are impregnated with a solution of luminescent or other compounds, such as nitrates of the rare earths, and, after subsequent drying, are exposed for a relatively short time to the action of ammoniacal vapours, with the purpose of changing only the nitrates into hydrated oxides; they are then washed to remove the ammoniacal double nitrates and are subjected to the partial alteration of the luminescent salts, usually woven. In place of threads, pieces of woven material or any artificial threads may be subjected to the same treatment in the manufacture of mantles. By this process it is said that the threads are impregnated with nincescent nitrates and covered with an impermeable layer of hydrated oxides, and that the presence of these compounds gives rise to a special chemical combination between the oxide molecules at the time of igniting the mantle.—W. C. H.

*Incandescent Lamps; Filaments for —.* A. Just and F. Hauman. Fr. Pat. 347,661, Nov. 4, 1904.

The body to be raised to incandescence is composed of tungsten or molybdenum or an alloy of these metals, or tungsten or molybdenum or a compound of these is combined with an organic agglutinant, and the carbon is introduced by placing the filaments in an atmosphere of hydrochlorides of these metals in the presence of a current of free hydrogen, and heating the filaments sufficiently to bring about a substitution of tungsten or molybdenum for carbon.—W. C. H.

*Incandescent [Gas] Lighting; Material for —.* J. H. Ladd. Fr. Pat. 348,133, Nov. 19, 1904. Under Internat. Conv., Nov. 24, 1903.

SEE Eng. Pat. 25,698 of 1903; this J., 1904, 1205.—T. F. B.

#### GERMAN PATENTS.

*Gas-Producer with a Horizontal Gasification-Zone; Decomposition of Tar and Condensed Aqueous Liquor in —.* J. Schlör. Ger. Pat. 155,742, August 25, 1902.

IN the bottom of the horizontal gasification-zone of an annular gas-producer, in the part furthest removed from the fuel, is cut a groove or channel, forming a chamber in which tar and condensed aqueous liquor collect. The temperature of this chamber is somewhat lower than that of the gasification zone, so that the tar is not again converted into vapour until the temperature of the gasification-zone is such that the volatilised tar is decomposed into permanent gases.—A. S.

*Water-Gas Generator and an Illuminating-Gas Plant in which the Illuminating Gas is Diluted with the Water-Gas; Method for the Utilisation of —.* W. Buch. Ger. Pat. 156,677, April 7, 1903.

IN the case of a partial or complete stoppage of the illuminating-gas plant, the water-gas is passed through a carburetting apparatus charged with suitable oils.—A. S.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

*Petroleum; Behaviour of Pennsylvanian — towards Polarised Light.* M. Rakusin. Chem. Zeit., 1905, 29, 360.

A 10 PER CENT. solution of Pennsylvanian crude oil in benzene examined in a 50 mm. tube in the polarimeter, was found to be dextro-rotatory (0.1°). The relative behaviour of this oil and Baku crude oil, as regards action on polarised light, indicates that the former contains less than one-fourth as much "molecular carbon" as the latter. The optical activity indicates organic origin and an asymmetrical structure of the hydrocarbon molecule in Pennsylvanian oil. The laboratory distillates are also dextro-rotatory, this property being inherent to the hydrocarbon and not due to the complex refining process; and the same behaviour is also exhibited by a 3 per cent. solution in benzene of the residue left at 250° C., when examined in a 50 mm. tube, the concentration indicating the proportion of "molecular carbon" ("Kohlige Substanzen") to be three times greater than in the Pennsylvanian crude oil.

The presence of "molecular carbon," which has also been shown by Charitschkoff, disproves the theory of a non-vegetable origin of petroleum. Moreover, in conjunction with the optical activity of the oil, it points to the formation of petroleum as the result of extremely protracted carbonisation at moderate temperature (with elimination of hydrogen). From the relative proportions of "molecular carbon," Pennsylvanian oil seems to be of more recent origin, geologically speaking, than that of Baku. Since all petroleum obtained by the synthesis of inorganic substances lack these two properties, an organic origin of this natural oil is indicated.—C. S.

*"Pipe Wax" in Boryslaw Crude Oil.* M. Wielezynski. Chem.-Zeit., 1905, 29, 364.

BORYSLAW crude oil contains in suspension solid hydrocarbons, intermediate between petroleum and ozokerite, which obstruct the boreholes and pipe lines, and render frequent cleansing necessary, the pipe lines being rinsed out with warm water or warm Schodnica crude oil, which is low in paraffin-wax. The product recovered in this way is locally termed "kindybal." It has the sp. gr. 0.9397 at 15° C., solidifying point 60° C., and m. pt. 61°–62° C.

On distillation it furnishes fractions ranging in sp. gr. from 0.7775 to 0.8305, and containing in the aggregate 24.3 per cent. of paraffin-wax. All the fractions from the 3rd, with a sp. gr. of 0.8186, to the last (11th) of sp. gr. of 0.7838, were semi-solid at the ordinary temperature. The collective fractions Nos. 5 to 8, had a solidifying point of 36° C. The substance is employed for mixing with waxes of high melting point, or is distilled for paraffin scale.—C. S.

*Oils: Determination of the Viscosity of Lubricating* — R. Hackel. XXIII., page 460.

#### ENGLISH PATENTS.

*Lubricants: Composition of* — E. F. Jarvis and H. W. Jarvis, Middlesbrough. Eng. Pat. 2139, Feb. 3, 1905.

Wood-tar oil is substituted for rosin oil or other derivatives of rosin used in the preparation of lubricants of the class consisting of rosin, coal-tar oils and lime.—T. F. B.

*Asphalt: Manufacture of Artificial* — or of the like Composition. J. J. Shedlock. Eng. Pat. 5712, March 8, 1904. IX., page 443.

#### UNITED STATES PATENT.

*Wood-Filler [Waste Product from Acetic Acid Manufacture]*. S. D. Kudysch. U.S. Pat. 782,252, Feb. 14, 1905. IX., page 444.

#### FRENCH PATENTS.

*Ammonia: Extraction of* —, from Gas Products by Dry Distillation. Soc. F. Brunck. First Addition, dated Nov. 5, 1904, to Fr. Pat. 331,077, of April 9, 1903. (Compare Eng. Pat. 8287, of April 9, 1903; this J., 1903, 795; and U.S. Pat. 773,784, of Nov. 1, 1904; this J., 1904, 1147.)

ACCORDING to the main patent, the ammonium sulphate formed in the vessel in which the ammoniacal gases come into contact with sulphuric acid, crystallises therein, and the crystals are withdrawn thence from time to time. Under the present Addition, the solution of ammonium sulphate (with the acid in excess) formed in the recipient vessel, is run continuously while hot into a series of coolers, from which, as crystallisation is effected, the cooled and acid liquid is pumped back into the closed cylinder receiving the gases, a supply of fresh acid being added as needed.—E. S.

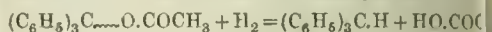
*Benzols and their Simple Hydroxy Derivatives: [Electrolytic] Process for the Production of* —. L. Scholvién. Fr. Pat. 347,862, Nov. 12, 1904. XI. A., page 446.

### IV.—COLOURING MATTERS AND DYE STUFFS.

*Dibenzalacetone and Triphenylmethane*. A. Baeyer. Ber. 1905, 38, 1156—1164.

By acting on *p*-trichlorotriphenylcarbinol with less than the theoretical amount of concentrated sulphuric acid, in solution in chloral, an acid sulphate,  $C_{19}H_{12}Cl_3 \cdot SO_4H + H_2SO_4$ , is obtained in the form of brown prisms or needles with a greenish-blue reflex. *p*-Tri-iodotriphenylcarbinol, when treated in the same manner, forms an analogous compound  $C_{19}H_{12}I_3 \cdot SO_4H + H_2SO_4$ , in crystals which are brown by transmitted light and show a strong green, metallic lustre. The chloral serves to bind the water which is formed. The author attributes the formation of these acid salts, which he calls "dimolsulphates" to the fact that the bases are too weak to decompose the "dimolsulphuric acid"  $(H_2SO_4)_2$ , of which he supposes concentrated sulphuric acid to consist. The above described sulphates are immediately decomposed by water, with formation of the carbinol, and by alcohol with formation of the colourless carbinol-ether. The tin chloride double salts  $C_{19}H_{12}Cl_4 + SnCl_4$  and

$C_{19}H_{12}I_4Cl + SnCl_4$  were also prepared as red crystals blue and green metallic lustre respectively. *p*-Tri-methyldimolsulphate  $(CH_3O \cdot C_6H_4)_3 : C \cdot SO_3H + I$  orange-yellow needles, soluble in alcohol with a yellow colour, which disappears on addition of water, was prepared in a similar manner to the above halogen dimolsulphates. With less sulphuric acid in chloral solution, another salt  $(C_{22}H_{21}O_3 \cdot SO_4H)_2 + H_2S$  formed in red needles. From *m*-trianisylcarbinol  $(C_{22}H_{21}O_3 \cdot SO_4H)_2 + H_2SO_4$ , could alone be obtained in claret-coloured needles. The author has now modified his views on halochromism. He now classifies coloured carbon compounds into two classes, the "halochromes" in which the colour is developed by formation and disappears when the substance is not in a salt, such as the salts of triphenylcarbinol and its derivatives, and "idiochromes" which are essentially coloured in themselves, such as Fuchson, Aurine, Homolka's base. The activity of the hydroxyl of triphenylcarbinol is, as a result of his more recent explanations by the author. This group is only an acid solution, the activity being due to the presence of carbonium valency. The peculiar property of these additive compounds with hydrogen, bisulphite and other substances is then developed, the carbonium ion, though a single bond, having the properties of a double bond. Thus, in the reduction of triphenylcarbinol in acetic acid solution, we have the equation:—



*Diphenyl: Quinonoid Derivatives of* —. R. Willstätter and L. Kalb. Ber., 1905, 38, 1232—1241.

DIPHENYLOQUINONE,  $O : C_6H_4 : C_6H_4 : O$ , was prepared by oxidising *p-p'*-dihydroxydiphenyl with lead peroxide and silver oxide. The best results were obtained by oxidising to the corresponding quinhydrone with barium peroxide in cold ethereal solution and complete reaction with the same agent in suspension in benzene. The yield is 50—55 per cent. The crystals crystallise either in hard red needles or in small needles of golden yellow colour. It is stable in the air, volatile, odourless, and decomposed by alkalis at hot water. In oxidising power it closely resembles quinone. It is difficult to separate the two benzenes by oxidation, but by boiling with lead peroxide and sulphuric acid, benzoquinone is formed in large quantities. Solutions of diphenylquinone are deep yellow in colour much more intensely coloured than those of benzoquinone. This fact deserves attention, as solutions of coeruleum, its tetra-*m*-methoxy derivative, are coloured deep blue. Diphenylquinhydrone,  $C_{24}H_{18}O_4$ , is obtained by solutions, in equimolecular proportions, of diphenylquinone and *p-p'*-dihydroxydiphenyl, or, in the form of a sodium salt, by oxidation of diphenol disodium with sodium carbonate solution with potassium ferric chloride. Its solution in strong sulphuric acid is deep blue, resembling that of coeruleum. By oxidation of benzoquinone in indifferent solvents with silver oxide or lead peroxide, a substance of the empirical formula  $C_{12}H_8O_4$  was obtained, and may be  $NH : C_6H_4 : C_6H_4 : NH_2$ ,  $NH_2 \cdot C_6H_4 \cdot C_6H_4 \cdot NH_2$ , or  $N : C_6H_4 : C_6H_4 : N$ . Its solution is yellow and more intense in colour than those of diphenylquinone. It is not reduced by sulphurous acid, but readily reduced to benzidine with dilute acid solution. With nitrous acid the base forms soluble yellow diazo-salts. These combine with naphthalene, forming a compound which is of a more yellowish red colour than Congo Red, but does not dye directly.—E. F.

*Diazoamines of Diphenylamine, Derivatives of Homologues of Aniline and the Naphthylamines*. L. Vignon and Simonet. Comptes rend., 1905, 140, 788—790.

AN extension of the study of the action of diazoaromatic amines on diphenylamine (see this J., 1904, 564 and 1023). By the addition of an aqueous solution of sodium nitrite to an alcoholic solution of diphenylamine, precipitating by cold water



ing the solution with ether, the diazoaminoclamines,  $R.N_2N(C_6H_5)_2$ , derived from the three is and from *o*-xylydine were isolated in a pure form. *m*-Xylydine gave a red oil possessing the properties of a diazoamine compound, but the pure compound could not be isolated. *p*-Xylydine gave no reaction, and dihydramine produced diazoaminonaphthalene when by the above process, but by the action of diazo naphthalene chloride on diphenylamine, coloured dye produced; they were unstable, giving off nitrogen during the corresponding naphthol, but they exhibited properties of diazoaminodiphenylamines. No such dye could be obtained with the three aminophenols, anthranilic or *o*-aminosalicylic acid.—T. F. B.

*es*; *Action of Formaldehyde and Sodium Bisulphite* on —. M. Prud'homme. Bull. Soc. Ind. Mul., Procès-verbaux, 1904, 184—185.

ases are produced by the joint action of sodium hydroxide and formaldehyde on diamines, such as benzotoluidine, azoxyaniline, *m*-azoxytoluidine, &c. the amino groups being acted upon and converted to  $NH.CH_2.SO_3H$  group. When diazotised and mixed with the usual dyestuff components, these dyed compounds which dye cotton from an alkaline bath and wool and silk from an acid bath.—E. F.

and *Aniline-salt*; *Action of Sulphur on* —. O. Hinsberg. Ber., 1905, 38, 1130—1137.

toluidine, aniline-salt and sulphur are melted together at  $-180^\circ C.$ , at least four crystalline substances are formed. These are: diphenylamine, in very small quantity only; dithioaniline,  $NH_2.C_6H_4.S.S.C_6H_4.NH_2$ , a yellow solid, to the amount of 10—15 per cent.; thioaniline, m. pt.,  $108^\circ C.$ ; and a new thioaniline, m. pt.,  $58^\circ C.$ , which the author considers to be the *o*-*p*-ind (4) $(NH_2)(C_6H_4.S.C_6H_4)(NH_2)(2)$ . The author regards the supposed thioaniline of m. pt.,  $85.5^\circ C.$  as a mixture. —E. F.

#### ENGLISH PATENTS.

*Manufacture of Dyestuffs* [Azo; *Manufacture of* —, *of Intermediate Products therefor*. J. Y. Johnson, on. From Badische Anilin u. Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 1997, 29, 1904.

*Production of* Feb. 26, 1904, to Fr. Pat. 338,819 of 1903; this J., 1904, 1026.—T. F. B.

*Manufacture of Colouring Matter* —. J. Y. Johnson. From Badische Anilin u. Soda Fabrik. Eng. 9861, April 29, 1904. XII. A., page 448.

*2-Oxy- and 2-Diazo-1-oxy-naphthalene Mono-Di-Tri-sulphonic Acids*; *Manufacture of* —. T. R. to, London. From Aniline Colour Works, formerly Geigy, Basle. Eng. Pat. 10,235, May 4, 1904.

the present no diazo compounds of the 1-amino-2-naphthalene sulphonic acids have been known, the sulphonic acids of 2-amino-1-hydroxy naphthalene are diazotised in the usual manner, in the presence of mineral acids, the nitrous acid acts chiefly as an oxidizing agent. It is now found that, without the addition of any other oxidizing agent, and simply by mixture of these sulphonic acids with sodium salts with a solution of sodium nitrite, a diazotisation takes place which is increased by heating. This is, however, accompanied by oxidation. In addition of a neutral copper salt or of some metallic salts be made, the oxidation is entirely prevented, and the diazotisation is greatly accelerated. *Example*.—Preparation of 1-diazo-2-naphthol-4-sulphonic acid. A paste of 12 kilos. of 1-amino-2-naphthol-4-sulphonic acid in 50 litres of water is cooled with ice and mixed with a solution of 1 kilo. of copper sulphate, then a solution of 3.5 kilos. of sodium nitrite is slowly added, until diazotisation is complete, the solution is filtered and the diazo compound precipitated with hydrochloric acid. —T. F. B.

#### UNITED STATES PATENTS.

*Azo Compound* [Azo Dyestuff], and *Process of Making Same*. E. A. Fournereux, Assignor to H. A. Metz, Brooklyn, N.Y. U.S. Pat. Reissue 12,330, March 21, 1905.

SEE U.S. Pats. 728,388 and 728,455 of 1903 (this J. 1903, 737).—E. F.

*Anthraquinone Dye* [Indanthrene Dyestuff]; *Greenish-blue* —. R. E. Schmidt, Assignor to Farbenfabriken of Elberfeld Co., New York. U.S. Pat. 785,121, March 21, 1905.

A new dyestuff is obtained by treating with formaldehyde and sulphuric acid the product obtained by heating 1,3-dibromo-2-aminanthraquinone with cupric chloride, nitrobenzene and sodium acetate. The resulting new dyestuff dyes unmordanted cotton in greenish-blue shades from a suitable reducing vat containing alkali hydroxide and hydrosulphite.—E. F.

*Anthraquinone Dye* [Indanthrene Dyestuff]; *Green-blue* —. R. E. Schmidt, Assignor to Farbenfabriken of Elberfeld Co., New York. U.S. Pat. 785,122, March 21, 1905.

THE dyestuff described in U.S. Pat., 682,523 (See Fr. Pat. 309,503, 1901; this J., 1902, 42) (Indanthrene), is treated with formaldehyde and sulphuric acid. The product dyes unmordanted cotton in greenish-blue shades from a reducing vat containing alkali hydroxide and hydrosulphite.—E. F.

*Anthraquinone Dye* [Indanthrene Dyestuff]; *Green* —. R. E. Schmidt, Assignor to Farbenfabriken of Elberfeld Co., New York. U.S. Pat. 785,123, March 21, 1905.

THE product obtained by heating 1,4-diamino-2,3-dibromoanthraquinone with cupric chloride, nitrobenzene and sodium acetate is treated with formaldehyde and sulphuric acid. The new dyestuff obtained dyes unmordanted cotton in green shades from a reducing vat containing alkali hydroxide and hydrosulphite.—E. F.

*Sulphur Dye* [Sulphide Dyestuffs]; *Orange* — and *Process of Making same*. A. L. Laska, Assignor to K. Oehler, Anilin- und Anilinfarben-Fabrik, Offenbach-on-Maine, Germany. U.S. Pat. 785,675, March 21, 1905.

AZO-DYESTUFFS resulting from the combination of the diazo-compounds from easily volatile aromatic amines and monoacetyltoluenediamine ( $CH_3 : NH_2 : NH : COCH_3 = 1 : 2 : 4$ ) are heated with sulphur at an elevated temperature in presence of benzidine or another base of the diphenyl series, and the product subsequently treated with alkali hydroxide. The dyestuffs formed in this way are soluble in alkali sulphide solutions, and dye cotton in orange-yellow shades from a bath containing sodium sulphide.—E. F.

#### FRENCH PATENTS.

*o-Nitro-o-aminoacetyl-p-aminophenol and Azo Dyestuffs susceptible to Chroming Derived therefrom*; *Process for Preparing* —. L. Cassella and Co. First Addition, dated Jan. 27, 1904, to Fr. Pat. 339,142, Nov. 2, 1903.

SEE Eng. Pat. 3096 of 1904; this J., 1905, 83.—T. F. B.

*Dyestuffs, Naphthalene* [from Naphthalene]; *Production of Blue-black* —. Badische Anilin und Soda Fabrik. Fr. Pat. 348,178, Jan. 30, 1904. Under Internat. Conv., Jan. 8, 1904.

SEE Eng. Pat. 2468 of 1904; this J., 1905, 23.—T. F. B.

*Dyestuff, Monazo, for the Manufacture of Lakes*; *Production of a Red* —. Badische Anilin und Soda Fabrik. Fr. Pat. 348,248, Feb. 1, 1904. Under Internat. Conv., Jan. 8, 1904.

SEE U.S. Pat. 759,716 of 1904; this J., 1904, 604.—T. F. B.

*Dyestuffs of the Anthracene Series* [Indanthrene Dyestuffs]; *Production of Grey* —. Badische Anilin- u. Soda-

Fabrik. First Addition, dated Nov. 15, 1904, to Fr. Pat. 341,126, Jan. 26, 1904.

ACCORDING to the original patent (this J. 1904, 820), certain diamino-anthraquinones are fused with potassium hydroxide to 180–200° C. According to this addition the same process is applied to the formaldehyde compounds of 1,5- and 1,8- diaminoanthraquinones. For instance, 100 kilos. of 1,5-diaminoanthraquinone-formaldehyde are incorporated, little by little, with 300 kilos. of fused potassium hydroxide, the temperature not exceeding 170° C. and kept at this temperature for one hour. The products dye vegetable fibres from an alkaline reducing vat in brownish-red shades, resembling Indanthrene in fastness and in general properties.—E. F.

**Naphthylamine Sulphonic Acids, Arylated 1,6- or 1,7-; Manufacture of —.** Actienges. für Anilin-Fabrikation. Fr. Pat. 348,149, Nov. 21, 1904.

1,4,6- or 1,4,7- NAPHTHYLAMINEDISULPHONIC acid, or a mixture of these two acids as obtained by sulphonating naphthionic acid, is heated with an aromatic amine, with or without the addition of the hydrochloride of such amine, and with or without addition of benzoic acid. The sulphonic acid group is eliminated and the amino group arylated by this means. For instance, 17 parts of 1,4,6-naphthylaminedisulphonic acid, 15 parts of aniline hydrochloride and 50 parts of aniline are heated to boiling for six to eight hours, the whole made alkaline with sodium carbonate, the excess of aniline driven off with steam, and the sodium salt of phenyl-1,6-naphthylaminesulphonic acid precipitated by common salt.—E. F.

#### GERMAN PATENTS.

**m-Nitro-o-chlorobenzylsulphonic Acid; Process for Preparing —.** Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 154,493, Aug. 24, 1902.

**m-NITRO-O-CHLOROBENZYL SULPHONIC ACID**, ( $\text{CH}_2\text{SO}_3\text{H}$ ;  $\text{Cl}:\text{NO}_2=1:2:5$ ) is produced by nitrating o-chlorobenzylsulphonic acid with 1 mol. of nitric acid in presence of sulphuric acid. The o-chlorobenzylsulphonic acid is produced by the action of sodium sulphite on o-chlorobenzylchloride. Nitrochlorobenzoic acid results on oxidising the acid; nitrohydroxybenzylsulphonic acid is produced by the action of alkali hydroxide; ammonia gives nitro-aminobenzylsulphonic acid, and aromatic amines produce the corresponding diphenylamine derivatives.—T. F. B.

**[Dyestuffs] Oxazine Derivatives of the Anthracene Series; Process for Preparing —.** Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 156,477, Oct. 24, 1903.

ALIZARIN in which the hydrogen in the 4-position is substituted by a hydroxyl or an amino group, is condensed with o-aminophenols in presence of boric acid. The sulphonic acids of the resulting oxazine derivatives are of use as dyestuffs. Thus, the sulphonated condensation product of Purpurin and o-aminophenol or o-aminocresol dyes wool in violet shades, and chrome-mordanted wool green shades; that from 4-aminoalizarin and o-aminophenol, when sulphonated, gives blue shades on wool in either case, whilst that from Purpurin-sulphonic acid and o-aminophenol dyes wool blue, and chromed wool, green.—T. F. B.

**Dyestuffs, Sulphide, for Cotton; Process for Preparing Yellow —.** Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 156,177, Dec. 15, 1903.

DYESTUFFS, which produce yellow shades on cotton from sodium sulphide solutions, are obtained by heating 2,2'-diamino-4,4'-oxaltoluide with three times its weight of sulphur, to 170°–200° C. for six to eight hours. The diamino-oxaltoluide is produced by heating together oxalic acid and m-tolylenediamine at 100°–225° C.—T. F. B.

**Dyestuffs, Monoazo, specially suitable for the Preparation of Lakes; Process for Manufacturing Yellow to Orange-Yellow —.** Badische Anilin und Soda Fabrik. Ger. Pat. 156,352, Sept. 10, 1903.

YELLOW to orange-yellow dyestuffs, very suitable for the

preparation of colour lakes (said to be fast to acids, and alcohol) are obtained by combining the diazotives of benzene- or naphthalene-sulphonic acid with nitro-m-phenylenediamine or with nitro-m-toluidine.—T. F. B.

**Dyestuffs, Monoazo, specially suitable for the Preparation of Lakes; Process for Manufacturing Red —.** Badische Anilin und Soda Fabrik. Ger. Pat. 156,157, Oct. 2, 1903.

THE phenyl ether of o-aminophenol-p-sulphon produced by reducing the condensation product of chlorobenzene-p-sulphonic acid and sodium phenylhydrazine is diazotised and combined with β-naphthol. prepared from this dyestuff in the usual manner fine red colour, and are stated to be insoluble in alkalis and light, and to possess good covering power.—T. F. B.

**Dyestuffs, Monoazo, susceptible to Chroming; Process for Preparing Black —.** Badische Anilin und Soda Fabrik. Ger. Pat. 156,157, Feb. 5, 1904.

DIAZOTISED picramic acid is combined with an sulpho derivative of 1,8-aminonaphthol-5-sulphonic acid. The latter compound is obtained by the action of sodium sulphide on 1,8-aminonaphthol-5-sulphonic acid; the sulphamino-compound need not be isolated. The dyestuff dyes wool from acid baths in violet shades, modified to very fast blue-black on subsequent chroming.—T. F. B.

**Dyestuffs, Sulphide; Process for Preparing a Black —.** Kalle und Co., Ger. Pat. 156,478, Nov. 27, 1903.

A MIXTURE of p-phenylenediamine and o-hydroxyaniline is oxidised to an indophenol by means of potassium persulphate. The leuco-indophenol, obtained by carbon dioxide through the sodium sulphide solution, is heated with sulphur and sodium hydroxide for about 20 hours at a temperature of 120–150° C. The dyestuff, extracted from the melt in the usual manner, dyes blue shades on cotton from sodium sulphide baths. It is stated to have a greater affinity for cotton than the indophenol derived from p-phenylenediamine.—T. F. B.

## V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

**Silk; Its Treatment Before and After Dyeing —.** G. H. Hurst. J. Soc. Dyers and Colourists, 1904, 99–102.

THE “boiling off” of silk is usually done in various constructed appliances; the author suggests that the Obermaier machine might be adopted for use in this process, especially when waste and Schappe are present under treatment.

During the “boiling off” process, the silk loses a considerable weight (25 to 30 per cent.). This loss can be restored without impairing the lustre, by placing the silk in a solution containing 20 grms. of gelatin for one hour at 38°–49° C., squeezing, gently drying afterwards transferring to a solution containing 2 grms. of formaldehyde per litre. The gelatin is rendered insoluble and the silk somewhat stiffened by the treatment; the process does not interfere with the subsequent operations.—M. C. L.

**Formic Acid; Application of —, in Wool Dyeing —.** Mettner. Z. Farben- u. Textil-Chem., 1905, 4, 1.

FORMIC acid behaves like lactic acid in causing chromium of the alkali bichromate mordanting to become completely absorbed by the wool fibre from a bath in which it is applied, thus enabling the dyeing to be proceeded with in the same bath as that in which the mordanting has been previously accomplished.



ff applied in this manner becomes perfectly fixed, dyings produced being, in respect to fastness to light, superior to those obtained by the usual method of staining and dyeing in separate baths. This method has been introduced into practice with satisfactory results, the wool being mordanted with 1.5 per cent. of acid (80 per cent.), and the bath being heated to 100° C., and maintained at this temperature for 1½–2 hours.

The bath having then been cooled to some extent addition to it of cold water, the dyestuff, according to nature, mixed with cold or dissolved in hot water, is finally introduced into it. About 2 per cent. of acid is next added, and the bath is heated until it is boiled for about two hours.—E. B.

**Discharges on Tissues Dyed with Red, Claret, Brown Azo Dyestuffs; Producing— with Sodium hydrosulphite-Formaldehyde.** "Société E. Zundel." Soc. Ind. Mulhouse, Procès-verbaux, 1904, 187.

For complete solution of the dyestuffs in the discharges used, an addition of phenol is made to the mixture. Only those dyestuffs which yield leucos are not decomposed by energetic reduction, are soluble. Certain sparingly soluble oxazine dyestuffs, dissolved in phenol, become sufficiently fixed, without the addition of tannic acid or other mordant. The discharges are produced by steaming the printed tissues for four hours.

A white discharge is obtained upon the brown dye (from Chrysoidine and diazotised *p*-nitraniline) by adding sodium carbonate to the discharge printing mixture.

Azo claret, more easily discharged than the *p*-nitraniline Claret, is produced from  $\beta$ -naphthol and ised aminoazotoluene. Fatty substances must be added to the discharge mixture for a white discharge of his dye.

Alkaline acids and acid salts have a favourable influence on the action of the hydrosulphite compound. In instances, e.g., in the case of acetic acid, these may be added in admixture with the steam. Another method for attaining the same end, is to prepare the steam-baths in acid salts or salts which have an acid reaction, sodium bisulphate (applied in a 1 per cent solution) or ammonium chloride.

For reserve-discharges upon H. Schmid's bronze (No. 1904, 658) are obtained by adding sodium acetate to the ordinary hydrosulphite colour discharge.

Insoluble azo dyestuffs are produced on the fibre by combining Chrysoidine with diazotised aminodiphenyl-, *o*-nitrotoluidine, benzidine, dianisidine, and *p*-nitraniline respectively.

A claret which is readily dischargeable is formed from  $\alpha$ -naphthylamine (and  $\beta$ -naphthol ?).

Sodium hydrosulphite in the presence of an excess of soda acquires great stability and increased discharging power for most dyestuffs. Such a mixture gives

perfect discharges with most azo dyestuffs, but an exception is found in the case of Paranitraniline Red. It may be applied to effect a white discharge upon the composite bronze dye produced by dyeing first in red with  $\beta$ -naphthol and diazotised  $\beta$ -naphthylamine and then over-dyeing with a blue or grey substantive cotton dyestuff, a red discharge being simultaneously obtained by printing sodium hydrosulphite-formaldehyde along with the white discharge-mixture. A blue discharge is obtained by adding Indanthrene to the alkaline mixture.—E. B.

**Hydrosulphites; Preparation of Alkali —, by the action of Formates on Bisulphite compounds of Aldehydes or Ketones.** A. Dubosc. Rev. Gen. Mat. Col., 1905, 9, 99–100.

STABLE hydrosulphites can be produced by heating to 104° C. an aqueous mixture of acetone sodium bisulphite and ammonium formate. If the mixture be kept alkaline, ammonium sesquicarbonate is produced, which distils off, leaving the hydrosulphite compound, which can be concentrated *in vacuo*. The reduction is really performed by the carbon monoxide from the formic acid. In practice, the mixture of "sulphite acetone or aldehyde" and ammonium formate, is heated to 84° C. At first hydrosulphite is formed, but later the carbon dioxide acts on the sulphite and forms carbonate. This can be avoided by working *in vacuo* and pumping off the carbon dioxide formed, or by adding a base the heat of formation of whose carbonate is less than that of sodium sulphite. Compounds of manganese, lead, zinc or ammonia may be used, especially the last, as it sublimes at 60° C., and the reaction takes place at 84° C.—A. B. S.

#### ENGLISH PATENTS.

**Wool Washing and Scouring Machinery, applicable for Carbonising Wool and other Fibrous Material and for continuously Dyeing and Bleaching Wool, Cotton, and other Fibrous Material.** J. Dawson, Rochdale. Eng. Pat. 7790, April 2, 1904.

THE object of this invention is to provide improved mechanism for washing and scouring wool in the loose state, and especially for immersing the wool and for passing it in a continuous manner from one end of the tank in which it is being treated to the other end. Two series of rake frames A and B (see figures) are employed, each approximately of the same length as the tank A', and each composed of four or more longitudinal bars or tubes carrying prongs or forks D. Each bar or tube is provided, at the entrance end of the machine, with an immerser projecting downwards from it, and consisting of a narrow perforated chamber F of about the same width as the bar or tube. The bars or tubes have pivoted to them at each end and at one or more intermediate points, arms I attached at their tops to a transverse bar I' with which is connected a central rod J. The rods J may be coupled to one or more crank arms J', or they may be connected with the arms of a beam lever, with the object of causing the rake frames alternately to rise and to fall, and to be pushed forward, when the prongs are immersed in the liquor contained in

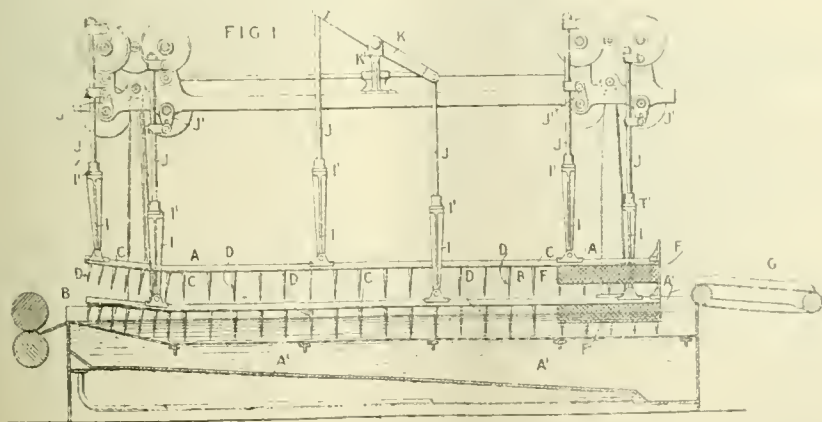
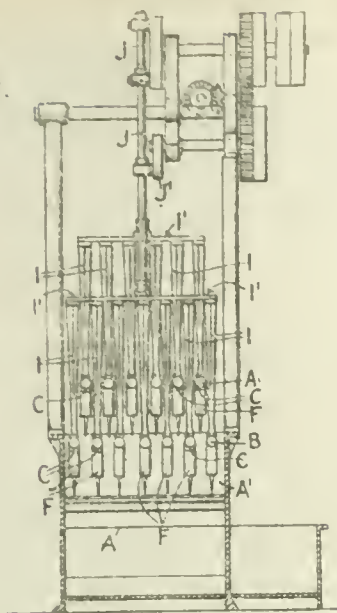


FIG 2.



the tank, and to be carried backward towards the entrance end of the machine, when the prongs are out of the tank, prior to their entering the tank again.—E. B.

*Wool and the like; Machinery for Washing, Scouring, Extracting, Neutralising, and Dyeing* — J. Pease, J. V. Parker and J. Hustler, Bradford. Eng. Pat. 9323, April 23, 1904.

A TANK fitted with a false bottom in the form of a grid, has mounted on opposite sides of it, pedestals serving as bearings for cross-shafts driven from a shaft placed alongside the tank. The cross-shafts carry drums to which are, preferably, attached arms extending along them and projecting out from them nearly far enough to touch the grid. When employed in extracting vegetable matters from loose wool, the tank is constructed of wood or metal, and is lined with an acid-resisting material, and the drums and arms are composed of glass or porcelain, or of wood sheathed with lead, &c. The delivery rollers at the exit end of the machine are also, in such case, made of or

covered with acid-proof materials, and so constructed that their bearings and the adjacent parts shall be protected from the acid solution used. The tank is, furthermore, so constructed as to facilitate its being cleaned out when required by means of jets of steam which are blown along its bottom, thus obviating the necessity of raising the false bottom.—E.

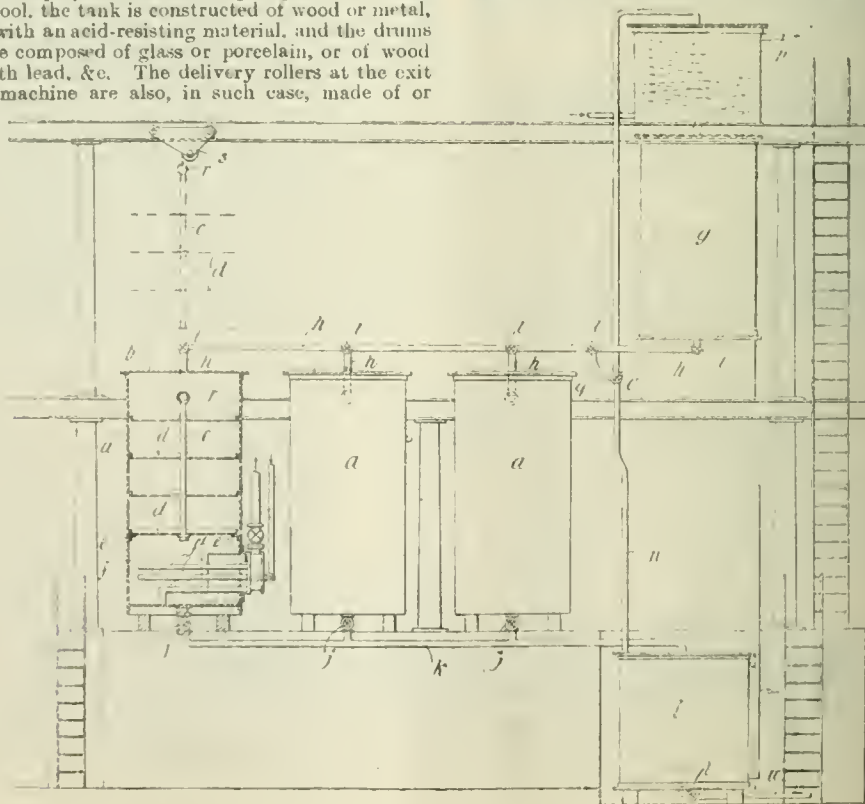
*Wool Scouring; Machinery for* — W. McNaul, Rochdale, Lancs. Eng. Pat. 10,005, May 2, 1904.

In the usual squeezing arrangement, consisting of rollers, the upper one of which is movable vertically, is pressed down by weights which work through compound levers, it is found that the jerking up and down of weights is apt to cause damage to the machine. To avoid this the weights are now seated on springs to prevent sudden shocks.

To immerse the wool in the scouring tank the immer is fixed on to a rod, one end of which is pivoted to the crank and the other end on to a rocking lever. A mechanism which drives the rakes also drives the immer and gives it an elliptical motion. The motion can be suitably altered or modified. By another arrangement the immer is moved horizontally by means of a lever connected to the first rake, and vertically by means of a cam.

In order to propel and agitate the wool in the washing trough, a number of immersers are fixed on to a shaft, one end of which moves with one of the rakes, while the other end passes between two rollers fixed on a shaft at the opposite end. The immersers consist of rectangular boxes with perforated tops, and are fitted with flaps which cover the perforations when the immer is raised, and so lift the enclosed water a short distance above the level of the liquid in the trough; this water in flowing agitates the washing liquor. To deliver the wool from the machine to the squeezing rollers an arrangement of forks is fitted, which is moved by means of levers and an elliptical gear-wheel so as to follow the inclined bottom of the trough. In another arrangement some of the forks are pivoted on to a frame which has a horizontal motion of its own.—A. B. S.

*Oil and Grease from Sponge Cloths, Cotton Waste, and all kinds of Grease-Laden Textile Materials; M*





*Means for Removing [Degreasing] —* S. G. London. Eng. Pat. 10,156, May 3, 1904.

g. and oil-laden textile materials, such as cotton sponge cloths, &c., are deposited in a grate, formed of perforated plates *d* (see figure) attached to a central shaft *c*, and are thus brought into an extraction vessel *a*, the bottom plate *d* resting upon brackets *e* and leaving at the bottom of the vessel a space *f* in which a closed coil *f'* is placed. To effect the extraction of the matters, &c., the vessel is closed by a hinged cover *g*, a charge of "benzine" or other solvent is admitted from a container *g*. The solvent passes down through the grate, and, while doing so, it is heated by the coil and vaporised, being thus caused to act more fully. After the lapse of some time, the valve *i* at the top of the vessel is closed, and, a valve *j* at the bottom opened, the solution obtained is withdrawn to a still *h*, the solvent is distilled back into the container *g*. The extracted materials are dried in the vessel *a* by means of a steam coil and are removed from the vessel by means of a travelling hoist *s*. The extraction is rendered a continuous process by arranging a series of similar vessels together and operating upon each in turn.—E. B.

*eg. Bleaching, Dyeing, or Similarly Treating Hanks of Yarn, Stubbing, Warps and the like; Machine for* J. J. Ellis, Huddersfield. Eng. Pat. 9787, April 1904.

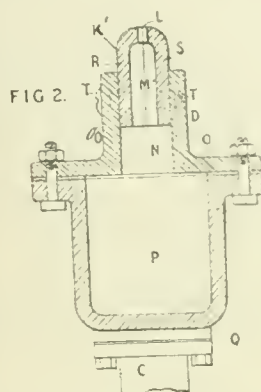
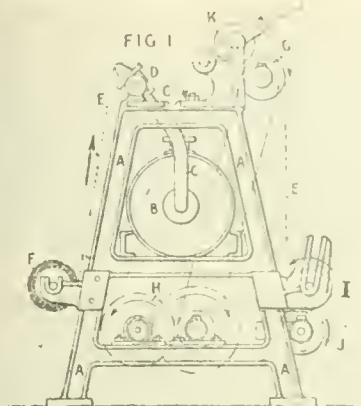
is engaging in the teeth of a horizontal, fixed, rack, are loosely mounted upon the turned ends of a shaft radiating outwards from a hub fixed at or near the top of a central, upright shaft. Sleeves to which reels are secured are secured to the pinions, the motion of the shaft causing the reels to move simultaneously round their own axes and round the shaft. A circular trough in which water or dye-liquor is supplied is placed below the reels. When the apparatus is employed in washing, the reels enter the trough on one side of a partition and flowing round the trough is withdrawn on the other side, the hanks of yarn, which are placed upon the reels as these are brought to the partition, being conveyed round the trough in the opposite direction to that in which the water is flowing and being removed from the reels after one passage round the apparatus. When used for dyeing, the trough is charged with dye-liquor and the reels are conveyed round it as many times as is necessary to produce the shade required.—E. B.

*Textile Fibres: Apparatus for* — H. Rössler, Weiler, Germany. Eng. Pat. 29,618, Dec. 31, 1904.

is wider at the bottom than at the top, conically tapered in the middle, and with holes at the bottom, is in a vertical position above the end of a steam pipe leading to an outer chamber which communicates at its top with a dye-vat. The materials to be dyed enter into the latter between two sieves. When the dye is turned on, the dye-liquor is set in motion and it rises in the outer chamber, flows over the top sieve, passes downwards through the materials, and from the bottom of the vat again to the outer chamber. A steam coil, fixed between the lower sieve and the bottom of the vat, may be employed to hasten the dyeing of the dye-liquor.—E. B.

*Textile Fabrics; Method and Apparatus for* — J. Haddan, London. From "Crosset and Debatiss," Liégeois-Verviers, Belgium. Eng. Pat. 29,094, Dec. 1904.

issues, wound in the wet state upon a roller *F* (see Fig. 1), are unwound from this, and, after passing at full width over a suction apparatus *D*, with which they are kept taut by means of a tension roller *K* (Fig. 1) and a guide roller *G*, are wound upon a roller *I*. The apparatus (also Fig. 2) has a head, consisting of "an oblong plate or pipe" *K* (Fig. 2), produced by fixing at a certain distance apart two plates of brass or copper, the space between which corresponds with the width of the tissues to be dried, the width of the orifice *L* and the height of the head being so adjusted as to ensure a sufficient



extractive action without excessive friction upon the tissues. Below the orifice *L* are an enlarged opening *M* and a channel *N* leading into a chamber *P*, with which a pipe *C* connected with a suction cylinder *B* (Fig. 1) and suction pump communicates.—E. B.

*Textile Fabrics, Paper, or other Lamellar Materials; Engraved Bowls or Rollers for Producing an Improved Reflecting Finish on* — W. J. Pope and J. Hübner, Manchester. Eng. Pat. 7745, April 2, 1904.

A REFLECTING finish of a homogeneous or uniform character is produced upon fabrics by means of a roller upon the surface of which is engraved a design made up of circles or closed angular figures, the circles being so minute, and both the circles and the lines composing the angular figures lying so close together, as to be undistinguishable by the unaided eye. (See also Eng. Pat. 4907 of 1904; this J., 1903, 273.)—E. B.

*Dust; Prevention and Laying of* — [Use of Suds from Wool-Washing]. W. M. Sandison. Eng. Pat. 18,904, Sept. 1, 1904. IX., page 443.

*Evaporator for Evaporating the Liquid in Brewers' Wash, Sewage Waste or Spent Dyes and the like, and Concentrating the Solids in the same, the Evaporator being also applicable as a Smoke Washer.* A. B. Lennox. Eng. Pat. 9516, April 26, 1904. XVIII. B., page 453.

#### UNITED STATES PATENTS.

*Retting Fibrous Stock; Process of* — J. E. Lappen, Decorah, Iowa, Assignor to L. L. C. Brooks and F. M. Catlin, St. Paul, Minn., U.S.A. U.S. Pat. 785,618, March 21, 1905.

FIBROUS materials, such as flax, are retted by a process which consists in boiling them under direct steam pressure first with lime and then with caustic soda.—E. B.

*Dyeing Apparatus.* D. F. Waters, Philadelphia, Pa., U.S.A. U.S. Pat. 785,283, March 21, 1905.

A DYE-VAT is combined with (1) a frame, upon which yarn-sticks, furnished with ratchet wheels are mounted, so as to be intermittently rotatable by means of an eccentric actuating a lever, and through this, a bar carrying pawls which engage with the ratchet wheels; (2) a liquor-circulating wheel, mounted on a horizontal axis and arranged to revolve in connection with the motion of the eccentric, etc.; (3), a heating pipe at the bottom of the vat; and 4 a false bottom, between the pipe and the frame, terminating short of the opposite ends of the vat.—E. B.

*Warp-Dyeing Machine.* T. E. Davis, Winston-Salem, N.C., U.S.A. U.S. Pat. 785,597, March 21, 1905.

A COMBINATION of apparatus for dyeing yarns in the form of warps, comprising a dye-vessel with a perforated false bottom, below which a heating-medium feed-pipe is placed; a pair of reel-carrying shafts; slotted frames into which the ends of the reel-carrying shafts are fitted; spacing bars interposed between the reels; mechanism for moving the reels vertically up and down; rollers for drawing and squeezing the warps, revolving in unison with the reels; guiding and spacing pins mounted on opposite side of the frames; a warp-feeding guide carried by the frames, working in conjunction with one of the reels, a warp-guiding device and an adjustable warp-feeding guide.—E. B.

*Metallising Fabrics [by Electrolysis]; Process of —.* C. Danilevsky and S. Tourchaninoff, St. Petersburg, U.S. Pat. 785,541, March 21, 1905.

"METAL" is first electrolytically deposited upon the fabric, which is then washed and treated with a mixture of stannous chloride and potassium cyanide.—E. B.

#### FRENCH PATENTS.

*Cellulose Threads; Process for Making Brilliant —.* R. Linkmeyer. Fr. Pat. 347,960, Nov. 16, 1904.

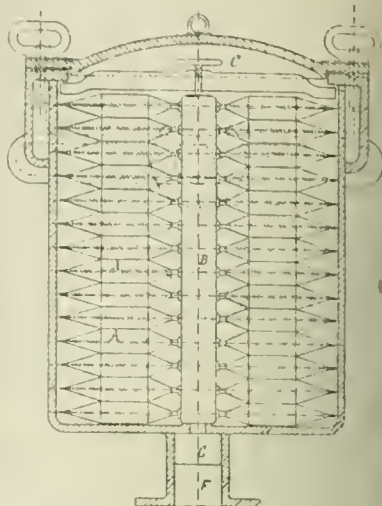
It is found that solutions of cellulose in ammoniacal copper solutions ("cellulose cuprammonium") are coagulated by solutions of alkali hydroxides as well as by acids. This process is utilised to produce artificial silk threads. The formed threads are washed either in water or in dilute acid. Such threads are stated to be perfectly transparent, and to possess great brilliancy; they are also said to be much stronger than cellulose threads produced by other processes, particularly when wet. The alkali appears to exert a similar mercerising effect on the cellulose to that produced on cotton.—T. F. B.

*Aniline Black on Wool; Process for Obtaining —.* M. Prud'homme. First Addition, dated Jan. 26, 1904, to Fr. Pat. 333,386, June 25, 1903.

THE mordanting of the fibre with chromic chromate preparatory to dyeing it with Aniline Black, as described in the principal patent (see this J., 1903, 1345), may be accomplished by either of the following methods:—Treatment in an aqueous solution of chromic acid, which is partially reduced; treatment with potassium bichromate (2 mols.) and sodium thiosulphate (1 mol.); treatment with chromic acid and sodium nitrite; treatment (hot) with potassium chromate (1 mol.) and a basic chromic salt (1 mol.). Instead of using excess of hydrochloric acid in the dyeing process, nitric or sulphuric acids may be used, and a part of the mineral acid may be advantageously replaced by an organic acid (particularly formic or oxalic acid). The dyeing may be carried out by immersing the mordanted fibre in the acid solution of aniline for a short time, and then removing it, and allowing the oxidation to finish in the air. Aniline may be replaced by other aromatic amines, e.g., the toluidines, xylydines, naphthylamines, phenylenediamines, benzidine, or amino-diphenylamines; for example, o-toluidine gives blue-black shades, and benzidine brown shades.

—T. F. B.

*Dyeing Threads on Bobbins; Arrangement of the Bobbin in Apparatus for — by the Circulation of Liquor.* C. Crépelle-Fontaine. Fr. Pat. 348,100, Nov. 12, 1904.



THE bobbins are held on perforated spindles A, which are fixed on a number of vertical tubes B, situated close together in a rectangular dye-vat, as shown in cross-section in the accompanying figure. The bobbins are placed closely together as possible, in order to economise space and liquor. For further economy, the spaces between the bobbins at both ends may be filled by conical projections fixed on the sides of the vat and on the tubes B. The dye liquor is introduced through the pipe F, and upwards through each of the tubes B, and thence through the spindles A, penetrating the material on the bobbins and overflows through orifices near the top of the vat into a channel which surrounds the vat, whence it is pumped off, and again introduced into the apparatus through F.—T. F. B.

*Printing on Fabrics [with Nitrocellulose]; Process of —.* A. Samuel. Fr. Pat. 348,015, Nov. 19, 1904.

A VARIETY of effects is said to be obtained by printing with nitrocellulose on dampened fabrics. The process may be conveniently carried out in a multi-colour printing machine, the apparatus used for printing in the first instance being employed for dampening the fabric. The nitrocellulose is applied in solution (e.g., collodion), by means of plain or engraved printing cylinders. It is pointed out that the preliminary dampening is essential for the production of brilliant effects.—T. F. B.

*Threads of all kinds; Treatment of — [with Nitrocellulose].* A. Samuel. Fr. Pat. 348,137, Nov. 22, 1904.

TEXTILE threads closely resembling silk thread are produced by dampening any kind of thread, and then coating it with a solution of nitrocellulose. (Compare preceding abstract.)—T. F. B.

*Discharges on [Fabrics Dyed with] Halogenated Anilines.* Badische Anilin und Soda Fabrik. Fr. Pat. 348,137, Jan. 26, 1904.

SEE U.S. Pat. 760,817 of 1904; this J., 1904, 659.—T. F. B.

*Formaldehyde-Hydrosulphite (Hydraldite); Process for Increasing the Reducing Power of —.* L. Cassa. Fr. Pat. 348,071, Jan. 27, 1904.

SEE Eng. Pat. 2573 of 1904; this J., 1905, 85.—T. F. B.

*Waterproofing Textile Materials, Bags, Casks, &c., and other Receptacles; Process for —.* F. D. Witte and L. Witte. Fr. Pat. 348,408, Nov. 11, 1904.

SEE Eng. Pat. 24,482 of 1904; this J., 1905, 129.—T. F. B.



## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

*er Dyeing; Practical Difficulties in* —. H. G. Skett. J. Soc. Dyers and Colourists, 1905, 21, 5—111.

FORMITY of shade in leather dyeing is difficult to n, because no two skins are alike in fineness of grain, ire, or shape; the skins are also often badly damaged, r imperfections, e.g., "salt," tan-, and drench-stains be hidden by dyeing the goods dark green or chocolate ss; goods possessing "tainted" grain are best dyed colours.

ion dyeing a pack of skins, slight differences in the texture tend to cause a variation in the colour, a must be allowed for when the goods are being ped " with dye solution in the finishing processes.

the preparation of skins for dyeing, the goods are ly immersed in a weak solution of sulphuric acid; great amount of acid will tend to cause serious ge to the leather.

e tray or vat method of dyeing is customarily dyed when small quantities of leather are to be dyed; a large number of skins are being worked, the drum dle method is used. When chrome leather is being ed, the greenish-blue colour, possessed by the skins ous to dyeing, materially affects the colour of the dyed er. Blacks are dyed by first drumming the skins ogwood extract solution, afterwards "fat liquoring" an oil emulsion, and finally passing them through an i striker" made of ferrous sulphate and a concen- d solution of tannin. Blacks obtained with coal-tar uffs are usually fairly satisfactory, but the leather the slight swollen effect produced by logwood, ier, sumach and fustic extracts are employed as mor- prior to applying the coal-tar dyestuffs; too great an s of the dyewood or tannin mordant will cause the er to lose its character and in extreme cases to crack t. Bad shaving conduces to an imperfect finished e; the shavers' scratches showing prominently in the ed skin. Unsuitable neatfoot oil or bad fat-liquor ause a white cloudy scum to appear on the finished er; mould is sometimes caused by micro-organisms e egg yolk employed in fat-liquoring or through the ying about in a wet condition during the process anufacture.

the discussion, J. W. Lamb stated that nitric and e acids cannot be used for stripping dyestuffs from er on account of their detrimental action on the leather —M. C. L.

### ENGLISH PATENT.

*e, Skins, Leather and the Like; Preparation for ansing and Dyeing* —. F. J. Petersen, Copenhagen, mark. Eng. Pat. 19,323, Sept. 7, 1904. Under ternat. Conv., Sept. 9, 1903.

EPARATION for use in cleaning and dyeing leather, s and tanned skins is made by dissolving stearic acid benzene," or other hydrocarbon, adding a concen- d solution of alkali, alkali carbonate, or bicarbonate her with a dyestuff insoluble in water. For example, azine" (100 parts) is shaken up with concentrated oma (5 to 20 parts); stearic acid (3 to 6 per cent.) ded, together with a suitable dyestuff, e.g., Nigrosine black gloves. Lanoline may be added to the com- ion in order to increase the natural softness and bility of the leather.—M. C. L.

## VII.—ACIDS, ALKALIS, AND SALTS.

*Hargreaves Process [for Manufacture of Hydrochloric cid]; A Study of the* —. W. Staedel. Chem. Ind., 1905, 28, 173—178, 198—204, 226—232.

author has made an attempt to elucidate the nature of reactions occurring in this process, by means of labora- t experiments. In the equation representing the ulti-

mate result of the process:  $4\text{NaCl} + 2\text{SO}_2 + \text{O}_2 + 2\text{H}_2\text{O} = 2\text{Na}_2\text{SO}_4 + 4\text{HCl}$ , 9 molecules take part. It is, therefore, to be expected that the reaction occurs in stages.

*Influence of Temperature and Concentration.*—Mixtures of the reacting gases of known composition were passed over salt heated in a tube, the temperature being ascer- tained by a thermoelectric pyrometer, and the speed of reaction was measured by the amount of sulphur dioxide which disappeared. Below  $450^\circ\text{C}$ . the reaction was very slow, but about that temperature it increased rapidly in speed. The concentration of sulphur dioxide had a marked influence upon the speed of reaction, as had also that of the water vapour, whilst dilution of the gases by nitrogen had but little effect, and increase of the proportion of oxygen was equally without influence. It would almost appear from these results that the sulphur dioxide and water together decompose the salt with formation of sulphite, which at the moment of its formation becomes converted into sulphate.

*Action of Sulphur Dioxide and Water Vapour on Salt.*—A number of experiments, in which sulphur dioxide and steam in various proportions were led over heated salt, showed that a certain small amount of sulphite was formed, and that the issuing gases contained hydrochloric acid. Quantitative measurements led to the conclusion that equilibrium was attained when the volume of hydrochloric acid in the gaseous atmosphere was about 0.002 of the volume of sulphur dioxide. This was confirmed by the converse experiment of passing hydrochloric acid gas over heated sodium sulphite, when the issuing gas always contained a corresponding amount of hydrochloric acid. The latter results were somewhat irregular, but the irregu- larities were traced to the fact that the sulphite at the temperatures employed decomposes to some extent according to the equation  $4\text{Na}_2\text{SO}_3 = 3\text{Na}_2\text{SO}_4 + \text{Na}_2\text{S}$ .

*Formation of Sulphuric Acid at  $450^\circ\text{C}$ .*—Sulphur dioxide, air or oxygen, and water vapour, were passed through a tube containing pumice, in fragments similar to those of the salt in the former experiments, heated to  $450^\circ\text{C}$ . No formation of sulphuric acid occurred, and the condensed sulphurous acid in the latter part of the appa- ratus showed no oxidation. The author attributes this to the rendering of the oxygen inactive, first, through the storage of the gases over paraffin oil, and, second, through its having been strongly heated. Direct experiments, in which atmospheric air and oxygen, before and after being heated, were led through aqueous solution of sulphur dioxide, showed a marked oxidation by the unheated gas, while that which had been heated was almost without action. As the oxygen entering into reaction in the Hargreaves process has been strongly heated in the pyrites burners and again in the first sulphate cylinder, the author considers it highly improbable that the direct formation of sulphuric acid occurs.

*Behaviour of Sodium Sulphite towards Heat and Oxida- tion.*—The decomposition of sodium sulphite into sulphate and sulphide, mentioned above, was studied. Rise of temperature greatly favours this reaction, though it occurs at so low a temperature as  $180^\circ\text{C}$ . Dry sodium sulphite, however, does not undergo this reaction at all: the presence of water is necessary. This acts possibly by hydrolytic decomposition— $\text{Na}_2\text{SO}_3 + \text{H}_2\text{O} = 2\text{NaOH} + \text{SO}_2$  (aqueous solution of sulphite, when merely warmed, becomes alkaline to phenolphthaleïn), and the sulphur dioxide so formed reacts on more sulphite— $3\text{Na}_2\text{SO}_2 + \text{SO}_2 + \text{H}_2\text{O} = 3\text{Na}_2\text{SO}_4 + \text{H}_2\text{S}$ . It is impos- sible to say how far this reaction occurs in the Hargreaves process, but it seems very probable that it does occur, especially when the supply of oxygen is short. The avidity with which sodium sulphite absorbs oxygen was shown by passing moist air over sodium sulphite heated in a bath of sulphur vapour; though each small quantity of air could only have been in contact with the sulphite for little over a second, the air after passing over the sulphite contained only 1–2 per cent. of oxygen. Clearly, then, if sulphite be formed at all in the Hargreaves process, its immediate oxidation to sulphate will follow at once. Raschig has already drawn attention (this J., 1904, 338) to the rapid oxidation of sulphite at the moment of its formation.

*Softening Temperature of Mixtures of Sodium Sulphate*

*and Chloride.*—The occasional melting of the salt in the Hargreaves process, with consequent loss of porosity and stoppage of the reaction, is one of the important practical difficulties of the process. It has been attributed to the formation of bisulphate; but this implies the direct formation of sulphuric acid, which, if the author's views based on the above experiments be correct, does not occur. Moreover, though bisulphate fuses far below the temperature of the Hargreaves process, yet it decomposes so rapidly at that temperature that its formation in any quantity is from this point of view, too, highly improbable. The author has investigated the freezing-points of mixtures of sodium sulphate and chloride, and finds that the temperature at which crystals begin to separate from the fused mass is lower as the mixture departs farther from pure sulphate or pure chloride, but that no mixture has a constant freezing point save  $\text{Na}_2\text{SO}_4 + \text{NaCl}$ , which behaves like a eutectic, and melts or solidifies at  $610^\circ \text{C}$ . Any mixture of the two salts containing fairly considerable proportions of either will begin to melt at this temperature when heated, and will become the more nearly fluid as its composition is nearer that of the eutectic. Actual experiment showed that mixtures containing 50, 70 and 85 per cent. of sulphate did soften at or very little above this temperature. The importance, then, of controlling the temperature of the process is obvious, for if it rise beyond  $610^\circ \text{C}$ , this softening will occur, while if it fall below  $500^\circ\text{--}550^\circ \text{C}$ , the speed of reaction diminishes too seriously for the process to be carried on.—J. T. D.

*Hydrofluoric Acid.* — I. E. Deussen. *Z. anorg. Chem.*, 1905, 44, 300—340.

HAVING regard to the increasing technical application of hydrofluoric acid, the author has carried out a full investigation of the acid with regard to its electric conductivity, and its influence on the inversion of cane sugar. The work is treated under the following headings:—Preparation of pure hydrofluoric acid; determination of the strength of hydrofluoric acid solutions; inversion of cane sugar by hydrofluoric acid (by the neutralisation method); conductivity of hydrofluoric acid solutions; rate of inversion by dilute hydrofluoric acid solutions; influence of temperature on rate of inversion by hydrofluoric acid; influence of neutral salts on the course of inversion by hydrofluoric acid; influence of sulphuric and silicofluoric acids on inversion by hydrofluoric acid; scheme for the preparation of a table showing the proportions of sulphuric and silicofluoric acids in hydrofluoric acid; examination of Spohr's statements on the rate of inversion by hydrofluoric acid; inversion experiments by direct determination. The results show that hydrofluoric acid behaves as a slightly weaker acid than phosphoric acid of equal concentration. In its influence on the inversion of cane sugar, it appears to occupy a position between a monobasic and a dibasic acid. A N/2 solution of ammonium fluoride was found not to cause any inversion of a 25 per cent. solution of cane sugar at  $25^\circ \text{C}$ .—A. S.

*Perstannic Acid and Perstannates.* S. Tanatar. *Ber.*, 1905, 38, 1184—1186.

HYDRATED stannic oxide, precipitated by sodium hydroxide from stannic chloride, and thoroughly washed, is mixed with excess of hydrogen peroxide, and dried, first on the water-bath at  $70^\circ \text{C}$ , finally in a desiccator. The dry powder has the composition  $\text{HSnO}_4 \cdot 2\text{H}_2\text{O}$ ; it slowly loses oxygen and water, and is gradually decomposed by water into stannic hydroxide and hydrogen peroxide; when dried at  $100^\circ \text{C}$ , its composition is  $\text{H}_2\text{SnO}_7 \cdot 3\text{H}_2\text{O}$ .

Potassium perstannate,  $\text{KSnO}_4 \cdot 2\text{H}_2\text{O}$ , is formed by adding excess of hydrogen peroxide to solution of potassium stannate, cooling to  $0^\circ \text{C}$ , and adding alcohol. Sodium perstannate is similarly obtained. It is much less soluble in water than the potassium compound. Both salts lose oxygen when heated and are slowly decomposed by water into stannate and hydrogen peroxide. Their solutions give precipitates with the salts of barium, strontium, magnesium, zinc, nickel, cobalt, and platinum, which are mixtures of perstannate and hydroxide. The

lead salt, dried in the desiccator, rapidly loses oxygen and leaves lead peroxide; there is thus no doubt that it is a perstannate.—J. T. D.

*Carbonates; Causticising of Alkali.* — G. Bodli. *Z. Elektrochem.* 1905, 11, 186—187.

As a typical case the reaction can be represented by the following equation:— $\text{K}_2\text{CO}_3 + \text{Ca}(\text{OH})_2 \rightleftharpoons \text{CaCO}_3 + 2\text{KOH}$ . The conditions necessary for progress of the reaction in the direction from left to right are discussed by the author by considering the various factors on which equilibrium depends. The greater solubility of calcium hydroxide, as compared with calcium carbonate, is a cause of the reaction, but calcium hydroxide is less soluble in caustic solutions than in pure water; similarly, calcium carbonate is less soluble in an alkali carbonate solution than in pure water. With increasing causticisation the two solubilities approach each other and are equal at the conditions of equilibrium. Expressing the solubility products by  $\frac{\text{Ca}}{(\text{OH})_2} = K_1$  and  $\frac{\text{Ca}}{\text{CO}_3} = K_2$  respectively

the above fact is represented by  $\frac{(\text{OH})^2}{(\text{CO}_3)} = \frac{K_1}{K_2} = K_3$ ; that

is, at a fixed ratio between the square of the hydroxide ions and the carbonate ions the equilibrium is attained. Direct experiment confirms the fact that the alkali carbonate concentration is approximately proportional to the square of the alkali concentration. By the use of barium or strontium compounds, it is possible to carry the causticisation further, since their hydroxides are more soluble and their carbonates less so than the calcium salts. Calculated values are as follows at  $18^\circ \text{C}$ .:—For calcium  $K_1 = 3.10^{-5}$ ,  $K_2 = 1.7.10^{-8}$ ,  $K_3 = 2.10^3$ ; for strontium  $K_1 = 8.6.10^{-4}$ ,  $K_2 = 0.5.10^{-8}$ ,  $K_3 = 2.10^5$ . The values of  $K_3$  found experimentally for calcium differ, however, considerably from those calculated, which is probably due to the physical condition and solubility of the carbonate which is obtained, differing from the calculated.—R. S. H.

*Lead and Silver Carbonates; Different Application of Watt's Principle to the Dissociation of the Carbonates.* A. Colson. *Comptes rend.* 1905, 140, 865—867.

THE decomposition of lead and silver carbonates into oxide and carbon dioxide is not a reversible reaction owing to the polymerisation of the metallic oxide. It can be made so by allowing the change to go on in a closed atmosphere. In the latter case allowance must be made in the determination of the dissociation pressure for the presence of aqueous vapour by cooling the manometer with ice. The presence of moisture greatly accelerates the dissociation of carbonates of these metals on heating.—B. J.

*Cupric Sulphide; Solubility of — in Alkali Sulphides.* A. Rössing. *Z. angew. Chem.*, 1904, 465—466.

HASSELDTER (see this J., 1905, 292) has quoted the author as saying that when a fusion of copper salt with alkali carbonate and sulphur is dissolved in water, practically all the copper is left in the residue. The author's statement was that under these circumstances practically all the copper goes into solution, and that when the solution is acidified, there is precipitated, along with sulphur, a copper sulphide of formula  $\text{Cu}_2\text{S}_6$ .—J. T.

*Manganese Borides; Preparation and Properties of the Borides.* E. Wedekind. *Ber.*, 1905, 38, 1228—1232.

WHEN manganese is allowed to combine with boron by Goldschmidt's Thermit method, a di-boride  $\text{MnB}_2$  is obtained. In practice 95 grms. of boron are placed in a crucible and well pressed down; 87 grms. of manganese thermit are then added, and the mixture fired in the usual way. A regulus is obtained which is purified by powdering and treating with chlorine gas, when any unchanged boron is converted into chloride, and can be removed by boiling with water. The boride is very stable, and dissolved by acids, boron trihydride is evolved. Alkali it yields a mixture of borate and manganese



When heated on platinum foil it melts with partial oxidation. The powdered material pressed into blocks is a conductor.

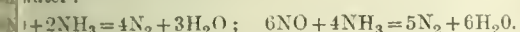
A mono-boride can be obtained by reducing manganese ( $Mn_2O_3$ ) in the electric furnace with boron, purification being effected as described above. This compound possesses somewhat similar properties, but is decomposed melting. If the elements be mixed in the electric furnace the mono-boride is obtained, but in a state very difficult to purify.—B. J. S.

*Withdrawal of — by Platinum.* R. Lucas. Z. Elektrochem., 1905, 11, 182—185.

Absorption of oxygen by platinum at temperatures of  $650^\circ\text{C}$ . led to the belief that oxygen forms a compound with this metal of some different constitution to that investigated by L. Wöhler (Ber., 1903, 36, 3475), this latter is only stable up to  $460^\circ\text{C}$ . The present experiments show that the absorption begins about  $5^\circ\text{C}$ . and increases rapidly up to about  $1000^\circ$  then goes off again. It has been found, however, that the reaction is entirely due to the small content of iridium (5 per cent.) which ordinary platinum possesses; the metal heated in oxygen to  $500^\circ$ — $900^\circ\text{C}$ . showed no reaction. This result is of particular importance in connection with work with Geissler and other vacuum tubes. (See also this J., 1904, 1147; 1905, 195).—R. S. H.

*Nitrogen; Preparation of Pure — from Nitrous and Nitric Oxides and Ammonia.* G. P. Baxter and C. H. Key. Amer. Chem. J., 1905, 33, 300—304.

Nitrous and nitric oxides when mixed with ammonia ignited, combine with the latter gas to form nitrogen water:—



In the case of nitrous oxide, the reaction takes place with great explosive violence, but with nitric oxide, it is necessary to heat the mixture to a high temperature in the presence of a catalytic agent. *Preparation of nitrogen nitric oxide.*—A regular stream of nitric oxide is obtained by allowing nitric acid of sp. gr. about 1.2 to run on to copper turnings or on to iron turnings mixed with a few small pieces of platinum. The gas is led through a washing-bottle containing a strong solution of ammonia, and then through a hard glass tube containing 1-inch rolls of copper gauze (or platinised asbestos) heated by a combustion furnace. The nitrogen is freed over water or dilute acid. The ammonia solution must not be allowed to become weaker than corresponds to sp. gr. 0.92. *Preparation of nitrogen from nitrous oxide.*—Nitrous oxide prepared from ammonium nitrate is decomposed into nitrogen and oxygen by passing it through a hard glass tube containing a 2-inch plug of platinised asbestos heated to dull redness. The gases are then led through a wash-bottle containing a strong solution of ammonia, and finally through a second hard glass tube containing a plug of platinised asbestos heated to redness.—A. S.

*Carbonates and Hydroxides; Behaviour of — towards Concentrated Solutions of Potassium and Ammonium Carbonates.* C. Arnold. Ber., 1905, 38, 1173—1176.

*Nitric Acid; Gravimetric Determination of — by means of "Nitron."* A. Gubier. XXIII., page 458.

*Benzyldiamine with Nitric Acid; Reaction of —.* I. Bay. XXIII., page 458.

*Nitronia; New Test for —.* A. Trillat and Turcher. XXIII., page 458.

*Nitronia; Electrolytic Oxidation of —.* E. Müller and F. Spitzer. XI. A., page 445.

*Salts to Nitrites; Electrolytic Reduction of —.* E. Müller and F. Spitzer. XI. A., page 445.

*Sulphur Sulphide; Electrolytic Behaviour of —.* J. Bodländer and S. Idaszewski. XI. A., page 446.

*Sulphides; Determination of — in presence of Iron Oxide and of Sulphates.* V. Harsteider and P. van Zuylen. XXIII., page 459.

*Alkali Hydratesulphites; Preparation of — by the Action of Formates on Bisulphite Compounds of Aldehydes or Ketones.* A. Dubosc. V., page 435.

# ENGLISH PATENTS.

*Salts, Natural, such as Alkaline Carbonates, Sulphates, Nitrates and Chlorides; Process for the Purification of —.* R. F. Wood-Smith, London. Eng. Pat. 11,256, May 16, 1904.

NATURAL salts, coloured by organic pigments, are extracted with hot water, a small proportion of sand or alumina is stirred into the saturated liquor, and after some hours, the clear liquor is decanted, and, in a closed vessel at about  $100^\circ\text{C}$ ., is subjected to the action of ozonised air passed through it in fine bubbles under pressure. The now colourless salt is isolated by crystallisation.—E. S.

*Lead [Nitrate]; Manufacturing Salts of —.* W. Mills, London. Eng. Pat. 6143, March 14, 1904.

SEE U.S. Pats. 754,667 of 1904, and 779,092 of 1905; this J., 1904, 371, and 1905, 132.—T. F. B.

*Silicates; Art of Decomposing Refractory —.* W. T. Gibbs, Buckingham, Canada. Eng. Pat. 23,473, Oct. 31, 1904. Under Internat. Conv., Oct. 30, 1903.

SEE U.S. Pat. 772,612 of 1904; this J., 1904, 1089.—T. F. B.

# UNITED STATES PATENTS.

*Nitrogen Compounds [Cyanides]; Process of Making —.* A. Frank, Charlottenburg and N. Caro, Berlin, Germany. U.S. Pat. 785,161, March 21, 1905.

A CARBIDE, infusible at the temperature employed, is acted upon by nitrogen whilst being heated to between a dark-red and a bright-yellow. The product is heated in the presence of carbon and of an oxygen compound of an alkali metal, and the cyanide formed is extracted. Or, cyanamide is leached out of the reaction product, and is treated for the production of a cyanide by usual processes.—E. S.

*Lead Dithionate; Process of Making —.* A. G. Betts, Troy, N.Y. U.S. Pat. 785,791, March 28, 1905.

SEE Eng. Pat. 15,308 of 1904; this J., 1904, 900.—T. F. B.

# FRENCH PATENTS.

*Nitric Acid and its Compounds; Electrical Process for the Manufacture of —.* Westdeutsch. Thomasphosphat-Werke G. m. b. H. Fr. Pat. 348,189, Nov. 22, 1904.

OXIDES of nitrogen are produced by exposing a mixture of nitrogen and oxygen to the electric discharge, the power used being less than 200 watts. The gaseous product is then treated with water or an alkali in the usual manner. It is claimed that by working with less than 200 watts, a product is obtained containing less than 50 per cent. of nitrous acid and its compounds.—A. S.

*Alkali Carbonates, Hydroxides, and Polysulphides; Simultaneous Manufacture of —.* P. Germain. Fr. Pat. 347,927, Jan. 22, 1904.

SODIUM sulphate, obtained from the chloride by the usual process, is ground with bituminous schist softened by heat, with which it is formed into briquettes. These are arranged in a furnace of the type of a cement furnace, with anthracite coal, in such a manner that there may be no contact between the briquettes and the furnace walls, the briquettes being also separated from each other by fuel. After furnacing, the briquettes are withdrawn and sorted according to the heat (known by the appearance) to which they have been subjected, in some sodium carbonate and polysulphide being formed, whilst others

contain caustic soda and the polysulphide. Potassium sulphate may replace sodium sulphate in the process.

—E. S.

*Ammonia; Extraction of — from Gas Products, by Dry Distillation.* Soc. F. Brunck. Addition to Fr. Pat. 331,077 of April 9, 1903. III., page 432.

*Metal Sulphates and other Salts; Producing — from Metal Sulphides and Sulphide Ores containing Iron.* O. Meurer. Fr. Pat. 347,970, Nov. 16, 1904.

A CRUSHED metal sulphide, sulphide ore or matte is mixed with from 10 to 15 per cent. of an alkali or alkaline-earth sulphide or polysulphide, and the mixture heated in a closed chamber. The product, after disintegration by exposure to the atmosphere, is washed, and the salts thus extracted are recovered from the solution for re-use. The residual mass is dried, powdered, and exposed to the air in a (preferably) heated chamber, to undergo oxidation with the formation of sulphates. In case insufficient iron monosulphide is present in the material to transform all the metals into sulphates, the metal oxides finally remaining may be dissolved in a suitable acid. (Reference is made to Fr. Pat. 295,379 of Dec. 18, 1899, and to an Addition thereto of March 24, 1902. Compare Eng. Pat. 26,668, of 1903; this J., 1904, 1027; and U.S. Pat. 733,590 of 1903; this J., 1903, 908.)—E. S.

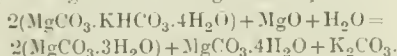
*Air and Gaseous Mixtures; Separating — into their Elements.* Soc. l'Air Liquide (Soc. Anon. pour l'Étude et l'Exploit. des Procédés G. Claude) et R. J. Levy. Second Addition, dated Nov. 4, 1904, to Fr. Pat. 338,842, of June 3, 1903. (This J., 1904, 823.)

In the system described in the main patent and first Addition thereto (this J., 1904, 1216), for producing oxygen by means of the methodical washing of a gaseous mixture of oxygen and nitrogen by liquid air, or by a liquid mixture of oxygen and nitrogen. The present Addition consists in increasing the yield of oxygen by the injection of atmospheric air, or of other mixtures of oxygen and nitrogen, into the rectifying apparatus. (Compare also Fr. Pat. 338,964, of 1903; this J., 1904, 1028.)—E. S.

#### GERMAN PATENTS.

*Potassium-Magnesium Carbonate; Decomposition of the — formed as an Intermediate Product in the Manufacture of Potassium Carbonate by the Magnesia Process.* Deutsch. Solvay-Werke, A.G. Ger. Pat. 157,354, May 29, 1903. Addition to Ger. Pat. 135,329, Oct. 6, 1901.

ACCORDING to Ger. Pat. 135,329, the potassium-magnesium carbonate was decomposed by means of the theoretical quantity of magnesia according to the equation:



It has now been found that if the temperature be maintained at not above 20° C., an excess of magnesia can be used, without any basic magnesium carbonate being formed. The use of an excess of magnesia ensures the complete decomposition of the potassium-magnesium carbonate.—A. S.

*Ammonia; Synthetic Preparation of —.* Westdeutsch. Thomsenphosphat-Werke, G.m.b.H. Ger. Pat. 157,287, Sept. 12, 1901.

A MIXTURE of hydrogen, nitric oxide, and carbon monoxide is subjected to the action of a contact substance such as spongy platinum or the like. The temperature is not allowed to rise above 80° C., and the reaction is accelerated by subjecting the gaseous mixture to the silent electric discharge. In practice the gaseous mixture would consist of Dowson gas or water-gas and nitric oxide. A mixture containing 12 parts by volume of hydrogen, 40 of nitric oxide, 44 of carbon monoxide and 4 of carbon dioxide yields on the average about 10 per cent. by vol. of ammonia.

—A. S.

*Lixiviating Apparatus for Salts.* R. Sauerbrey. Ger. Pat. 155,729, July 1, 1903.

THE apparatus consists of two or more troughs provided

with Archimedean screws, and connected at one end chambers at the side. The salt to be dissolved is introduced into the trough at the end where the concentrated solution is discharged. The particles of salt carrying the outflowing concentrated solution into the side-chamber connected to the first trough, are caused to pass into a channel through which the incoming liquid flows, are carried along by the latter into the side-chamber connected to the second or last trough, whereby any so compounds in these particles are dissolved.—A. S.

#### VIII.—GLASS, POTTERY, AND ENAMEL

*Glass; Studies on Coloured —.* A. Leecrenier. Soc. Chim. Belg., 1904, 18, 395—403

THE authors divide colouring materials into three varieties according to the way in which they act on glass, direct colouring materials, "saturation," and "cementation" colouring materials. Direct colouring materials which include cobalt sesquioxide, nickel oxide, ferric ferrous oxides, cupric oxide, chromium sesquioxide trioxide, manganese protoxide and sesquioxide, vanadium trioxide, and sulphides and selenides of alkali and alkaline earths, produce a colour, the intensity of which depends only on the proportion of material present and the kind (e.g., soda or potash glass used). With "saturation" colouring materials such as cuprous oxide, gold and silver salts, stannous oxide phosphates, arsenates and fluorides, the colour generally depends only on conditions of temperature when more than a certain minimum proportion of material is present; below this minimum no colour is produced. Thus, cuprous silicate being colourless, conditions must be such that red cuprous oxide is set free, the colour is to be produced. With gold, the colour depends on the size of the particles of metallic gold deposited, substances producing opalescence, such as phosphorus &c., a certain minimum amount must also be present, otherwise the glass remains clear. "Cementation" colouring materials are applied by mixing them with silver chloride, sulphide, chromate or phosphate, covering the surface of the polished glass with the mixture and heating to a temperature below the softening point for some time. After cooling, the surface of the glass is washed with water; the glass takes up the colour to a certain depth without losing its brilliance. Red glass gives a yellow colour in this way; a red colour produced by means of cupric oxide, the glass being first in an oxidising and then in a reducing atmosphere.

When several colouring materials are present in the same glass, molecular changes take place till equilibrium is established. This state is determined not only by the temperature to which the glass is heated, but also by the pressure and by the action of light. Thus, if a glass containing ferrous silicate, manganous oxide is heated, and the glass cooled quickly, the rose-red colour of manganous silicate is produced. If the glass be reheated and cooled slowly, this substance is reduced, and a colourless glass results, which on exposure to intensely actinic light, or to X-rays, again becomes rose-red, owing to the oxidation of the manganous silicate at the expense of the ferric compounds formed during the reheating. Similarly, if glasses containing an oxide of a heavy metal, such as lead, and an alkali sulphide be quickly cooled, the colour due to the alkali sulphide is produced; if, on the other hand, they are slowly cooled, they become black from the formation of the sulphide of the heavy metal.—A. G.

*Analytical Methods used at the Val-Saint-Lambert Glass Works.* A. Leecrenier. XXIII., page 458.

*Ceramic Products; Determination of Melting-point of —.* J. Bronn. Z. angew. Chem. 1905, 18, 460—2.

THE apparatus of Heraeus (this J., 1905, 133), as he himself points out, is far too costly ever to come into general use. The author uses a tube of fireclay, magnesia, or other refractory material, 70 mm. diameter, which is supported in a channel of fireclay strengthened outside by sheet iron, somewhat shorter than the tube. The ap-



en the tube and channel is packed with "kryptol," suitable electrodes are provided to transmit a current—100 amperes at 100—120 volts. The heating of the is effected as gradually as possible, partly by regulating the current by means of a resistance, partly by turning off for short periods till temperature-equilibrium between kryptol and tube is approximately reached. With 81 amperes at 110 volts, Seger cones are melted, while cone 39 is unaffected; and with the practice the temperature can be regulated and practically constant for some time. Apparently the furnace works equally well with continuous or alternating current: it lasts for a long time, and the tubes and about 10 alternate heatings (up to cone 30) and so on. At higher temperatures they do not last so long, twelve to fifteen Seger cones can be heated at once in the furnace. For the highest temperatures unglazed must be employed, which are porous to the reducing gas generated in the furnace; for most things requiring very high temperatures, however, this reducing gas is in no way objectionable.—J. T. D.

*Glass; Use of — in Chemistry.* Berthelot. XXIII., page 457.

*Glass; Permeability of —.* Berthelot. XXIII., page 457.

*Vessels; Use of — in the Laboratory.* F. Mylius and A. Meusser. XXIII., page 457.

#### GERMAN PATENTS.

*Glass; Production of White Lime or Lead —.* L. Bock. Ger. Pat. 157,135, Sept. 18, 1902.

Large is mixed with an alkali sulphate which, on forming a covering layer protecting the molten glass from the injurious action of the fire-gases. The amount of alkali sulphate added is about  $\frac{1}{10}$ th— $\frac{1}{2}$ th of the amount of alkali carbonate in the charge.—A. S.

*Process of Drying —.* B. Thomans. Ger. Pat. 156,475, Feb. 7, 1902.

Goods before burning are dried by being heated in a chamber and simultaneously exposed to superheated steam at a temperature of 160°—400° C. It is found that by the use of steam instead of air, the drying is rapid and uniformly, and no cracks are formed on the surface of the goods.—A. S.

### X.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

*Brick and Dinas Brick in the Construction of Retort Laces.* F. Leisse. J. f. Gasbel., 1905, 48, 257—261.

A great drawback to the use of firebrick in the construction of retort furnaces is its high coefficient of contraction when exposed to high temperatures, the shrinkage being 5—7 per cent. at 1300° C. This and the tendency of firebricks when heated, quickly lead to deformation of the retorts. The same defect of shrinkage also attaches to shales with a large percentage of clay (Rakonitz and Leurode shales); whilst bauxite contains too large a portion of iron and titanate acid to be suitable for the purpose. On the other hand, Dinas brick, which consists of 95 per cent. of silica, 2—3 per cent. of alumina, iron oxide, and 1—2 per cent. of lime, withstands a higher temperature than firebrick, and increases slightly in volume, the linear expansion in good samples being 3.4 per cent. at 1700° C. (14 days' exposure). Moreover, the furnaces built of this material at Cologne are found to bear fluctuations of temperature very well; and the walls can be built thinner than when firebrick is used, the larger combustion chambers thus possible facilitate the utilisation of heat. (Pyrometric tests show the superiority of 70° C.) Though Dinas brick is more expensive than firebrick, it is less corroded by flying ash and other chemical agents; and there is no cracking of the pillars

as with firebrick, the heat being more uniformly distributed through the mass. Although the granular structure and porous character of the material have given rise to the view that it is a bad conductor of heat. As a matter of fact its conductivity is about 20 per cent. higher than that of the best firebrick, this quality being apparently due rather to the relative percentage of silica and alumina than to the structure. To secure these results, however, it is essential that the Dinas brick should be of the highest possible quality, and the furnaces constructed with the greatest care.—C. S.

#### ENGLISH PATENTS.

*Asphalt, Artificial; Manufacture of — or of the like Composition.* J. J. Shedlock, Colchester. Eng. Pat. 5712, March 8, 1904.

LIME, or other suitable material, such as limestone, is mixed with tar or similar material, and the finely-divided mixture is subjected to the action of steam or inert gas, such as carbon dioxide or nitrogen, at a temperature of from 300° to 500° F. The more volatile constituents of the tar, &c., are driven off in this manner, leaving a mixture which may be used like ordinary asphalt. The treatment with steam or gas is carried out in a closed chamber, into which the mixture is fed at the top, and in which it falls from one of a number of horizontal trays to the next. Each tray has a perforation, through which the mixture is caused to fall as it is moved around on the tray by a scraper revolved by a centrally-placed axle. The superheated steam or gas enters the chamber through a pipe having one outlet between every two trays. Suitable arrangements are made to condense the volatile constituents.—A. G. L.

*Plaster of Paris; Manufacture of — and Apparatus therefor.* W. Brothers, Prestwich, Lancs. Eng. Pat. 5853, March 10, 1904.

GYPSUM is treated with steam at a temperature of about 250° F., until it becomes converted into plaster of Paris, which is then further dried at a temperature not below 170° F., by means of steam. For this purpose the gypsum is placed in a hollow revolving chamber, fitted with an outer jacket, into or through which steam is admitted from the hollow trunnions on which the chamber revolves. If the gypsum is treated directly with the steam, a fixed pipe is also placed in the chamber which always supplies steam at the top of the chamber. During the final drying operation, steam is only admitted into the outer casing. The gypsum may be ground before or after the treatment.—A. G. L.

*Stone, Artificial; Manufacture of — in Imitation of Marble or Granite and the like.* L. Lefranc, Lausanne, Switzerland. Eng. Pat. 9769, April 28, 1904.

SEE Fr. Pat. 328,262 of 1903; this J., 1903, 952.—T. F. B.

*Wood, and Goods of different kinds, and for Drying such Goods; Impts. in Heating, Steaming, and Chemically Treating —.* C. McWhirter, London. Eng. Pat. 14,869, July 2, 1904.

THE boiler in which the material is to be treated (creosoted, for instance) is surrounded by a steam-jacket. The steam-jacket is surrounded by an outer jacket, leaving a space between the two, through which air is circulated, and which is connected, either to an adjacent drying chamber, or to the boiler itself, if it is desired to use that as a drying chamber. In this way the hot air required for drying or disinfecting is heated by the steam which serves also to heat the boiler. The material may be treated in the boiler, and then removed to the adjacent drying chamber, or it may be dried in the boiler by connecting it with the air-jacket.—W. H. C.

*Dust; Prevention and Laying of —.* W. M. Sandison, Ayton, N.B. Eng. Pat. 18,904, Sept. 1, 1904.

ROAD surfaces are treated, by sprinkling or saturating, with the soap suds obtained from wool washing, which are previously mixed with a suitable, preferably disinfectant, oil or grease, such as creosote. Suds from which

the grease has been partly removed, or which have been partly deprived of potassium salts may be used; in the last instance, a deliquescent salt is added. For transport purposes the suds may be evaporated to lessen their bulk.

—A. G. L.

#### UNITED STATES PATENTS.

*Wood-Filler.* S. D. Kudysch, Philadelphia. U.S. Pat. 782,252, Feb. 14, 1905.

A PULP-LIKE "filler" for rubbing into wood, is obtained by combining a volatile liquid with the coloured residuum produced in the manufacture of acetic acid from calcium acetate. The residuum is ground with water, neutralised with milk of lime or of baryta, dried, and is then mixed with the volatile liquid, which may be, for instance, water, alcohol, benzine, or turpentine.—E. S.

*Refractory Articles; Process of Manufacturing* — P. Klein, Riga, Russia. U.S. Pat. 784,621, March 14, 1905.

PURE aluminium hydroxide  $Al_2(OH)_6$  is mixed with from 10 to 80 per cent. of pulverised quartz, moulded, pressed and burned, thereby yielding a new refractory article, consisting of aluminium silicate containing upwards of 42 per cent. of alumina.—W. C. H.

*Colouring Natural Compact Crystalline Stones; Process of* — A. Wultze, Assignor to Chem. Techn. Fabr. Dr. A. R. W. Brand und Co., Charlottenburg, Germany. U.S. Pat. 786,082, March 28, 1905.

SEE Eng. Pat. 5594 of 1903; this J., 1904, 188.—T. F. B.

#### FRENCH PATENT.

*Bricks, Artificial Stone, and Similar Products; Process of Making* — L. F. Kwiatkowski. Fr. Pat. 347,918, Nov. 15, 1904.

SEE U.S. Pat. 775,222 of 1904; this J., 1904, 1217.—T. F. B.

#### GERMAN PATENTS.

*Stone, Tubes, Retorts, Muffles, &c.; Manufacture of Refractory* —, and of Fireproof Coatings on Ceramic Objects. O. Pufahl. Ger. Pat. 156,756, Dec. 24, 1902.

CLAIM is made for the use of the rare earths or their mixtures or compounds as constituents of the raw mixtures for the production of artificial stone, retorts, &c., and as a refractory coating on ceramic objects.—A. S.

*Colour [for Stone, &c.]; Preparation of a Facing* — Gogolin-Gorasdzer Kalk- u. Zement-Werke, A.-G. Ger. Pat. 156,597, Aug. 26, 1903.

BURNT clay or the like is ground, digested with hydrochloric acid, and the chlorine compounds removed by washing with water. The pigment produced is mixed with about 25 per cent. of cement, and sufficient water to form a paste, which is applied to the object to be coloured.—A. S.

*Asbestos Objects from finely-divided Asbestos; Preparation of* — without the use of Binding Agents. J. Bernfeld. Ger. Pat. 156,794, Feb. 17, 1904.

THE present patent is an addition to Ger. Pat. 148,936 (see Eng. Pat. 16,493 of 1901; this J., 1902, 1143). The objects before being heated are treated with acids to increase their strength and resistance to acid.—A. S.

### X.—METALLURGY.

*Steel, Chrome-Vanadium; Heat Treatment of* — H. R. Sankey and J. R. Smith. Inst. Mech. Eng., Dec. 16, 1904. Engineering, 78, 871—877.

THE authors examined the effects of different heat-treatments on a chrome-vanadium steel containing:—carbon, 0.297; silicon, 0.059; manganese, 0.394; chromium, 1.066; and vanadium, 0.169 per cent. The steel as cast showed, after rolling, a yield-point at 36.9 tons per sq. in.;

ultimate stress, 54.1 tons; elongation, 24 per cent 2 ins.; and contraction, 44.9 per cent. The heat-treatments were:—Annealing for half an hour at 500°, 600°, 800°, 900° and 1100° C.; soaking for 12 hours at 500°, 620°, 690°, 800°, 900°, and 1200° C.; water quench from 500°, 690°, 800°, 900° and 1200° C.; oil quench from 500°, 690°, 800°, 900° and 1200° C.; oil quench from 500°, 690°, 870° and 1000° C. with reheating 6 mins. at 350° C.; oil quenching from 690° and 90 with reheating for 10 mins. at 600° C. Appar the only critical point in the cooling of the steel was 710°—715° C., and only the treatments at temperatures higher than this produced marked changes in the results of the mechanical tests. The yield-point and breaking were considerably reduced, the elongation and contraction slightly increased, and the impact figure (work absorbed in producing fracture at one blow) greatly increased by annealing and by soaking at 800° C. and higher temperatures. Annealing at 900° C. produced, on the whole, the best results. The steel was spoiled by quenching in oil from 800° C. Quenching in oil caused a great reduction in the impact and bending test figures. It was found that heat treatment had a greater effect on the results of impact tests than on those of the tensile tests. Chrome-vanadium steel is less sensitive to heat-treatment than carbon steel. A spring made of a steel containing the same proportions of chromium and vanadium as that described above, but 0.44 per cent. of carbon, was capable of bearing about twice as great a load as a good carbon steel spring, but the extension was about 7 per cent. greater with the chrome-vanadium steel. Chrome-vanadium steels which have been injured by overheating are restored to a considerable extent, by reheating to about 900° C.—A.

*Metals; Oxidation of* — in the Cold in presence of Ammonia. C. Matignon and G. Desplantes. Compt. rend., 1905, 140, 853—855.

VARIOUS metals were placed in closed flasks containing oxygen and a small quantity of ammonia, and allowed to stand for a number of hours. The amount of metal passed into solution was determined in each case: cobalt, nickel, silver, cadmium, zinc, molybdenum, tungsten and manganese were all considerably oxidised, whilst chromium and vanadium were not attacked. In the case of mercury, the usual "Millon's" base is formed, especially when the metal is allowed to go on in absence of light.—B. J. S.

*Iron Ores and Slags; Analysis of* — R. N. XXIII., page 459.

*Ferro-silicon; Determination of Carbon in* K. Jene. XXIII., page 459.

#### ENGLISH PATENTS.

*Malleable Castings; Production of Iron suitable for Manufacture of* — A. Zenzen, Charlottenburg, Germany. Eng. Pat. 6,997, March 23, 1904.

THE process consists in preparing in a Bessemer converter white iron containing from 2 to 2.5 per cent. of carbon, 0.5 per cent. of silicon, and about 0.2 per cent. of manganese, but poor in phosphorus and sulphur. To this is added about half the quantity of an iron melted in a crucible furnace, of such composition, that after the reaction which occurs on mixing the two metals are complete, the white iron is produced containing 2.5 to 3 per cent. of carbon, about 0.5 per cent. of silicon, and 0.3 per cent. of manganese, the proportion of phosphorus and sulphur being very low.—R. S. H.

*Iron and Steel; Manufacture of* — B. Talbot. Inst. Mech. Eng. Pat. 9110, April 20th, 1904.

A FURNACE having two or more hearths separated by bridges, is so arranged "that the heat and atmosphere contained in the slag on the finished metal in one hearth," is utilised for the refining of the metal in another hearth by causing it "to boil over the bridge," or otherwise transferring it from one hearth to the metal in the other.—J. H. C.



*Extraction of — from Solution in Water* [See p. 11. C. Ciantar and U. Ciantar, London. Pat. 689, Jan. 11, 1904.

Water is forced through small delivery pipes into a receptacle containing mercury, so that the two are violently agitated together, and part of the water is "floured." The mercury should occupy one-third of the depth of the receptacle. When sufficiently "floured," the water and "floured" mercury are drawn into a series of settling tanks in which the "floured" mercury containing some gold separates, and is recovered for further use.—J. H. C.

*Gas-Furnace; Treating —, and Utilising the Gases Thereof.* J. H. W. Stringfellow, Walthamstow. Pat. 5648, March 8, 1904.

Gas is obtained as usual from the slag, and is then used in a process, by pounding, crushing and screening, separates from it the granular matter mechanically mixed with it. This procedure is designed to separate into two parts, the siliceous wool and the non-granular matter. This latter may be utilised for the generation of gas for firing forges, driving gas-engines, by treatment with sulphuric acid, or it may be used for the recovery of ammonia from sewage, or for other purposes.—A. G. L.

*Gas Machines for Separating Liquids from Solids, and Water from Ground Ore, and for Filtering the Solid Liquids.* J. C. Fell. From D. E. Bigelow. Pat. 8298, April 11, 1904. L., page 427.

#### UNITED STATES PATENTS.

*Iron; Process of Purifying Pig —.* J. B. Nau, New York. U.S. Pat. 786,048, March 28, 1905.

Pig-iron is poured upon a mass of broken pieces of metallic ore in such a manner that it descends in channels through the spaces between the pieces of ore, as a bath in which the ore is kept immersed for a certain period, the molten purified metal being then off. The process may be made continuous by introducing the molten pig-iron into contact with the lower body of ore, heating the upper part of the ore by means of the heat generated in the purifying, drawing off the molten purified pig-iron and adding further quantities of molten pig-iron over part and of ore to the upper part of the body of ore. A. S.

*Process of Reducing —.* D. R. Robertson, Little, Colo. U.S. Pat. 786,051, March 28, 1905.

Ly-divided ore is heated and agitated with water, ice of ammonia, potassium nitrate and rock-salt; water, "iron-water" and nitric acid are then added to the mixture again agitated. After allowing to settle, the metals are precipitated upon the ore pulp, and the solid matter is drained, cooled, and dried, preparatory to smelting.—A. S.

*Separating and Refining Complex —.* E. Hedburg, for the American Reduction Co., Chicago. U.S. Pat. 85,167, March 21, 1905.

ores are dried, roasted, treated while hot with a hydrocarbon, partially cooled by an air-blast, and passed through magnetic fields of progressively increasing strength. In some cases lime is added to the ore while it is roasted.—J. H. C.

*Roasting —.* C. H. Repath and F. E. Repath, Assignors to F. Klepetko, New York. U.S. Pat. 7, March 21, 1905.

hearthings are so arranged that there is always an open body of material extending throughout the hearth. By means of a hollow central stirring shaft with rabblers, the material is continuously passed between central and marginal openings from one hearth until finally discharged at the bottom

of the furnace. The products of combustion from an external firebox are led to the lower hearth and thence pass to a discharge flue.—J. H. C.

#### FRENCH PATENTS.

*Steel Furnace with Blast.* C. B. M. Lancon. Fr. Pat. 348,074, Oct. 21, 1904.

This is essentially a Martin furnace provided with tuyères and so mounted that it may be turned on its longitudinal or transverse axis. The tuyères are so arranged that the blast may be made to play upon or beneath the surface of the bath at will.—J. H. C.

*Copper; Process for the Separation of —, particularly from Low-grade Ores.* P. and A. Weiller. Fr. Pat. 347,840, Oct. 31, 1904.

The minerals are fused with suitable fluxes so as to form sulphides or silicates from which the copper is precipitated by iron.—J. H. C.

*Gas, Blast-Furnace; System of Utilising —.* P. L. Hulim. Fr. Pat. 348,177, Jan. 30, 1904. L., page 430.

#### GERMAN PATENT.

*Zinc and Cadmium; Muffle for the Distillation of —.* O. Unger. Ger. Pat. 156,342, July 31, 1903.

The furnace consists of two or more thin-walled muffles fitting one within the other, with, if necessary, spaces between. By the use of two thin-walled muffles, capable of free movement, instead of a single thick-walled one, strains during heating and cooling, and the formation of cracks are prevented.—A. S.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A.)—ELECTRO-CHEMISTRY.

*Nitrates to Nitrites; Electrolytic Reduction of —.* E. Müller and F. Spitzer. Ber., 1905, 38, 1190—1194.

MÜLLER and Weber showed that nitrates are electrolytically reduced to nitrites when the cathode is coated with spongy copper, but as the continuance of the process renders the copper smooth and coherent, and thus favours the further reduction to ammonia, they were obliged from time to time to polarise the cathode anodically, and thus regenerate the spongy surface. The authors find that the same end is attained by mixing a copper salt with the electrolyte, and thus slowly depositing copper during the electrolysis. Working in this way with mixtures of nitrate and nitrite (much disturbance and irregularity arose in the earlier experiments through the use of nitrite containing a trace of lead), they find that in solutions already containing 30 per cent. of nitrite, further nitrite can be produced corresponding to 80 per cent. of the current used. Müller and Weber had shown that, working with a diaphragm, a loss occurred through the nitric acid set free at the anode destroying the nitrite in the pores of the diaphragm, and the authors therefore endeavoured to work without one. So long as a platinum anode was used, anodic oxidation of the nitrate occurred; but Büttemann, and, independently, Traube and Biltz, found that this was not the case with an iron anode. The latter investigators stated, however, that this oxidation did occur in presence of copper salts; but the authors have shown that want of hydroxyl ions, and not the presence of copper salts, was the cause of the oxidation observed by Traube and Biltz, and they have found that a reduction of nitrate to nitrite corresponding to 84 per cent. of the current used can be kept up for long periods in a solution already containing 36 per cent. of nitrite, without a diaphragm, if the copper precipitated on the cathode be renewed in the solution.—J. T. D.

*Copper Sulphide; Electrolytic Behaviour of* — G. Bodländer and S. Idaszewski. *Z. Elektrochem.*, 1905, 11, 161—182.

With a view to studying the possibility of obtaining copper by the electrolysis of fused cuprous sulphide, the authors have carried out an extensive research on the electrical and other properties of this substance. Cuprous sulphide melts at  $1091^{\circ}\text{C}$ , and in the fluid condition can form intimate mixtures with metallic copper, but when the material solidifies the copper is thrown out. In accordance with the early work of Hittorf, but contrary to recent published work, it is found that the cuprous sulphide behaves as an electrolyte in the solid condition, but that its electrical conductivity at ordinary temperatures is very low. With increasing content of cupric sulphide both the power of conducting electrolytically, as also the low conductivity at ordinary temperatures gradually disappear since the cupric compound exhibits metallic conduction. As a consequence, when fused cuprous sulphide is submitted to electrolysis in a U-tube, the decomposition products are removed by depolarisation and, therefore, do not appear in the free state. Fused sodium sulphide has a decomposition voltage of 1.62, fused potassium sulphide one of 1.65. In the molten condition cuprous sulphide and sodium sulphide are miscible within certain limits, and the presence of a double compound ( $\text{NaCuS}$ ) has been found by isolation of small steel-blue crystals of this composition. In the fused mixture on electrolysis, the copper migrates in the form of a complex ion to the anode, and copper is deposited at the cathode only by a secondary reaction. The practical preparation of copper by electrolysis of the fused sulphide, or of mixtures with the alkali sulphides, is, therefore, considered to be hopeless.—R. S. H.

#### ENGLISH PATENTS.

*Heating by Electricity [Electric Furnace]; Impts. in* — A Voelker, Berlin. Eng. Pat. 10,873, May 11, 1904.

SEE Fr. Pat. 343,094 of 1904; this J., 1904, 988.—T. F. B.

*Poles or Electrodes of Electrolytic Apparatus [Electrolysis of Alkali Chlorides]*. G. J. Atkins, Tottenham, Middlesex. Eng. Pat. 11,470, May 18, 1904.

THE trough-shaped carbon anode with concentric rotating cathode previously invented by the author (this J., 1901, 815), is modified in such a way that the anode takes the form of a hollow cylinder of carbon, almost entirely surrounding the rotating cylindrical cathode. An opening is left at the upper part for the escape of the gases evolved during electrolysis. By this means the cathode is completely immersed in the electrolyte, and the oxidation, caused by the alternate action upon its surface of the electrolyte and atmospheric air, is prevented.—R. S. H.

*Grain and Rice; Process of Preparing a Solution for use in Bleaching* — J. L. Lawson, Leith. Eng. Pat. 10,211, May 4, 1904.

A MIXTURE consisting of calcium chloride, 35 parts, borax, 2 parts, and boric acid, 1 part, is placed in a small perforated box fixed to the inside of a large tank constructed of non-conducting material such as wood or earthenware. The tank is then filled with water until, as the level rises, the small perforated box becomes half full. The ratio of water to mixture should be as 10:1. After passing steam into the tank and box until complete solution has been effected, an electric current is passed through the solution for from 30 minutes to one hour, during which time the steam pipes are removed. Steam is again passed into the tank to mix its contents, and the solution is then ready for the bleaching and purifying purposes referred to.—W. P. S.

*Oleic Acid; [Electrical] Conversion of — into Stearic Acid and like Compounds*. A. de Hemptinne. Eng. Pat. 1572, Jan. 26, 1905. XII., page 448.

#### UNITED STATES PATENTS.

*Electric Furnace*. W. C. Arsem, Schenectady, N. Y. Assignor to General Electric Co., New York. U. S. Pat. 785,335, March 21, 1905.

THE material to be heated is supported within a heat space enclosed by a helix of graphite, arranged within an air-tight chamber, provided with a sight opening with means whereby it can be cooled. The helix of graphite, which serves as the heater, is surrounded by a double-walled screen of refractory material, the space between the walls being filled with a heat-insulating material. The ends of the helix are connected to tubular conductors, through which a cooling fluid can be circulated. Means are provided for exhausting the air and for introducing an inert gas into the outer chamber.—A.

*Electrode for Electric Furnaces*. E. F. Price, G. E. and J. G. Marshall, Assignors to Union Carbide and Carbon Co., Niagara Falls, N. Y. U. S. Pat. 785,832, March 28, 1905.

THE hood of the furnace projects downwards into the working chamber. In the top of the hood, which is provided with a cooling arrangement, are holes in which electrode-holders fit loosely, with a refractory luting packing. Each electrode consists of a number of graphite rods. Each holder has a water-chamber provided with a baffle, and in the chamber are a number of removable sockets threaded internally, into which the graphite rods composing the electrode fit. A refractory cement of relatively high resistance, with a support of perforated metal, is provided between and around the graphite rods, whilst the portion of each rod projecting into the working chamber is encased in a metal sheath, with a packing of carbonaceous cement between the rod and the sheath.—A.

*Milk; Evaporated* — L. P. Britt, Assignor to F. W. Mayer. U. S. Pat. 783,015, Feb. 21, 1905. XVIII., page 452.

*Metallising Fabrics [by Electrolysis]; Process of* — C. Danilevsky and S. Tourchaninoff. U. S. Pat. 784,401, March 21, 1905. V., page 438.

#### FRENCH PATENTS.

*Electrodes for Electrolytic Apparatus*. G. J. Atkins. Fr. Pat. 348,008, Nov. 18, 1904.

SEE Eng. Pat. 11,470 of 1904, preceding these.—T. F. B.

*Insulating Material, Impermeable, Incombustible, Attacked by Acids*. U. A. Marga. Fr. Pat. 348,022, Nov. 22, 1904.

SEE Eng. Pat. 25,128 of 1904; this J., 1905, 136.—T. F. B.

*Ozone; Apparatus for the Industrial Manufacture of — by means of Liquid Air*. P. M. Oudin. First Addition dated Oct. 21, 1904, to Fr. Pat. 347,148, of Oct. 7, 1904 (this J., 1905, 282).

AIR, strongly cooled and compressed, is, under the present addition, substituted for the liquid air used in the apparatus described in the main patent.—E. S.

*Benzols and their Simple Hydroxy Derivatives; [Electrolytic] Process for the Production of —*. L. Scholten. Fr. Pat. 347,862, Nov. 12, 1904. Under International Convention, May 27, 1904.

WHEN coal or other form of carbon, coal tar, or coal oils are submitted to the action of a direct electric current in a porous vessel, or an alternating current in any receptacle, in presence of water and of "any soluble or insoluble acid, base, or salt, inorganic or organic," it is stated that at first benzene and its homologues, and then the hydroxy derivatives are produced. Very weak currents are said to suffice for the reaction, and the temperature at which it is carried out has very slight influence on the process.—T. F. B.



*ic Acid and its Compounds; Electrical Process for the Manufacture of ——. Westdeutsch. Thomasphosphat-Werk G. m. b. H. Fr. Pat. 348,189, Nov. 1904. VII., page 411.*

## 7. (B).—ELECTRO-METALLURGY.

### ENGLISH PATENTS.

*ds; Electrolytical Extraction of —— from Solutions. F. Webb, London. Eng. Pat. 6832, March 21, 1901.*

M is made in electrolytic apparatus for the extraction of metals from solutions, of the combination of a graphite cathode with a cathode of any suitable material (graphite, etc.). If the cathode is made of material other than graphite, it is coated on the surface with graphite. The electrodes are arranged within the apparatus at a distance from  $\frac{1}{4}$  in. to  $\frac{3}{4}$  in. apart.—A. S.

*r-jackets, Casings and the Like: Electrolytic Manufacture of ——. A. F. Bosquet, Paris. Eng. Pat. 627, Sept. 24, 1904. Under Internat. Conv., Feb. 10, 1904.*

The invention relates to the manufacture of copper jackets for explosion motors, &c., by the electrolysis of copper, and is similar to the previously described method of the same inventor (this J., 1904, p. 1). The space for the water is occupied by a material as gutta-percha or wax, coated with graphite, which is melted out after the copper deposit has reached the site thickness. The whole is enclosed in a perforated mould, which closes the orifices of the explosion motor, or other article on which the jacket is being made, but leaves sufficient space for the electrolyte to be in contact with those portions of the surface of the metal which are to receive the deposit.—R. S. H.

### UNITED STATES PATENTS.

*ls from Ores; Apparatus for Extracting ——. A. Hendryx, Los Angeles, Cal. U.S. Pat. 785,214, March 21, 1905.*

The apparatus consists of a tank with a conical bottom and radial partitions or ribs which are radially disposed; a central spreader placed above the tank, a central pipe communicating with its lower part, suitably placed electrodes within the tank, apparatus for raising pulp, and discharge passage controlled by a valve. The ore pulp is placed in the tank, and portions of it are continuously raised from the bottom and discharged through the sheet over the spreader so as to secure thorough mixing. The raised pulp then flows gently between the electrodes, a current being maintained the while.

—J. H. C.

*ls [Aluminium] and Alloys; Process of Producing ——. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 1,185, March 28, 1905.*

An alloy of aluminium and copper is produced by adding aluminium to a fused mass consisting of an oxide of a metal or metals having greater affinity for oxygen than aluminium or copper, and subjecting the mixture to the action of an electric current capable of reducing the aluminium and copper. Claim is also made for the process of reducing metal from substances containing the same, which consists in "exposing a fused mass containing substance to the action of a metal-yielding electric current, while subjecting the fused substance to the action of a non-metal-yielding current, and through the same between electrodes at an angle to the path of the metal-yielding current, and one of which electrodes is in common with the metal-yielding-current electrode."—A. S.

*Aluminium or other Metals; Process of Extracting ——. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 6,244, March 28, 1905.*

The process consists of electrolysis a fused mixture of one or more compounds composed of a single metal compound with fluorine and with different non-metallic elements

other than halogens, and, if desired, in presence of a substance capable of combining with one of the non-metallic elements. The E.M.F. used is insufficient to liberate fluorine, but is capable of liberating the less electro-negative non-metallic element or elements. For example, a fused mixture of aluminium fluoride and alumina is electrolysed with a carbon anode, whereby metallic aluminium is produced, together with oxygen, the latter combining with the carbon to form carbon monoxide. From time to time fresh alumina is added, and the reduced aluminium withdrawn.—A. S.

*Metals [Zinc]; Process of Electrodepositing ——. E. D. Kendall, Brooklyn, N.Y. U.S. Pat. 786,221, March 28, 1905.*

It is claimed that metallic zinc is deposited in the form of a hard, adherent coating on surfaces of iron, steel or other metal by passing an electric current between a cathode consisting of the metal to be plated, and a suitable anode in an electrolyte containing zinc sulphoglycerate.—A. S.

### GERMAN PATENT.

*Iron Objects; Electrical Process for the Case-Hardening of —— by means of a Resistance-Mass of Granulated Charcoal. Kryptol-Ges. m. b. H. Ger. Pat. 156,232, Feb. 12, 1903.*

The portions of the iron object to be case-hardened are brought into contact with the resistance-mass, and the latter is connected to a source of electricity. For the cementation of soft iron, a box is used of which two opposite sides or portions of such sides are made of conducting material. The box is packed with alternate layers of coarse charcoal powder, and of the pieces of soft iron, and is then connected to a source of electricity. According to the strength of the current and the time for which it is passed, iron of different degrees of hardness can be produced.—A. S.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*Heptadecylic Acid; Investigation of the Natural Occurrence of ——. D. Holde. Ber., 1905, 38, 1247—1258.*

*Olive Oil.*—In former communications (this J., 1901, 1903; 1902, 126) the author described a mixed glyceride isolated from olive oil and concluded that it contained a heptadecylic acid,  $C_{17}H_{34}O_2$ . He has now made a further examination of this substance, fractionally precipitating a larger quantity with magnesium acetate. After 15 precipitations a fraction consisting of nearly pure palmitic acid was obtained. The early precipitates contained acids of higher molecular weight (282—291) melting below  $56^\circ C$ , but after the 15 crystallisations a small amount of an acid, melting at  $74^\circ$ — $76^\circ C$ , was separated. The second to the fifth fractions melting at  $53.5^\circ$  to  $54.7^\circ C$ , and having a mol. equiv. of 268 to 269, were united and further fractionated, and eventually yielded different acids, some of which had a mol. equiv. above 290. Hence the conclusion was arrived at that the supposed heptadecylic acid was really a mixture of acids of high molecular weight with palmitic acid. This was confirmed by the behaviour of an artificial mixture of 0.3 gm. of arachidic acid, 0.7 gm. of stearic acid, and 1 gm. of palmitic acid, which, when fractionated, yielded four successive fractions closely corresponding in mol. equiv. and m. pt. with the supposed heptadecylic acid. The solid fatty acids of the olive oil itself yielded, after 15 fractionations, an acid of mol. equiv. 368.7 and m. pt.  $72^\circ$ — $72.8^\circ C$ . (lignoceric acid,  $C_{24}H_{48}O_2$ , has mol. equiv. 368 and m. pt.  $80.5^\circ C$ ).

*Kreis and Hafner's Heptadecylic Acid.*—The author has examined the actual substance prepared by Kreis and Hafner (this J., 1903, 1136), which had a m. pt. of  $55.5^\circ$ — $56.6^\circ C$ , and, after numerous fractionations, has isolated stearic acid (m. pt.  $68^\circ$ — $69^\circ C$  and mol. equiv. 280.1).

*Gérard's Heptadecylic Acid.*—Gérard claimed to have isolated a heptadecylic acid from datura oil (this J., 1890,

1137), and the author's previous work (this J., 1902, 1459) supported that statement. By fractional distillation *in vacuo*, and repeated crystallisation of the products from alcohol, Gérard's "daturic" acid now yielded an acid with a m. pt. of 57°—58.5°, gradually rising to 63°—64° C., and with a mol. equiv. as high as 329.

Nördlinger's Heptadecylic Acid (this J., 1892, 445) was prepared by the author from palm oil, and submitted to further fractionation in larger quantities. In this case, too, the author concluded that when several fractions showed a constant m. pt. of about 56° C., and the mol. equiv. of heptadecylic acid, the phenomenon was due to an intimate admixture with palmitic acid of fatty acids of very high molecular weight. Eventually an acid was isolated melting at 68°—68.5° C., and having the mol. equiv. 288.—C. A. M.

*Oils; Determination of the Viscosity of Lubricating* —. R. Hackel. XVIII., page 460.

*Walnut Oil; Detection of Foreign Oils in* —. J. Bellier. XXIII., page 459.

#### ENGLISH PATENTS.

*Oleic Acid; [Electrical] Conversion of — into Stearic Acid and like Compounds.* A. de Heipenne, Gand, Belgium. Eng. Pat. 1572, Jan. 26, 1905. Under Internat. Conv., March 19, 1904.

OLEIN and similar compounds are subjected to an electric discharge in an atmosphere of hydrogen, preferably at a pressure lower than that of the air. The olein, &c., is spread in a thin layer on metallic plates, between which passes the current, and it is stated that under these conditions hydrogen is absorbed with the formation of a considerable proportion of stearin and other substances of higher melting point. The process is repeated until about 20 to 30 per cent. of the oleic acid has been converted, and the solid products are then separated by chilling and filtering the mixture.—C. A. M.

*Sponge Cloths, Cotton Waste and all kinds of Grease-laden Textile Materials; Method and Means for Removing Oil and Grease from* —. S. G. Hall. Eng. Pat. 10,156, May 3, 1904. V., page 436.

*Resin Soap; Manufacture of* —. E. Fischer, Dresden, Germany. Eng. Pat. 11,436, May 18, 1904.

SEE Fr. Pat. 343,617 of 1904; this J., 1904, 1036.—T. F. B.

#### FRENCH PATENTS.

*Hydroxystearic Acid; Process for Manufacturing — [from Oleic Acid].* Standard Oil Co. Fr. Pat. 348,089, Oct. 31, 1904. Under Internat. Conv., Aug. 12, 1904.

SEE U.S. Pat. 772,129 of 1904; this J., 1904, 1102.—T. F. B.

*Edible Oils; Process and Apparatus for Neutralising* —. P. H. Klein. Fr. Pat. 348,010, Nov. 18, 1904. XVIII. A., page 452.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

#### (A).—PIGMENTS, PAINTS.

##### ENGLISH PATENTS.

*Lakes; Manufacture of Colouring Matter* —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 9674, April 27, 1904.

SEE Fr. Pat. 342,903 of 1904; this J., 1904, 989.—T. F. B.

*Lakes; Manufacture of Colouring Matter* —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 9861, April 29, 1904.

In Fr. Pat. 342,903 of 1904 (this J., 1904, 989), is described the production of lakes from acid dyestuffs by the use of basic aluminium salts alone. Lakes possessing exactly similar properties are obtained by substituting for the

free hydrochloric, nitric or acetic acids, or their aluminium salts (*loc. cit.*), the barium or lead salts of one of acids, and carrying out the precipitation at a high temperature. For example, an insoluble yellow lake obtained by adding two parts of barium chloride to a mixture of 200 parts of a 4 per cent. paste of basic aluminium sulphate, and 1 part of Naphthol Yellow S, and b the mixture for some time. It is necessary that the amount of acid radical present in the lead (or barium) and aluminium salts should be only from one-sixth to one-twenty-fourth the amount required for the formation of the normal salts.—T. F. B.

*Lakes [from Azo Dyestuffs]; Manufacture of Colour* —. H. E. Newton, London. From Farbwerke vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,512, June 2, 1904.

SEE Fr. Pat. 343,631 of 1904; this J., 1904, 1036.—T. F. B.

*Point; Manufacture of* —. J. E. Kollinger, Mannheim. Eng. Pat. 22,732, Oct. 21, 1904. Under Internat. Conv., Oct. 21, 1903.

DOLOMITE containing 20 to 50 per cent. of magnesian carbonate is burnt, saturated with petroleum, and burnt; this process furnishes a very finely divided product suitable for the preparation of a white paint by grinding it with a saponifiable binding agent (*e.g.*, linseed oil) or without rosin or mineral oil. This pigment may serve as a base for the preparation of coloured pigments. (Compare Fr. Pat. 328,114 of 1903; this J., 1904, 1036.)—T. F. B.

#### UNITED STATES PATENTS.

*Pigments; Process of Producing Black or Dark Brownaceous* —. D. J. Ogilvy, Cincinnati, U.S. Pat. 785,696 and 785,697, March 21, 1905.

BLACK or dark-coloured pigments are produced by exposing a carbonaceous flame, either in motion (Pat. 785,696) or stationary (Pat. 785,697), to impinge upon a material containing in solution a suitable material capable of overcoming "the repellent nature of the carbonaceous deposit towards the water."—A. S.

*Paint [Iron Hydride].* G. W. Gesner, New York. U.S. Pat. 786,023, March 28, 1905.

SEE Eng. Pat. 16,029 of 1904; this J., 1904, 989.—T. F. B.

#### GERMAN PATENTS.

*Monazo Dyestuffs specially suitable for the Preparation of Lakes; Process for Manufacturing Yellow to Orange Yellow* —. Badische Anilin u. Soda Fabrik. Ger. Pat. 156,352, Sept. 10, 1903. IV., page 434.

*Monazo Dyestuffs specially suitable for the Preparation of Lakes; Process for Manufacturing Red to Orange* —. Badische Anilin u. Soda Fabrik. Ger. Pat. 156,353, Oct. 2, 1903. IV., page 434.

#### (B).—RESINS, VARNISHES.

##### UNITED STATES PATENT.

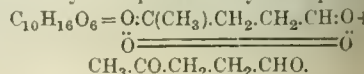
*Varnishes; Process of Manufacturing* —. A. Billancourt, and L. Rambaud, Paris. U.S. Pat. 785,450, March 21, 1905.

SEE Fr. Pat. 334,430 of 1903; this J., 1904, 69.—T. F. B.

#### (C).—INDIA-RUBBER, Etc.

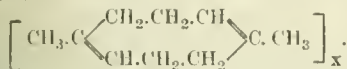
*Caoutchouc; Decomposition and Constitution of* —. C. Harries. Ber., 1905, 38, 1195—1203.

FURTHER experiments have shown that caoutchouc decomposes (this J., 1904, 830) when decomposed with yields only levulinic aldehyde or acid. The compound melting at 197° C., which was obtained in small quantities and was previously described as an acid, is actually superoxide of levulinic aldehyde. The decomposition of the ozonide may be represented by the equation:—





fact that only levulinic aldehyde is formed by the position of caoutchouc ozonide with water, shows the caoutchouc hydrocarbon molecule,  $C_{10}H_{16}$ , must be of a closed carbon ring, and not, as has hitherto been deduced, of an open carbon chain. Molecular weight determinations with the pure caoutchouc ozonide point to formula  $C_{10}H_{16}O_6$  for this compound, and it is probable that Para caoutchouc is a loose complex of methyleyclo-octadiene. (1.5) molecules :



formula is in accord with the properties of caoutchouc with its behaviour on destructive distillation.—A. S.

*percha ; Detection and Determination of Bituminous substances in —.* Pontio. XXIII., page 460.

#### ENGLISH PATENT.

*er Solutions ; Novel or Improved Means of Preparing —, and the Utilisation of such Means and of sequent Treatment for the Conversion of Waste into serviceable Rubber.* Robinson Bros., Ltd., and G. A. Clift, West Bromwich, Staffs. Eng. Pat. 6471, Feb. 17, 1904.

The preparation of rubber solutions, and in the case of waste into serviceable rubber, the use of pyridine and other bases or "heavy bases," extracted from coal and other sources, is claimed. In the preparation of caoutchouc rubber from waste, the latter is first extracted with the pyridine or other bases, and the solution then treated with an acid, which combines with the bases, causes separation of the dissolved rubber. For the preparation of rubber solutions, the rubber is first dissolved in pyridine or other bases, and the solution treated with benzol or other naphtha or usual rubber solvent, with an acid. The acid combines with the bases, and the rubber is retained in solution by the naphtha or other solvent.—A. S.

#### FRENCH PATENTS.

*er ; Artificial —.* H. C. Bonet. Fr. Pat. 347,943, Nov. 18, 1904.

parts of ceresin, 6 parts of lac or gum-lac, 13 parts of rosin, 3 parts of rosin and 6 parts of Trinidad are melted together, and 100 parts of waste gutta-percha, previously softened by treatment with boiling water, are added in small portions. Seventeen parts of calcium carbonate or calcined magnesias are then incorporated with the molten mass by kneading, until the mixture is homogeneous.—A. S.

*indie Press [Vulcanising] with a Horizontal Autoclave —.* Soc. Morane, Jeune et Cie. Fr. Pat. 347,943, Nov. 21, 1904.

A CYLINDRICAL casing A, having doors at each end, is arranged to enclose the press-plates C of a series of hydraulic presses, the rams G, passing through the leather cup-joints H. In this way the material under treatment can be heated directly by steam introduced into the casing, this being of special advantage when vulcanising rubber materials under pressure. In treating extended bodies such as cables, the end doors are provided with circular openings, having suitable joints, through which the cable is led, and in this way a cable of any length can be treated.

—W. H. C.

#### XIV.—TANNING, LEATHER, GLUE, SIZE.

*Tanning by Means of Hydrodynamic Pressure ; Comparison between —, and the Ordinary Method.* H. de Marneffe. Collegium, 1905, 96, 100—105.

WHEN the drum is employed as a mechanical adjunct in tanning, an indispensable condition is a swelling of the hide in order to promote a considerable separation of the fibres, so as to allow of a rapid absorption of the tanning infusion ; this separation tends to destroy the physical properties of the skin. Mechanical operations, after the hide has been impregnated with tanning material, bring about a purely artificial cohesion of the tannin easily destroyed however by water. Further disadvantages of this method are the impossibility of obtaining a leather perfectly tanned the length of time required, and the waste of mechanical power.

When the tannage is performed by hydrodynamic pressure, the maximum fixation of tannin can be obtained with a minimum amount of tanning material, the method can be employed independently of motive power, and the preparatory operations of liming, bating, &c., can be dispensed with. The acidity produced during the fermentation processes subsequent to the ordinary method of tanning, is indispensable in order to fix the tannin in the fibres. (See this J., 1905, 284.)—M. C. L.

*Leather Dyeing ; Practical Difficulties in —.* H. G. Crockett. VI., page 439.

#### ENGLISH PATENTS.

*Leather ; Apparatus employed in the Manufacture of —.* H. R. and C. R. Hall, both of York, and B. and D. Wright, both of Leeds. Eng. Pat. 10,105, May 3, 1904.

THE invention consists in the replacement of the revolving cylinder provided with blades common to the ordinary setting machine, by a revolving central brush, in order to adapt the machine for use in blacking, seasoning and brushing operations.

The solution to be used for blacking or seasoning is contained in a tank placed above the machine, and is fed through pipes, which are perforated at the outlet, to two or more smaller brushes used as "feeders," which revolve in contact with the central brush, but at a slower rate of speed.

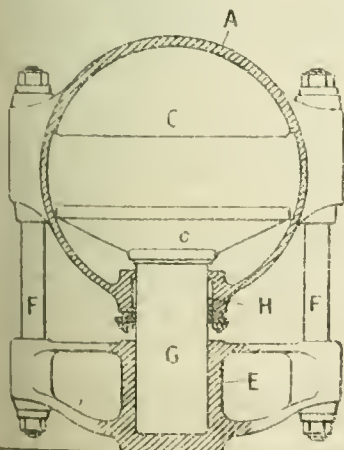
The leather to be treated is placed on the table of the machine, and is moved about under the revolving central brush, the machine being worked exactly as when used in the operation of setting, &c.—M. C. L.

*Gloves, Skins, Leather, and the like ; Preparation for Cleansing and Dyeing —.* F. J. Petersen. Eng. Pat. 19,323 Sept. 7, 1904. VI., page 439.

#### FRENCH PATENTS.

*Vegetable Tanning ; Rapid —.* R. Berthon. Fr. Pat. 347,711, Jan. 16, 1904. (See also this J., 1905, 339.)

THE pelts are prepared by immersing them in a solution of common salt (12 to 15 per cent.) and sulphuric acid (2 per cent.) for 6 to 24 hours, and after draining for 6 hours, placing them in a 5 to 10 per cent. solution of a neutral soap for from 10 minutes to 2 hours, according to the amount of swelling obtained. The tannage is performed in the drum with ordinary vegetable tanning materials, and an addition of turpentine ( $\frac{1}{2}$  per cent.) and potassium chlorate ( $\frac{1}{2}$  per cent.).—M. C. L.



*Skins; Machine for Preparing, Oiling, or Mechanically Treating — with a Solution.* H. F. Dougherty. Fr. Pat. 347,842, Oct. 31, 1904.

SEE Eng. Pat. 23,016 of 1904; this J., 1905, 98.—T. F. B.

*Horny Matters; Process for the Treatment of —.* L. E. Nottelle and L. A. Leroux. Fr. Pat. 347,702, Nov. 7, 1904.

HORNS, nails, fetlocks, wool, hair and other epidermal products are immersed in a mixture of nitric and sulphuric acids, and zinc chloride for 1 to 2 months, and after washing are transferred to a solution of tannin, alcohol and dextrin for 14 days; the operations being repeated, if necessary. The tannin may be replaced by potassium bichromate or alum. The amount of acid required varies between 20 and 50 grms. per litre, and the proportion of sulphuric acid to nitric acid from  $\frac{1}{2}$  to  $\frac{1}{3}$ , according to the quality of the material and the degree of impregnation required. —M. C. L.

## XV.—MANURES, Etc.

*Sugar Cane; Influence of Sodium Salts in the Soil on the Composition of —.* H. C. Prinsen-Geerligs. Mededeelingen van het Proefstation voor Suikerriet in West Java "Kagok" te Pekalongan, No. 76. Chem. Centr., 1905, 1, 897.

SUGAR-CANES take up but very little sodium even when grown on soil which has been treated with sodium chloride; the chief part of the chlorine present in the canes is combined with potassium. On treating the soil with sodium chloride, this reacts with the potassium salts present, and renders them available as plant-food. The fact that soil gives up only very small quantities of saline matter when extracted with pure water, but considerable amounts when extracted with sodium chloride solution is in accord with this view. An attempt to grow sugarcane on a soil as far as possible free from potassium, showed that the latter cannot be replaced by sodium, since notwithstanding repeated watering with sodium chloride solution, the plants soon died.—A. S.

### ENGLISH PATENT.

*Slag, Blast-Furnace; Treating — and Utilising the Products thereof.* J. H. W. Stringfellow. Eng. Pat. 5648, March 8, 1904. X., page 445.

### FRENCH PATENT.

*Sewage and Foul Waters containing Organic and Albuminoid Matters; Product named, "Phospho-zinco-alumino-magnesian," applicable to the Treatment of —, and Process of Manufacturing the same.* J. M. Lallemand and A. Goutierre. Addition to Fr. Pat. 232,990 of Aug. 14, 1902. XVIII. B., page 453.

## XVI.—SUGAR, STARCH, GUM, Etc.

*Sugar Works; Use of Barium Aluminate in —.* E. Rembert. Bull. Assoc. Chim. Sucri. Dist., 1905, 22, 759-765. (This J., 1903, 563.)

FURTHER tests on the use of barium aluminat have confirmed the former results and show the purifying action of this product on diffusion juice, carbonated juice and first and second jet syrups. The increase in purity was over 1 per cent., due chiefly to elimination of organic non-sugar. Barium was present in all cases in the filtered juice and syrup. By the introduction each day of 18 litres of the reagent into the third and fourth pans of a quadruple effect of 1000 sq. metres, the period during which the apparatus could be run without cleaning was increased from 7 to 10 days, steam of lower pressure was required to produce evaporation, and the density of the issuing syrup was increased owing to the action of the reagent in preventing incrustation. Experiments show that used in considerable quantity, it acted unfavourably on the metal of steam generators,

and that normally it does not cause any corrosion if the contact is prolonged, the corrosion due to the steam is minimised, or rendered nil, by the use of sufficient quantities of the reagent.—L. J. DE W.

*Potato Starch; Conversion of — by Mineral Acid. Influence of Proportion of Acid, Steam Pressure, Time of Boiling on Formation of Dextrose and Dextrin.* E. Parow. Z. Spiritusind., 1905, 28, 121-123.

THE author has studied the rapidity of conversion of potato starch by dilute sulphuric acid, as measured by the relative proportions of dextrose and dextrin in the extract, under varying conditions. Four experiments were made at concentrations which yielded syrups containing 30-31.5 per cent. of extract. The conditions employed in these conversions were:—(1) 1 per cent. of sulphuric acid (on the raw material), 1 hour under a pressure of 14.5 lb per sq. in.; (2) 0.8 per cent. acid, boiled under a pressure of 22 lb.; (3) 0.8 per cent. of acid, boiled under a pressure of 29 lb.; (4) 1.0 per cent. of acid, boiled under a pressure of 14.5 lb.

Samples of the syrups were withdrawn at intervals and examined as to the progress of conversion. The following numbers, selected from the tables and accompanying the paper, illustrate the nature of the results; the times are recorded from the moment the full pressure chosen for the experiment was reached.

Conversion No.	Dextrose, Per Cent. of Total Extract		
	(1)	(2)	(3)
After 10 minutes under full pressure	16.02	27.17	50.2
20 "	31.06	45.5	62.5
30 "	42.5	57.7	75.16
40 "	54.3	—	—
60 "	68.7	—	—
80 "	83.3	—	—

Although the use of higher pressures enormously increases the velocity of the conversion, it is preferable to boil with moderate pressure for a longer time in order to expel the volatile aroma characteristic of potato starch.—J. F. B.

*Hydrofluoric Acid.* I. E. Deussen. VII., page 450.

*Sugar Cane; Influence of Sodium Salts in the Soil on the Composition of —.* H. C. Prinsen-Geerligs. VII., page 450.

*Gum Arabic in Tragacanth Powder; Rapid and Sensitive Method for the Detection of —.* E. Paget. X., page 460.

### ENGLISH PATENT.

*Cooling and Drying Granular Materials such as Sugar and the like; Apparatus for —.* F. Worms, Germany. Eng. Pat. 9355, April 23, 1904.

SEE Fr. Pat. 342,619 of 1904; this J., 1904, 929.—T.

### UNITED STATES PATENTS.

*Sugar from Masseuite; Process of Recovering —.* W. Huch, Helmstedt, Germany. U.S. Pat. 789,700, March 21, 1905.

THE masseuite is mixed before entering the vacuum with diluted molasses from the first jet, masseuite in this manner as to cause the re-solution of the microcrystalline sugar of the masseuite, whilst leaving the larger crystals undissolved. The mixture is then evaporated and concentrated *in vacuo* so as to cause the deposition of sugar on the larger crystals and increase their size.—J. F. B.

*Starch Material.* J. Kantorowicz, Breslau, Germany. Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 785,216, March 21, 1905.

SEE Eng. Pat. 5574 of 1904; this J., 1905, 144.—T.



## FRENCH PATENT.

*r. Molasses or Syrups; Process for Improving the Purity of —.* H. R. Langen. Fr. Pat. 348,030, v. 19, 1904.

Exhausted slices of beetroot or sugar cane retain, after giving a certain quantity of the original juice of a high degree of purity. This juice is utilised by treating the red slices with diluted molasses or any syrup of lower purity than the original juice. The purity of the resulting juice is thereby improved, and the improvement can be increased to a very considerable extent by treating several batches of slices with the same liquor successively, preferable to neutralise the alkalinity of the diluted molasses before mixing with the slices.—J. F. B.

## GERMAN PATENT.

*r. Manufacture of — [from Sugar-Beet Pulp].* Arendt and G. de la Rogère. Ger. Pat. 154,754, v. 25, 1904. XIX., page 454.

## II.—BREWING, WINES, SPIRITS, Etc.

*ys; Defects of the Present Season's —.* Vogel. Z. ges. Brauw., 1905, 28, 205—209.

Various complaints have been made by Bavarian brewers concerning the abnormal behaviour of the malts derived from barleys of the 1904 crop. The yield of extract is notably lower than in the previous season. The wort does not clarify as it should; in some cases it is the main wort runs off slowly and in other cases it is the spargings which are faulty. The majority of the complaints refer to attenuations, which are frequently 10 per cent. or in excess of the usual values. In conjunction with this it is stated that the beer does not drop bright in fermenting tuns, the yeast shows no tendency to "clump," and so long as it remains in suspension, it continues to work; it settles well, however, in the lager.

With regard to the clarification of the wort, the author states that as long as the weather remains cold, the difficulty may be cured by allowing the mixture of wort and water to remain for a few hours before bottling, but in hot weather such a procedure is likely to fail. As regards the excessive attenuations, attention must first be paid to the malt, and a remedy might be found by curing at a higher temperature, or else maintaining the present curing temperature for a somewhat longer time. The difficulty might also be surmounted by fermentation tun by slightly chilling the beer when it arrives at the stage of full fermentation ("early head"). In case it would be well to pitch at a slightly higher temperature, in order that fermentation may set in early and strongly, and as soon as the beer reaches the stage of "early head," at a temperature, say, of 10° C., to start fermenting so that the temperature is lowered to 2° C. as quickly as possible. Should the above means of curtailing the attenuations, the author proposes to change the procedure during mashing by introducing, as all precautions, a modification of the principle of "spring" mashing process when making the decoction.

This consists in dropping the cooler mash into hot water or boiling mash, so that the temperature "stand" for saccharification is reached from above instead of from below, and the temperatures, at which a proportion of readily fermentable sugar is produced, avoided.—J. F. B.

*r. Fermentation; Contribution to the Study of —.* E. Kayser. Ann. de la Brass., 1905, 8, 5—7.

The author's experiments go to show that the lactic acid produced mannitol and afterwards consumes the alcohol, the attack being, however, retarded by the presence of alcohol.—C. S.

*m Dioxide; Fixation of — by Amphoteric Amino Acids.* M. Siegfried. Z. physiol. Chem., 44; through Abh. f. Brau., 1905, 22, 179—180.

The author finds that solutions of the salts of the amino

acids of the glycol series, including those of asparagine, aspartic acid and glutamic acid, possess the property of absorbing carbon dioxide to form the salts of the corresponding carbamic acids, e.g., in the case of glycolic acid,  $\text{COOH}\cdot\text{CH}_2\cdot\text{NH}_2\cdot\text{COOH}$ . Solutions of the salts of the amino acids have a strong alkaline reaction, and the passage of a current of carbon dioxide through a solution of a barium or calcium salt of this series does not cause an immediate precipitation of earthy carbonate. The author has isolated and characterised a series of calcium salts of these carbamic acids. They are soluble in water, but are slowly decomposed on long standing, or rapidly on heating, with precipitation of the carbonate. A similar loose fixation of carbon dioxide in presence of a base was observed with other amphoteric amino bodies, including peptones, albumoses and true albumin, and the nature of the reaction is probably the same as in the formation of the carbamic acid salts.

There is evidence also that the free amino acids and the albuminoid derivatives possess a certain affinity towards carbon dioxide even in absence of a base, although the combination so obtained is far less stable. A solution of asparagine absorbs considerably more carbon dioxide than does water, owing probably to the formation of a carbamic acid; solutions of peptones, albumoses, &c., behave in a similar manner. It is suggested that the nitrogenous constituents of beer play an important part in fixing the carbon dioxide at low temperatures in the manner indicated above, and that carbamic acids are produced which are decomposed, at the higher temperature of the palate, with regeneration of carbon dioxide.

—J. F. B.

*Berr; Carbonated —.* A. E. Berry. J. Inst. Brewing, 1905, 11, 153—174.

THE time and stage at which the beer is carbonated have a great influence on the results; with simple carbonation the best beers are obtained when the process is performed after about two months' storage. The correct proportion of carbon dioxide for obtaining a good condition is about 0.4 per cent. of the weight of the beer, but the pressure to be employed in carbonating depends largely on the character and gravity of the beer. The brewing of light gravity ales for carbonating requires careful attention. As a rule, English malt alone is not suitable for light bottled beer on account of its high proportion of protein. A small proportion of flaked maize is frequently advantageous. The duration of boiling the wort is also an important factor; it should be long enough to ensure complete coagulation, but not so long as to cause the re-solution of precipitated albuminoids. The best coagulation in this class of wort is obtained when the hops are added in two portions, part being reserved until the wort has been boiled for some time. The yeast should be carefully cultivated and strengthened, because, except when chilling and filtration are resorted to, the whole of the work of cleansing the beer from unstable albuminoids falls on the yeast. Some beers do not carbonate so well after they have been filtered, but in the case of chilled beers filtration is imperative. It is advisable to store the beer in cask for two to three weeks before chilling, since it will remain clear for a longer time in bottle; if this be done, the filtration should be effected in the cold cellar and not at a higher temperature.—J. F. B.

## ENGLISH PATENTS.

*Wort; Treatment [Boiling] of —.* F. B. Aspinall and M. J. Cannon, both of London. Eng. Pat. 10,361, May 3, 1904.

THE wort is brought into contact with highly-heated surfaces and retained in contact therewith at a regulated pressure as long as desired. For this purpose the wort is forced by a pump through a check valve into a serpentine pipe heated by a steam-jacket. From this pipe the wort passes into a cooler, consisting of a similar pipe to the heater, but having a cold-water jacket. The end of the pipe as it leaves the cooling jacket is closed by a valve which can be regulated to open at any desired pressure.

The pressure of the steam supply is also regulated to give the required heat.—W. P. S.

*Evaporator for Evaporating the Liquid in Brewers' Wash, Sewage Waste or Spent Dyes and the like, and Concentrating the Solids in the same, the Evaporator being also Applicable as a Smoke Washer.* A. B. Lennox. Eng. Pat. 9516, April 26, 1904. XVIII. B., page 453.

*Hydrocarbons and the like: Method of Enriching — (and Denaturing Alcohol).* E. Phillips. Eng. Pat. 7793, April 2, 1904. II., page 439.

#### UNITED STATES PATENTS.

*Yeast Cells; Process of Obtaining the Contents of —.* W. Hess, Frankfort-on-Main. U.S. Pat. 785,733, March 28, 1905.

SEE Eng. Pat. 8722 of 1901; this J., 1901, 1128.—T. F. B.

*Yeast Cells; Process of Obtaining the Contents of —.* W. Hess, Assignor to L. W. Gaus, Frankfort-on-Maine. U.S. Pat. 785,734, March 28, 1905.

SEE Addition of July 16, 1902, to Fr. Pat. 310,349 of 1901; this J., 1903, 434.—T. F. B.

*Brewing; Art of —.* J. Schneible, Weehawken, N.J. U.S. Pat. 777,549, Dec. 13, 1904.

THE following procedure is claimed. The waste mixture of yeast and beer, which remains at the bottom of the fermentation tuns after the pitching yeast and clear beer have been withdrawn, and which is generally thrown away, is added to the wort in the copper during the succeeding brewing, and is boiled therewith, the hops being added subsequently. In this manner the extract and yeast foods are conserved.—J. F. B.

#### FRENCH PATENTS.

*Cider; Treatment of — before Bottling, in order to Preserve the Sparkle.* A. C. Guilbert. Fr. Pat. 348,098, Nov. 8, 1904.

THE cider is placed in casks in which it is lined with singlass; after eight days the liquid is racked off into fresh casks in which it also remains for eight days. It is then placed in bottles provided with conical corks which can be easily withdrawn; the bottles are stacked, neck downwards, for 12—15 days. A deposit is formed on the cork and is thrown out by reversing the bottle and withdrawing the cork. Lastly, the cider is decanted into bottles with patent stoppers and stored in an upright position.—J. F. B.

*Spirituans Liquors; Process for Ageing Potable —.* R. J. Finswell. Fr. Pat. 348,231, Nov. 24, 1904. Under Internat. Conv., Oct. 5, 1904.

SEE Eng. Pat. 21,380 of 1904; this J., 1905, 340.—T. F. B.

## XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

### (A).—FOOD.

*Butter; Detection and Determination of Boric Acid in —.* M. Monhaupt. XXIII., page 459.

*Lactic Acid; Volatility of —, with Steam.* F. Utr. XXIII., page 460.

#### ENGLISH PATENTS.

*Grain and Rice; Process of Preparing a Solution for use in Bleaching —.* J. L. Lawson. Eng. Pat. 10,211, May 4, 1904. XI. A., page 446.

*Meat; New Process of Preserving —.* J. Craveri, Buenos Ayres. Eng. Pat. 13,266, June 11, 1904.

THE preserving liquid employed consists of a mixture of 100 litres of a saturated solution of sodium chloride and three to five litres of glacial acetic acid. To this, a small quantity

of potassium nitrate may be added. The liquid may be prepared by saturating dilute acetic acid with sodium chloride. The meat may be preserved in pieces, or preserving liquid may be injected into an artery of a freshly killed and bled animal.—W. P. S.

#### UNITED STATES PATENT.

*Milk; Evaporated.* L. P. Britt, New York, Assignor to F. Mayer, New York. U.S. Pat. 783,015, Feb. 21, 1905.

WHOLE or skimmed milk is evaporated under reduced pressure at a temperature below 105° F.; while the milk is in the evaporating pan, a current of electricity (three volts) is passed through it. The milk is then reduced to a pasty mass, or completely dried and ground. The product is soluble in water, and is apparently sweeter in taste than ordinary milk.—W. P. S.

#### FRENCH PATENTS.

*Milk; Process for Making Dry Soluble —.* A. C. Jung. Fr. Pat. 347,739, Nov. 8, 1904. Under Internat. Conv., May 17, 1904.

THE process consists in preparing a dry, but easily soluble milk by adding calcium in the form of a compound higher alcohol, preferably a calcium compound of a higher alcohol (e.g., calcium sacrate), previous to evaporation. It is claimed that the reason why ordinary dried milk is so difficult to dissolve is due to the concentration of the lactic acid, naturally present, during the evaporation. Concentrated lactic acid tends to separation of the calcium salt in an insoluble form. The addition of a known quantity of calcium sacrate neutralises the lactic acid, and renders soluble the calcium salts which would otherwise be made insoluble by the boiling.—M. C. L.

*Milk Powders and Products; Process for Preparing —.* C. Jung. Fr. Pat. 347,877, Nov. 12, 1904.

EQUAL quantities of milk, either whole or skimmed, are separately boiled and then evaporated under reduced pressure, to thick syrups. These are now mixed and further evaporated to dryness and powdered. Acids, extracts of coffee, tea, cocoa, barley, &c., may be added before evaporation.—W. P. S.

*Milk Product, Easily Digestible and Free from Gases; Process for the Preparation of a —.* S. Széke E. Kovács. Fr. Pat. 348,235, Nov. 24, 1904.

SEE Eng. Pat. 25,621 of 1904; this J., 1905, 207.—T. F. B.

*Oils, Edible; Process and Apparatus for Neutralising —.* P. H. Klein. Fr. Pat. 348,010, Nov. 18, 1904.

THE oil is treated with an alcoholic solution of potassium hydroxide, and then washed several times with water. This treatment is carried out in cylindrical vessels provided with stirrers, a steam coil, condenser and a valve for running off the separated oil. The residual small quantities of alcohol are evaporated off, raising the temperature by means of the steam.—W. P. S.

### (B).—SANITATION; WATER PURIFICATION.

*Drinking Water; Determination of Ammonia in —.* A. Tillat and Turchet. XI., page 459.

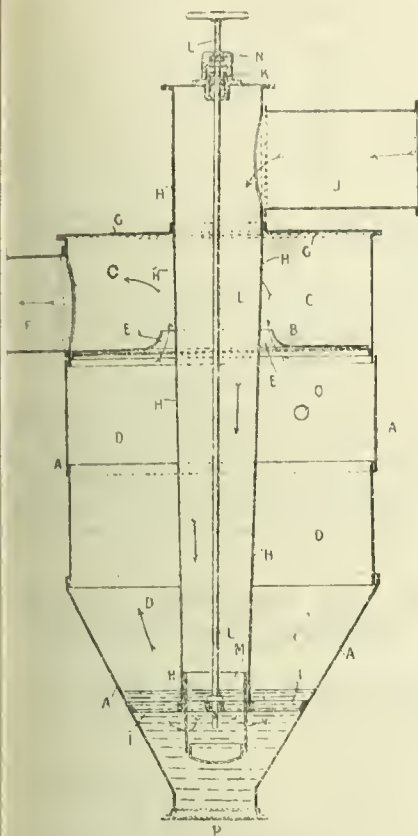
#### ENGLISH PATENTS.

*Filter Beds for Sewage.* M. J. Adams, Scotswell, Tyne. Eng. Pat. 8944, April 12, 1904.

CERTAIN transverse divisions or barriers are so placed in the filter-bed, that the filtering material is not washed away by the supply of sewage. A tipping bucket or trough is employed to give an intermittent supply of sewage.—W. P. S.



ator for Evaporating the Liquid in Brewers' Wash, the Waste or Spent Dyes and the like, and Concentrating the Solids in the same, the Evaporator being also capable as a Smoke Washer — A. B. Lennox, Castle-on-Tyne. Eng. Pat. 9516, April 26, 1904.



apparatus consists of a cylindrical casing A, having a lower portion and a removable bottom discharge, and is divided into two compartments C and D by partition B. It is provided with a cover plate G, and let pipe F, connected to an exhaustor or vacuum. Through the cover G, a slightly tapered tube H leaving an annular space E between the tube H and partition B. The tube H has an inlet branch J, and a disposed rod L, which passes through a stuffing-box in the closed top of the tube, and is connected at its lower end to a perforated bucket M. The upper part of rod L has a thread cut upon it and passes through a nut so that by rotating the rod L the bucket M may be raised or lowered, exposing more or less of the perforated bucket and so regulating the admission of gas into the

liquid to be evaporated or to be used for washing. The liquid is fed through the opening O, and hot gas or steam is drawn by the exhaust through the pipe J, passes through the perforations in the bucket M, up through the tube and escapes, laden with vapour, or in the case of washing, free from solid matter, out through the tube to the exhaustor. The solids deposited may be drawn through the bottom opening closed by the plate P.

—W. H. C.

and the like; Purification of — H. Pescbges, Berlin, Germany. Eng. Pat. 10,867, May 11, 1904.

The tank is completely filled with water, the displaced air being drawn through a tube at the top. The air-pipe and the supply pipe are then closed, and the sewage supply

pipe, which enters near the bottom of the tank, is opened, as is also the discharge pipe, which enters at the bottom of the tank and reaches nearly to the top. The upper end of the discharge pipe is funnel-shaped. The sewage is drawn from a well, and the discharge pipe delivers the water into a second well. The sludge which settles in the tank is drawn off by means of a pipe at the funnel-shaped bottom of the tank, whilst oily matters collecting at the top of the tank pass through a small tube into a separate collecting well. The action of the plant is that of a siphon.—W. P. S.

Slag; Treating Blast-Furnace —, and Utilising the Products thereof. J. H. W. Stringfellow. Eng. Pat. 5648, March 8, 1904. X., page 445.

#### FRENCH PATENT.

Sewage and Foul Waters containing Organic and Albuminoid Matters; Product named "Phospho-zinco-alumino-magnésien," applicable to the Treatment of —, and Process of Manufacturing the same. J. M. Lallemand and A. Goutierre. Third Addition, dated Jan. 22, 1904, to Fr. Pat. 323,900, Aug. 14, 1902 (this J., 1903, 568; 1904, 556, 1040).

Two hundred kilos. of natural aluminium phosphate are calcined, ground, and treated with 100 kilos. of hydrochloric acid of "20°–22°," or 100 kilos. of sulphuric acid of "53°," and 300 kilos. of water. The product obtained is used as a precipitant for sewage and effluents, and it is claimed that the sludge produced forms a valuable manure.

—A. S.

#### (C).—DISINFECTANTS.

Smoke; Antiseptic Properties of certain kinds of —. A. Trillat. Comptes rend., 1905, 140, 797–799.

SAMPLES of soot taken from chimneys of houses and factories were all found to contain paraldehyde to the amount of 0.28 to 0.35 per cent. (compare this J., 1904, 744 and 1164). This explains the presence of formaldehyde in the atmosphere, already noted by Henriot (this J., 1904, 209 and 758). It is found that the combustion of sugar, saccharine substances and certain resins gives rise to formaldehyde, especially if the combustion be carried out in an iron vessel. The products of combustion of sugar are also found to include acetone, methyl and ethyl alcohols, acetic acid, benzaldehyde, and certain phenolic compounds. It is considered that the acetone and acetic acid would prevent the polymerisation of the formaldehyde, which would account for the powerful germicidal properties of the products of combustion of sugar; e.g., it was found that *B. coli*, *B. subtilis*, and the bacteria of typhoid and cholera were destroyed by a treatment for four hours at 40° C. in a 12 litre vessel into which the products of combustion of 2 grms. of sugar were introduced.—T. F. B.

#### ENGLISH PATENT.

Wood and Goods of Different kinds, and for Drying such Goods; Impts. in Heating, Steaming and Chemically Treating —. C. McWhirter. Eng. Pat. 14,869, July 2, 1904. IX., page 443.

### XIX.—PAPER, PASTEBOARD, Etc.

Wood Pulps; Percentage of Resin in Chemical —. W. Herzberg. Mitt. K. Materialprüfungsamt, 1904, 22, 180–182.

THE author has determined the percentage of resin in a large number of samples of wood-cellulose of good quality. The air-dry cellulose was extracted with ether in a Soxhlet's apparatus: the results are summarised in the following table:—

Description of Pulp.	Number of Samples Analysed.	Percentage of Resin.		
		Maximum.	Minimum.	Mean
Sulphite pulps, Mitscherlich:				
Unbleached .....	19	0.85	0.37	0.58
Bleached .....	6	0.60	0.32	0.44
Sulphite pulps, Ritter-Kellner:				
Unbleached .....	11	0.78	0.43	0.59
Bleached .....	7	0.65	0.22	0.45
Sulphite pulps, process unknown:				
Unbleached .....	8	1.07	0.38	0.72
Bleached .....	0	0.60	0.28	0.43
Soda and "sulphate" pulps:				
Unbleached .....	6	0.13	0.01	0.04
Bleached .....	6	0.07	0.01	0.03

Hence it is concluded that in the case of sulphite pulps the method of boiling has no appreciable influence on the percentage of resin, that bleached pulps contain slightly less resin than unbleached, and that the average proportion of resin in a sulphite pulp of superior quality is about 0.5 per cent. Soda and "sulphate" pulps contain on the average only 0.04 per cent. of resin, and the difference between these and the sulphite pulps is so marked that the proportion of resin might serve as a means of distinguishing between the two classes of pulp.—J. F. B.

#### ENGLISH PATENT.

*Textile Fabrics, Paper or other Lamellar Materials; Engraved Bells or Rollers for Producing an Improved Reflecting Finish on —.* W. J. Pope and J. Hübner. Eng. Pat. 7745, April 2, 1904. V., page 437.

#### FRENCH PATENTS.

*Paper Pulp for the Manufacture of Photographic or other Papers; Process for Eliminating the Metallic Particles contained in —.* M. le Normant des Varannes and A. Regnouf de Vains. Fr. Pat. 347,925, Jan. 22, 1904.

THE invention relates to the production of a paper free from all metallic particles, and especially suitable for photographic purposes. The heavier metallic particles are first removed from the pulp which is then freed from a considerable portion of its water by passing it over suction boxes, and then pressing it. The pulp thus produced is rolled, and treated with gaseous chlorine in air-tight receptacles; this treatment, which converts the metals into chlorides and bleaches the pulp at the same time, is complete in an hour. The pulp is then thoroughly washed in a stone washer, sized, and then made up in the usual manner, with the exception that, in order to prevent the introduction of fresh metallic particles, the various parts of the paper machine with which the paper comes in contact are covered with ebonite.

—T. F. B.

*Cellulose; Process for the Acetylation of —.* Badische Anilin und Soda Fabrik. Fr. Pat. 347,906, Nov. 14, 1904. Under Internat. Conv., Oct. 1, 1904.

THE processes at present in use for the preparation of acetylcellulose have the disadvantage that the acetylcellulose is dissolved in the acetic acid or anhydride, and must be subsequently precipitated. In the present process the solution of the acetylcellulose is prevented by carrying out the reaction in presence of a sufficient quantity of some liquid in which acetylcellulose is insoluble (e.g., ether or benzene). The acetylation proceeds more rapidly if the cellulose (cotton, mercerised or not, wood, paper, &c.) is first damped; it may be impregnated with dilute sulphuric acid to obviate the necessity of introducing the latter into the solution. The sulphuric acid may be replaced by organic sulphonic acids, or by phosphoric acid. One of the advantages of this process is that it enables cotton in the form of flock, yarn, or fabrics to be acetylated without altering its appearance. The following is an example of the process: 10 kilos. of dry degreased cotton are heated in a mixture of 50 kilos. of acetic anhydride containing 5 per cent. of sulphuric acid, and 150 kilos. of toluene, at a temperature of 70°–80° C., wrung out, washed and dried.—T. F. B.

*Cellulose Threads; Process for Making Brilliant —.* K. Linkmeyer. Fr. Pat. 347,960, Nov. 16, 1904. V., page 438.

*Threads of all kinds; Treatment of — [with Cellulose].* A. Samuel. Fr. Pat. 348,137, Nov. 1904. V., page 438.

#### GERMAN PATENT.

*Paper; Process of Manufacturing —.* C. Aren and G. de la Royère. Ger. Pat. 154,754, Dec. 24, 1903.

CLAIM is made for the use of the cellulose of sugar beets for the manufacture of paper. It is obtained by treating the beet-pulp with an alkali or alkaline earth solution, and then with an alkali carbonate solution.—T. F. B.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Thorium and the Cerite Earths; Separation of — from Normal Sodium Sulphite.* H. Grossmann. M., page 458.

*Mercury Oxyhalides; New —.* T. Fischer and Wartenburg. Chem.-Zeit., 1905, 29, 308.

MERCURIC oxide only combines on heating with mercuric halides to form basic salts, when the temperature can be very carefully regulated. Thus, the oxides  $\text{HgO}$ ,  $\text{HgCl}_2$ , and oxybromide  $\text{HgO} \cdot \text{HgBr}_2$  are formed on heating the materials together with a little water at 100° in sealed tubes.

These compounds are both dark red crystalline compounds, which can be separated from the sludge by decanting and running water. On treatment with hydrochloric acid, mercurous and mercuric halides are obtained quantitatively, a reaction by which these basic salts can be analysed. To prepare mercurous oxyiodide  $\text{Hg}_2\text{I}_2 \cdot \text{HgO}$ , alkali potash is added drop by drop to a boiling solution of mercuric iodide. The resulting mercurous iodide is washed in sealed tubes with mercuric oxide for 80 hours at 100° when crystals are obtained as above.—B. J. S.

*Carbon Tetrabromide; Preparation and Purification of —.* A. von Bartsch. Chem.-Zeit., 1905, 29, 378.

ACCORDING to Wallach, carbon tetrabromide is formed by treating acetone with bromine in extremely dilute solution. In order to increase the yield of tetrabromide the following modification is suggested. 150 c.c. of acetone containing 25 per cent. of sodium hydroxide are added to one litre of water and treated with 1 c.c. of acetic acid and 5 c.c. of bromine. The mixture is thoroughly shaken and allowed to rest for two or three hours and the precipitate filtered off. The filtrate is then treated repeatedly with fresh acetone and bromine until no further precipitation takes place. The best result is obtained with a solution of 6 c.c. of acetone and 20 c.c. of bromine. The reaction is best effected by dissolving the product in a small quantity of boiling methyl alcohol, filtering while still hot, allowing the tetrabromide to crystallise, and adding water in excess to complete the separation.—D. B.



*pink Mercuriodides*. M. Francois. Comptes rend., 1905, 140, 861—863.

Compound  $(C_5H_5N.HI)_2.HgI_2$  is obtained as colourless crystals melting at  $159^\circ C.$  by warming on the water-bath of pyridine, 20 c.c. of hydrochloric acid and c.c. of potassium-mercuric iodide solution (100 grms. mercuric iodide and 75 grms. of potassium iodide per

Compound  $C_5H_5N.HI.HgI_2$  is best obtained by warming on the water-bath 2.27 grms. of mercuric iodide, 18 grms. of pyridine hydroiodide, and 10 c.c. of water in a conical flask. After the reaction is complete, 10 c.c. of water are added, and the mixture is warmed for 10 minutes. The product is then allowed to crystallise; pure, it melts at  $151^\circ C.$

Compound  $(C_5H_5N.HI)_2(HgI_2)_3$ . 9 grms. of pyridine iodide, 18 grms. of mercuric iodide, and 250 grms. of pyridine are warmed at  $90^\circ C.$  for two hours. The mixture is cooled to  $60^\circ C.$ , filtered, and the filtrate again cooled to  $0^\circ C.$ , when crystals are obtained, melting at  $101^\circ C.$

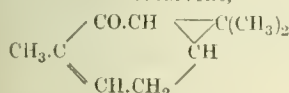
Compound  $C_5H_5NHI(HgI_2)_2$ . 60 grms. of mercuric iodide are dissolved in 90 c.c. of 30 per cent. hydroiodic acid. The mixture is diluted with 600 c.c. of water, and 10 c.c. of 1 per cent. aqueous pyridine is run in. A precipitate is obtained, which on recrystallisation furnishes compound melting at  $121^\circ C.$ —B. J. S.

*Menthone derived from Hexahydrothymol*. L. Brunel. Comptes rend., 1905, 140, 792—794.

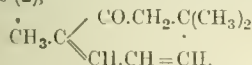
Two stereo-isomeric hexahydrothymols, or thymenthols (see this J., 1905, 248) are converted, on treatment with the calculated quantity of chromic acid in acetic acid solution, at low temperatures, into thymenthone,  $C_{10}H_{18}O$ . This is a colourless liquid, of similar odour and odour to natural menthone; its sp. gr. at  $0^\circ C.$  is 0.911, and its b. pt.  $212^\circ C.$  It is slightly soluble in water, and soluble in alcohol, ether and acetic acid. On treatment it gives rise to  $\beta$ -thymomenthol. It does not combine with alkali bisulphites. Thymomenthylamine,  $C_{10}H_{19}NH_2$  is produced by reduction of the oxime; it is a colourless liquid, b. pt.  $208^\circ C.$ , rapidly oxidised by air; it forms salts with acids, including a crystalline nitrate.—T. F. B.

*Carvone and Essential Oils*. 71st Communication. Carvone and its Reduction Products; Constitution. O. Wallach and H. Köhler. Annalen, 1905, 344, 94—116.

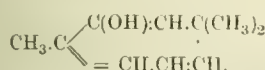
BAEYER's formula for eucarvone,



is in accord with several properties of the compound, and the authors bring forward evidence in favour of the view that the ketone is trimethyl (1.4.4) -cycloheptan-2-one ( $\Delta^{5,7}$ )-one-(2),



is a compound would, with regard to its optical properties, behave as an alcohol



The formation of eucarvone from carvone hydrobromide, is probable that a compound corresponding to von Baeeyer's formula is formed as an intermediate product. (See also this J., 1899, 397.)—A. S.

*Umbelliferone*; Origin and Composition of Essential Oil of —, Glucoside and New Enzyme. E. Bourquelot and H. Hérissay. Comptes rend., 1905, 140, 870—872.

The root of *geum urbanum* contains a glucoside (called by the authors *geine*), which is decomposed by the accompanying enzyme (*gease*). On treating the purified oil with benzoyl chloride, benzoyl-eugenol was obtained. It was not found possible to decompose the glucoside by means of known

enzymes (emulsin, invertin, &c.), hence, it is concluded that *gease* is a new enzyme. Attempts were made to isolate the glucoside by dissolving the extract in alcohol and pouring an equal volume of ether on to the surface of the solution without mixing the liquids. On standing, spherical crystals, which gave the reactions of *geine*, were deposited on the walls of the vessel.—B. J. S.

*Acetone*; Determination of — by the Iodoform Method. G. Keppeler. XXIII., page 460.

*Lactic Acid*; Volatility of — with Steam. F. Utz. XXIII., page 460.

*Quinine*; Solubility of — in Ammonia and the Testing of Quinine Sulphate. W. Duncan. XXIII., page 460.

*Nicotine*; A Molybdenum Compound of — [Determination of]. E. Meslénzi. XXIII., page 460.

# ENGLISH PATENTS.

*Essences*; Manufacture of Culinary —. J. K. Blogg, Melbourne, Australia. Eng. Pat. 1312, Jan. 23, 1905.

A pure tasteless mineral oil is employed in place of alcohol for dissolving the essential oils for making essences. —W. P. S.

*Perfumes* [Cyclohexene Derivatives]; Manufacture of New — and of Intermediate Products therefor. O. Imray, London. From Farbwerke vorm. Meister, Lucius and Brüning, Hoechst on the Main, Germany. Eng. Pat. 11,747, May 21, 1904.

SEE U.S. Pat. 782,689 of 1905; this J., 1905, 290.—T. F. B.

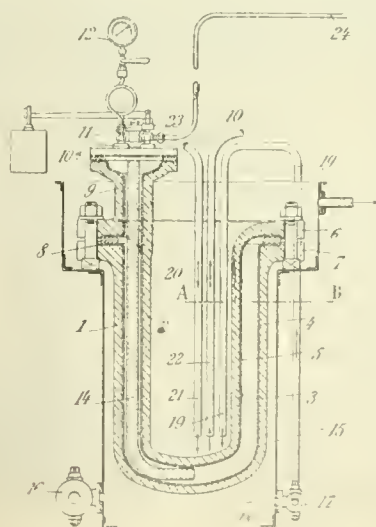
[*m*-Tolylsemicarbazide] Pharmaceutical Compound; Manufacture of a —. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 12,440, June 1, 1904.

THE nitrile of *m*-tolylhydrazine-carboxylic acid,  $\text{CH}_3 \cdot \text{C}_6\text{H}_4 \cdot \text{NH} \cdot \text{NH} \cdot \text{CN}$ , obtained by the action of cyanogen bromide on *m*-tolylhydrazine, is converted into *m*-tolylsemicarbazide by the addition of 1 mol. of water. The nitrile may be dissolved in ether, and the solution shaken with several portions of dilute hydrochloric acid; the semicarbazide is obtained on evaporating the hydrochloric acid extracts. (See Eng. Pat. 7954 of 1904; this J., 1905, 345).—T. F. B.

# UNITED STATES PATENTS.

*Methyl Chloride*; Apparatus for Making —. M. E. Douane, Paris. U.S. Pat. 777,406, Dec. 13, 1904.

Two iron vessels, lead lined, 1 and 2, are bolted together to form an autoclave, in which the hydrochloric acid



and methyl alcohol are heated. A tube 9 extends upwards from the autoclave, and is closed by a plate 10, which carries a pressure-gauge and safety-valve. The tube 14 serves for the introduction of the acid and alcohol, and also for the removal of the methyl chloride. The autoclave is contained in a vessel 15, which can be heated by hot water, introduced through the cock 16. Hot water may also be transferred from this vessel into the space within the autoclave 20, by the pipe 19. This space is provided also with another water inlet 21, and an outlet 22. The methyl chloride is run off through the pipe 24 to a receiver, whence it is passed through a vessel containing milk of lime, and then to another receiver; thence it passes through two vessels containing sulphuric acid, and lastly up a column of coke impregnated with sulphuric acid. It is then ready for condensation and compression. The six vessels (receivers and washers) are all placed in a suitable casing, and "connected together to form a battery."—T. F. B.

*Dialkyl Carbinols [from Cyclo-citrylidene-acetic Acid]; Process of Making* —. F. Hoffmann, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat., 778,243, Dec. 27, 1904.

THE dialkylcarbinols derived from cyclo-citrylidene-acetic acid, of the composition  $C_9H_{15}.CH:CH.CR_2OH$  are obtained by the interaction of cyclo-citrylidene-acetic acid with the addition compounds of an ether and the corresponding alkyl magnesium halide. The reaction product is decomposed with water, and the ethereal solution is shaken with sodium carbonate solution and distilled with steam; the resulting ethereal solution, which contains the carbinol, is dried, and distilled *in vacuo*. The application of the above process to the preparation of the known dimethylcarbinol



is especially claimed.—T. F. B.

#### FRENCH PATENT.

*Uleo-Resin Derived from the Peel of Citrus Fruits, and Process of Manufacturing it*. E. J. Sheenan, Fr. Pat. 348,111, Nov. 11, 1904.

SEE U.S. Pats. 775,502 and 775,546 of 1904; this J., 1904, 1237.—T. F. B.

#### GERMAN PATENTS.

*Dihydroxy-Aldehydes; Process for the Preparation of Aromatic* —. R. Sommer, Ger. Pat. 155,731, Aug. 21, 1902.

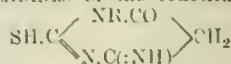
AROMATIC dihydroxyaldehydes, in which the hydroxyl groups occupy the *o*-position with respect to each other, are obtained by oxidising monohydroxyaldehydes with hydrogen peroxide in presence of iron salts. For example 1 kilo. of ferrous sulphate dissolved in 30 litres of water, and 115 kilos. of a 3 per cent. hydrogen peroxide solution are added to a solution of 12.2 kilos. of *p*-hydroxybenzaldehyde in cold water. The mixture is heated to 50° C. for an hour, and the iron is precipitated by barium hydroxide. The protocathechuic aldehyde may then be precipitated from the filtrate by means of lead acetate. Protocatechuic aldehyde is also obtained by this method from *m*-hydroxybenzaldehyde, whilst salicylic aldehyde furnishes *o*-cresylaldehyde (2,3-dihydroxybenzaldehyde).—T. F. B.

*2-Alkylxy-pyrimidines; Process for Preparing* —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 155,732, March 14, 1903.

2-ALKYLOXY-4-IMINO-6-OXYPYRIMIDINES are prepared by the interaction of alkyl-ethers of iso-urea,  $NH.C(OR)NH_2$ , with cyano-acetic esters in which the hydrogen atoms in the methylene group are replaced by a metal. These compounds may be converted into xanthine by reducing their nitroso-derivatives to alkylxyhypoxanthines, and heating these with formic acid.—T. F. B.

*Thiopyrimidine Derivatives; Process for Preparing* —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 155,732, March 14, 1903.

IMINOTHIOPYRIMIDINES of the constitution



where R represents hydrogen or alkyl, are produced by the action of metal-substituted cyano-acetic esters  $CN.CM_2.COOR$ , on thionrea or its mono-alkyl derivatives. These derivatives can be converted, by the process described in the preceding abstract, into the corresponding thiohypoxanthine or its alkyl derivative, which is converted on oxidation to xanthine or alkyl-xanthine.—T. F. B.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*Gelatinobromide Films; Action of Hydrogen Peroxide on* —. W. Merckens, Z. angew. Chem., 1901, 489—490.

THE author concludes that the action of hydrogen peroxide upon gelatinobromide films is not of a "chemical" but of a physical character, as Russell has shown, and that the real agent in producing an image is the nascent oxygen arising from the decomposition of hydrogen peroxide in the film. The effect of ozone is probably due to a similar cause. Repetition of Russell's experiments with various metals leads to the conclusion that the capability of metals to form hydrogen peroxide in air is probably connected directly with their electro-positive character.—J. T. D.

*Actino-autography*. ti. Lamm, Chem.-Zeit., 1905, 305—306.

WHEN photographic plates, on the films of which deposited small objects of copper and brass, are exposed in the dark, film upwards, in boxes made of straw board for two or three days, they are found to be covered with shadows of the articles may subsequently be obtained by developing. This is due to the radio-activity of the cardboard.

The light emitted seems to proceed, not from the surface as a whole, but from a number of points, hence it gives rise to multiple and irregular outlines. After an experiment has been made the box becomes "fatigued," but recovers itself on being allowed to rest. Other substances, notably, aluminium, possess the property of radio-activity, and photographers are therefore warned against using dark slides of this metal.—B.

#### UNITED STATES PATENT.

*Photographic Emulsion; Colour-Sensitive* —. Process of Making same. K. Kieser, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 785,219, March 21, 1905.

SEE Fr. Pat. 336,298 of 1903; this J., 1904, 337.—T. F. B.

#### FRENCH PATENT.

*Paper Pulp for the Manufacture of Photographic Papers; Process for Eliminating the Metallic Part contained in* —. M. Le Normant des Varannes, A. Regnoul de Vains, Fr. Pat. 347,925, Jan. 22, 1905. XIX., page 454.

## XXII.—EXPLOSIVES, MATCHES, Etc.

#### ENGLISH PATENTS.

*Explosives; Manufacture of* —. N. Ceipek, Vienna, Eng. Pat., 14,480, June 27, 1904.

CLAIM is made for a mixture of ammonium nitrate, and nitrate and aluminium powder. Specified proportions of these ingredients are:—10 to 15 parts of ammonium nitrate with 90 to 85 parts of a mixture of 85 parts of ammonium nitrate with 15 parts of aniline nitrate.—C. A. M.



**Combustive Compound; Manufacture of an Improved**  
H. Maximi, Brooklyn, N.Y. Eng. Pat. 28,376,  
27, 1904.

making rods or cylinders of a self-combustible com-  
bustible, designated "motorite," which are intended to be  
used in a confined space to provide motive power for  
automobile torpedoes, the difficulty presents  
itself that if the rods are made by forcing the plastic  
"motorite" through dies, longitudinal rifts or cracks  
which allow the flame to pass along the rod, so that  
it gives rather than progressive combustion ensues.  
To avoid this difficulty the "motorite," which is a mixture  
of parts of nitroglycerin, 5 parts of soluble guncotton,  
parts of trinitrocellulose or "military guncotton"  
dissolved in 30 parts of any suitable solvent  
such as acetone, is kneaded thoroughly and rolled  
into sheets, part of the solvent being evaporated by  
passing the rolls to 120° F., any cracks that may be  
formed being in a direction parallel to the surface of the  
sheets. The sheets are punched into discs, which are  
then laid one upon the other and pressed forming short  
cylinders. The flat surfaces of these cylinders are  
then treated with the solvent, several cylinders being then  
pressed into rods or longer cylinders. The solvent is  
then removed and the sides of the rods coated with a varnish  
which is not self-combustible and which is composed of  
gum camphor, gum arabic and a suitable solvent,  
such as acetone. The cylinders are then dried and  
pressed into metal cases. In rods so formed any cracks  
being in a direction at an angle with the length of the rod,  
consequently the rods burn slowly and steadily.

—W. H. C.

UNITED STATES PATENT.

**Combustive Compound.** F. G. Dokkenwadel, Coshocton,  
N.Y. Assignor to H. M. Grant, New York. U.S. Pat.  
848,040, March 21, 1905.

A combustible compound is produced by coating maize  
or other vegetable husks, previously dipped in a  
varnish solution, with a mixture of sodium and  
potassium nitrates and sulphur.—T. F. B.

FRENCH PATENTS.

**Lighting Tube Containing Trinitrotoluene.** L. A. Lheure.  
Fr. Pat. 348,245, Feb. 1, 1904.

Eng. Pat. 27,167 of 1904; this J., 1905, 250.—T. F. B.

**Explosives; New Class of Chlorate** — L. A. Lheure.  
Fr. Pat. 348,247, Feb. 1, 1904.

Eng. Pat. 27,166 of 1904; this J., 1905, 250.—T. F. B.

GERMAN PATENTS.

**Lighting Apparatus; Centrifugal** —, with a Drum of  
Heat-Proof Material. Gebr. Heine. Ger. Pat. 165,225,  
May 5, 1903.

Outlet-channels for the acid are provided with over-  
valves.—A. S.

**Matches; Preparation of an Ignition Material for** —,  
free from Phosphorus. R. Gans. Ger. Pat. 157,424,  
Jan. 14, 1903.

The patentee claims the employment as a constituent of  
ignition masses for matches of the sulpho compounds  
obtained by the action of sulphur on a salt or salts of a  
polythionic acid (di-, tri-, tetra- and pentathionic acid)  
or on salts of acids obtained by the oxidation of poly-  
thionic acids or thiosulphuric acid. The following  
example is given of the composition of a useful ignition  
mass:—The sulpho compound of euprous-barium poly-  
thionate, 20; pumice, powdered quartz, &c., 27.2; potas-  
sium chlorate, 44.8; and glue, 8 per cent. (See also this  
J., 1902, 792.)—A. S.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, Etc.

**Quartz Glass; Use of** — in Chemistry. M. Berthelot.  
Comptes rend., 1905, 140, 817—820.

QUARTZ glass has proved very useful to the author in the  
study of reactions at very high temperatures. It can  
readily be worked in the oxyhydrogen, or preferably, in  
the oxy-acetylene flame; and uniform tubes are obtainable  
of 10 mm. diameter, and 0.7 mm. thickness, which will  
stand a pressure of 3 atmospheres up to the softening  
point, viz., 1400° C. Tubes 20—25 mm. in diameter were  
also made, but they were not sufficiently uniform in thick-  
ness to be used for pressure.

Quartz glass sealed tubes are conveniently heated in  
electrical resistance furnaces, and can be cooled after-  
wards by plunging into cold water, whilst at a red heat.  
They are not attacked by acids.—B. J. S.

**Quartz Glass; Permeability of** —. M. Berthelot.  
Comptes rend., 1905, 140, 821—825.

At high temperatures quartz glass allows gases to pass  
through its walls by a process of osmosis. Thus, a tube  
containing 4 c.c. of oxygen was heated at 1300° C. for  
an hour, and after cooling, was opened under mercury;  
3 c.c. of nitrogen were then found to have diffused  
through from the air. The hydrocarbons, naphthalene  
and methane were also heated in a similar way. At the  
end of an hour carbon, together with a very small quantity  
of hydrogen and nitrogen was found in the tube, showing  
that at high temperatures these compounds are resolved  
into their elements.—B. J. S.

**Quartz Vessels; Use of** — in the Laboratory. F. Mylius  
and A. Meusser. Z. anorg. Chem., 1905, 44, 221—224.

WATER has no appreciable action on vitrified quartz, even  
at 100° C. Alkaline solutions form soluble silicates with  
the quartz, the action beginning at comparatively low  
temperatures. The following are some of the results  
obtained with a quartz flask of 78 c.c. capacity, the surface  
in contact with the liquid being in each case 89 sq. cm. :—

Reagent.	Duration of test.	Temperature.	Loss of weight.
		°C.	Mgms.
Water .....	several days	18—100	0.0
10 per cent. solution of ammonia .....	2 days	18	0.8
10 per cent. solution of sodium hydroxide .....	2 days	18	0.4
30 per cent. solution of potassium hydroxide .....	4 days	18	1.2
30 per cent. solution of sodium hydroxide .....	2 days	18	0.0*
2N-sodium hydroxide solution .....	3 hours	100	48.4
2N-sodium carbonate solution .....	3 hours	100	12.4
2N-potassium hydroxide solution .....	3 hours	100	31.0
N <sub>2</sub> -sodium hydroxide solution .....	14 days	18	2.0
N <sub>2</sub> -sodium carbonate solution .....	14 days	18	0.6
Saturated solution of barium hydroxide .....	14 days	18	0.0*
Saturated solution of sodium phosphate .....	14 days	18	0.0*
N <sub>2</sub> -phosphoric acid solution .....	14 days	18	0.0*
25 per cent. solution of ammonia .....	60 days	18	0.0
25 per cent. solution of ammonia .....	6 hours (with four renewals of the reagent)	up to 60	2.6

\* In these experiments a slight loss of weight would have been shown by a more sensitive balance.

When barium hydroxide solution was kept in a quartz vessel for six months at 18° C., with exclusion of air, small prismatic crystals of barium silicate formed on the sides of the vessel. Dilute acids, with the exception of hydrofluoric acid, have no appreciable action on quartz vessels even at 100° C.; concentrated sulphuric acid is also without action. Phosphoric acid has no action at 18° C., but when concentrated in a quartz vessel, a reaction begins above 400° C., which causes strong corrosion of the vessel, and separation of white silicic phosphate. Hydrofluoric acid acts strongly upon quartz vessels. From a 30 per cent. solution of potassium hydroxide, quartz vessels absorb potash: the alkali cannot be removed by rinsing with cold water, but is extracted by boiling water. A similar action was not observed in the case of a 30 per cent. solution of sodium hydroxide. Quartz vessels have also the power of absorbing small quantities of certain dyestuffs (Methylene Blue, Congo Red, Rhodamine, Aniline Blue, Iodocsin) from their solutions.—A. S.

### INORGANIC QUALITATIVE.

*Diphenylamine; Reaction of — with Nitric Acid.*  
I. Bay, Comptes rend., 1905, 140, 796—797.

The deep blue coloration produced by the action of nitric acid on diphenylamine sulphate, which has been looked upon as a characteristic reaction for nitric acid, is also observed on oxidising diphenylamine by means of a number of other oxidising agents, and also by long exposure to the atmosphere. It is pointed out that, in general, all aromatic amines give rise to more or less highly coloured oxidation products.—T. F. B.

*Ammonia; New Test for —.* A. Trillat and Turchet.  
Bull. Soc. Chim., 1905, 33, 304—308.

The black precipitate or coloration due to the production of nitrogen iodide by the action of iodine on ammonia may serve as a delicate test for the presence of the latter, and for its determination colorimetrically. The direct use of iodine is not convenient, since the reaction between iodine and ammonia does not take place when only traces of ammonia are present. But if iodine chloride be employed in presence of a base, the reaction is very delicate, and affords an appreciable coloration with only one part of ammonia per 500,000. The best method for applying the test consists in producing the iodine chloride *in situ* by the action of an alkali hypochlorite upon potassium iodide; the liquid to be tested should be approximately neutral. It should be borne in mind that the precipitate of nitrogen iodide is soluble in excess of either of the two reagents, and that an excess of potassium iodide is especially to be avoided, since the liberation of iodine from the latter is liable to lead to confusion. In doubtful cases it is advisable to extract the free iodine from the test liquid by shaking with chloroform, in which the nitrogen iodide is insoluble. It must, however, be remembered that under the influence of the chloroform, nitrogen iodide soon begins to undergo decomposition. The reaction is available for all ammonium salts, including the cyanide and sulphide, for which the Nessler test is inapplicable.—J. F. B.

### INORGANIC QUANTITATIVE.

*Nitric Acid; Gravimetric Determination of — by means of "Nitron."* A. Gutbier. Z. angew. Chem., 1905, 18, 497—499.

The author has investigated the solubility of nitron nitrate in water. He obtains and treats the precipitate nearly according to the directions of Busch (this J., 1905, 292) except that the liquid after precipitation is allowed to cool to the room temperature before immersion for 1—1½ hours in ice-water, and the precipitate is never sucked dry by the pump till the whole has been completely rinsed in from the beaker to the crucible by portions of the filtrate, and after sucking dry is at once washed with 10—12 c.c. of ice-cold water, 1 c.c. at a time. He finds that the washing involves a loss which would make the results too low by 0.1—0.25 per cent.; but there is evidently some compensating error, for many, both of Busch's and of his own results, are practically correct.

Determinations carried out by the author show the method gives very good results not only with potassium nitrate alone, but also with mixtures of the nitrate with potassium permanganate and bichromate, calcium magnesium sulphates, potassium and sodium chlorides, and potassium bichromate, potassium chloride, calcium carbonate, potassium chloride and bromide, iodides be present, they must be destroyed by the addition to the boiling solution of potassium iodate or acetic acid, till all the iodine is boiled off. The method is said to be not only accurate, but convenient, and requires but little practice to obtain good results.—J. T.

*Thorium and the Cerite Earths; Separation of — by Normal Sodium Sulphite.* H. Grossmann. Z. Chem., 1905, 44, 229—236.

The trivalent cerite earths are quantitatively precipitated as normal sulphites by normal sodium sulphite. Thorium and zirconium give gelatinous precipitates of basic sulphites, readily soluble in excess of the reagent. Two double alkali thorium sulphites were isolated:  $\text{Th}_2(\text{OH})_2(\text{SO}_3)_2 \cdot 2\text{Na}_2\text{SO}_3 + \text{aq}$  and  $\text{Th}(\text{OH})_2\text{SO}_3 \cdot 2\text{Na}_2\text{SO}_3 + \text{aq}$ . The method proposed by Chavastelon (this J., 1904, 462) for the separation of thorium from cerium by means of sodium sulphite, is of no use when only a small proportion of thorium is present, as, for example, in monazite. From dilute solutions of thorium nitrate, a basic sulphite is precipitated by normal ammonium sulphite; zirconium nitrate gives, with excess of this reagent, a clear solution from which after 12 hours, gelatinous ammonium-zirconium sulphite separates. The solubility of the hydroxides of the monazite earths in aqueous sulphurous acid decreases in the following order: cerium, didymium, lanthanum, thorium. The normal sulphites are precipitated from solutions by warming in presence of free acid.—A.

*Glass Works; Analytical Methods used at the Saint-Lambert Works.* A. Iccrenier. Bull. Soc. Chim. Belg., 1904, 18, 404—412.

*Sand.*—Fineness is determined, as this is a measure of the rapidity of melting. Iron is determined in the way after fusion of 2 grms. of the sand with 9 grms. of sodium potassium carbonate in a platinum crucible. A very pure sand will contain 0.005 to 0.015 per cent. of ferric oxide. For goblet making it may contain up to 0.040 per cent. of ferric oxide.

*Alumina, lime and magnesia* are determined after volatilising silica with hydrofluoric acid in presence of a little sulphuric acid.

*Soda.*—The product obtained by the ammonium process is usually employed. Sodium carbonate is determined as usual. Iron as under *Sand*.

*Potash.*—The ordinary methods are used except iron, which is determined as above.

*Limestone.*—Organic matter and insoluble residue determined by dissolving 100 grms., collecting the residue on a tared filter, weighing and igniting. The loss in weight corresponds to the organic matter. Sulphate, phosphorus and bases are looked for in the solution.

*Lead.*—For iron, 20 grms. of the sample are dissolved in a slight excess of nitric acid, and the liquid is diluted to 250 c.c. with water, and the lead determined by precipitation with potassium sulphate. 200 c.c. are filtered through a dry filter and evaporated to dryness. The residue is dissolved in 1 c.c. of hydrochloric acid and a little water, the solution diluted to 500 c.c.; a measured volume of sodium thioeyanate solution is then added, and the obtained matched against that given by a blank solution which a solution of ferric chloride is gradually added. Copper is determined in a similar manner by comparison of its ammoniacal solution with a standard tint.

*Glass.*—The glass is decomposed by hydrofluoric acid, sulphuric acids, and the various bases determined as usual. If lead be present, it cannot be left directly as residue as sulphate, as it retains large quantities of sodium sulphate; hence, it is necessary to dissolve the sulphate in hydrochloric acid, and precipitate lead, with arsenic and antimony, as sulphide.

*Potassium nitrate.*—This should not contain more than 0.02 per cent. of impurities. Sodium chloride is determined as usual.



*um nitrate*.—Chili saltpetre is used, and the impurities are determined as usual.

*manganese dioxide*.—Determined iodometrically.

*hydrofluoric acid*.—The specific gravity is determined 0.0 c.c. gutta-percha bottle with narrow neck. For free acid, 10 c.c. are evaporated on the water-bath; the tinium tube partly closed by a paraffin wax stopper, the residue is titrated with alkali. For hydrofluoric acid, a rough test is first made by adding ammonium acetate to a portion of the acid; according to the amount of silica precipitated, from 5 to 25 grms. are diluted with water and neutralised with potassium hydroxide, an ammoniacal solution of zinc oxide and a little sodium carbonate are then added, and the whole heated until all the ammonia is expelled. The residue is thoroughly washed, leaving the silica, which is ignited and weighed.—A. G. L.

*Iron; Determination of — in Presence of Iron and of Sulphates*. V. Hassreidter and P. van den. *Bull. Soc. Chim. Belg.*, 1904, 18, 413—416.

In the oxidising action of ferric salts on the sulphuric acid evolved in the determination of sulphides, the evolution method, in such materials as roasted iron, the authors reduce the ferric iron by using a solution of stannous chloride in hydrochloric acid, and a small quantity of metallic tin. Any sulphates remain unattacked. The sulphuretted hydrogen is absorbed in hydrochloric acid saturated with calcium, and finally weighed as barium sulphate; or it may be absorbed by standard iodine solution which, after evolution is complete, a wash-bottle containing a standardised solution of sodium thiosulphate placed after the absorption bulbs containing the solution to catch any iodine vapour carried over, this method cannot be used if arsenic is present in the substance, as this also would reduce the iodine.—A. G. L.

*Iron and Slags; Analysis of —*. R. Namias. *Monit. Scient.*, 1905, 19, 279—280.

In discussing various methods for the separation of iron from iron and aluminium, the author recommends the following process:—

5 grms. of the substance are fused with alkali carbonate and the silica separated with hydrochloric acid in the usual manner. The filtrate from the silica is then divided into two parts. In one portion the iron, aluminium and manganese are precipitated with ammonia and calcium sulphide, and the calcium and magnesium removed in the filtrate in the ordinary way. The other portion the liquid is boiled with excess of zinc oxide, which completely precipitates the iron and aluminium as oxides, the manganese remains in solution. Zinc oxide is more efficient than barium carbonate, which brings on more manganese also, if much of this metal is present. The precipitated oxides, with excess of zinc oxide, are dissolved in much hydrochloric acid and ammonia added to precipitate the iron and aluminium. In presence of a large excess of ammonia and a large quantity of calcium chloride, the zinc remains in solution, but it is not dissolved the hydroxides and reprecipitate with ammonia. The precipitate is ignited and weighed, and dissolved in warm hydrochloric acid, which process is repeated by well grinding the ignited precipitate, and the estimated preferably by the iodometric method (J. 1904, 456). Manganese may be determined iodometrically by permanganate solution in a portion of the filtrate from the oxides of iron and aluminium.—F. SPN.

*ferro-silicon; Determination of Carbon in —*. K. Jene. *Chem.-Zeit.*, 1905, 29, 309.

In order to estimate the carbon present in ferro-silicon, the author endeavoured to find a more convenient method of volatilisation in chlorine. He found that by mixing finely powdered substance with copper oxide, burning in a stream of oxygen, and weighing the carbon as carbon dioxide, fairly concordant results could be obtained. Thus, by the chlorine method, a specimen gave 0.72 per cent., by the new method of direct combustion it gave 0.732—

0.717 per cent. The substance is so refractory, that ordinary methods involving solution are inapplicable.

—B. J. S.

*Butter; Detection and Determination of Boric Acid in —*. M. Monhaupt. *Chem.-Zeit.*, 1905, 29, 362—363.

When the proportion of boric acid in the sample is small, the direct saponification and incineration method is troublesome, and is conveniently replaced by the following: A fairly large amount of the substance is weighed out and placed in a wide-necked flask, fitted as a wash-bottle, in which it is well shaken up for a short time with a measured quantity of water at 50°—60° C. After settling, the underlying water is blown out into another vessel until the fat commences to rise in the delivery tube. This water is cooled to the initial temperature, and an aliquot part is rendered strongly alkaline with caustic potash and evaporated. The residue is incinerated, the ash triturated and rinsed with hot water into a 100 c.c. flask, the solution filtered, cooled, made up to the mark, and an aliquot part (e.g., 100 c.c.) treated by the Joergensen method. In calculating the results an allowance of 15 c.c. per 100 grms. of fat is made for the water content of the substance, including dissolved salt and milk. A comparison of the results of the two methods shows a difference of not more than 0.001—0.002 per cent. of boric acid. The new method is applicable to the determination of borax as well as free boric acid.—C. S.

*Ammonia in Drinking Water; Determination of — as Nitrogen Iodide*. A. Trillat and Puchet. *Bull. Soc. Chim.*, 1905, 33, 308—310.

The nitrogen iodide reaction (see page 458) may be applied for the determination of ammonia in drinking water. The procedure is as follows: 20—30 c.c. of water are placed in a test-cylinder and three drops of a 10 per cent. solution of potassium iodide, free from ammonia, and subsequently two drops of commercial "eau de Javel" are added. The brownish-black coloration is produced immediately if the proportion of ammonia exceeds 2 mgrms. per litre. For smaller proportions of ammonia, the water should be evaporated in presence of a little sulphuric acid to a small bulk, and the liquid should be neutralised before testing. The liberation of iodine imparts a straw-yellow coloration to the liquid, which, however, in the majority of cases does not interfere with the test. The colour due to iodine may be discharged by a very slight excess of hypochlorite. The colour of the nitrogen iodide gradually disappears, but it is sufficiently permanent for colorimetric comparison. The delicacy of the reaction is far less influenced by the dissolved matters of the water than that of Nessler's test.—J. F. B.

## ORGANIC QUALITATIVE.

*Walnut Oil; Detection of Foreign Oils in —*. J. Bellier. *Ann. Chim. anal. appl.*, 1905, 10, 52—57. *Chem. Centr.*, 1905, 1, 965.

For the detection of poppy-seed oil, the author uses a method based on the slight solubility of the solid fatty acids in 70 per cent. alcohol at 17°—19° C. in presence of a definite quantity of potassium acetate. Poppy-seed oil contains a larger proportion of solid acids than walnut oil, and consequently, under similar conditions gives a larger quantity of precipitate. 1 c.c. of the oil is warmed in a test-tube with 5 c.c. of a solution of 16 grms. of caustic potash in 110 c.c. of 91—93 per cent. alcohol, until a clear solution is produced. The test-tube is heated in a sand-bath for half an hour at about 70° C., a quantity of acetic acid solution (25 grms. of the glacial acid in 75 c.c. of water) exactly equivalent to the caustic potash is added, and the tube cooled first in water at 25° C., and finally in water at 17°—19° C. with frequent shaking. Under these conditions pure walnut oil gives only a slight precipitate, barely sufficient to cover the bottom of the tube, whereas poppy-seed oil (and other oils) quickly gives a copious precipitate. A few per cent. of olive, sesame, cotton-seed, arachis, linseed or rape oil, and about 10 per cent. of poppy-seed oil can be detected in this way.—A. S.

*Tragacanth Powder; Rapid and Sensitive Method for the Detection of Gum Arabic in —.* E. Paget. Ann. Chim. anal. appl., 1905, 10, 63. Chem. Centr., 1905, 1, 967.

A cold solution of the sample (1:30) is shaken with an equal volume of a 1 per cent. solution of guaiacol and a drop of hydrogen peroxide. If gum arabic be present, an immediate brown coloration is produced. The reaction is caused by an oxydase present in gum arabic.—A. S.

#### ORGANIC QUANTITATIVE.

*Quinine; Solubility of — in Ammonia; and the Testing of Quinine Sulphate.* W. Duncan. Pharm. J., 1905, 74, 438—440.

EXPERIMENTS made by treating saturated solutions of quinine sulphate with ammonia, both gaseous and in solution, show that contrary to the view generally held, ammonia diminishes the solubility of quinine in water. It was found that quinine is soluble to the extent of 1 in 2286 of 10 per cent. ammonia and 1 in 2505 of 32.5 per cent. ammonia, whereas the solubility in water is 1 in 1960 at 15° C., according to the U.S.P. The author recommends replacing ammonia by calcium hydroxide solution in testing the purity of quinine sulphate, and suggests also the titration of the quinine sulphate solution with calcium hydroxide solution in presence of phenolphthalein as indicator. The following examples are cited: 20 c.c. of a saturated solution of commercial quinine sulphate required 41 c.c. of calcium hydroxide solution to form a clear liquid; and 2.8 c.c. to show alkalinity with phenolphthalein. The sample was then adulterated with: (a) 1 per cent., (b) 3 per cent. and (c) 5 per cent. of cinchonidine sulphate. The volumes of calcium hydroxide solution required to form a clear solution and to show alkalinity with phenolphthalein with 20 c.c. of a saturated solution of the sample were now: (a) 45 and 3.3 c.c.; (b) 55 and 3.8 c.c.; and (c) 71 and 4.7 c.c. respectively.—A. S.

*Oils; Determination of the Viscosity of Lubricating —.* R. Hackel. Mitt. kaiserl. k. Königl. technol. Gewerbe-Museum in Wien, 1905, 15, 44—51.

THE author's experiments with an officially standardised Engler's viscosimeter, heated by means of a gas ring or

a spirit lamp, confirm the results of previous observers who have found that when a ring burner is used the oil, the probable error at 50° C. lies within 10 limits, and at 100° C. is close to the permissible whereas in determinations in which a ring burner is used, the probable error (based on the mean of the maximum and minimum results) keeps well within the permissible limits. In order to avoid the difficulty of working without the use of a ring burner, the author devised the apparatus shown in the figure, in which the temperature is regulated without the use of either a ring or a spirit lamp. The outer ring-shaped chamber, which forms the heating bath of the viscosimeter, is connected with two other vessels (fixed at a higher level) by means of tubes fitted with taps. One of these is heated by means of a Bunsen burner, whilst the other contains a coil through which passes a current of water. Oil is placed in each of them, and it is a simple matter to add either hot or cold oil to that in the chamber, whilst an additional outlet tube with a tap is fitted in the bottom of the latter, for the purpose of withdrawing oil that has been made too hot or too cold.—C. J.

*Gutta-percha; Detection and Determination of Bituminous Substances in —.* Pontio. Ann. Chim. anal. appl., 1905, 10, 57—58. Chem. Centr., 1905, 1, 967.

THE bituminous substances used to adulterate gutta-percha are completely soluble in petroleum ether, chloroform and carbon bisulphide, but only to the extent of 38 per cent. in ether, whereas gutta-percha is completely soluble in the last-named solvent. The residue of gutta-percha under examination is extracted with ether, the residue weighed, then extracted further with chloroform or carbon bisulphide and weighed. The percentage of bituminous substances is then calculated with the aid of the formula:  $R = \frac{b}{100 - b} \times 100$

where  $b$  = the percentage required,  $R$  = the weight of residue after extraction with ether, and  $m$  = the weight of the insoluble impurities contained in the gutta-percha.

*Lactic Acid; Volatility of — with Steam.* Chem.-Zeit., 1905, 29, 363—364.

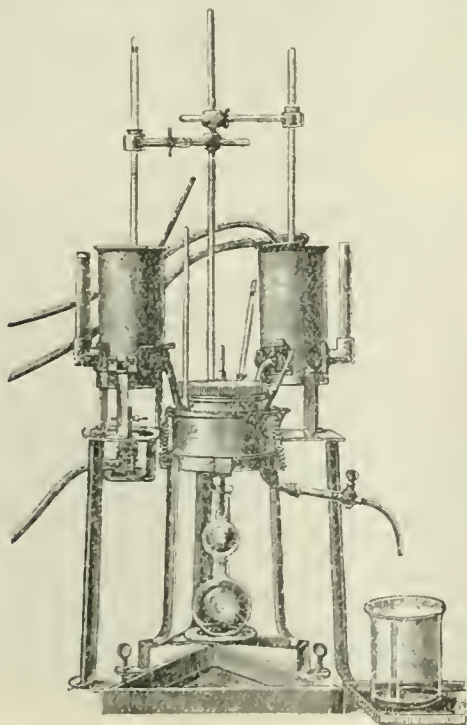
FROM experiments made in connection with the tannic coagulation of milk, the author concludes that while lactic acid is carried over in the distillate from aqueous solutions, the volatility increasing with the concentration of the solution, this volatility is not sufficiently great to enable the acid to be quantitatively separated from aqueous solution by this means.—

*Acetone; Determination of —, by the Iodoform Reaction.* G. Keppeler. Z. angew. Chem., 1905, 18, 461—462.

VAUBEL and SCHETER (this J., 1905, 252) state that Messinger's method yields inaccurate results, which they attribute to the iodine titration by means of thiosulphate. They do not trace the cause of this error, but propose to substitute sodium arsenite for the thiosulphate. If the error they mention occurs, it is due, as Topf has pointed out, to oxidation of the thiosulphate to tetrathionate instead of tetrathionate. Collischonn (this J., 1905, 18) has described in great detail the precautions necessary for success in determining acetone by Messinger's method, and the author finds that the method, when the necessary precautions are attended to, gives accurate results.—J. J.

*Nicotine Molybdenum Compound [Determination of Nicotine].* E. Meslénzi. Landw. Vers.-Stat., 1905, 61, 321—349. Chem. Centr., 1905, 1, 904—905.

ON adding a 20 per cent. solution of ammonium molybdate to an acetic acid solution of nicotine, tetra-anhydrous acid dinitric ammonium molybdate (shortly, ammonium molybdate) is produced. The compound consists of white microscopic prisms decomposing at 150° C., melting, insoluble in cold water, ether, alcohol, benzene, chloroform and glycerol, slightly soluble in hot





soluble in dilute acids. It is decomposed by alkalis, proportion of molybdic acid in the compound can be determined by simply igniting it in a platinum crucible, and in a porcelain crucible by means of asbestos; no reduction of molybdenum trioxide occurs if the bottom of the porcelain crucible be heated to only faint redness. The determination of nicotine in presence of ammonia, the author recommends triturating 0.25 gm. of substance with 5 c.c. of dilute potassium hydroxide solution and 15–20 grms. of burnt gypsum, extracting the mass with 2 hours with anhydrous ether, shaking the extract with 10 c.c. of 15 per cent. pure hydrochloric acid, evaporating off the ether, dissolving the residue in 96 per cent. alcohol, precipitating with platinum chloride, and determining the amount of nicotine from the weight of osmium contained in the precipitate; 1 equivalent of osmium = 1 equivalent of nicotine.—A. S.

## XXVII.—SCIENTIFIC & TECHNICAL NOTES.

*Transformations of Multirotatory* ——. Tanret. Bull. Soc. Chim., 1905, 33, 337–348.

The modifications of dextrose, galactose, lactose and sucrose,  $\alpha$ ,  $\beta$  and  $\gamma$  have been recognised (see Armstrong, J., 1904, 388). The author now brings direct proof of the stable  $\beta$ -modification is a mixture of the  $\alpha$ - and  $\beta$  forms and he proposes to call the stable form  $\epsilon$  instead of  $\beta$  and to use the term  $\beta$  for the form hitherto known. This change brings the two dextroses  $\alpha$  and  $\beta$  (formerly  $\alpha$  and  $\beta$ ) into correspondence with the methylglucosides  $\alpha$  and  $\beta$ . The exact composition of the solution of the stable rotatory power depends on the concentration, temperature, and it is the variation of this equilibrium which accounts for the variation of rotatory power according to these conditions. The two dextroses  $\alpha$  and  $\beta$  can be completely converted one into the other in the solid state under conditions where the equilibrium cannot be maintained by the prolonged action of heat or small proportions of moisture. Long heating of amorphous fused dextrose at 100°C. converts it into the  $\beta$ -modification, and the isolation of the latter is comparatively rapid if small proportions of this modification are sown. Small proportions of the  $\beta$ -dextrose into  $\alpha$ -dextrose. Galactose is especially sensitive to the influence of moisture.

—J. F. B.

*Chemical Action of* ——. J. Ciamician and P. Silber. Ber., 1905, 38, 1176–1184.

The authors now give a continuation of their previous experiments on the reduction of nitrobenzene by the aid of this J., 1904, 138, 341). On exposing a mixture of parts of nitrobenzene and benzaldehyde to the action of light for a long time, dibenzoylphenylhydroxylamine and benzoic acid are the principal products, but in addition to these, benzoylphenylhydroxylamine, dibenzylaminophenol, benzoyl- $\alpha$ -aminophenol, benzanilide, benzene, and  $\alpha$ -oxyazobenzene are also obtained in small quantities. The last two compounds increase in quantity when the time of decomposition is very long.—B. J. S.

*Ethylate*. P. Nicolardot. Comptes rend., 1905, 140, 857–858.

The author states that the soluble product of the reaction of sodium ethylate and alcoholic ferric chloride is not ferric ethylate as previously supposed by Grimaux (Comptes Rend., 1884, 98, 105); but merely a soluble double compound of the hydroxides of sodium and iron, similar to which the author has recently shown to be formed in aqueous solution (Comptes rend., 1905, 140, 310). A report of this the results of a large number of determinations of the proportions of iron and chlorine precipitated when sodium ethylate is added to a solution of ferric chloride, are given.—B. J. S.

## New Books.

NEW GERMAN TARIFF AS MODIFIED BY TREATIES. Statement showing (1) The New German "General" Customs Tariff. (2) The Modifications made in that Tariff by each of the New German Treaties with Russia, Switzerland, Italy, Roumania, Belgium, Austria-Hungary, and Servia. (3) The New German "Conventional" Tariff Resulting from all these Modifications; with comparison with the existing German rates of duty on Imports from the United Kingdom. Presented to Parliament by Command of His Majesty. Eyre and Spottiswoode, Printed for His Majesty's Stationery Office, London, 1905. Price 1s. 10d. To be purchased directly or through any bookseller, from Wyman and Sons, Ltd., Fetter Lane, London, E.C. and 32, Abingdon Street, Westminster, S.W., or Oliver and Boyd, Edinburgh, or E. Ponsonby, 116, Grafton Street, Dublin.

The classes of goods referred to and included in this Tariff are as follows:—(1) Agricultural and forest produce, and other natural, animal, and vegetable produce, food-stuffs, &c. (2) Mineral and fossil raw materials; mineral oils. (3) Coal tar, coal tar oils, &c. (4) Prepared wax, fatty acids, paraffin, wax wares, soap, &c. (5) Chemical and pharmaceutical products, colours, &c. (6) Animal and vegetable textile materials and wares thereof. (7) Leather and leather wares, furriers' wares, &c. (8) Caoutchouc wares. (9) Plaits and plaited goods of vegetable materials other than textile fibres. (10) Stoneware, earthenware, glass, &c. (11) Precious metals and wares thereof. (12) Base metals and wares thereof, &c. There are in this volume 227 pages of tabulated data.

MINERAL RESOURCES OF THE UNITED STATES. Department of the Interior, United States Geological Survey, Charles Walcott, Director. Calendar year 1905. DAVID T. DAY, Chief of Division of Mining and Mineral Resources. Government Printing Office, Washington. 1904.

8vo. volume containing "Letter of Transmittal," Introduction, and 1178 pages of subject matter, and the alphabetical index of the subjects. The following are the items of which geographical and industrial details are given:—I. Iron Ores: (i) Statistics of the American Iron Trade for 1903. II. Manganese Ores. III. Gold and Silver. IV. Copper. V. Lead. VI. Zinc. VII. Aluminium and Bauxite. VIII. Mercury. IX. Steel-Hardening Metals. X. Platinum. XI. Lithium. XII. Antimony. XIII. Arsenic. XIV. Tin. XV. Coal. XVI. Coke. XVII. Gas, Coke, Tar, and Ammonia at Gas Works and in Retort Coke Ovens. XVIII. Petroleum. XIX. Natural Gas. XX. Asphaltum and Bituminous Rock. XXI. Stone. XXII. Clay-Working Industries. XXIII. Cement. XXIV. Precious Stones. XXV. Tale and Soapstone. XXVI. Abrasive Materials. XXVII. Borax. XXVIII. Fluorspar and Cryolite. XXIX. Gypsum and Gypsum Products. XXX. Phosphate Rock. XXXI. Salt. XXXII. Sulphur and Pyrites. XXXIII. Barytes. XXXIV. Mineral Paints. XXXV. Asbestos. XXXVI. Flint and Felspar. XXXVII. Graphite. XXXVIII. Magnesite. XXXIX. Mineral Waters. XL. Monazite and Zircon. XLI. Glass Sand.

REPORT OF THE DEPARTMENTAL COMMITTEE ON INDUSTRIAL ALCOHOL, 1905. [Cd. 2472.] Price 3d. Wyman and Sons, Ltd., Fetter Lane, London, E.C., and 32, Abingdon Street, Westminster, S.W., or Oliver and Boyd, Edinburgh, or E. Ponsonby, 116, Grafton Street, Dublin.

This report of 27 pages contains Terms of Reference, the Report of the Committee to the Chancellor of the Exchequer, and the Report of Sub-Committee on their visit to Germany. It will be found, together with the appendices on pages 397 to 426 of this issue of the Journal.

## Trade Report.

### I.—GENERAL

GERMANY; TRADE OF — IN 1904.

For. Off. Ann. Series, No. 3333.

#### Imports.

The most notable increases in imports (over 1903) are :—

Articles.	Quantity.
	Tons.
Earths and ores .....	1,065,000
Coal .....	384,000
Copper and manufactures thereof .....	30,000
Instruments, machinery .....	32,500
Drugs, dyestuffs and chemicals .....	120,000
Wood, carving material, &c. ....	372,000
Oils and fats .....	63,000
Paper .....	34,400

Among drugs, dyestuffs and chemicals imported the principal increases were :—

	Increase.
	Tons.
Drugs, dye-stuffs and chemicals—	
Nitrate of soda .....	39,000
Superphosphates .....	9,000
Ice .....	49,000
Oils and fats—	
Oil cake .....	56,000
Hog's lard .....	9,700
Paper—	
Swedish wood-pulp .....	9,600
Cellulose, &c. ....	19,800
Pasteboard .....	4,400

#### Exports.

The principal changes in exports relate to :—

Articles.	Increase or Decrease.
	Tons.
Cotton and manufactures of cotton .....	+ 6,000
Wool and manufactures of wool .....	+ 2,100
Manufactures of linen, jute, &c. ....	— 4,300
Coal, coke and fuel .....	+ 815,000
Earths, ores and metals .....	+ 418,500
Iron and manufactures of iron .....	+ 711,000
Copper and manufactures of copper .....	+ 3,400
Zinc and manufactures of zinc .....	+ 5,900
Lead and manufactures of lead .....	— 6,800
Instruments and machinery .....	+ 30,600
Drugs, dyestuffs and chemicals .....	+ 81,000
Wood, carving materials, &c. ....	— 44,700
Oils and fats .....	+ 33,500
Paper .....	+ 5,500
Corn and agricultural produce .....	+ 210,200
Articles of food and drink .....	— 318,200

Some of the important increases in exports of drugs, dyestuffs and chemicals are :—

Articles.	Quantity.		
	1904.	1903.	1902.
	Metric tons.	Metric tons.	Metric tons.
Aniline, &c., dyes .....	30,831	29,336	28,806
Chlorate of potash .....	140,765	125,302	106,924
Indigo (mostly artificial) .....	8,730	7,233	5,284
Sulphate of potash and potash magnesia ....	64,390	56,455	40,787

Sulphate and potash magnesia were exported to :—

Country.	Quantity.		
	1904.	1903.	1902.
	Metric tons.	Metric tons.	Metric tons.
France .....	4,583	5,019	1,841
United Kingdom .....	4,622	5,154	2,971
Netherlands .....	9,127	6,351	4,211
Spain .....	1,498	1,373	611
United States of America .....	37,598	33,011	27,911
Hawaiian Islands .....	1,524	1,168	311

Exports of chlorate of potash increased, especially to United States of America, which took 83,600 tons in 1904 compared with 70,200 tons and 61,580 tons in 1903 and 1902 respectively.

The exports of indigo were distributed as follows :—

Country.	Quantity.		
	1904.	1903.	1902.
	Metric tons.	Metric tons.	Metric tons.
Belgium .....	201	179	111
France .....	155	154	111
United Kingdom .....	1,168	1,055	811
Italy .....	450	448	311
Netherlands .....	494	397	211
Austria-Hungary .....	1,259	1,262	111
Russia .....	340	309	211
Sweden .....	53	74	111
Switzerland .....	61	86	111
Spain .....	72	70	111
Turkey .....	77	29	111
Egypt .....	369	170	111
India .....	37	60	111
China .....	1,171	768	111
Japan .....	472	342	111
United States of America .....	2,162	1,736	1,111

The exports of earths, ores and metals compared with exports in 1903 were :—

Articles.	Increase or Decrease.
	Tons.
Kainit and other fertilising salts .....	+ 130,000
Cement .....	— 100,000
Sand, marl and gravel .....	+ 197,000
Carbonate of lime .....	+ 6,000
Porcelain earth and feldspar .....	+ 10,000
Iron ore .....	+ 91,000
Slag .....	— 24,000
Thomas slag .....	+ 41,000

The remarkable falling-off in the exports of cement chiefly due to reduced shipment to the United States of America, viz., 94,100 tons, against 221,700 tons in 1903.

### II.—FUEL, GAS, AND LIGHT.

CHARCOAL: U.S. CUSTOMS DECISION.

March 13, 1905.

Charcoal is dutiable at 20 per cent. *ad valorem* under section 6 of the tariff as a "manufactured article unenumerated," and not as assessed under paragraph 97 "article composed of carbon."—R. W. M.

### III.—TAR PRODUCTS, PETROLEUM, Etc.

PITCH: U.S. CUSTOMS DECISION.

March 30, 1905.

Merchandise invoiced as tar, and claimed to be free of duty under various paragraphs of the tariff, and which analysis was found to be a mixture of asphaltic bitumen compounds partly sulphonated, was decided to be dutiable at 20 per cent. *ad valorem* under section 6, as a "manufactured article unenumerated."—R. W. M.



**OIL (PETROLEUM) DISCOVERY IN GERMANY.**

*U.S. Cons. Rep., No. 2211, March 21, 1905.*

December 23 last, oil was reached at a depth of 112 ft. at Eickeloh, a small town on the Leine River, just at the point where this river joins the Aller. The well yields daily 16,500 litres (4,372 gall.) of oil.

**OIL INDUSTRY OF INDIANA.**

*Eng. and Mining J., March 30.*

During 1904 a large area of producing territory was added to the Indiana oilfield. This addition was made by gradual development along the margins of tested productive territory; the field, which covered 1,350 square miles on January 1, 1904, has been increased by at least 100,000 acres. About 300 new oil companies were formed and incorporated during the year, and 55 foreign companies were admitted to do business in the State under the corporation law. There were 4,049 producing wells drilled during the year, and 577 dry holes.

The production of the Indiana wells in 1904 proved the highest on record. The production increased from 14,444 bbl. in January, to 1,065,620 bbl. in December; production for the year, 10,744,849 bbl.; valuation, \$6,688,000. The average price paid was 1.08½ dols. per barrel. The owners received about 6,000,000 dols. for their oil, and the rest was received by the well owners. At the close of the year 30,540 producing wells were in operation in Indiana, a limited number of which produce gas.

**VII.—ACIDS, ALKALIS, Etc.**

**CHEMICAL IMPORTS OF MEXICO.**

*For. Off. Ann. Series, No. 3332.*

In 1902 the value of the chemicals and drugs imported into Mexico was \$52,594, while in 1903 the value was \$81,926.

The imports of colours, in powder or crystals and also intended for use, amounted to 101,589 lb., as compared with 92,926 lb. in 1902. Colours in powder and in solution are supplied in the following proportion:—United Kingdom, 70 per cent.; the United States, 10 per cent.; Germany, 8 per cent.; and the remainder from Belgium, the United Kingdom and other countries. Sixty per cent. of the prepared colours come from the United States, 10 per cent. from the United Kingdom, 10 per cent. from Germany, and the remainder from France, Belgium and other countries.

Drugs and chemicals of all kinds (including patent medicines), were imported to the value of 105,054 lb., as compared with a value of 92,345 lb. in 1902. Of the drugs and chemicals the greater part came from the United Kingdom—43 per cent.—but a very large proportion—36 per cent.—comes from France; Germany comes next with 10 per cent.

Sodium carbonate and potash were imported to the value of \$1,400,000, as compared with \$2,720,000 in the previous year. Imports of these articles come almost exclusively (90 per cent.) from the United Kingdom. It is, however, quite possible that in the next year the importation of caustic soda and potash will be much less, as the output of the paper mills is decreasing. The mills are being bought up by the paper company of San Antonio, which now supplies the market with the greatest production of all kinds of paper, and as the number of mills increases the consumption of caustic soda will naturally also.

**SULPHUR TRADE; SICILIAN —.**

*Cham. of Com. J., April, 1905.*

In 1904 the exports of sulphur from Sicily amounted to 40,000 tons, of which 20,957 were shipped to the United Kingdom and Malta, and about 11,000 tons to Australia and India. On December 31, 1904, the stock on hand amounted to 370,606 tons.

**BARYTES. (BARIUM SULPHATE, ARTIFICIAL):**

**U.S. CUSTOMS DECISION.** *March 29, 1905.*

Barytes was assessed for duty at one-half cent per lb. as "artificial sulphate of barytes," under paragraph 46 of the tariff. The importers claimed it to be dutiable at 75 cents or 5 dols. and 25 cents per ton, as "unmanufactured" or "manufactured barytes." The Board of General Appraisers found the merchandise to be artificial sulphate of barytes and affirmed the assessment of duty.—R. W. M.

**MINERAL WATERS OF NICARAGUA.**

*For. Off. Ann. Series, No. 3337.*

In the Republic of Nicaragua there are a number of hot springs, and also springs and lakes of mineral waters that may possibly be of value when the country is more fully developed. Amongst the most noticeable is the lake of Nejapa, near Managua, whose waters contain a considerable quantity of bicarbonate of potash, bicarbonate of soda, and sulphate of magnesia. This water when rubbed on any greasy object, at once forms a lather.

**CHARCOAL STICKS: U.S. CUSTOMS DECISION.**

*March 29, 1905.*

Sticks of charcoal used in chemical laboratories in connection with blowpipe analysis are dutiable under Section 6 of the tariff, as "manufactured articles, unenumerated," at 20 per cent. *ad valorem*. The assessment of duty at 35 per cent. *ad valorem* as "articles composed of carbon" under paragraph 97 was overruled.—R. W. M.

**VIII.—GLASS, POTTERY, AND EARTHENWARE.**

**GLASS POWDER: U.S. CUSTOMS DECISION.**

*March 25, 1905.*

Powered glass of several colours, intended for decorative purposes, was held to be dutiable at 45 per cent. *ad valorem* as a "manufacture of glass," under paragraph 112 of the tariff.—R. W. M.

**IX.—BUILDING MATERIALS, Etc.**

**CEMENT; GERMAN IMPORTS AND EXPORTS OF —, FROM 1900 TO 1904.**

*For. Off. Ann. Series, No. 3333.*

	Quantity.				
	1904.	1903.	1902.	1901.	1900.
Imports ..	Met. tons. 60,180	Met. tons. 49,370	Met. tons. 52,018	Met. tons. 87,262	Met. tons. 79,303
Exports ..	635,247	742,381	699,378	560,612	600,386
Excess of exports	575,067	692,511	647,360	473,350	521,083

**X.—METALLURGY.**

**IRON AND STEEL PRODUCTION: BRITISH —.**

*Eng. and Mining J., March 30, 1905.*

The pig iron made in Great Britain last year was 8,562,658 long tons, which is a decrease of 248,546 tons, or 2.8 per cent., from 1903; but an increase of 44,965 tons, as compared with 1902. Nearly two-fifths of this iron was made with imported ore. The production of iron ore in Great Britain—lacking only a small quantity taken from quarries or shallow pits—was 9,161,588 tons, while the imports were 6,100,556 tons. Last year Spanish ore was 4,648,335 tons, or 76.2 per cent. of the total imports. The average consumption of ore was 1.78 tons per ton of iron made. With an average of 325 furnaces in blast last year, the output per furnace was 26,346 tons.

The steel production for two years has been as follows, in long tons:—

	1903.	1904.
Bessemer .....	1,910,018	1,781,533
Open-hearth .....	3,124,083	3,245,346
Total .....	5,034,101	5,026,879

The decrease in 1904 was made up by a decrease of 128,485 tons, or 6·7 per cent. in Bessemer, and an increase of 121,263 tons, or 3·9 per cent., in open hearth steel. The open-hearth furnace holds its own, and more, with British steel-makers. Last year open-hearth steel was 64·5 per cent. of the total. The average output of Bessemer steel per converter in use was 35,630 tons for the year, while the result from the open-hearth furnaces was 9,400 tons.

The basic process, which is confined to open-hearth work in America, is applied to the converter in Great Britain to a considerable extent. The division of steel into acid and basic in 1904 was as follows:—

	Acid.	Basic.
Bessemer .....	1,120,224	652,309
Open-hearth .....	2,583,282	662,004
Total .....	3,712,506	1,314,373

The basic open-hearth process has made less impression in Great Britain than in America, as shown by the figures. The proportion of acid steel last year was 73·8 per cent. of the total.

The ratio of steel to pig-iron production, which was 57·1 in 1903, increased to 58·7 in 1904. In the United States this ratio was 84·1 last year.

#### MERCURY PRODUCTION OF THE WORLD.

*Bd. of Trade J., March 30, 1905.*

The following table, showing approximately the mercury production of the world during the past two years, is extracted from the *Eng. and Mining J.* (New York):—

	1903.	1904.
	Metric tons.	Metric tons.
United States .....	1,288	1,480
Austria—Idria Mines .....	520	536
Spain—Almaden .....	914	1,020
Italy .....	314	355
Total .....	3,036	3,391

A metric ton is, approximately, 29·6 flasks. The total for 1904 was, therefore, about 100,374 flasks. The only producing countries of any importance not included above are Russia and Mexico, figures for which have not been received. In 1903 Mexico reported 190 and Russia 362 metric tons. Assuming that their output was about the same in 1904, and making an allowance for the smaller producers, such as Japan and Germany, a total for the year of 3,980 metric tons, or 134,460 flasks of mercury, would be arrived at.

#### XII.—FATS, FATTY OILS, Etc.

##### SOAPS AND OILS IN CYPRUS.

*Bd. of Trade J., April 13, 1905.*

The island produces several plants which yield essential oils, and, with cultivation, could grow much more. Some origanum oil has been distilled under contract with the Agricultural Department, from wild thyme. The small soap factory at Limassol does not make use of any essential oils, and prepares only household soap. The olive oil used is imported. The reason for this is that the oil required in soap making is obtained from the residue which remains after the oil has been extracted from the olives. No

olive oil producer in Cyprus possesses the necessary apparatus for treating this residue. A co-operative soap factory, distilling essential oils from island grown plants, utilising the olive oil produced from the trees belonging to the co-operators themselves, should have a good prospect of success.

#### XIII. A.—PIGMENTS, PAINTS, Etc.

##### ROUGE: U.S. CUSTOMS DECISION.

*March 30, 1905.*

Rouge for polishing purposes, consisting of 96·4 to 98·93 per cent. of oxide of iron, is dutiable at 30 per cent. *ad valorem* as a "colour" under paragraph 58 of the Tariff. The Board held that it was a colour regardless of the use to which it is applied.—R. W. M.

#### XIV.—TANNING; LEATHER; GLUE.

##### HIDE POWDER: U.S. CUSTOMS DECISION.

*March 13, 1905.*

Merchandise invoiced as "Chromirtes Hautp" consisting of dry powdered raw hide and oxide of chromium, was decided to be dutiable at 25 per cent. *ad valorem* as a "chemical compound" under paragraph 58 of the tariff. The Board overruled the claim of the importer that it was dutiable at 20 per cent. *ad valorem* under section 6 as a "manufactured article."—R. W. M.

#### XVI.—SUGAR, STARCH, Etc.

##### SUGAR FROM SPAIN PROHIBITED.

*Bd. of Trade J., March 30, 1905.*

An Order in Council has been published, dated 27, 1905, providing that whereas it appears from a report of the Permanent Sugar Commission that a bounty on the production or export of sugars is granted in Spain on sugar from Spain (not including molasses and sweetened products) shall (except in transit) be prohibited to be imported into the United Kingdom from after April 3 next.

##### SUGAR EXPORTS OF GERMANY.

*For. Off. Ann. Series, No. 3333.*

The exports of sugar for the last three calendar years are:—

	Quantity.		
	1904.	1903.	1902.
	Metric tons.	Metric tons.	Metric tons.
Sugar of all kinds—			
Raw .....	320,704	461,165	490,000
Other .....	459,736	559,028	570,000
Total .....	780,440	1,020,194	1,060,000

##### ARROWROOT STARCH: U.S. CUSTOMS DECISION.

*March 30, 1905.*

Arrowroot, consisting of the starch extracted from the tubers of the arrowroot plant, is dutiable as "starch" at 1½ cents per pound, under paragraph 285 of the Tariff. The Board held that the provision for "starch" was more specific than that for "arrowroot."—R. W. M.

#### XVII.—BREWING, WINES, SPIRIT, Etc.

##### METHYLATED SPIRIT IN SWITZERLAND.

*Chem. and Drug., April 15, 1905.*

Since January 1, 1905, methylated spirit has been obtained in Switzerland exclusively from the Confederation of Switzerland.



Administration. Previously firms were able to methylated spirit on payment of the duties. In no foreign alcohol will be admitted into Switzerland unless addressed to the Confederated Spirit Administration.

#### SAKE: U.S. CUSTOMS DECISION.

March 3, 1905.

United States Circuit Court of Appeals has decided saké is dutiable at 20 per cent. *ad valorem* as a manufactured article unenumerated under section 6 of the tariff. The Court held that saké is similar to beer in material and use, and also similar to still wine in use, but has also characteristics not found in either. Hence it does not resemble either beer or wine sufficiently to establish a similitude to either for the purposes of tariff classification.

Treasury Department has decided to appeal to the United States Supreme Court against this decision. The decision of the appeal, duty will be levied at 15 per gallon under paragraph 296, as a still wine. Amount involved is estimated at 500,000 dols.

—R. W. M.

#### XX.—FINE CHEMICALS, Etc.

#### OIL AND RESINOID: U.S. CUSTOMS DECISIONS.

March 20 and 24, 1905.

Oil concrete and resinoid of orris are dutiable at 30 per cent. *ad valorem* as "essential oils" under paragraph 3 of the tariff. The claim of the importer that oil of orris was free of duty as "enfleurage grease" under paragraph 626, was overruled. The evidence showed that the orris root was extracted by a volatile solvent in the same manner as enfleurage grease, but that the resulting product or resin of orris had been treated separately by distillation to obtain the white concrete oil. The evidence also showed that the resinoid was the result of a process of distillation.—R. W. M.

#### ETHERS IN SWITZERLAND.

Chem. and Drug., April 15, 1905.

Feuille Federale Suisse of February 22 contains text of a notification of the Federal Department of Commerce, announcing that from February 20 monopoly-duty (in addition to the import-duty) will be levied on certain ethers, on importation into Switzerland, at the following rates:—Alcoholised ether (Hoffmann's spirit), at 100 kilos.; nitric ether, 90f.; and formic ether, at 100 kilos.; essence of rum, 100f.

#### ETHER (AMYL ACETATE): U.S. CUSTOM DECISION.

March 30, 1905.

Liquid for the Hefner Alteneck lamp, which, on importation, was found to be pure amyl acetate, was held dutiable at 2 dols. per pound as a "fruit ether" under paragraph 21 of the tariff.—R. W. M.

#### I.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

##### PHOTOGRAPHIC PAPER EXPORTS OF GERMANY.

For. Off. Ann. Series, No. 3533.

Exports of photographic paper have increased very much during the last three years. The figures are:—

Year.	Quantity.	Value.
	Metric tons.	£
1904 .....	1,644	891,250
1903 .....	1,218	660,550
1902 .....	474	284,700

Of which there were shipped to—

Country.	Quantity.		
	1904.	1903.	1902.
	Metric tons.	Metric tons.	Metric tons.
United Kingdom .....	627	572	129
Belgium .....	235	26	10
United States of America .....	333	235	51

#### PHOTOGRAPHIC PLATES: U.S. CUSTOMS DECISION.

March 31, 1905.

Photographic dry plates of glass, which have been exposed abroad in a photographic camera, are dutiable at 45 per cent. *ad valorem*, as "manufactures of glass," under paragraph 112 of the tariff.—R. W. M.

## Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

#### I.—PLANT, APPARATUS, AND MACHINERY.

- [A.] 6448. Bastian and Calvert. *See under VII.*  
 „ 6534. Hunt. Separation of liquids from solids. March 28.  
 „ 6762. Forshiepiepe and Schäfer. Drying apparatus.\* March 30.  
 „ 6782. Kaehl. Centrifugal apparatus.\* March 30.  
 „ 6784. Fitzpatrick. Manufacture of briquettes. March 30.  
 „ 6804. Richard. *See under X.*  
 „ 6850. Defays. Apparatus for treating liquids with gases or vapours. March 31.  
 „ 6876. Löffler and Weidle. Filters.\* March 31.  
 „ 7101. Hemptinne. Apparatus for absorbing gases by a liquid under the action of the silent electric discharge.\* April 4.  
 „ 7179. Wilkinson. Precipitation or settling tanks. April 5.  
 „ 7468. Newton (Worthington). Apparatus for cooling or evaporating liquids.\* April 8.  
 „ 7494. Nicholas. Rotary filtering apparatus. April 8.  
 „ 7495. Dawkins (Massey-Harris Co.). Centrifugal liquid separators.\* April 8.  
 „ 7522. Mélotte. Centrifugal separators. [Belg. Appl., May 14, 1904.]\* April 10.  
 „ 7573. Lake (Sterzing). Furnaces.\* April 10.  
 „ 7599. Bach. Manufacture of refractory furnaces and the like.\* April 10.  
 „ 7792. Lyle. Continuous roasting and drying apparatus. April 12.

- [A.] 7804. Wilson. Apparatus for heating or cooling fluids. April 12.
- .. 7808. Dewar. Absorbents for gases or vapours, and the application thereof for purifying or recovering gases or vapours. April 12.
- .. 7961. Lennox. Means for evaporating liquids and concentrating the solids in the same. April 14.
- .. 7962. Lennox. Evaporators for evaporating the liquid in brewers' wash, pot ale from distilleries, waste or spent dyes and the like, and concentrating the solids in the same. April 14.
- .. 8025. British Thomson-Houston Co. (General Electric Co.). Filtering devices for separating impurities from liquids. April 14.
- [C.S.] 7739 (1904). Hoffbauer. Drying apparatus. April 12.
- .. 8600 (1904). Beeman. Mixing, churning, concentrating or drying of semi-liquid or viscous materials and apparatus therefor. April 11.
- .. 8605 (1904). Webb. *See under X.*
- .. 9924 (1904). Smallwood. Furnaces. April 5.
- .. 10,094 (1904). Reese. Heating solid materials or crucibles, pans, retorts, &c., containing them. April 12.
- .. 13,952 (1904). Imray (Soc. Anon. d'Etudes Electrochimiques). *See under XI.*
- .. 16,427 (1904). Browne and McKinlay. Apparatus for subjecting gases or vapours to the action of liquids or liquid agents or vapours therefrom, especially applicable for washing or scrubbing, or enriching illuminating or other gases and for "recovery" purposes. April 12.
- .. 25,213 (1904). Mathys (Gayley). Method of treating gases. April 12.
- .. 25,216 (1904). Mackenzie (Lloyd). Apparatus for making extracts and the like. April 5.
- .. 25,502 (1904). Junkers. Heating and cooling apparatus. April 19.
- .. 28,424 (1904). Vial. Vaporising apparatus. April 19.
- [C.S.] 1738 (1904). Whitfield. Process and apparatus for the manufacture of combustible gas from and like substances. April 5.
- .. 7347 (1904). Thwaite. Generating combustible gas from hydrocarbonaceous and other solid materials. April 5.
- .. 7592 (1904). Radcliffe. Gas generators and manufacture of gas. April 5.
- .. 8492 (1904). Hodge. Gas purifiers. April 11.
- .. 9396 (1904). Reese. Gas producer. April 11.
- .. 9668 (1904). Lynn. Gas producers. April 11.
- .. 10,926 (1904). Dempster and Sons, Ltd., and S. Gas retorts. April 5.
- .. 11,719 (1904). Hills and Schill. Producer generators. April 12.
- .. 12,247 (1904). Carolan (General Electric Co.). Electrodes and lamps for arc lighting. April 19.
- .. 13,161 (1904). Carolan (General Electric Co.). Manufacture of filaments for incandescent lamps. April 19.
- .. 16,427 (1904). Browne and McKinlay. *See under XI.*
- .. 24,064 (1904). Onslow. Gas burners for heating purposes. April 19.
- .. 28,765 (1904). Maréchal. Purifying or desulphurising lighting gas. April 5.
- .. 257 (1905). British Thomson-Houston Co. (General Electric Co.). Electric arc lamp electrodes. April 12.
- .. 616 (1905). Dents. Continental Gas-Ges. burners. April 5.

### III.—DESTRUCTIVE DISTILLATION, TARS, PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [A.] 6798. Garroway. Preparation of acetic acid, acetone, and methyl alcohol. March 31.
- .. 7630. Henderson. Apparatus for treating paraffin wax. April 11.
- .. 7699. Van der Ploeg. Manufacture of emulsions of heavy mineral oils or the like. April 11.
- [C.S.] 10,466a (1904). Dreyman. *See under XVII.*
- .. 23,680 (1904). Rud. Rütgers Chem. Fabrik f. Tarprodukte. Treatment of heavy tar oils for the manufacture of pitch or of a special kind of oil. April 12.

### IV.—COLOURING MATTERS AND DYESTUFFS.

- II.—FUEL, GAS, AND LIGHT.
- [A.] 6433. Morton and Crosta. Gas producers and similar apparatus. March 27.
- .. 6434. Crosta and Morton. Gas producers. March 27.
- .. 6563. Wilton. Treatment of gases produced in the destructive distillation of coal or other carbonaceous material for the purification thereof and recovery of bye-products, and apparatus for use therein. March 28.
- .. 6693. Bölling. Process for producing moulded blocks of silicon or boron carbide.\* March 29.
- .. 6753. Darch and Marriott. Manufacture of artificial fuel. March 30.
- .. 6780. Leadbeater. Artificial fuel. March 30.
- .. 6794. Bell. Apparatus for the manufacture of gas. March 31.
- .. 7307. Wall. Apparatus for the manufacture of gas suitable for heating and illuminating purposes. April 6.
- .. 7310. Capitaine. Process for maintaining the temperature in a gas producer working with a varying consumption of gas. [Ger. Appl., April 9, 1904.]\* April 6.
- .. 7324. Cutler. Gas purifiers. April 6.
- .. 7499. Thomas. Means for treating coal smoke. April 8.
- .. 7713. Elworthy and Williamson. Manufacture of gas for illuminating, heating or power purposes. April 11.
- [A.] 7002. Imray (Meister, Lucius und Brüning). Manufacture of a bisulphite compound of a certain dyestuff. April 3.
- .. 7022. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series and colouring matters therefrom. April 3.
- .. 7390. Imray (Meister, Lucius und Brüning). Manufacture of indigo pastes. April 7.
- .. 7835. Johnson (Dye Works, formerly Dyer, Huguenin and Co.). Manufacture of leuco-guanine dyes.\* April 12.
- .. 7838. Oehler. Production of indophenolsulphonic acids. [Ger. Appl., Nov. 30, 1904.]\* April 12.
- .. 7839. Lake (Oehler). Production of blue monochrome dyes.\* April 12.



910. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of 5-nitro-2-amidophenol and of colouring matters derived therefrom. April 13.

936. Ransford (Cassella and Co.). Manufacture of naphthylencurea-oxysulphonic acid and of dyestuffs therefrom. April 15.

363 (1904). Imray (Sec. Chem. Ind. in Basle). Manufacture of new amidothioaliphyl derivatives and of new dyestuffs therefrom. April 5.

363 (1904). Lake (Oehler). Manufacture of mono-azo dyes. April 12.

1,863 (1904). Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of green sulphur dyes. April 12.

1,956 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of hydroxyethylaniline and derivatives thereof. April 19.

97 (1905). Imray (Dye Works, formerly Durand, Huguenin and Co.). Manufacture of new dyestuffs derived from dyestuffs of the oxazine class. April 5.

64 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of phenylglycine salts. April 12.

61 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters. April 19.

#### -PREPARING, BLEACHING, DYEING,

#### ING AND FINISHING TEXTILES, YARNS, AND FIBRES.

49. Hearn and Jehn. Printing in multi-colours or tones. March 27.

35. Johnson (Badische Anilin und Soda Fabrik). Printing indigo on vegetable fibre.\* March 27.

45. Armitage. Finishing certain fabrics. Mar. 29.

43. Sterne-Price. Method of bleaching, cleaning, and treatment of ramie. March 30.

20. Kother. *See under XI.*

70. Stalker. Method of dyeing or colouring fibres, yarns, threads and textiles, also applicable to the dyeing or colouring of leather and feathers. April 5.

11. Riep and Baner. Greasing medium for fibrous materials and woven fabrics.\* April 5.

56. Tait. Treating and dressing flax and other fibres.\* April 10.

92. Johnson (Badische Anilin und Soda Fabrik). Manufacture of discharging agents. April 10.

18. Lake (Cottrell and Sons Co.). Art of colour printing.\* April 11.

17. Delhotel. Process and apparatus for regaining the benzine employed for cleaning fabrics. [Fr. Appl., July 16, 1904.] April 12.

33. Lennox. *See under I.*

16. Atkinson and The Calico Printers Association, Ltd. Production of photo-engraved surfaces for printing textile fabrics. April 15.

11 (1904). Palmer. Figuring or shading of velvet. April 19.

10 (1904). Partridge. Machines for dyeing yarns and slubbings. April 12.

736 (1904). Bernhardt. Potash leaching apparatus for raw wool. April 5.

[C.S.] 13,484. (1904). Dolder. Process for dyeing cotton and the like in the form of cops, spools and so forth with alizarin red. April 19.

„ 13,867 (1904). Muntadas y Rovira. Process and apparatus for the bleaching of fabric and yarn. April 12.

„ 16,105 (1904). Möller-Holtkamp. Dressing or sizing of yarns. April 19.

„ 25,703 (1904). Scharmann. Apparatus for dyeing, bleaching, boiling and rinsing textile fabrics, &c. April 12.

„ 25,704 (1904). Scharmann. Apparatus for dyeing and treating textile materials and fabrics. April 12.

„ 27,565 (1904). Crespin. Process and apparatus for the manufacture of artificial silk, horse hair, ribbon, or straw. April 19.

„ 6495 (1905). Johnson (Badische Anilin und Soda Fabrik). Printing indigo on vegetable fibre. April 19.

#### VI.—COLOURING WOOD, PAPER, LEATHER, ETC.

[A.] 7170. Stalker. *See under V.*

#### VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 6439. Wultze. Process for manufacturing lead carbonates. March 27.

„ 6448. Bastian and Calvert. Method of treating a gas or gases by catalysis and catalyser therefor. March 27.

„ 6585. Dents. Gold- und Silber-Scheide Anstalt, vorm. Rössler. Manufacture of sodium perborate. [Ger. Appl., June 11, 1904.]\* March 28.

„ 6611. Tee. Manufacture of white salt from rock salt. March 29.

„ 6700. Gittings. Acids. March 30.

„ 6759. Westhausser. Manufacture of hydrochloric and hydrobromic acids. March 30.

„ 6796. Edwards. Table salt. March 31.

„ 6798. Garroway. *See under III.*

„ 7030. Cie. des Prod. Chimiques d'Alais et de la Camargue. Calcination of hydrated alumina. [Fr. Appl., April 8, 1904.]\* April 3.

„ 7034. Paramore. Treating and utilising chlorine gas.\* April 3.

„ 7062. Brownsdon. *See under X.*

„ 7549. Spence, Spence, and Peter Spence and Sons, Ltd. Production of alum. April 10.

„ 7616. Cornillanx. Extraction and purification of sulphur.\* April 10.

„ 7916. Driffield and The United Alkali Co., Ltd. Purification of sulphuric acid. April 13.

„ 8057. Van Schwarz. *See under X.*

[C.S.] 12,634 (1904). Bloxam (Tcherniac). Treatment of ferrocyanides to obtain hydrocyanic acid. April 12.

„ 14,464 (1904). Lake (Chem.-Techn. Fabrik, Dr. A. R. W. Brand und Co.). Recovery of carbonic acid from waste gases. April 19.

#### VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 6699. Gittings. Manufacture of precious stones. March 30.

„ 7086. Turner. Decoration of ceramic ware. April 4.

- [C.S.] 9776 (1904). Richardson. Process and apparatus for the manufacture of glass. April 5.  
 „ 3906 (1905). Johnson (Heraeus). Manufacture of quartz glass. April 5.

# IX.—BUILDING MATERIALS. CLAYS, MORTARS, AND CEMENTS.

- [A.] 6546. Barratt, and The United Asbestos Co., Ltd. Coverings and linings for lessening conduction of heat.\* March 28.  
 „ 7043. Wolman. Composition for impregnating wood. April 3.  
 „ 7267. Moore. Composition for making refractory bricks, furnace linings, tuyères, retorts, crucibles, &c. April 6.  
 „ 7268. Moore. Composition for making refractory bricks, furnace linings, tuyères, retorts, crucibles, and the like. April 6.  
 „ 7521. Brodie. Treatment of the clinker from refuse destructor furnaces. April 10.  
 „ 7537. Wynne. Manufacture of cement from blast furnace slag. April 10.  
 [C.S.] 9680 (1904). Lake (Jenequel and Hayn). Manufacture of building materials, heat insulating materials and the like. April 5.  
 „ 9706 (1904). South. Bricks. April 5.  
 „ 28,729 (1904). Weed. Treating wood for preserving and like purposes. April 12.

# X.—METALLURGY.

- [A.] 6468. Soc. Electro-Metall. Française. *See under XI.*  
 „ 6698. Gittings. Manufacture of metals. March 30.  
 „ 6804. Richard. Compositions and metallic bars for indicating temperatures in kilns, ovens, &c. March 31.  
 „ 6931. Newton (Falding). Roasting furnaces.\* April 1.  
 „ 7062. Brownson. Production of metallic mercury and of mercury sulphide from ores of mercury and other mercurial compounds. April 4.  
 „ 7098. Hommel. Extraction of metals from ores or compounds. April 4.  
 „ 7114. Saunders. Apparatus for separating gold and other metals from their ores. April 4.  
 „ 7131. Weiller and Weiller. Process for extracting copper from copper ore, more particularly from poor copper ore.\* April 4.  
 „ 7144. Sulman, Picard and Ballot. Ore concentration. April 4.  
 „ 7154. Perry. Cleaning of tin slags in the blast furnace. April 5.  
 „ 7332. Cowper-Coles. Manufacture of metallic calcium. April 7.  
 „ 7525. Cowper-Coles. Manufacture of zinc dust. April 10.  
 „ 7624. Griesbach. Utilising tinplate scrap and other waste tinned goods and the like. April 11.  
 „ 7660. MacIvor and Fradd. Treatment of sulphide ores containing zinc. April 11.

- [A.] 7714. Elworthy and Williamson. Production of nickel. April 11.  
 „ 7803. Sulman, Picard and Ballot. Ore concentration. April 12.  
 „ 7915. Best, Hollingsworth, and The United Co., Ltd. Apparatus for the treatment of refractory ores. April 13.  
 „ 8037. Cowper-Coles. Zinc alloys. April 13.  
 „ 8057. Van Schwarz. Gas furnace for calcining ores, limestone, magnesite, and the like. April 13.  
 [C.S.] 7602 (1904). Defays. Reverberatory furnace. April 5.  
 „ 8605 (1904). Webb. Filtering apparatus for the extraction of water from finely-crushed materials. April 12.  
 „ 9482 (1904). Nau. Process of refining metals. April 5.  
 „ 19,053 (1904). Massenez. Manufacture of steel by the basic bessemer process. April 5.

# XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- [A.] 6468. Soc. Electro-Metall. Française. Production of cast iron, more particularly a view to the manufacture of steel. [Feb. 24, 1904.]\* March 27.  
 „ 6650. Schenk. Galvanic cells.\* March 27.  
 „ 6786. Gerard and Fiedler. Plates for electrolysis.\* March 30.  
 „ 6790. Potthoff. Apparatus for electrolysis. March 30.  
 „ 6872. Wood-Smith. Apparatus for the electrolysis of gases. March 31.  
 „ 7004. Reynolds. Electric furnaces. April 3.  
 „ 7020. Kother. Electrodes for electrolysis in the manufacture of bleaching powder. April 3.  
 „ 7101. Hemptinne. *See under I.*  
 „ 7133. Fellows, Pickup and Tice. Electric motive battery. April 4.  
 „ 7534. Wynne. Heating by electricity. April 11.  
 „ 7720. Leitner. Manufacture of acetylene. April 11.  
 „ 7903. Fennell and Perry. Electric accumulator or secondary electrolytic cells. April 11.  
 [C.S.] 7814 (1904). Bauer (Dutertre and Nodet). Apparatus for roasting and heating apparatus. April 11.  
 „ 10,559 (1904). Siemens Bros. and Co., Ltd. Eichenauer. Galvanic batteries. April 6.  
 „ 10,881 (1904). Carolan (Gen. Electric Co.). Apparatus of conducting chemical reactions by means of mercury vapour arc. April 5.  
 „ 13,223 (1904). Holden, and Chamberlain & Ham. Electrolytic meters. April 12.  
 „ 13,952 (1904). Inray (Soc. Anon. d'Etude Chimiques). Apparatus for submitting materials and vapours to the action of the electric current. April 12.  
 „ 27,901 (1904). Gardiner. Storage cells. April 12.  
 „ 28,601 (1904). King. Apparatus for the deposition of metals. April 12.



315 (1905). Thompson (Pillüger Accumulatoren-Werke). Plates for secondary batteries. April 19.

3798 (1905). Goodson. Process of galvanising, tinning, and otherwise plating wire and other metallic bodies. April 19.

I.—FATTY OILS, FATS, WAXES, AND SOAP.

3967. Rivers. Glycerine compound. April 3.

7616. Buchanan. Apparatus for heating linseed oil. April 11.

10,466 (1904). Dreyman. Production of fatty acids such as are used in the manufacture of candles, lamp-oils, cooking fats, soaps, and the like. April 12.

10,466A (1904). Dreyman. *See under* XVIII. A.

—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

7935. Ransford (Cassella und Co.). Manufacture of colour lakes. April 13.

10,895 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matter lakes. April 5.

14,634 (1904). Newton (Bayer und Co.). Manufacture of new colour lakes. April 12.

27,757 (1904). Giband and Bang. White pigment. April 19.

(B.)—RESINS, VARNISHES.

751. Lederer. Solutions of organic compounds suitable as lacquers, varnishes, waterproofing and impregnating media, and for the manufacture of films, filaments and insulating materials. March 30.

750. Bell. Antifouling substances for ships. April 12.

(C.)—INDIA-RUBBER.

129. Lawrence. Process of cleaning rubber.\* April 4.

694. Morisse. Treatment of the milks or lactiferous juices of caoutchouc, gutta-percha, balata and the like.\* April 11.

705. Morisse. Process for the direct utilisation of the lactiferous juices of caoutchouc, gutta-percha and balata. April 11.

8,294 (1904). Petersen. Process for reclaiming and regenerating rubber. April 19.

TANNING; LEATHER, GLUE, SIZE, Etc.

788 (1904). Faucheux and Boissière. Manufacture of gelatine and glue. April 19.

6,888 (1904). Hannemann. Non-desiccating depilatories. April 19.

XVI.—SUGAR, STARCH, GUM, Etc.

[A.] 7334. Holoubek. Manufacture of lignine starch, amyloid and dextrose or alcohol from wood, cotton and other waste, peat and other fibrous vegetable matters. April 7.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 7725. Hunt. Manufacture or purification of whiskey and other spirits. April 11.

„ 7963. Lennox. *See under* 1.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(A.)—FOODS.

[A.] 6457. Fränkel. Manufacture of a malt food. March 27.

„ 7922. Héritte. Alimentary extracts of blood. April 13.

„ 7982. Glas. Manufacture of soluble milk powder. [Ger. Appl., May 17, 1904.]\* April 14.

„ 8013. Taylor. Manufacture of food.\* April 14

„ 8014. Taylor. Preparation and preservation of cream and similar fatty substances or emulsions.\* April 14.

„ 8015. Taylor. Ferruginous foods.\* April 14.

[C.S.] 10,466A (1904). Dreyman. Utilisation of fatty acid esters as alimentary fats, illuminating oils, ointment bases, and the like. April 19.

(B.)—SANITATION; WATER PURIFICATION.

[A.] 7521. Brodie. *See under* IX.

„ 7963. Lennox. *See under* I.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 6783. Soc. Desmarais et Morane, and Denis. Means for filtering and drawing collodions and cellulose solutions. [Fr. Appl., April 26, 1904.]\* March 30.

„ 6926. Claviez. Manufacture of paper threads. April 1.

„ 7140. Holken. Process for improving paper yarn.\* April 4.

„ 7766. Stephan (Rolier). Manufacture of paper.\* April 12.

[C.S.] 11,269 (1904). Coleman. Paper machines. April 10.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 6719. McNicol. Production of refined saccharine. March 30.

„ 6948. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of salicylic acid glycerine formal ester. April 1.

- [A.] 7481. Hefti. Preparation of the carbamidophenolsulphonates of amines. April 8.
- „ 7830. Langer. Process for producing blood albumin preparations.\* April 12.
- „ 7840. Clemmensen and Heitmann. Hypnotic compounds.\* April 12.
- [C.S.] 11,259 (1904). Abel [Act.-Ges. f. Anilinfabr]. Manufacture of derivatives of barbituric acid. April 5.

#### XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 6877. Mézáros. Process and means for producing pigment pictures, single or multicoloured photographs, and plastic or printing plates with a silver salt or like emulsion.\* March 31.

- [A.] 7341. Jones. Manufacture of photographic printing paper. April 7.
- „ 7557. Imray (Meister, Lucius und Brüning). Manufacture of coloured photographic images. April 11.
- „ 7693. Robicsek. Manufacture of gelatine emulsion papers. April 11.
- „ 7967. Thornton. Coloured photographs methods of producing same. April 14.
- [C.S.] 23,729 (1904). Lüttke, Arndt and Löwe. Photographic developers. April 12.

#### XXII.—EXPLOSIVES, MATCHES, Etc.

- [A.] 6651. Haddan (Roth). Explosives containing aluminium or other light metals.\* March 10.
- „ 6672. James (Golovin). Manufacture of a powder for shooting and blasting purposes. March 10.



# JOURNAL OF THE Society of Chemical Industry.

A RECORD

FOR ALL INTERESTED IN CHEMICAL AND ALLIED MANUFACTURES.

ISSUED TWICE A MONTH.

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### COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

### ANNUAL GENERAL MEETING, 1905.

The Annual General Meeting will be held in London in July next, and the proceedings will commence on Monday, July 10th.

In accordance with the provisions of Rule 18 of the By-Laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Dr. Edward Divers, F.R.S., has been nominated to the office of President under Rule 8; Dr. L. Baekeland, Mr. J. Carter Bell, Dr. J. Lewkowitsch, and Mr. N. H. Martin have been nominated Vice-Presidents under Rule 8; and Mr. Wm. H. Nichols has been nominated a Vice-President under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the ordinary members of the Council. Forms for this purpose can be obtained, on application, from the General Secretary, or from the Hon. Local Secretaries of the Canadian, New York, and Sydney Sections.

*Extract from Rule 18* :—"No such nomination shall be valid unless it be signed by at least ten members of the Society who are not in arrear with their subscriptions, nor unless it be received by the General Secretary, at the Society's office, at least one month before the date of the Annual General Meeting, at which the election to which it refers takes place. Nor shall any such nomination be valid if the person nominated be ineligible for election under Rules 12 or 13. No member shall sign more than one nomination form."

### INDUSTRIAL ALCOHOL COMMITTEE.

The report of this Committee, which was appointed by the Chancellor of the Exchequer in September last to inquire into the existing facilities for the use, without payment of duty, of spirit in arts and manufactures, and, in particular, into the operation of Section 8 of the Finance Act, 1902, has been published, together with the minutes of evidence. The report will be found in the April 29th issue of the Journal, together with a full abstract of the Appendixes. Such of the Committee's proposals as need legislative sanction will be embodied in a Revenue Bill.

At a meeting of the Council, held on April 25th, the following resolutions were passed :—

1. "That this Council welcomes the Report of the Industrial Alcohol Committee with the Blue Book containing the evidence and appendixes upon which the Report is based, and resolves that a letter be sent thanking the Chancellor of the Exchequer for his action in appointing the Committee, and expressing a trust that he may see his way to give legislative effect to the recommendations of the Committee at an early date."

2. "That this Council also desires to record its appreciation of the persistent efforts of Mr. Thomas Tyrer in the cause of Industrial Alcohol, and hereby tenders him its thanks for his services on the Industrial Alcohol Committee."

## SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

At a meeting of the Organising Committee of the Sixth International Congress of Applied Chemistry, held in Rome on March 2 last, Prof. E. Paternò in the chair, it was decided to divide the Congress into the number of sections as was the case at Berlin in 1902. At the suggestion of the Presidents of foreign Committees the date of meeting was fixed for April, 1906, during Easter week.

All communications with respect to the Congress should be addressed to the President, Prof. E. Paternò, Via Panisperna 89, Rome.

## Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses also to be avoided as tending to create confusion. In sending subscriptions, the use of the form attached to the application helps in the verification of addresses which the safe delivery of the Journal depends.

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Fairball, E. J.; all communications to 8, Scarboro Road, Stroud Green, N.  
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Highley, Arnold, 1/o Rochdale; Hawthorn View, 1, forth, near Leeds.  
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Tankard, Arnold R., 1/o Sheffield; 22, Sandford 1, Moseley, Birmingham.  
Waterhouse, Robt., 1/o Altrincham; 8, Severn 1, Sheffield.  
Wrampelmeier, T. J., 1/o London; Chemists' Club, West 55th Street, New York City, U.S.A.

## Deaths.

- Pont, Francis G. du, Montehanin, Del., U.S.A.  
Samuelson, Rt. Hon. Sir Bernhard, Bart., F.R.S., Prince's Gate, London, S.W.



## Liverpool Section.

Meeting held on Wednesday, April 12th, 1905.

MR. EUSTACE CAREY IN THE CHAIR.

### THE WOOD DISTILLATION INDUSTRY.

BY MAX MUSPRATT.

(this Journal, April 29th, 1905, pp. 372-374.)

#### DISCUSSION.

A. SMETHAM said the subject was of great importance to Wales and English agriculture; it had also been taken up by the Board of Agriculture. Whether the distillation of the waste lands of Great Britain could be carried out at a profit was still a matter of doubt, but there was no doubt that certain areas might be very profitably planted, and no doubt if some company could be formed to work on the lines Mr. Muspratt has suggested in the districts a profitable industry could be started. The great difficulties was that a very large proportion of the land called "waste" was useless alike for growing ordinary farm produce and for growing timber, the climatic conditions were such that it would be impossible to get anything like a crop of timber in any of the mountain sides in a period of 30 years. Suitable conditions 30 years was sufficient to get a profitable growth, but he did not think such could be grown in that period in many parts of Wales, for example. With regard to the working, one of the great difficulties would be the getting of the timber in these remote places, and it would be to him that in many districts the cost of carrying the wood to the factory would be almost as great as the cost of the products from the sources of supply in the other great timber-growing countries. The land in England was far too circumscribed to allow of the land for timber growing, and a greater area than 15s. an acre was required if the land was to be cultivated. The limit of profit suggested was too small to furnish anything like an adequate rent. It was a thing how, in some of the country places, land was sold at high prices for sheep running and so on. The Board of Agriculture had suggested more particularly the areas which were used for water catching should be planted, which should be planted, and he was fully in agreement with that suggestion. It would have a beneficial effect in increasing the rainfall, and it would also have a beneficial effect, he thought, in the purification of the water from such areas. Unfortunately the difficulties of the areas at anything like reasonable rates seemed to be increasing greatly, and every Corporation—the local Corporation included—had to pay more and more for the areas from which the public got their water. It was possible that if they should realise even a moderate profit from the planting of timber in such areas it would be better than leaving them entirely unproductive, and to the extent he thought there would be a future and a considerable future for the planting of waste lands in the land. But he was equally certain that any lands which could be profitably cultivated would never pay for the production of charcoal or even for the production of timber.

MR. ARTHUR CAREY asked how far the association was advocating the afforestation of waste lands and approaching the Government, and with what object? A short time ago a statement was made in connection with the question of the afforestation of waste lands was brought up. Mr. Balfour said it would be a very good thing. Under those circumstances he thought Mr. Carey had not the full facts before him. Mr. Muspratt, he estimates, put down the sum of 25s. per acre for the timber. That appeared a very low estimate. What would be the value of felling timber would be used?

MR. HERRBERT DAVIES said he was interested in a large estate in South Wales which was for the most part waste land. It was a very hilly country, unsuitable for agricultural purposes, and the proprietor many years ago planted a good deal of it with timber, but he found, as Mr. Smetham suggested, that, although he was near his market, the cost of haulage in this hilly district was so very great that almost the whole of the profit was absorbed in that one item alone, and with regard to the rent, the land, while unsuitable for agricultural purposes, was now getting a high rent for sporting purposes; but the timber part of it was a failure, although it was done on a large scale—5000 or 6000 acres. That one item, haulage, was so great as practically to destroy all profit on the timber.

MR. MUSPRATT said, with regard to the felling cost, the only definite figure he could get was from an Edinburgh expert who put the cost at 25s. The planting cost was £5 an acre. So far as the waste lands were concerned, the whole of that aspect of the subject first came into his mind in connection with the Vyrnwy watershed. He found that the Water Committee had been for some time past going in steadily for planting, without any ulterior object except that it was going to improve the catchment area, and he thought it was extremely desirable that if by any chance that could be systematised and this timber brought into profitable use that it would be an offset to some of the heavy expenses in connection with their water system. So far as rent was concerned in the case of lands owned by Government which were not really used, and especially as regards these watersheds, there was an opening for a satisfactory industry. Of course the distillation would have to be carried out on the spot. If the districts were hilly, especially such as at Vyrnwy, a certain portion of the hills on the side of the lake would be selected, and the timber would be allowed to come down upon slides into the water and be collected at the far end where the factory would be situated. That was also an expert question. He did not think the comparatively small quantity of timber in so large a body of water would affect the water. He felt that the subject was in its infancy as far as this country was concerned, and he hoped to get it thrashed out.

## London Section.

Meeting held at Burlington House, on Monday, March 6th, 1905.

MR. A. GORDON SALAMON IN THE CHAIR.

### THE MECHANICS OF FIRE.

BY HENRY E. ARMSTRONG, PH.D., LL.D., F.R.S.

We are fireworshippers, both by inheritance and of necessity, sun-love being instinctive in mankind at large; and yet the sight of fire excites no wonder in most minds, such is the contempt bred of familiarity. At the present day, fire is the basis of all manufacturing industry in which motive power is a dominant factor—and as Niagaras are but sparsely distributed must remain so to the end of time: nevertheless, we have scarce a thought for the morrow—scarce a pang of regret crosses our minds at the reflection that our fuel stores will be exhausted a few short centuries hence; the subject is dealt with almost in a flippant manner in the recent report of the Royal Commission on our Coal Supplies. We may well ask, therefore: "Is there no altruism in us that we calmly suffer the great wrong to posterity which is involved in the wicked waste of fuel now going on throughout the so-called civilised world?" The Atlantic liner is known to eat up coal at the rate of a ton every 2½ minutes as she voyages between New York and Hamburg; but no one thinks of the curses which pos-

terity will heap upon us if we take no steps to insure against a recurrence of the ice age—if we practice so little economy in the use of fuel. I must confess to feeling much sympathy myself with Professor Boyd Dawkins' contention that we should put a stop to the export of smokeless coal. To treat coal at all as a mere stone is a disgrace to our civilisation—we ought not to allow its exportation except in forms in which its energy-content is fully utilised. In pre-Joulian times there would have been some excuse for us—now, in view of the existence of a Society of Chemical Industry, it is impossible to plead even extenuating circumstances. But has this Society in its collective capacity, have its members individually, ever given proper consideration to the subject—have they ever thought of the transcendental importance of the study of fire and have they done anything to promote it? In referring to this subject, in my address to Section L at the meeting of the British Association at Belfast in 1902, I said: "A scuttle full of coal excites no emotion in the literary mind: it should be one to call up harrowing visions, as well as a vista of memories extending far back into the ages of time—for in no other stone can we find a more wonderful sermon." Now, I may ask, "Does even a truck full of coal excite any emotion in the manufacturing mind—except through an account book?" I can conceive of no nobler purpose for this Society than that it should raise an insurance fund on behalf of fire, not against fire—for the scientific study of fire and its applications; so that Carlyle's words may no longer have any measure of truth: "From us, too, no chemistry, if it had not stupidity to help it, could hide that flame is a wonder."

Is not the present method of education such that chemistry has little but stupidity to help it? The discovery of fire-air—as Scheele most properly termed it—was the beginning of a new era in the history of the world. If we reflect on what has happened since: on the marvellous advance in knowledge which has accrued from the introduction of the experimental method; on the manner in which the use of science in the service of the world has increased our power and revolutionised our habits: we may well be struck dumb with wonder. But we should temper such wonder with amazement at the fact that instructors of our youth make no serious attempt to bring such knowledge properly before their pupils—no serious attempt to recognise the advent of a new discipline. Our children are in the hands of Goths! We hear of classical scholars reading Greek with feet on fender: if such could really see into the fire in front of them, they would realise that the vain imaginings of men in the past are as nothing in comparison with the wonders that we are beginning to see to-day in the world at large; they would set some value upon training truly calculated to cultivate the power of imagination and insight.

The question I have asked is an all-important one to consider. The state of chemical industry in this country would scarcely be so parlous as it is if our schools and universities had done their duty. The raw material of genius is abundantly at our disposal—yet we are even less regardful of it than we are of the energy content of coal. Ought not this Society, therefore, to take some definite share in promoting the immediate reform, root and branch, of our system of education? The journal it publishes is very valuable as a record of what other people are doing; but should not the Society display more directive and constructive activity? Is the lesson of Japanese success to be entirely wasted upon us—cannot we, too, show that we know how to organise victory?

I trust this prologue may not be entirely out of place: fire, it is well known, often leads to the blowing-off of steam.

In the present essay, it is proposed to deal mainly with fire as produced by oxidation of ordinary fuels; it should be pointed out, however, that the inquiry into the mechanics or true inwardness of fire cannot well be regarded as otherwise than co-extensive with that into oxidation phenomena generally, including those which attend vital changes.

My own initiation as an active fire-worshipper dates back to 1867, when I heard the late Sir Edward Frank-

land's wonderfully illustrated and entrancing lecture at the Royal Institution, (1) in which the insufficient Davy's explanation of the cause of the luminous flame was pointed out for the first time. I have listened to a more stimulating course. To me, a student, it was of infinite importance to hear doubt upon current belief and authority called in on the display of solid grounds for such disbelief eminently inspiring. I would that every student attend a course of lectures on the ethics of disbelief.

I began to play with fire myself only in 1885, although I had formed views of my own about oxidation phenomena at least ten years previously. But my temerity was even in those youthful days, as I ventured to predict a mere mixture of hydrogen and oxygen—of these alone—would be found to be incombustible: (2) and has proved to be the case. Brereton Baker's achievement is, I suppose, known to all.

We have reason to be proud of the part which I chemists have played in unravelling the mystery. The name of Davy, of course, comes first on the list: work such as Frankland, Dixon, Brereton Baker and have done is no unworthy sequel even to that of the Davy.

Dixon's memorable discovery of the incombustible carbon monoxide in the absence of water, which was announced in 1884, (3) must be regarded as the act of importance in the modern fire drama. Following this came H. B. Baker's epoch-making observations on the influence of moisture on the occurrence of chemical change, (4) which were crowned by a demonstration, in 1903, of the incombustibility of hydrogen, (5) even when wet, in the absence of iron. There remain to be mentioned the investigations carried out during recent years by Bone and his fellow-workers on the nature of the interchanges attending slow combustion in mixtures of hydrocarbons with insusceptible oxygen for complete combustion; these are of great value as enabling us to trace the various stages of interchanges which precede complete combustion, in fact, the course of change. Twenty short years have brought marvellous additions to our knowledge; but the fruitful sources of error, the text books, are silent on matters and the work is appreciated here only by a narrow circle; it would seem that on the Continent Europe English is an unknown tongue: there is consolation in this, seeing that we are commonly bad linguists.

#### *Combustion of Hydrogen.*

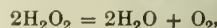
The study of fire may with advantage be begun by considering the formation of water from its elements; this will afford the opportunity of taking into account all that is fundamental in the occurrence of a change in gases.

We are accustomed to talk glibly of oxygen combining with hydrogen to form water; but this is, of necessity, an imperfect, if not altogether misleading, statement of the actual course of events in a change which involves the formation of a molecule represented by the symbol  $H_2O$  from molecules such as those of hydrogen and oxygen, which are pictured to be by the symbols  $H_2$  and  $O_2$ .

The phenomena are undoubtedly electrolytic in character; indeed, no other interpretation can well be given. H. B. Baker's supremely important observation that a wet mixture, in equivalent quantities, of hydrogen and oxygen (so-called electrolytic gas) is inexplosive when it is taken to exclude acid impurity or such as may be present from soft glass, (7)

It is commonly stated that water is the sole product of the fact that hydrogen peroxide is a constant end-product of the interaction is too often overlooked.

There seems to be little doubt that, as Trautmann argued, (8) hydrogen peroxide is never formed at low temperatures excepting as a product of the direct recombination of the oxygen molecule. It is not formed under conditions by oxidation of water, the interaction



not being reversible to any appreciable extent



natures, as it is one which involves an endothermic of considerable magnitude. At high temperature, however, it unquestionably is reversible; therefore reversibility must be entertained that hydrogen peroxide is a secondary and not a direct primary product of interaction of hydrogen and oxygen. The probability that such is the case is not great, however, if the hydrogen is involved in the formation of water—if chemical changes generally—be regarded as electrolytic in character; and there would seem to be no other point open to us, since it is established that such changes take place when the conditions are those which give rise to the formation of a voltaic couple. Electrolytic interchange can only take place in an electrolyte; therefore, conducting water, not water, is essential to the occurrence of the change and some between the hydrogen and the oxygen, which must respectively be subject to attack—the one by the positive ion, the other by its positive ion. According to the law, hydrogen peroxide cannot be otherwise than a product of the primary change. The importance of these deductions will be apparent later on. To arrive at a final conclusion as to the true inwardness of the matter, it is necessary to consider fully the nature of the electrolytic change, although this may involve a somewhat lengthy digression from the main topic of discussion.

#### Nature of Electrolytic Changes.

Under this heading all changes may be included which involve the passage of a current—both those induced by the passage of a current derived from outside sources and those which involve the production of an electric current. Cases of electrolytic change may be distinguished: the first, that in which the ions of the electrolyte are discharged at and escape from the electrodes, these being called the "electrodes"; the second, that in which one or other ion of the electrolyte is discharged at the electrodes; the third, that in which both ions of the electrolyte are discharged at the electrodes. The second may be said to be of unipolar, the third one of bipolar depolarisation. Cases of chemical interchange may be reckoned either as cases of unipolar depolarisation or as cases of bipolar depolarisation; but it is doubtful whether even the electrolysis comes under case one, whether there be such a thing as a chemically inert electrode. In all cases, metallic and carbon electrodes, in some form of "chemical" attraction upon the electrolyte—it may well be this circumstance which gives them special value.\* Those who have followed Sir James Dewar's wonderful experiments with liquid air at low temperatures must have been profoundly impressed by the attractive powers of this substance. (9) However, although the simplest conceivable case of electrolysis is apparently one in which a diatomic electrolyte is merely resolved into its ions A and B and these are discharged at and escape from the electrodes, such a case has no real existence; even the electrolysis of hydrogen chloride does not come within it, as the effective electrolyte must be supposed to be of greater complexity than is represented to be by the conventional formula.

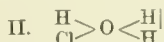
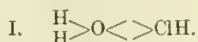
For the matter of convenience, electrolytic conductors may be divided into simple and composite electrolytes—the former class comprising those which are conductors of electricity (autolytes) (comp. Bousfield, W. R. and Lowry, Phil. Trans. R. Soc., 1904, 204, 256) and the latter class comprising those which act as conductors when associated with one another. But although a division is desirable—for purposes of classification and for distinguishing those which will co-operate with their partners from those in which the co-operation is between the electrolyte and the solvent (e.g., acids with water)—it is not improbable that, in the process of electrolysis, the electrolyte is essentially similar to the solvent in all classes: the molecule of a simple electrolyte probably co-operates with another similar molecule much as the (heterolyte) molecules of solute and solvent co-operate in the case of composite electrolytes.

The influence of surfaces is not dealt with in this essay, a subject which has in no way received the attention it deserves: the extent to which they affect the rate, if not the nature, of gaseous interchanges has yet to be appreciated: there is little doubt that, in not a few cases, the changes supposed to take place in gases are in reality surface phenomena.

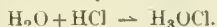
At bottom, the action of a solvent cannot well be otherwise than a chemical process in which both solvent and solute at all periods mutually affect each other. Generations of chemists have held this view and it is now again coming to the fore, if it be not already tacitly admitted by all (comp. Walden, *Deut. chem. Ges. Ber.* 1905, 38, 345—409). But the original upholders of the ionic dissociation dogma have never yet had the courage to confess that, since the fundamental premises of their hypothesis that the solvent is inoperative except mechanically can no longer be sustained, the hypothesis is practically a dead letter.†

Any consideration of the nature of the process of solution must involve the discussion of that most difficult of all problems, the problem of valency, including that of its attribute residual affinity, an attribute ever present in the mind of the chemist but only recently recognised by the physicist under the guise of specific inductive capacity.

Of late years, precision has been given to our ideas by work such as that done by Pope on asymmetric sulphur and nitrogen compounds and by Collie and Tickle and others on oxonium salts. Although it is not proved that sulphur can act as a tetrad in the same sense that it acts as a dyad or that nitrogen can act as a pentad in the same sense that it acts as a triad, we cannot do otherwise than grant that radicals from the added compound become separately combined with the sulphur and nitrogen in the formation of sulphonium and ammonium compounds. Whether this be true of the oxonium compounds is open to question; at present there is no evidence which compels us to assert that such is the case. To take a concrete example, it is to be supposed that when hydrogen chloride dissolves in water, a compound of the two molecules is formed. Assuming that a molecule of each is concerned, the compound may be represented in two ways—



For the purposes of the present argument, it matters little whether the one or the other formula be adopted. Such molecules would be in a state of unstable equilibrium: in consequence of the association of the chlorine with the oxygen, these elements would have less hold upon the hydrogen than they had when they enjoyed its possession undisturbed, so that the chlorine, if not the oxygen, would be more attractive of other elements. What is termed ionisation may be regarded as a consequence of the formation of such complexes; in the case of a compound like hydrogen chloride, which is said to be almost completely "ionised" in solution, action may be supposed to take place almost entirely in the forward direction.

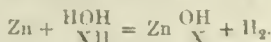


But "ionisation," on this hypothesis, is a state of readiness to travel—not a state of actual travel; and co-efficients of ionisation are co-efficients of potential activity not of suicidal mortality.

It remains to consider the part which such complexes (composite electrolytes) may be assumed to play in chemical interchanges. As special attention has been drawn by Traube (8) to the formation of hydrogen peroxide from zinc, water and oxygen, it will be desirable to discuss the behaviour of this metal towards "water" and acids

† Fortunately, there are signs that the strange hypothesis that electrolytes are compounds gifted with suicidal mania is losing its popular hold and there is hope that ere long the dogma that the ions pursue a lonely existence in the watery wastes of solution will no longer be taught to confiding youth as gospel but will figure only as a convenient mathematical fiction: the conception being one which runs counter to the feeling which surely is innate in all of us—that nature governs by attraction and affection—and which forbids us to believe that she revels in disruption. It is of no slight importance to the progress of our science that we recover sanity of judgment and become chemists once more, especially that we again seek to develop the technique which distinguished the older workers. Highly as we must value the aid which mathematicians and physicists have rendered of late years in extending our methods of inquiry, it is none the less a mistake to allow those to legislate for us who have but a distant acquaintance with our subject matter and who necessarily, therefore, lack that fine sense of sympathy and instinct which only intimate knowledge bred of constant intercourse can give.

first. By hypothesis, zinc cannot act on water pure and simple: some "impurity" must be present to condition change; ordinarily the interaction may be pictured as taking place in the following manner between the metal coupled with an electronegative conductor and water in presence of a minute amount of acid impurity (HX):

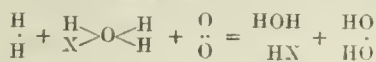


Directly or indirectly, the zinc hydroxy-salt thus produced is converted by the action of water into zinc hydroxide and the acid HX. The cycle is then repeated, so that gradually the zinc is more and more attacked, although, owing to the very high resistance of the electrolyte, action proceeds very slowly. As the amount of acid present is increased, there is more and more opportunity for change to occur and action proceeds far more rapidly; moreover, the hydroxy-salt is then converted into the salt of the acid used. In early days, the formation of the salt was explained by assuming that the metal was oxidised at the expense of water and that the oxide so produced combined with what is now spoken of as the acid-forming oxide or anhydride, which formerly figured as the acid; latterly it has been assumed that the metal displaces the hydrogen of the acid. The view stated above may be said to be a compromise between these two explanations and to include both.

As zinc has a heat of oxidation higher than that of hydrogen, there is no reason to suppose that oxygen intervenes—as it must in the case of a metal such as copper, for example, if dissolution take place. The formation of hydrogen peroxide from zinc and "water" is therefore to be ascribed to a secondary change—to oxygen depolarisation at the negative conductor.

Although Traube found that but little hydrogen peroxide was to be detected when "water" alone acted on zinc, by substituting lime water for water, he was successful in obtaining an amount almost corresponding to that indicated by the equation  $\text{Zn} + \text{OH}_2 + \text{O}_2 = \text{ZnO} + \text{H}_2\text{O}_2$ , conditions being then secured which made the survival of the peroxide possible. (8) It may be pointed out that when a metal such as zinc is dissolved in presence of oxygen the amount of peroxide formed must depend entirely on the extent to which the negative conductor becomes coated or plated with oxygen: slow dissolution and constant agitation must therefore promote its formation; when action is rapid and hydrogen is evolved in considerable quantity, the presence of oxygen at the negative electrode surface is practically precluded. On the other hand, it is to be supposed that the formation of hydrogen peroxide is a necessary part of the change in those cases in which the oxidisable substance has a heat of oxidation below that of hydrogen; there can be no output of energy unless it be formed.

To apply what has been said to the formation of water. The oxidation of hydrogen may be regarded as typical of all those cases in which no change can take place unless there be oxygen depolarisation. The manner in which it may be supposed to take place is shown in the equation:



In so far as it escapes decomposition by heat, it may be supposed that the hydrogen peroxide which is formed initially—by direct reduction of the oxygen molecule—itself acts as depolariser; so that eventually the whole oxygen molecule is effective, although its utilisation takes place in two stages.

Thus represented, the formation of water by combustion of hydrogen is obviously a process of *hydroxylation*. Probably this is true of all oxidations; as will be apparent later on, there is the clearest evidence in the case of the hydrocarbons that hydroxy-derivatives are first produced.

The strongest argument, perhaps, in favour of the view here put forward is that afforded by H. B. Dixon's remarkable observations on the influence of excess of hydrogen and of excess of oxygen on the rate of propagation of the explosive wave. (10) His results are embodied in

the following table; [they are, in part, expressed graphically in Fig. 1. It will be seen that while excess of hydrogen promotes combustion, excess of oxygen retards the rate of change; a somewhat paradoxical result at first sight.

TABLE I.

4H <sub>2</sub> : 1O <sub>2</sub>	3532	H <sub>2</sub> : 1O <sub>2</sub> + 1N <sub>2</sub>	2121
3H <sub>2</sub> : 1O <sub>2</sub>	3527	H <sub>2</sub> : 1O <sub>2</sub> + 1½N <sub>2</sub>	2051
2H <sub>2</sub> : 1O <sub>2</sub>	3268	H <sub>2</sub> : 1O <sub>2</sub> + 2N <sub>2</sub>	1821
H <sub>2</sub> : 1O <sub>2</sub>	2821		
H <sub>2</sub> : O <sub>2</sub>	2381		
H <sub>2</sub> : 2O <sub>2</sub>	1927		
H <sub>2</sub> : 3O <sub>2</sub>	1707		
H <sub>2</sub> : 4O <sub>2</sub>	1281		

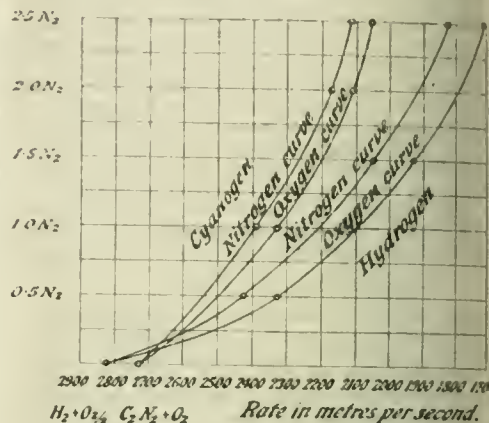


FIG. 1.

But this influence of oxygen meets with an explanation when it is borne in mind that whereas the stability of molecules of water, of hydrogen and of oxygen diminishes as temperature rises, the stability of hydrogen peroxide increases, being at a maximum at some relatively elevated temperature which has not yet been determined. There can be no doubt, in fact, that water is difficult to oxidise at high temperatures; consequently, oxygen and water hold one another in check; each either must tend to retard combustion. Excess of hydrogen on the other hand, should promote combustion, because it is present in more than the equivalent proportion and because it diminishes the proportion of hydrogen peroxide by promoting its dissociation. (11)

All that has been said above is simply expressed in the following diagram representing the interchanges as reversible.

#### Combustion of Hydrocarbons.

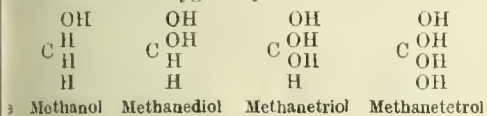
It is necessary to discuss the combustion of hydrocarbons next to that of hydrogen, before considering the combustion of carbon monoxide and of carbon, as the interpretation of the behaviour of these latter is only possible when the behaviour of the former is understood.

Of late years, much has been said as to which is the more combustible constituent of hydrocarbons, hydrogen or the carbon. Faraday, in discussing the chemistry of the candle flame, told his young hearers that the forces which hold the two elements together are so nicely balanced that the hydrogen is made to combine first, the carbon afterwards; and in view of the tenacity of hydrocarbon flames to smoke, such a conclusion would well seem to be natural if not necessary. But, as I pointed out (10, p. 160), the fact that hydrogen is separated when hydrocarbons are exploded with insufficient oxygen led Karsten, in 1861, to formulate the conclusion before any portion of hydrogen is burnt all the carbon is burnt to carbonic oxide and that then the oxygen divides itself between the carbonic oxide and hydrogen. Thirty years later, Smithells became a strenuous advocate of this doctrine, going so far as to say (12) that "The view that carbon is separated from hydrocarbons by the preferential combination of oxygen with hydrogen is opposed, the author thinks, to all experimental evidence."

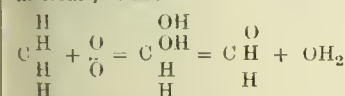


vidence, which he is of opinion goes to show f the oxygen supply be limited, carbon will burn hydrogen." In a correspondence which passed n Sir G. Stokes and myself early in 1892, I ed to demur to such an interpretation; at the sion of my letter, I said: (13).  
garding the interactions in flames as consisting eries of simultaneous and consecutive explosions, ich we can only examine the final steady state, it to me that the phenomena are necessarily of n vely complex character and that their appreciation ecessful interpretation must tax our powers of nalysis in a very high degree. It will certainly ise at present to infer that either the oxidation ydrocarbons or the separation of carbon and also rogen from them takes place entirely in any one

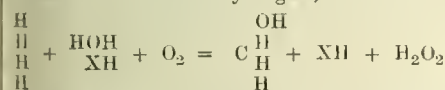
interpretation was somewhat scoffed at by a onist in the discussion; but time has brought enge. The recent work of Dr. Bone and his es has, I think, entirely justified my conservative e. In the course of a brilliant series of investi- s on the incomplete combustion of hydrocarbons e temperatures, these chemists have shown that i is gradually introduced into the hydrocarbon o precisely as it is when wet oxidising agents are so that, in principle, there is no distinction to be e between slow combustion and high temperature ve combustion. From the outset I was inclined o the view which I was the first to express in a o form, I believe, as far back as 1874, in my "Intro- i to the Study of Organic Chemistry" (Longman's), n reality, oxidation is always a process of ylation (14) which takes place under the conjoint ee of water and oxygen, e.g. :—



their earlier experiments, Bone and Wheeler d in obtaining evidence only of the production aldehyde:  $\text{CH}_2\text{O} = \text{CH}_2(\text{OH})_2 - \text{OH}_2$ . Therefore, it ssible to represent the interaction as one in which ygen molecule, as it were, slipped into the hydro- molecule, thus :—

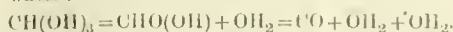


sequently when it was found that ethane may be d to ethylic alcohol, all doubt was removed as to lidity of my argument that the interaction is a i in every way comparable with that involved in mation of water from hydrogen; thus :—

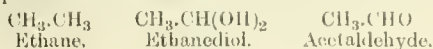


ng that the process is one involving hydroxylation, d seem that the hydrogen of the hydrocarbon is tacked. But if mere appearances be not allowed eive, looking below the surface, we may, I think, ulate the prior attachment of oxygen both to the f the hydrocarbon and to the oxygen of water; and range as only taking place within complex systems nstituted. If so, both parties to the discussion ell consider that they carry their arms honourably ction—both had faint glimmerings of the truth. n Bone and Wheeler's observations became , at once the scales fell from our eyes: it was clear e formation of carbon monoxide and of hydrogen h previous observers had regarded as proof of the r affinity of carbon for oxygen (15)—was due to the position by heat of primary educts; that, in fact, ere *thermoschists*, not direct products of oxidation. n diol giving rise first to formaldehyde and then on monoxide and hydrogen :—

$\text{CH}_2(\text{OH})_2 = \text{CH}_2\text{O} + \text{OH}_2 = \text{CO} + \text{H}_2 + \text{OH}_2$ ;  
methanetriol to formic acid and then to carbon monoxide and water :—



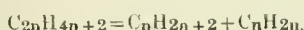
Proceeding a stage higher in the paraffin series, the behaviour of ethane is at first similar to that of methane. Owing to the fact that ethylic alcohol is more readily oxidised than ethane, the action cannot well be arrested at the first stage. But Bone and Stockings have had no difficulty in showing that acetaldehyde is produced; the relation of this compound to ethanediol is, of course, of the simplest :—



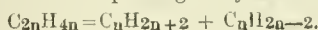
As combustion proceeds, the acetaldehyde is in part resolved into the simple *thermoschists*, methane and carbon monoxide; in part, it is further oxidised, probably to glycolic aldehyde,  $\text{CH}_2(\text{OH}) \cdot \text{COH}$ , which then breaks down into formaldehyde. At an early stage, therefore, the ethane is resolved into derivatives of methane.

The behaviour of more complex hydrocarbons than ethane, whether of the paraffin or other series—of hydrocarbons generally, in fact—is doubtless similar to that of ethane. But, judging from observations such as those made by Thorpe and Young on the decomposition of paraffin wax by distillation under pressure and by Miller and myself on the products of the manufacture of oil gas, (16), there is little doubt that, as a rule, when combustion is once started, the more complex hydrocarbons are resolved in the wave front into simple hydrocarbon molecules prior to oxidation; in the case of benzenoid hydrocarbons, such thermal decompositions probably only set in when oxidation has taken place to some extent.

The intolerable alliaceous stench emitted by the oil motor of to-day is undoubtedly traceable in part, if not entirely, to the presence of such "cracked" hydrocarbons in the escaping gas; the odour being that characteristic of "oil gas," which is well-known to be largely due to certain unsaturated hydrocarbons of the  $\text{C}_n\text{H}_{2n-2}$  or acetylene series. It would seem to be the rule that, when heated, all paraffins are more or less readily resolved into a paraffin containing half the number of carbon atoms present in the original hydrocarbon and the corresponding olefine:

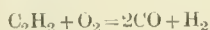


The olefines, in like manner, are converted into a lower paraffin and the corresponding acetylene:

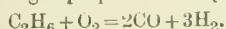


Carbon is separated when this process is carried to the bitter end. It should be noted, however, that this separation is not a simple process of decomposition but one involving the formation of an exceptionally complex molecule ( $\text{C}_n$ ) from its simple components.

It was argued originally that the carbon in hydrocarbons must be supposed to undergo combustion in preference to the hydrogen, because when either acetylene or ethylene is exploded with its own volume of oxygen only carbon monoxide and hydrogen are produced, no carbon being deposited:

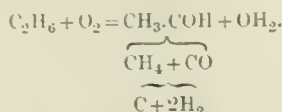


From this point of view, ethane should also give carbon monoxide and a larger proportion of hydrogen:

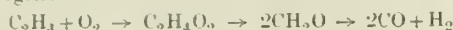


Dr. Bone has been good enough to inform me that such is not the case but that when the mixture of ethane and oxygen is exploded in a sealed glass bulb a lurid flame fills the bulb; in fact, much carbon separates, the volume increasing only to slightly less than two and a half times that of the original mixture. This result is complete disproof of the hypothesis that the carbon burns preferentially, especially when the character of the products is considered. But very little carbon dioxide (about 4 per cent.) is formed: the chief gaseous products are carbon monoxide (about 35.5 per cent.) and hydrogen

(45—49 per cent.); there are present besides these, however, not only ethylene and acetylene (3—4 per cent.) but also a not inconsiderable proportion of methane (10—11 per cent.). Dr. Bone tells me that about 15 per cent. of the carbon of the ethane was separated as such during the explosion, about 25 per cent. of the hydrogen appearing as steam. On washing out the tubes with water, after the explosion, a solution was obtained in which aldehyde was easily detected. These results are readily understood if it be supposed that the ethane is first converted into acetaldehyde, which then decomposes into carbon monoxide and methane; and that, in turn, this latter is partially resolved into carbon and hydrogen:



When a mixture of equal volumes of ethylene and oxygen is exploded, neither does carbon separate nor is steam formed; the end products are simply carbon monoxide and hydrogen:



Dr. Bone has made experiments on the thermal decomposition of acetaldehyde and formaldehyde which have afforded results entirely confirmatory of these arguments.

If acetylene be oxidised in contact with its own volume of oxygen, it affords both carbon monoxide and formaldehyde when the combination is effected below the ignition point; but above the ignition point, only carbon monoxide and hydrogen are obtained. The separation of carbon when it is burnt in the air must be regarded as due to its decomposition by heat—not to the preferential combustion of the hydrogen. There can be little doubt, in fact, that Davy expressed a correct opinion in saying, in 1818, that—

"Flame must be considered as the combustion of an explosive mixture of inflammable gas or vapour and air, for it cannot be regarded as a mere combustion at the surface of contact of the inflammable matter..."

#### Combustion of Carbon Monoxide.

Of all known combustibles, carbon monoxide is apparently the most paradoxical in its behaviour; it is the most thirsty among gases, the explosive wave travelling at the maximum rate in a moist mixture of carbon monoxide and oxygen only when a large proportion of water is present. The influence of water is fully displayed in the following table and in Fig. 2.

TABLE 2.

Condition.	Per Cent. of Steam Present.	Mean Rate in Metres per Second.
Well dried .....	—	1,264
Dried .....	—	1,305
Saturated at 10° C. ....	1.2	1,676
" 20° C. ....	2.3	1,703
" 28° C. ....	3.7	1,713
" 35° C. ....	5.6	1,738
" 45° C. ....	9.5	1,693
" 55° C. ....	15.6	1,666
" 65° C. ....	24.9	1,526
" 75° C. ....	38.4	1,266

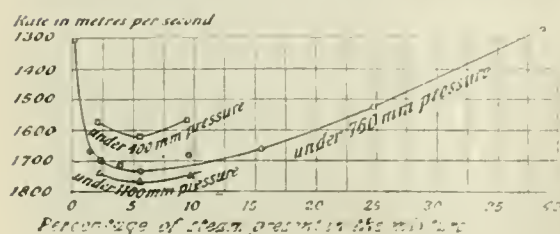
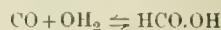


Fig. 2.

It is noteworthy that the addition of steam to dry gaseous mixtures does not increase but some diminishes the rate of explosion.

If the explanation that has been given of the manner in which methane undergoes combustion be accepted from being exceptional, this behaviour of carbon monoxide is precisely that which is to be expected. Granting carbon monoxide is not a direct produce of combustion but a mere thermosehist formed by the resolution of primary products such as methanediol and methane, its oxidation must be preceded by its reconversion to formic acid:



Since this change occurs only to a relatively small extent owing to the instability of formic acid at high temperature it must take place up to a certain point with increasing readiness as the proportion of water is increased—steam may be added, if the pressure be increased, as high pressure will promote the formation of formic acid and also favour its persistence. The constant appearance of carbon monoxide in relatively large amount among the products of incomplete combustion is readily explicable from this point of view, especially in cases in which little or no steam is present—as, for example, on exploding a mixture of cyanogen and oxygen. (17)

The results obtained on exploding cyanogen, methane and ethylene with various proportions of oxygen and nitrogen are given in Tables 3, 4 and 5 and in Figs. 1 and 3.

TABLE 3.

$\text{C}_2\text{N}_2 : \text{O}_2$	2728	$\text{C}_2\text{N}_2 : \text{O}_2 + \text{N}_2$	2398
$\text{C}_2\text{N}_2 : 2\text{O}_2$	2321	$\text{C}_2\text{N}_2 : \text{O}_2 + 2\text{N}_2$	2166
$\text{C}_2\text{N}_2 : 3\text{O}_2$	2110		

TABLE 4.

$\text{CH}_4 : \text{O}_2$	2528	$\text{CH}_4 : 1\frac{1}{2}\text{O}_2 + \frac{1}{2}\text{N}_2$	23
$\text{CH}_4 : 1\frac{1}{2}\text{O}_2$	2470	$\text{CH}_4 : 1\frac{1}{2}\text{O}_2 + 1\frac{1}{2}\text{N}_2$	21
$\text{CH}_4 : 2\text{O}_2$	2322	$\text{CH}_4 : 1\frac{1}{2}\text{O}_2 + 2\frac{1}{2}\text{N}_2$	18
$\text{CH}_4 : 3\text{O}_2$	2146		
$\text{CH}_4 : 4\text{O}_2$	1963		

TABLE 5.

$\text{C}_2\text{H}_4 : \text{O}_2$	2507	$\text{C}_2\text{H}_4 : 2\text{O}_2 + \text{N}_2$	2413
$\text{C}_2\text{H}_4 : 2\text{O}_2$	2581	$\text{C}_2\text{H}_4 : 2\text{O}_2 + 2\text{N}_2$	2211
$\text{C}_2\text{H}_4 : 3\text{O}_2$	2368	$\text{C}_2\text{H}_4 : 2\text{O}_2 + 4\text{N}_2$	2024
$\text{C}_2\text{H}_4 : 4\text{O}_2$	2247	$\text{C}_2\text{H}_4 : 2\text{O}_2 + 6\text{N}_2$	1878
$\text{C}_2\text{H}_4 : 6\text{O}_2$	2118	$\text{C}_2\text{H}_4 : 2\text{O}_2 + 8\text{N}_2$	1734
$\text{C}_2\text{H}_4 : 8\text{O}_2$	1980		
$\text{C}_2\text{H}_4 : 10\text{O}_2$	1856		

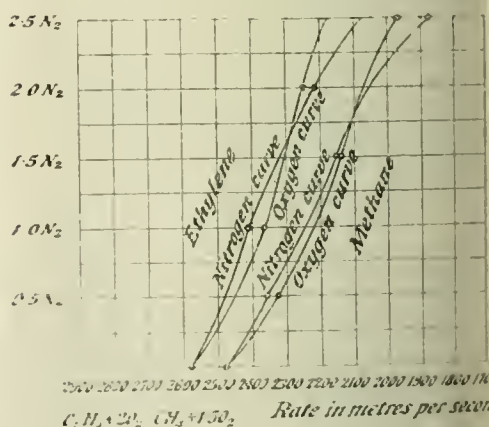


Fig. 3.

#### Combustion of Carbon.

Carbon, it must be remembered, is misrepresented by the symbol C. Actually, expressions such as  $\text{C}_x$ , etc., in which x and y are high unknown values, should be used for its varied forms. Each element in the carbon complexes may be thought of as undergoing oxidation separately (14) in a circuit comprising the composite electrolyte and oxygen; the an



which is eventually obtained may be regarded as a product of later changes. At this point of view, the readiness with which and extent to which the dioxide is formed on burning must depend on the amount of water present. The following results obtained by H. B. Baker, in 1885, in a series of comparative experiments in which carbon was heated both in moist and in dried oxygen (\*) are of interest from this point of view:—

Wet.	Dried. 1 week.	Wet.	Dried. 2 weeks.	Wet.	Dried. 4 weeks.	Wet.	Dried. 8 weeks.	Wet.	Dried. 12 weeks.	Wet.	Dried. 16 weeks.
50.1	15.4	51.0	19.0	45.3	14.1	23.3	12.5	58.8	15.8	52.4	17.8
22.2	20.6	31.2	14.8	32.5	27.8	60.0	27.5	23.2	24.2	25.2	16.5
—	41.3	—	46.1	—	28.2	—	39.0	—	33.3	—	45.0
27.6	22.6	17.7	20.0	22.1	29.8	16.6	21.0	17.9	26.6	22.3	20.6

The only definite evidence at present available as to the nature of the carbon complex, to which reference is made above, is that afforded by the production of mellitic or benzenehexacarboxylic acid,  $C_6(COOH)_6$ , on the oxidation of charcoal. (18) The formation of such an acid may be regarded as proof of the existence in the carbon molecule of at least one  $C_6$  benzene (phenyl) nucleus. In the mind the marked tendency of carbon atoms to become grouped in sixes—revealed in the formation of benzene and benzenoid hydrocarbons at high temperatures—also be postulated as probable that the carboxylic groups in the mellitic acid are severally formed by the breaking down of  $C_6$  groups in the charcoal, much in the same way that phthalic or benzenedicarboxylic acid is formed from naphthalene or diphenyl.



assuming that a tetraphene complex is fundamental to the carbon molecule, to account for the absence of oxygen it must be further supposed that at least two systems are superposed or united; on such an assumption, the molecule of amorphous carbon would contain at least 36 atoms. When benzenoid hydrocarbons undergo combustion, apparently the complex breaks down into simpler molecules, at an early stage, when oxidation takes place only partially—as in the case of the paraffins, etc.; it is at least probable that similar modifications set in when the complex carbon molecule is oxidised. It is obvious that all such conclusions are based on speculations—nevertheless they rest on a substantial basis of fact.

#### Retardation of Combustion by Oxygen.

In discussing the combustion of hydrogen, it has already been pointed out that oxygen, when used in excess, is more effective than any other diluent in retarding the combustion. Dixon has shown that it is an active diluent in other cases of explosive combustion; and similar observations have been made by Bone and his fellow-workers in the course of their experiments on low temperature combustion. Dixon's values for cyanogen, methane, ethylene are given in tables 3 to 5. It will be seen that the damping effect of nitrogen but very slightly exceeds that of oxygen in the case of the hydrocarbons.

The different influence exercised by oxygen when water is present in excess is well brought out on contrasting the curves representing the behaviour of carbon monoxide and of cyanogen (Fig. 1) with those representing that of the hydrocarbons (Fig. 3): in the latter the influence rises to a maximum and then falls

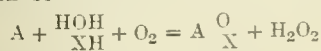
In the case of gases such as carbon monoxide and cyanogen, it is not difficult to understand that oxygen should exercise such a damping effect, if, as suggested, it enters into combination with water at high temperatures to form hydrogen peroxide, thus withdrawing water from the sphere of action. But in the case of hydrogen and hydrocarbons such an explanation is scarcely sufficient, as the amount of water present from the moment that these gases begin to undergo combustion must be far in excess of the amount requisite to secure the maximum rate of change; in such cases oxygen must itself be held back by combination with water. But this explanation that oxygen may be held back in the form of hydrogen peroxide by water involves the important conclusion that oxygen itself,

not hydrogen peroxide, is the effective depolariser in combustions—in other words, that hydrogen peroxide does not operate, at all events to any great extent, as depolariser in changes at high temperatures. Surprising as this conclusion may appear to be at first sight, it is less so when it is borne in mind that whilst the stability of the oxygen molecule diminishes, the affinity of water for oxygen—and, therefore, the stability of hydrogen peroxide—is at a maximum at high temperatures. When electrolytic gas is mixed either with oxygen or with nitrogen or with steam, oxygen has most effect and steam least in retarding combustion; it is not surprising that this should be the case, as steam is the one substance which increases as combustion proceeds and is the least likely, therefore, to influence the process.

#### Autoxidation—The formation of peroxides and of ozone.

As already pointed out, the inquiry into the mechanics of fire cannot well be regarded as otherwise than co-extensive with that into oxidation phenomena generally. It will therefore be desirable to indicate briefly the bearing of the main argument put forward in this communication on the interpretation of the class of phenomena termed autoxidations, in which change takes place automatically under the influence of ordinary molecular oxygen. It is recognised that a peroxide is always produced, although its existence may be ephemeral. Engler and Weissberg, who have fully discussed the subject in their monograph, "Kritische Studien über die Vorgänge der Autoxydation" (Vieweg und Sohn, Braunschweig, 1904), contend, however, that two kinds of autoxidation are to be distinguished: in the one, molecular oxygen unites with hydrogen, forming hydrogen peroxide, as in the case of the oxidation of zinc; in the other, the autoxidisable substance is directly peroxidised, hydrogen peroxide being formed from the peroxide by a secondary process—by the action of water. The oxidation of turpentine is supposed to be a case of this latter kind.

It may be pointed out that there is no need at present to assume that oxygen ever acts otherwise than as molecular oxygen; not the slightest proof has yet been given that even so-called nascent oxygen is atomic or ionic oxygen—that it is other than oxygen in actual circuit with the oxidisable material. If it be granted that an electrolyte intervenes in all cases of chemical change, the direct oxidation of any substance becomes an impossibility. Therefore, when conducting water is the electrolyte, molecular oxygen,  $O_2$ , must in all cases give rise primarily to hydrogen peroxide, if the general equation of oxidation be—



It will be said that in several of the cases studied, water was not present. I venture to think, however,

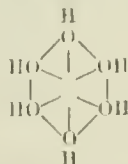
that the precautions which have been taken hitherto to preclude water have not been such as to make this a satisfactory answer; indeed, I am persuaded that oxidation will not take place in any case if water be excluded. This conclusion is one from which, so far as I can see, there is no escape.

While discussing this question, it is desirable to consider the manner in which peroxidation of water and of oxygen takes place in ordinary cases of electrolysis. Solutions of sulphuric acid of different strength, it is well known, afford very different proportions of oxygen, the departure from the "normal" volume being greater the more concentrated the acid and the smaller the electrode surface relatively to the current used, the diminution arising from the production of ozone and persulphuric acids. Apparently peroxide of hydrogen is never present except after an interval; it is supposed to be formed by the action of water on persulphuric acid.

But it must be confessed that on all such points our knowledge is of the vaguest; what commonly passes for fact is purest assertion. It is usually stated that the ions in a solution of sulphuric acid are  $H^+$  and  $HSO_4^-$ —water is supposed to remain practically neutral and unchanged. But there is not the slightest foundation of fact for such a view; it may well be that both the acid ( $HX$ ) and water molecules are simultaneously laid under contribution in electrolysis: that while both present hydrogen atoms to the negative electrode, the one furnishes  $OH$  and the other the radicle  $X$  to the positive electrode; the fate of these may be different according to the concentration, as  $X$  itself varies in character with the concentration, being in some cases derived from a more or less hydrated form of sulphuric acid ( $H_2SO_4$ ), in others from more or less sulphated molecules ( $H_2SO_4 \cdot SO_3$ ).

It is conceivable that the  $OH$  and  $X$  groups associate as they arise; or it may be that the  $OH$  groups and the  $X$  groups associate separately forming  $H_2O_2$  and  $X_2$ ; and that in dilute solutions especially  $X$  acts upon water, forming the acid and hydrogen peroxide. At present, we cannot determine the extent to which these various possibilities are realised in practice.

The oxygen which is evolved during electrolysis appears to be formed by the decomposition of the "peroxides" under the influence of the electrode surface at which they are initially produced. Inasmuch as ozone is produced chiefly when acids of medium strength are electrolysed, but little being formed when the acid has a density exceeding about 1.4 grams. per c.c. (20), it is conceivable that it is formed from hydrogen peroxide rather than from persulphuric acid. This explanation derives some probability from the fact that ozone is produced in considerable quantity when carbon is burnt under liquid oxygen (Dewar), in which case hydrogen peroxide would necessarily be an immediate product of the combustion. It may even be suggested that it is conceivable, as oxygen sometimes behaves as a tetrad element, that an oxygen-benzene may be formed which breaks up into ozone and water—



The formation of ozone during the oxidation of phosphorus may, in like manner, be regarded as dependent on the prior formation of  $O_3H_2$  rather than, as suggested by Ostwald, of a higher oxide of phosphorus.

It may also be suggested that the luminous glow which is often seen in cases of slow combustion (21) is to be connected with the formation and breakdown of ozone.

It is not improbable that in cases in which ozone acts as depolariser, i.e., as an oxidising agent, the hydride  $H_2O_2$  is first produced as an ephemeral product and that the "ozonides" are formed from this in the same way that peroxides are formed from  $H_2O_2$ .

In this sketching the inwardness of the phenomena of oxidation, I have dealt only with the *leit-motiv*. To

do more would be but to complicate the consideration of the primary problems. I have made a confession of faith, more definite than any that has been published elsewhere, I believe, yet essentially identical in principle with views put forward twenty years ago, and trust that my exomologesis may be of use and not without interest, as showing that the appreciation and sincere interpretation of the phenomena of fire are well within our powers of mental analysis.

Fire has wondrous attributes even in ordinary but in the eyes of the philosopher it borders on the fabulous: indeed the dull equation of the chemist,  $CH_4 = CO_2 + 2H_2O$ , does but poor justice to an explosive fire-damp, depriving it, as it does, of all the poetry of the picture before us should be one of marvellous and infinite variety: of hurrying myriads of molecules constantly interchanging partners at rates bordering on the inconceivable; of a chaos of ordered revolt. Chemistry would have less stupidity to help it if notice could be taken of these things: and it behooves us to remember that the faculty of imagination is the corner stone of progress even in industry.

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## DISCUSSION.

H. BRERETON BAKER said he was carrying out experiments on combustion in order to determine moisture had such an important influence—why substances would not burn if they were dry. He it go quite so far as Dr. Armstrong in the matter or; he did not feel that he could admit that ionic ionation could be consigned to the limbo of lost ss. The possibility of the different polarities of oxygen, which Brodie imagined some 40 years ago, was present in his mind. The oxygen may be supposed to break up into two oxygen ions when an electrolyte is present. He went with Dr. Armstrong inasmuch as he agreed that the presence of an electrolyte was necessary for chemical action. If it were not for that theory, which he referred to over and over again, he was quite sure that fully half of his own work would not have been done. He tried some experiments about two years ago, if a very dry gas had a smaller volume than a gas by mere passage over phosphorus pentoxide. The degree of dryness would not stop chemical action, the gas were left in contact with the phosphorus for a few days, it made all the difference between going on and stopping. He tried to find out if there was any contraction when ordinary dry gas was made as dry as possible, and he had an apparatus so delicate that it would detect a contraction 1/1000th of the volume by direct measurement. He some six months' drying to see if any contraction took place. If there had been any contraction he would have considered it was proof of dissociation of moisture gas; he was disappointed when he found no contraction took place. But he did not conclude that disproved the ionic explanation at all, and an appointment came to an end in talking over the matter with Prof. Townsend, who told him there were 14 ions present in a litre. Some members would, he thought, remember how many billions of molecules were in a litre of oxygen, but, at all events, what he had to measure was, not one part in 7,000, but 14 in many billions, and it did not seem possible to measure it by direct measurement. The experiments he was now making were to ascertain if the presence of ions could be determined by an indirect method. If a gas was very dry, it did not allow an electric current to pass through it, and that looked like ionisation. He took three similar bits of glowing phosphorus, placed them in lead tubes, and over them a photographic plate was placed. He wanted to measure the amount of light emitted by these pieces of glowing phosphorus. One was charged positively from a large accumulator; the second was charged negatively, and the third was left uncharged. The phosphorus was just moist enough to make it a conductor. He left it about half an hour and developed the plates; under the positive tube he had a black mark; under the negative scarcely any; the third was about the mean of the other two. This was only one experiment, and many more would be required to confirm the observation. It seemed to him that the experiment, which of course required confirmation, would throw some light on the question as to whether ozone were really produced, the positive ions of oxygen being attracted to one side, and the negative ions to the other. There were very few positive ions combining with the phosphorus; what became of them? They were there when phosphorus glowed ozone was produced. He did not measure the ozone coming from a piece of phosphorus, but if the hypotheses were correct, he would find little ozone at the positive end, whilst much would be produced at the negative end.

F. DIVERS said that if it were always borne in mind, it should be, that molecular quantities are, according to the fundamental theory of chemistry, those proportions in which substances chemically interact, there would be no hesitation in admitting that the product of the union of oxygen with hydrogen must be hydrogen peroxide, the formation of water resulting from the union of hydrogen with its molecular equivalent of hydrogen. The valuable and beautiful experiments made by Dr. Bone

and his fellow-workers upon the oxidation of hydrocarbon gases, owed very much of their interest to the fact that they had served to demonstrate the apparently invincible error of regarding a chemical compound as a mixture of its elements. Thus, in the combustion of methane, there could not properly be asked the question, whether its carbon oxidises before or after its hydrogen, since there is neither carbon nor hydrogen present to be oxidised, but only the homogeneous substance, methane. He had had the opportunity of pressing this fact upon the attention of Dr. Bone, on the occasion of the reading of his first paper on the subject, and the evidence afforded by subsequent papers by Dr. Bone and his colleagues had been fully in accordance with it. Water and the oxides of carbon are products of the break-up of oxidised hydrocarbons, not products of the oxidation of hydrogen and carbon.

Mr. DAVID HOWARD said that, speaking from the point of view of a manufacturing chemist who used large quantities of fuel, the question was, where did all the calories go to? How was the tremendous loss to be set right? This could only be done by realising the great complexity and difficulty of so simple a thing as burning coal. It was by following up this question thoroughly and with the aid of modern methods of investigation, that economies in the consumption of fuel could be effected,

Dr. H. G. COLMAN congratulated Prof. Armstrong on the manner in which his suggestion of 20 years ago, that combustion always took place through hydroxylation had been confirmed by the results of Dr. Bone and his fellow workers. They were all agreed that so far as that portion of the work was concerned, the evidence was very strong, that the position maintained by Prof. Armstrong was correct. But he must say he did not feel quite convinced of the correctness of Prof. Armstrong's view as to mechanism of the reaction by which the oxygen was introduced between the carbon and the hydrogen. He felt, with Dr. Brereton Baker, that the evidence at present was not sufficient to convince them that that really took place in the manner suggested. At the same time, one could not advance without making hypotheses, and even if this did not prove in the end to be altogether correct, it would probably prove to contain at least a portion of the truth. With regard to the combustion of cyanogen and oxygen, he did not quite understand what explanation the author gave of the formation of CO from a mixture of cyanogen and oxygen, even where it was dried as far as possible. He rather gathered that he would say, that in reality this mixture was not absolutely dry, but only dried so far as their means enabled them, and still contained some moisture. Further, speaking of carbon, Prof. Armstrong said that many people attributed to it, without thinking, a much simpler constitution than it really possessed, whereas the carbon molecule had in reality a very complex constitution. He was inclined to go further, and doubt whether there was such a thing as elementary amorphous carbon; whether they had not really to deal, in the case of amorphous carbon, with a very condensed hydrocarbon, or rather a mixture of hydrocarbons, in which the number of atoms of carbon was so great and of hydrogen so small that practically the hydrogen was hardly detectable.

Dr. C. A. KOHN said that to anyone connected with the problem of oxidation, this discourse had been one of exceptional interest, and Dr. Armstrong had shown how much was left out, and how little was indicated, by the ordinary equations employed in expressing simple oxidations like that of hydrogen. The intermediate formation of hydrogen peroxide was proved by many simple experiments, and it was in connection with this initial change that Dr. Armstrong had put a new view before them, the necessity of an electrolytic medium. It was not very evident how far this intermediary helped one in following up the changes which were capable of being fairly well understood without it. In the case of hydrogen itself, there was perhaps less field for argument, but in that of autoxidation such an hypothesis did not appear to be called for as far as experimental work had gone at present. Where one was concerned with organic substances of the type of benzaldehyde, it had been shown

by Baeyer and Villiger that oxidation proceeded through the addition of molecular oxygen to the oxidised compound, from which benzoic acid subsequently resulted. He should like to ask Prof. Armstrong if, in these cases, he also introduced this intermediate electrolyte, namely, a small portion of hydrochloric acid in association with water. As regards the action of water itself, experimenters differed as to whether it was necessary to such oxidation or not; Jorissen and Nef came to opposite conclusions in the case of benzaldehyde. For his own part, he had experimented in this direction, and was not able to prepare any benzaldehyde which did not oxidise on exposure to dry air. It seemed undoubtedly that moisture was required for the oxidation, but whether it was necessary to introduce hydrochloric acid with the water was a point on which further evidence must be awaited.

Mr. R. J. FRISWELL said he was interested in the communication referred to by Prof. Armstrong from Dr. Bone, who stated that when he burnt certain hydrocarbons containing a relatively large amount of carbon, carbonic oxide, hydrogen and 15 per cent. of carbon were obtained.

Some years ago he investigated the manufacture of lamp black, or vegetable black, as it is termed, from the "green oil" obtained from gas works. Roughly there was in the hydrocarbon mentioned by Prof. Armstrong, as used by Dr. Bone, a body containing about 75 per cent. of carbon and 25 per cent. hydrogen. In these "green oils" the percentage of carbon was higher. The oils flowed in a small stream on to a plate and were burned with a limited amount of air. Curiously enough the percentage of carbon obtained from them was extremely close to the one mentioned by Dr. Bone as obtained in his accurate experiments; the carbon being from 15 to 17 per cent. of the total weight of oils burned. There was no doubt in his mind that there was among the other products of combustion carbon monoxide in considerable quantities.

Another point was the introduction of hydroxyl groups by oxidation at low temperatures, and in this connection he would refer them to some work he had published on the action of weak nitric acid on coal. By reducing the products so formed with zinc dust he was able to introduce a large number of hydroxyl groups into the coal. The coal had thus been made to revert towards the state in which it had previously existed as an imperfect or peat-like coal.

The question of the utilisation of fuel was, of course, one of enormous importance and immense complexity, and he felt sure a great stimulus would be given by the study of this question.

Prof. H. E. ARMSTRONG, in reply to Dr. Colman's question with reference to the combustion of cyanogen, said that in that case the drying could be carried very much further than it could be in the case of carbon monoxide without stopping the combustion; a very small amount of water would be sufficient, he thought, to initiate its conversion into carbon monoxide. In a paper communicated to the Chemical Society some months ago he had given a scheme indicating a way in which he thought the explosion of cyanogen might be explained. Dr. Kohn had referred to the way in which benzaldehyde and similar compounds underwent autoxidation. This was a rather complicated and difficult subject to discuss; but, stated briefly, his opinion was that in such cases they must imagine a mechanism very similar to that which he had suggested should be thought of as playing the active part in ordinary combustion phenomena. He did not think they could accept the idea that the organic peroxide was a primary product any more than they could accept the idea that the hydrogen peroxide was a primary product in cases of oxidation such as that of hydrogen and those he had discussed that evening. He was quite prepared to admit, however, that there was a good deal of room even now for difference of opinion. What he desired to urge was that there should be some clear idea before them of what might be supposed to happen, so that they should be able to discuss these matters at all events from a common platform.

The difficulty which others had in putting themselves into what he might call a rational position in considering such questions was very surprising; he did not know how it arose, and never could quite understand the hesitation. But it was evident that men who had worked much on the subject—Prof. Dixon and others—had greatest difficulty in seeing their way through explanation of the kind which he had offered. They seemed to be so thoroughly saturated with facts and so thoroughly got into the habit of reading their observations directly, instead of considering what might be behind them, that it was very difficult for them to suppose there was a complex machinery at work such as he pictured.

## Manchester Section.

Meeting held at Manchester, on Friday, April 7th, 1906.

MR. J. CARTER BELL IN THE CHAIR.

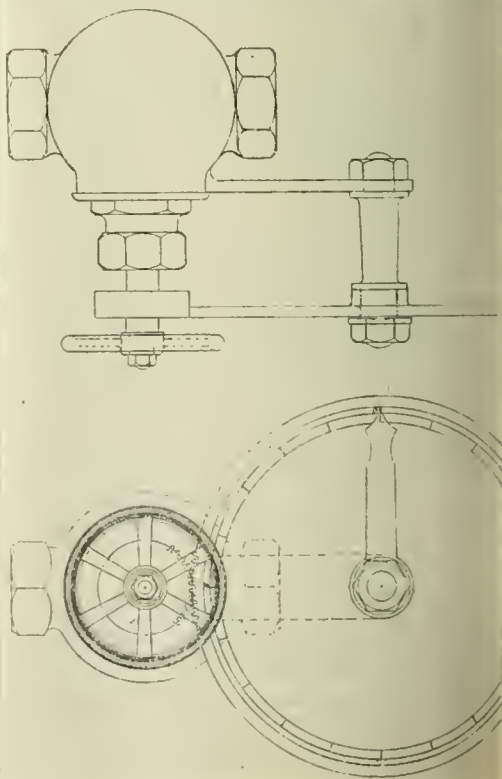
### A REGULATING VALVE FOR CONTROLLING THE ADMISSION OF STEAM TO VITRIOL CHAMBERS.

BY W. H. COLEMAN.

Everyone who has had to control the working of a set of vitriol chambers will agree that the proper regulation of the steam supply is of the utmost importance.

The average tower man, when questioned will frequently reply that he has put on or taken off "just a breath" or "a half" or "a quarter of a turn" of the valve. This answer leaves some doubt in one's mind as to exactly what has been done. In order to obviate this difficulty an attempt to gain a better method, and to try to obtain a means of knowing the history of the steam supply to a chamber during some time previous to any alteration the author has devised the valve shown, and he hopes that the matter is not too trifling to be worthy of your attention.

The valve, which is of the ordinary screw-down pattern,





toothed wheel formed on the spindle which engages another wheel of greater diameter working on a port attached to the body of the valve. The face of larger wheel has been divided and numbered. When valve is closed the pointer indicates the figure 0 on scale, and when fully opened it indicates for this circular valve 16.

Steam, after being reduced to any suitable pressure some type of reducing valve, is adjusted by means of indicating valve, and one can tell at a glance how it is open.

Board or slate is hung up by the side of the valve and power man writes down the time, steam pressure and other figure every time that he makes an alteration in steam supply. In this way, the history of the steam for the few preceding hours is always at hand, and if the supply require alteration, it is easy to determine how much or how little that alteration should be.

### SUSPENDED MATTER IN SEWAGE AND EFFLUENTS.

BY GILBERT JOHN FOWLER, D.SC., AND EDWARD ARDERN, M.SC.

It is becoming more and more generally recognised the real difficulty in the problem of sewage purification is, not so much in producing a good effluent, as in getting a satisfactory method of dealing with sludge. It is a thorough understanding of this problem it is necessary to know the character of the suspended matter at different stages of the purification process, *viz.*, in the sewage, in the tank-effluent, and in the filtered effluent.

#### *Suspended matters in Sewage.*

These may be classified as follows:—

- (i.) Floating material and detritus.
- (ii.) Finely disseminated solids
- (iii.) Matter in emulsion or colloidal matter.

Inference may be made to the experiments which have been made in Berlin by Dr. Monti\* of passing sewage through a series of fine sieves.

#### *(I.) Floating Material and Detritus.*

The character of the above varies in different towns requiring necessary a modification in methods of screening, in Manchester, owing to the large quantity of cotton rags, &c., it is advisable to screen the sewage as it enters the works, whereas at Birmingham, it is possible, instead of screening the whole of the sewage, to simply screen the sludge. Included under the head of floating matters, there will, of course, be quantities of solid faeces, &c., vegetable debris, &c.

The following is the result of examination of an average lot of detritus removed from the screening chamber at Manchester. It consists of a large proportion of sand and fine material, a fair amount of coal, also of stones, &c., small pieces of brick, wood, paper, leaves, &c.

Analysis of dry matter:

Loss on ignition, 34.9 per cent.  
Mineral matter, 65.1 per cent.  
Fine material (less than  $\frac{1}{16}$ th in.), 66 per cent.  
Coarse material (above  $\frac{1}{16}$ th in.), 33 per cent.

Ueber die Schwimm-u. Schwwebstoffe des Berliner Abwassers." Dr. Monti. Archiv für Hygiene, Band XIV.

Sample.	Suspended matter* after incubation at 80° F. for 6 days.					
	In presence of air.			In absence of air.		
	Mineral.	Organic and Volatile.	Total.	Mineral.	Organic and Volatile.	Total.
Raw sewage .....	0.7	3.1	3.8	1.0	2.0	3.1
" after filtration through coarse paper .....	0.3	2.4	2.7	—	—	—
" after filtration through fine paper during the first 2 minutes .....	0.4	2.3	2.7	0.2	0.6	0.8
" after filtration through fine paper after the first 2 minutes .....	0.2	1.55	1.75	—	—	trace

\* The suspended matters in this and the following experiments were determined by extraction in a centrifuge, washing by distillation, drying and weighing.

Coal picked out by hand from the coarse material 21.7 per cent. 7.2 per cent. of original material.  
Mineral ash in coal, 3.2 per cent.  
Ditto in coarse material (*minus* the coal), 41.8 per cent.  
Ditto in fine material, 80.5 per cent.  
The disposal of this material constitutes a separate problem from the disposal of sludge proper.

#### *(II.) Finely Disseminated Solids.*

These consist chiefly of hydrated oxides of iron and alumina, from iron pickling and dye works refuse, clay particles from surface of roads, lime and magnesium salts, and organic matter, alone or in combination with iron and alumina.

All these may be, to a large extent, removed by settlement. A considerable proportion of these matters constitutes the main bulk of what may be termed inevitable sludge.

#### *(III.) Matter in Emulsion or Colloidal Matter.*

Beyond what can be removed by settlement there are the matters in emulsion. The removal or oxidation of these matters constitutes a third problem.

The object of the paper is to put on record certain preliminary observations which have accumulated, in regard to matters classified under the last head, more especially in dealing with Manchester sewage, and to indicate where further investigation is necessary.

It will be convenient to refer to these matters as they occur in—

- (a.) Sewage.
- (b.) Effluent from chemical precipitation.
- (c.) Effluent from septic tanks.
- (d.) Effluent from contact beds.
- (e.) Effluent from continuous filters.

#### *(a.) Sewage.*

Much information as regards the matters in emulsion may be obtained by submitting the various liquids to dialysis. This method was suggested in the Annual Report of the River Committee for the year ending March, 1901, p. 41. Since then, interesting work has been done by Kröhnke and Biltz,\* which shows that a considerable proportion of the oxidisable matter in carefully filtered sewage, "sorgfältig filtriertes Abwasser" (presumably through paper) is incapable of passing through a membrane of parchment. It is, however, important to point out that there are difficulties in obtaining a filtrate of constant composition, by filtration of sewage through paper.

This is illustrated by the following experiment.

A sample of (Moss Side) domestic sewage was allowed to stand until the visible suspended matter had deposited, the top water was then syphoned off, and one portion filtered through coarse filter paper and another portion through fine paper. The filtrate passing through the fine paper in the first two minutes was collected separately from the later portions.

The settled sewage and the three filtrates thus obtained were incubated at 80° F. for six days, both in presence and in absence of air.

The following results were obtained (in grains per gallon):—

\* "Ueber organische Kolloide aus Städtischen Abwasser und deren Zustandsaffinität." O Kröhnke and M. Biltz. Hygienische Rundschau, 1 Mai, 1904.

The following is a description of the samples after incubation in absence of air:—

1. Settled sewage.—Black, very putrescent.
2. Ditto, filtered through coarse paper.—Dark coloured, putrescent.
3. Ditto, filtered through fine paper, first 2 minutes.—Dark coloured, putrescent (less degree than 2).
4. Ditto, filtered through fine paper, later portions.—Light coloured opalescent, slight putrescence.

Other experiments, in which the sewage was subjected to filtration without previous settlement, have also indicated that during the first few minutes of the operation, a slimy layer forms upon the paper, which retards the passage of colloidal matter.

The method of dialysis furnishes an excellent means of distinguishing between oxidisable matter of a harmful nature and that of a much less complex, and in many cases comparatively harmless character.

In this connection the following comparative experiments between Moss Side and Manchester sewage may be given.

*Comparison of domestic (Moss Side) with Manchester Sewage.*

*Method of Experiment.*—750 c.c. of the sample after settlement of visible suspended matter was placed in a glass cylinder; a parchment cylinder containing 750 c.c. of distilled water was then introduced (the relative size of the cylinders being such that the level of the liquids is the same). Portions of the liquid, both from inside and outside the parchment, were taken at stated intervals:—

Interval.	3 Minutes Oxygen Test.				Albumenoid Ammonia.				Chlorine.			
	Moss Side.		Manchester.		Moss Side.		Manchester.		Moss Side.		Manchester.	
	Inside.	Outside.	Inside.	Outside.	Inside.	Outside.	Inside.	Outside.	Inside.	Outside.	Inside.	Outside.
1 hour ....	trace	1.32	0.08	3.08	—	—	—	—	0.8	4.2	1.6	14
2 „ ....	0.04	1.20	0.36	2.88	—	—	—	—	1.1	4.1	2.6	12
5 „ ....	0.08	1.16	0.84	2.56	—	—	—	—	2.2	4.0?	6.6	10
24 „ ....	0.28	1.00	1.20	1.92	0.07	0.34	0.09	0.29	2.8	2.8	7.3	7.5
Ratio ..	1 to 3.6		1 to 1.6		1 to 4.9		1 to 3.2					

## II.

Interval.	3 Minutes Oxygen Test.				Chlorine.			
	Moss Side.		Manchester.		Moss Side.		Manchester.	
	Inside.	Outside.	Inside.	Outside.	Inside.	Outside.	Inside.	Outside.
2 hours .....	0.04	1.20	0.48	3.36	1.6	4.8	3.6	9.8
4½ „ .....	0.08	1.14	0.66	3.16	3.0	3.8	5.2	8.2
6 „ .....	0.12	1.04	0.84	2.92	3.0	4.0?	5.6	7.6
24 „ .....	0.16	0.88	1.32	2.16	3.2	3.4	6.6	6.6
Ratio .....	1 to 5.5		1 to 1.6					

In the case of Manchester, the oxidisable matter consists largely of phenolic bodies and sulphocyanates.

It should be mentioned that in order to avoid excessive dilution, no attempt was made to remove the whole of the dialysable matters in solution, the experiment being only continued till equilibrium was attained.

Further experiments show that no deposition takes place on incubation in the case of Moss Side or Manchester, in the liquid which passes through the parchment membrane, whereas in all cases the liquid containing the colloids does deposit on incubation.

The difference above referred to, between Manchester

and purely domestic sewage, can also be shown by similar filtration through paper, the amount of deposit on incubation being greater in the case of domestic sewage than that of Manchester.

It has also been observed that the filtrates obtained by filtering domestic sewage through fine filter paper are more putrefactive than those obtained from Manchester sewage.

The influence of micro-organisms must, however, be forgotten and consequently it is important, in bacteriological examination should be made, side by side with the chemical investigation. This has not hitherto been done.

It is obvious that the work to be done by filters is largely conditioned by the amount of colloidal matter, as this represents potential suspended matter.

Exact knowledge as to the nature of this colloidal matter is at present wanting.

### (b.) Effluent from Chemical Precipitation.

It is possible, by suitable addition of chemicals, greatly to decrease the amount of colloidal matter in sewage at considerable expense however, and with the production of an excessive volume of sludge.

Thus, *e.g.*, by heating sewage with basic ferric acetate a crystal clear solution can be obtained.\*

It is possible, therefore, by chemical treatment of order to minimise the work to be done by filter beds except under rare conditions, however, the process is generally considered too expensive.

The method of dialysis, in any event, will form a useful

means of showing how far chemical treatment has been effective.

### (c.) Effluent from Septic Tanks.

It has been found that the Manchester septic tank effluent, if allowed to stand, deposits quantities of organic matter; deposit also takes place even if the tank-effluent is first filtered through paper.

The following experiments may be given as illustrations:—

\* "Das Städtische Siedwasser und seine Beziehung zur Flussverunreinigung." M. Rubner. Archiv für Hygiene, Band X



## I.

on septic tank effluent, allowed to stand at room temperature, in absence of air.

*Suspended Matter in Grains per Gallon.*

Date.	Number of Days Standing. (Room Temper.)	Solids in Suspension.		
		Organic and Volatile.	Mineral.	Total.
Oct. 22	0	1.2	2.0	3.2
24	2	2.0	2.4	4.4
Nov. 4	13	3.8	2.6	6.4
10	28	3.6	2.6	6.2
Dec. 10	50	2.6*	2.4	5.0*
21	90	4.6	2.8	7.4

\* Slightly overheated in drying.

immediate increase in the mineral matter, and to a tent in the volatile matter, is no doubt partly due to oxidation of ferrous sulphide.

may be mentioned that where a sample of tank effluent was allowed to stand in absence of air for 12 days a much larger quantity of deposit was obtained.

## II.

A sample of septic tank effluent was filtered through coarse paper, one portion of the filtrate was incubated (F.) in absence of air; the other, in presence of air. After incubation, 11 days.

*Solids in Suspension.*

	Organic and Volatile.	Mineral.	Total.
Incubation in presence of air	2.6	2.0	4.6
Incubation in absence of air	3.0	2.4	5.4

## III.

A sample of septic tank effluent taken November 14th, one portion filtered through coarse filter paper,

another filtered through fine paper. In the case of the fine paper, the liquid passing through in the first five minutes was collected separately from the later portions of the filtrate.

The three filtrates thus obtained were allowed to stand (in presence of air) at the room temperature, for 30 days. The suspended matter which had deposited was then determined as follows:—

	After filtration through Coarse Paper.	First 5 mins. filtrate from Fine Paper.	Filtrate, after first 5 mins. from Fine Paper.
Total .....	1.8	1.2	1.0
Organic and volatile .....	1.2	0.8	0.6
Mineral .....	0.6	0.4	0.4
Per cent. of organic and volatile .....	72	67	60

Here, also, information is needed with regard to the exact nature of this deposit, but it may be mentioned that some of the iron originally in solution is in a colloidal form, as is shown by the following experiment:—

*Iron in solution in septic tank effluent (grains Fe per gallon).*

After filtration through paper.	After filtration through porous pot.
0.53	0.225
(Means of ten determinations).	

In studying the effect of septic action on sewage, examination by dialysis will afford useful information.

The following experiments appear to indicate that of the oxidisable matters in the Manchester septic tank effluent a slightly greater proportion is colloidal than in the settled sewage:—

*Comparison of Settled Septic Tank Effluent with Settled Sewage.*

*Method of Experiment.*—Similar to that used in the comparison between Moss Side and Manchester Sewage:

*Results in Grains per Gallon.*

Samples taken after diffusion was complete.	3 Minutes' Oxygen Test.		Albumenoid Ammonia.	
	Settled Sewage.	Settled Septic Effluent.	Settled Sewage.	Settled Septic Effluent.
I.				
Inside parchment cylinder .....	0.50	0.66	0.06	0.04
Outside " " .....	1.20	1.28	0.19	0.165
Ratio .....	1 to 1.5	1 to 1.9	1 to 3.2	1 to 4
II.				
Inside parchment cylinder .....	1.20	1.10	0.075	0.085
Outside " " .....	1.58	1.90	0.16	0.20
Ratio .....	1 to 1.3	1 to 1.7	1 to 2.1	1 to 2.4

These determinations were to some extent interfered with by the presence of storm water.

Before drawing any general conclusion a large series of determinations are necessary, and also comparative experiments with domestic sewage.

*(d.) Effluent from Contact Beds.*

Through a filtrate, as it comes from the bed (primary), is comparatively free from suspended matter, it is only observed that deposition takes place on standing in absence of air, leaving the supernatant liquid perfectly clear.

Similar observations have been made by filtration through paper and by dialysis to those recorded in the case of septic tank effluent, with similar results as to the deposition of suspended matter.

The character of the matter depositing is, however, undoubtedly different in the case of the effluent from contact beds from that in sewage and septic tank effluent, but further experiment is needed in order to exactly determine this difference.

The following is an analysis of the matter deposited, after standing in contact with air, in the effluent from single contact beds in Manchester:—

Organic and volatile, 56.3 per cent.	Calculated on total dry matter.
Mineral, 43.7 per cent.	
Mineral Matter Contains	
Silica 8.4 per cent.	3.8 per cent.
Fe <sub>2</sub> O <sub>3</sub> 52.7 per cent.	23.0 per cent.
Al <sub>2</sub> O <sub>3</sub> 12.8 per cent.	5.6 per cent.
CaO 13.3 per cent.	5.8 per cent.
Total nitrogen in dry matter—4.7 per cent.	

The following experiments were made, in order to determine the effect of aeration, under different con-

ditions, on the amount and character of the suspended matter, and on the oxidisable matters in solution, as measured by the three minutes' oxygen test, and in the second case also by the proportion of nitrate.

The samples were divided among several bottles, and exposed to the following conditions:—

- (a.) Air bubbled through continuously.
- (b.) Standing in closed bottles at room temperature.
- (c.) Standing in closed bottles in incubator (80° F.).
- (d.) Standing in partially-filled bottles at the room temperature.
- (e.) Standing in partially-filled bottles in incubator (80° F.).

The results obtained, after different periods of time, are given in the following tables:—

*I.—Sample from Primary Contact Bed, Five Minutes after Opening the Exit Valves.*

Time.	a				b				c				d				e			
	Suspended matter		Iron in Solution	3 Minutes' Ox. Abs. (filtered)	Suspended matter		Iron in Solution	3 Minutes' Ox. Abs. (filtered)	Suspended matter		Iron in Solution	3 Minutes' Ox. Abs. (filtered)	Suspended matter		Iron in Solution	3 Minutes' Ox. Abs. (filtered)	Suspended matter		Iron in Solution	3 Minutes' Ox. Abs. (filtered)
	Total	Mineral			Total	Mineral			Total	Mineral			Total	Mineral			Total	Mineral		
At start .....	3.4	1.4	0.10	1.92	3.4	1.4	0.10	1.92	3.4	1.4	0.10	1.92	3.4	1.4	0.10	1.92	3.4	1.4	0.10	1.92
After 4 hours .....	3.8	—	0.07	2.00	3.8	—	0.07	2.00	3.8	—	0.06	1.84	4.2	2.0	0.07	1.92	5.2	3.0	0.0	—
" 24 ..	6.2	3.6	0.05	1.96	2.8	1.0	0.05	2.16	3.8	1.8	0.06	1.84	4.2	2.0	0.07	1.92	5.2	3.0	0.0	—
" 48 ..	6.6	3.6	0.08	1.12	3.0	1.8	0.10	1.88	—	—	—	—	5.0	2.8	tr.	1.60	—	—	—	—
" 72 ..	6.2	2.4	0.08	1.00	3.8	1.8	0.07	1.84	3.0	2.0	0.06	1.68	5.0	2.2	0.06	1.00	5.8	2.0	0.0	—
" 144 ..	—	—	—	—	—	—	0.10	1.80	—	—	—	—	5.0	2.2	tr.	0.88	—	—	—	—

*II.—Average Filtrate from Primary Contact Bed*

Time.	a					c					d					e				
	Suspended matter		Iron in Solution	3 Minutes' Ox. Abs. (filtered)	Nitrate	Suspended matter		Iron in Solution	3 Minutes' Ox. Abs. (filtered)	Nitrate	Suspended matter		Iron in Solution	3 Minutes' Ox. Abs. (filtered)	Nitrate	Suspended matter		Iron in Solution	3 Minutes' Ox. Abs. (filtered)	Nitrate
	Total	Mineral				Total	Mineral				Total	Mineral				Total	Mineral			
At start .....	1.8	1.1	0.12	1.28	0.55	1.8	1.1	0.12	1.28	—	1.8	1.1	0.12	1.28	—	1.8	1.1	0.12	1.28	—
After 4 hours .....	2.8	1.4	0.07	1.40	0.38	—	—	—	—	—	2.6	1.6	0.08	0.78	—	1.6	0.6	tr.	—	—
" 24 ..	2.2	1.2	0.08	1.28	0.67	1.4	0.8	0.07	1.20	—	2.6	1.6	0.08	0.78	—	1.6	0.6	tr.	—	—
" 48 ..	3.4	1.8	0.07	1.04	0.56	2.2	1.2	0.06	1.24	—	2.4	1.4	0.06	0.76	—	3.6	2.6	0.04	—	—
" 72 ..	3.4	1.8	—	0.84	0.59	1.8	1.0	—	1.18	—	2.9	1.6	—	—	—	4.1	3.0	—	—	—
" 144 ..	3.6	2.0	—	0.80	0.58	2.4	—	—	1.20	—	—	—	—	—	—	3.6	2.4	—	—	—
" 168 ..	—	—	—	—	—	—	—	—	—	—	3.0	1.6	—	0.64	—	—	—	—	—	—

*(e.) Effluent from Continuous Filters.*

The effluent from an open continuous filter in good order, will contain suspended matter in a granular condition.

Our observations show that this suspended matter, if incubated by itself, in absence of air, still contains sufficient organic matter to become putrefactive.

It is worthy of investigation whether, as the age of the filter increases, this suspended matter, besides increasing in amount, does not also become of a more noxious character.

Information is required as to the amount of colloidal matter still present, after settlement of the granular suspended matter, and the consequent possibility of further deposition taking place.

With continuous filters of fine grade, although no suspended matter may pass away in the effluent, a certain amount of accumulation is ultimately bound to take place in the bed.

*Summary.*

In addition to the ordinary sludge obtained by settlement of the sewage, the sewage chemist is faced with the disposal, ultimately, of the residue left after transformation of the colloidal matters in pseudo solution or emulsion.

Experiments are in progress, in order to determine what proportion of these can be actually oxidised by bacterial activity, and what proportion will have eventually to be dealt with and removed from the filtering medium by washing or screening.

*DISCUSSION.*

Mr. Wm. THOMSON wished to know whether seopical examination had been made of the matter which precipitated from the clarified sewage on standing, and, if so, whether it did not consist of bacteria or fungoid growths. Was it possible that the colloidal bodies be due to bacterial organisms which continued to die in the effluent?

Dr. J. GROSSMAN said that 18 months ago he had engaged by the Bradford Corporation to design and install a system for the recovery of fat and manure from sewage sludge, which was now in work. His first impression was that the process could only be used where sewage, owing to local circumstances, contained a large amount of fat. But he had come to the conclusion

it would be possible to apply his system to a great number of towns. The general applicability of the method to some extent depend upon the amount of organic matter contained in the sewage, and Dr. Fowler's researches and his method of determining the amount of organic matter would be of assistance in future practical work. Up to the present the tendency in sewage purification has been to reduce the amount of sludge to a minimum, as the sludge obtained was in nearly every case a nuisance and expense. For that reason, where precipitant was used, the quantity of the latter was insufficient to precipitate the colloidal matter, which thus passed away in the effluent. But colloidal matter contained valuable manurial constituents which during their passage through the contact beds were wasted. It would, in future, be necessary to ascertain the exact balance between the quantity of precipitant and the quantity of organic matter thrown down, which would give the best commercial result in the working up of the sludge. The extra quantity of the latter would be compensated for by the increased value of the products obtained from its distillation.

Mr. E. HALLIWELL (Preston) agreed with Dr. Grossman that the question of suspended matter in effluents was of great importance, and had hardly received the consideration to which it was entitled. In the case of spray filters, the suspended matter in the effluent was present in variable quantities, but as it contained a large proportion of the organic matter it was necessary that it should



During the first week, or even months, of the use of a filter the quantity was in some cases very large but after some time the suspended matter began to settle, and in many cases would average about 10 parts per 1,000. If the revolution of the sprinkler arms were retarded by the wind or other causes, the amount was very large and a very foul effluent was produced. The suspended matter probably accounted for some of the suspended solids, but the main cause was the suspended matter present in the tank effluent. At Nelson it was found that approximately 6,000 gallons of wet sludge, containing about 1 per cent. of solid matter, was deposited from 6,000,000 gallons of effluent from sprinkler filters.

BAILEY said that in his own experience he had encountered somewhat similar difficulties as Dr. Fowler, mentioning the impurities in the Manchester atmosphere. He had been astonished to find that in times of air of Ancoats compared very favourably with that of Owens' College district in regard to the amount of suspended matter. Yet there was a great difference in quality. The air in the neighbourhood of the College was saturated with carbon and matter which was only removed upon by oxidising agents, that of Ancoats had a much more abundant amount of matter which seemed to resemble water's colloidal matter, and oxidised much more readily.

He had been able to differentiate between these two by the use of permanganate and bichromate of potash, and experience led him to appreciate fully the great need of investigation of sewage along the lines of the Manchester problem.

CHAIRMAN said that in Salford they treated the effluent of the sewage with lime and iron salts, and it was due to this process that suspended matter present in the effluent in passing through the tanks it did not settle. He experimented with the effluent by allowing it to stand in for three or four hours in the tanks and at the end of that time he found about 1½ to 2 grains per gallon of suspended matter. The Salford Corporation had spent about £10,000 during the past 12 months in trying to overcome the difficulty of suspended matter, but had met with little success.

FOWLER, in reply to Mr. Thomson, said that a typical examination of sewage effluents showed some of bacteria and also the higher forms of life. He pretended to have more than touched the fringe of the subject. They needed to make complete organic analyses of all these products, and that was difficult to do as it took a very long time to obtain the necessary quantity of materials. The Chairman had very much misunderstood him with regard to filtered effluent. It was not what could be seen in the effluent, but the potential matter contained therein, that he was concerned in. If he (the Chairman) were to indicate the potential matter in the Salford tank-effluent, he would find some interesting facts. With regard to the suspended matter, the average in Manchester was about 32 grains per gallon, but in storm sewage it might run up to 700. In reply to Dr. Grossman, he did not think the valuable constituents of the sewage matters were lost. Manure had to undergo a process of fermentation before it was useful for agricultural purposes, and when this humus was washed from the filter beds and mixed with a little lime, it constituted an excellent manure.

## New York Section.

Meeting held at the Chemists' Club, on Wednesday, April 19th, 1905.

MR. RUSSELL W. MOORE IN THE CHAIR.

### ANALYSES OF SENNA.

BY RUSSELL W. MOORE, M.A., M.Sc.

Testing of senna for customs purposes presents no special difficulties; 10 grms. of the drug are boiled in a litre flask

with water, and the contents of the flask made up to the mark and thoroughly mixed; 200 c.c. are filtered off and evaporated to dryness on the water bath and the residue dried in the steam oven to constant weight. Attempts to extract with water in a Soxhlet tube were unsuccessful, as the extraction was extremely slow, and even after long continuance was incomplete. The Treasury regulations require 28 per cent. of "soluble matter." The following results were obtained from six different samples: 34.37, 32.75, 39.00, 38.54, 39.44 and 38.28 per cent. soluble matter—average 37.06 per cent.

The results being well above the required standard in every case, indicate that importations of senna are generally of good quality, and that there is no great necessity for frequent chemical analysis.

Meeting held at Chemists' Club, on Wednesday, April 19th, 1905.

MR. RUSSELL W. MOORE IN THE CHAIR.

### THE DETERMINATION OF ACETIC ACID IN WHITE LEAD.

BY GUSTAVE W. THOMPSON.

In the manufacture of white lead by any process involving the use of acetic acid, a certain portion of the acetic acid seems to be bound firmly so that it cannot be washed out in any ordinary process of manufacture. The amount of the acetic acid which is fixed by the white lead depends largely upon the quantity used in the process of manufacture. As to whether this acetic acid is objectionable or not, I do not propose to speak in this paper further than to say that there is a popular impression that the acetic acid should be as low as possible. The Navy Yard specifications demand a white lead which shall not contain "acetate in excess of fifteen one-hundredths of 1 per cent. of glacial acetic acid." It seems reasonable, furthermore, that whether the acetic acid is objectionable or not, the intelligent purchaser of white lead should be enabled, as far as possible, to know what he is buying, and perhaps trace back results to some definite cause.

I am unable to state the form in which the acetic acid is combined which renders it insoluble in water. The following facts may be somewhat of an indication, however, in this matter: An ordinary lead acetate solution will take up varying amounts of lead oxide to form basic lead acetate. The more concentrated the lead acetate solution is, the less basic will be the formed acetate; for instance, the ordinary pharmacopœia solution—"Liquor Plumbi Subacetatis"—contains two equivalents of lead to one of acetic acid, and, while this solution may be made more basic than this by adding an excess of litharge, the amount of litharge which it will take into solution in excess of that required to form the pharmacopœia solution is comparatively small. Working with dilute solutions of lead acetate, however, solutions can be obtained containing as much as ten equivalents of lead to one of acetic acid. These very basic dilute solutions may, however, be regarded by some as supersaturated solutions, for the reason that the basic lead tends to separate out on slight provocation, carrying with it some acetic acid. If this very basic lead acetate, which separates out, is washed with distilled water, it appears to form a colloidal solution, from which the basic lead is readily precipitated in the presence of suspended inert material, and especially in the presence of electrolytes. Ordinary water is usually used for washing white lead, and, as this water contains more or less saline substances, any of this extremely basic acetate that is present will be precipitated with the white lead, and go into the finished product.

I have tried a great many processes for the determination of acetic acid in white lead. Very few white leads will show the presence of lead acetate by the iodide test, provided a thoroughly clear extract is obtained before

adding the reagent. Potassium iodide will, by itself, slowly give a yellowish tint to white lead, but the amount of lead which may be dissolved out by distilled water from a white lead is no measure of the amount of acetate present, for the reason that the longer the white lead is washed with distilled water, the greater will be the amount of lead dissolved, colloidal solutions apparently being formed. Unsatisfactory results seem also to be obtained when one endeavours to carry out the acetic ether test with the use of alcohol and sulphuric acid, applying the test directly to the lead carbonate. Inasmuch as the amount of glacial acetic acid present in white lead ranges from 0.05 per cent. in Dutch process white lead to 0.7 per cent. in some precipitated white leads, it will readily be seen that the acid should first be isolated before any qualitative test can be properly applied to it; and I have reached the conclusion that the easiest way to test qualitatively for acetic acid in white lead is really to determine it. Practically all of the methods that have been recommended for the determination of acetic acid in white lead involved its distillation. I have used three different methods for conducting this determination, and have finally rejected two and adopted the third. The two methods rejected are:—First, the determination involving the boiling of the white lead with sodium carbonate supposedly to form sodium acetate, filtering out the undissolved lead, acidifying the filtrate with sulphuric acid, and distilling to recover the acetic acid. This method appears to be objectionable, for the reason that all of the acetic acid present in the white lead is not obtained by this method; some of it remains unaffected by the sodium carbonate. The second method is that recommended by Lunge, in his "Methoden," which consists in treating the white lead with dilute sulphuric acid, and distilling the acetic acid thus liberated. The objection to this method is the same as that found to the method involving the treatment of the white lead with sodium carbonate, namely, that all the acetic acid is not liberated by the treatment. It is to be noted, even, that white lead can be heated with strong sulphuric acid until fumes are evolved without a complete decomposition of the carbonate present. The method finally adopted is as follows:—

18 grms. of the dry white lead are placed in a 500 c.c. flask, this flask being arranged for connection with a steam supply, and also with an ordinary Liebig condenser. To this white lead is added 40 c.c. of syrupy phosphoric acid, 18 grms. of zinc dust, and about 50 c.c. of water. The flask containing the material is heated directly and distilled down to a small bulk. Then the steam is passed into the flask until it becomes about half full of condensed water, when the steam is shut off and the original flask heated directly and distilled down to the same small bulk—this operation being conducted twice. The distillate is then transferred to a special flask and 1 c.c. of syrupy phosphoric acid added to ensure a slightly acid condition. The flask is then heated and distilled down to a small bulk—say, 20 c.c. Steam is then passed through the flask until it contains about 200 c.c. of condensed water, when the steam is shut off and the flask heated directly. These operations of direct distillation and steam distillation are conducted until 10 c.c. of the distillate require but a drop of N/10 alkali to produce a change in the presence of phenolphthalein. Then the bulk of the distillate is titrated with N/10 sodium hydroxide, and the acetic acid calculated. It will be found very convenient in this titration, which amounts in some cases to 600–700 c.c., to titrate the distillate when it reaches 200 c.c., and so continue titrating every 200 c.c. as it distills over.

The details in this described method, as regards the supply of steam from an outside flask, its condensation and subsequent evaporation, are not essential to the process, but can, of course, be modified so as to conform to the ordinary method of distilling acetic acid from acetate of lime. If the white lead contains appreciable amounts of chlorine, it is well to add some silver phosphate to the second distillation flask, and not to carry the distillation from this flask too far at any time. If the dry white lead under examination has been obtained by extraction as a residue from white lead paste, it is well that this

extraction should be exceedingly thorough, as, other fatty acids may be held and distilled with the acetic. Even then, they will not interfere with the final titration as they may be filtered from the distillate before titration should that be desired.

## Nottingham Section.

Meeting held at Nottingham on Wednesday, March 1905.

MR. J. T. WOOD IN THE CHAIR.

### THE COMPOSITION OF SCOURING SOAP

BY T. A. GERARD.

The user of soap for scouring textiles usually as the percentage of fatty acids. The amount of free fat is presumed to be inconsiderable and hence not, ordinary analysis, often separated from the combined fatty acids. The amount of free fat, however, is always inconsiderable. Various samples of soap for scouring textiles, were found to contain as much as 2.7 per cent. unsaponified fat. As the usual guarantee percentage of fatty acids is 62, if the free fat be included, the amount of saponified fat may be 59.3 which would be a loss to the consumer. The free fat and the combined fatty acids should be always separated, the latter being admittedly the only portion of the scouring soap. If a maximum of free fat, not over 0.6 per cent., could be specified, it would be an advantage to the buyer, as it would preclude the use of fat containing over 1 per cent. unsaponifiable, and ensure the soap being skilfully made. Free fat is not only useless, but neutralises the saponifying effect of a considerable amount of the combined fatty acids. Moreover, when the amount of free fat is 0.6 per cent., the goods scourer run a risk of being damaged. There is a temptation to use the cheapest fats in the manufacture of scouring soaps. These cheap fats are usually incompletely saponifiable. The following are from a series of tests made recently in the laboratory of my firm:—

White tallow (refined)	0.02—0.03	unsaponifiable
Brown " " " "	0.20—0.65	"
Bone grease " " " "	0.40—2.42	"
Skin grease " " " "	1.45—7.10	"
Olein " " " "	1.20—8.60	"

Recovered greases from 7 per cent. to 50 per cent. These are offered to soapmakers as materials for the manufacture of scouring soaps.

### DISCUSSION.

Mr. S. J. PENTECOST said that no doubt but that dyers fell into the common error of buying from the percentage of fatty acids given on analysis, taking the trouble to ascertain how much free fat was included in this percentage. In the case of acetate cottons or silk goods, soaps containing free fat were not only bad economically, but they also in some extent with the lustre and finish of the goods. He had always found that for scouring cotton goods, tallow soap gave better results as a detergent than those made from the oleins (specially those distilled from grease, or those containing resin, and Mr. Gerard seemed to confirm that opinion. Could Mr. Gerard say what was the exact nature of the unsaponifiable matter found in the oleins he had referred to in his figures?

Mr. S. R. TROTMAN said he could speak from experience as to the truth of Mr. Gerard's statements. The percentage of unsaponifiable matter in soap was frequently found to be high, and the fact that they were made with benzine recovered and that a sufficiently volatile spirit had not been



traction. Much care was required in the selection for this purpose, as if they contained any con- portion boiling above 120° C., it was extremely to recover it from the grease. He had on several come across cases of trouble in hosiery and ds, which were undoubtedly due to the presence which had been introduced with soap, and he d, from experiments made in his laboratory, that a goods were treated with a soap containing free it was practically impossible to subsequently this grease by washing with water or neutral water, and this residual grease, which was retained res, was undoubtedly the frequent cause of sub- rouble, such as patchiness in dyeing.

ARCHBUTT asked the nature of the "White which contained only 0.02 per cent. of unsaponi- ter. He thought a good soap should contain 63 per cent. of fatty acids. Mr. Trotman's re- minded him of a statement made by Dr. Perkin isussion on a paper published in the current

number of the journal (March 15, p. 227), that if wool were worked in water containing olive oil and carbonate of potash and then rinsed in clean water, oil could not be squeezed out from the wool in quantity, whilst cotton under the same condition retained very little oil. He thought this might have a practical application other than in connection with dyeing.

Mr. T. A. GERARD, in reply, said there were three reasons for olein containing unsaponifiable matter. They were:— (1) Overheating in the distillation; (2) it was made from recovered greases which greases contained unsaponifiable matter; (3) adulteration.

As to obtaining a good sample, the white tallow was specially prepared, as it was to be used for particular work, toilet soap for instance. He was told that 62 was the recognised percentage of fatty acids to specify, but he only put that as a minimum. The percentage was generally greater. Impure greases were mostly used for brown household soaps for export, but very bad greases were made into a close soap for wire drawing.

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## ANT, APPARATUS & MACHINERY.

ENGLISH PATENTS.

Impts. in —. A. Smallwood, London. Eng. Pat. 9924, April 30, 1904.

Box or grate of the furnace communicates with a chamber, above which is an arch of refractory From the latter a number of projecting pieces downwards; these pieces, which may have the ridges or "draught-board" pattern projections, mix the gases, and, by becoming incandescent, heat, so that complete combustion is secured.—

s, Centrifugal; Liners for —. A. L. nson, Stockholm. Eng. Pat. 10,422, May 6, Under Int. Con., May 16, 1903.

Pat. 779,990 of 1905; this J., 1905, 147.—T. F. B.

Devices for Evaporating Liquids and for other es; Impts. in —. A. B. Lennox, Newcastle-le. Eng. Pat. 15,733, July 15, 1904.

casing having inlet and outlet orifices, is fitted onical screw-down valve. The valve seat or the radial tangential or helical grooves formed upon

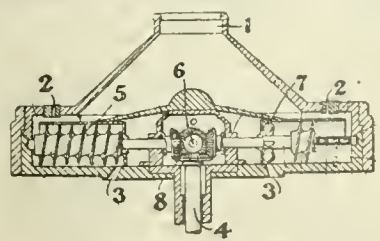
its surface, so that the liquid may issue in jets, which impinge upon one another, in order to produce a spraying action, which may be regulated by altering the position of the valve. To allow the valve to be used to close the orifice entirely, the grooves are stopped short of the inner end of the cone.—W. H. C.

Extracts and the like; Apparatus for Making —. J. W. Mackenzie, London. From J. U. Lloyd, Cincinnati, U.S.A. Eng. Pat. 25,216. Nov. 19, 1904.

See U.S. Pat. 777,115 of 1904; this J., 1905, 78.—T. F. B.

UNITED STATES PATENTS.

[Separator] Machine; Centrifugal —. K. P. Nilsson, Stockholm. U.S. Pat. 785,910, March 28, 1905.



THE bowl of the centrifugal machine, fed through the opening 1, has the discharge openings 3, for the "slime" placed at a shorter radial distance from the spindle 4, of the machine than the openings 2 for the liquid. Screws 5, enclosed in chambers and driven by the gearing 6, from the shaft 4, are arranged to draw the "slime" from the outer part of the bowl and to deliver it by means of the wings 7, through the discharge openings 3.—W. H. C.

*Separators, Centrifugal; Liner for* —. C. A. Hult and O. W. Hult, Stockholm. U.S. Pat. 787,179, April 11, 1905.

THE bowl of the centrifugal separator, provided with a central inlet pipe, has an annular depression formed in its bottom. The liner consists of a number of vertical plates or blades, which are held in position by being threaded on a ring passing through holes in the plates. The blades are adjusted to intersect the radii of the bowl, and have passages in their lower edges through which the liquid can flow.—W. H. C.

#### FRENCH PATENT.

*Distilling and Making Extracts; Apparatus for* —. J. U. Lloyd. Fr. Pat. 348,251, Nov. 25, 1904.

SEE U.S. Pat. 777,115 of 1904; this J. 1905, 78.—T. F. B.

#### GERMAN PATENTS.

*Filter Element.* W. Hartmann. Ger. Pat. 154,314, Nov. 1, 1902.

THE filter element is composed of a number of thin perforated plates with grooves or furrows on both sides, and placed one above another in such a way that the grooves of neighbouring plates cross one another, whilst the perforations are all in vertical alignment, forming a number of collecting channels. The plates may be held together by a perforated tube passing through one of the collecting channels. According to one claim, the filter element is composed of annular plates forming a cylinder, the liquid to be filtered being delivered at the inner and outer circumferences of the plates, and the filtrate discharged through the channels formed by the perforations of the plates.—A. S.

*[Separator] Centrifugal Apparatus.* H. Rahrbach and W. Goergen. Ger. Pat. 154,351, Nov. 21, 1902.

THE centrifugal apparatus claimed has a number of separating spaces, in the form of closed conical chambers, arranged one above the other. The conical division walls of the chambers are arranged on a central, axial tube, and the inner walls of each chamber are provided with furrows or are made in a corrugated form in order to expedite the separation.—A. S.

*[Separator] Centrifugal Apparatus.* H. Rahrbach and W. Goergen. Ger. Pat. 154,352, Nov. 21, 1902.

IN centrifugal apparatus with division walls of the kind described in Ger. Pat. 48,615, these walls are provided with furrows or grooves of such a shape that the separating space is increased in a radial direction.—A. S.

## II.—FUEL, GAS, AND LIGHT.

#### ENGLISH PATENTS.

*Gas; Process and Apparatus for the Manufacture of Combustible* — from Peat and like Substances. C. Whitfield, Kettering. Eng. Pat. 1738, Jan. 23, 1904.

IN the production of combustible gas from peat and like substances, the heat of the producer gas is utilised for evaporating the moisture in the fuel. For this purpose the top of the producer is fitted with a heating chamber, which is encased by an outer shell or surrounded by a coil and closed at the top by a plate provided with a charging hopper. The hot gas is caused to circulate through the jacket or coil around the heating chamber, evaporating the moisture from the peat prior to its entering the producer. Simultaneously the gas is cooled and prepared

for subsequent treatment. The moisture thus evaporated is mixed with air if required after condensing part and conveyed to the ash-pit or lower part of the producer where it is used for maintaining the combustion of the —R.

*Gas; Process and Apparatus for Generating Combustible* — from Hydrocarbonaceous and other Solid. B. H. Thwaite, London. Eng. Pat. 7347, March 1904.

THE combustion of a column of solid fuel is initiated at the upper level by the introduction of a certain proportion of air, sufficient to cause the evolution of the more volatile of the hydrocarbons. By a secondary admission some distance below the upper level, the lower part of the column of fuel is maintained at a high degree of incandescence. The downward direction of the combustion is maintained by pressure or by aspiration, moisture contained in the fuel and hydrocarbons being liable to recondense after volatilising, and thus causing to pass through the high-temperature zone of combustion, where the hydrocarbon vapours are made more or less permanent, while the moisture is dissociated into free hydrogen and oxygen, the latter combining with carbon to form carbon monoxide. The apparatus consists of a cylindrical steel or iron shell lined with refractory material and provided on its base with a central outlet tube capped with a steel cover from which the gas is suspended. The steel shell is supported by standards, and the whole is placed in a water bath, which keeps the fire-bars cool and prevents the gas from escaping into the outer air. The bottom of the water bath is conical; the incumbering ash and clinker slide down the slope to a point outside the shell of the generator, and are readily removed. The gas is exhausted by means of a fan or blower, located behind the condensing apparatus, and forced into a pressure governor to establish a constant gas pressure supply to the engine.—R. L.

*Gas Generators; Improvements in* — and in the Manufacture of Gas. J. Radcliffe, Thornton Heath. Eng. Pat. 7592, March 30, 1904.

THE generating chamber, fitted with gas outlet feeding hopper, is combined at its lower end with an inclined revolving chamber. By introducing a proper proportion of air, or air and steam, to the chamber directly and a small supply only at the lower end of the revolving chamber the combustion is maintained entirely in the fixed chamber, while the revolving chamber is chiefly employed as a receptacle for the hot gases, removing them from the generating zone and directing them to the passing part of the air blast which is heated on its way to the generating chamber. The revolving chamber is of a frusto-conical form, or cylindrical at upper end and frusto-conical or curved inwardly at lower end. The ashes, when at rest, must be inclined at an angle of about 42°, which is the "natural slope" of the material being dealt with.—R. L.

*Gas Producers; Impts. in* —. A. H. Lynn, London. Eng. Pat. 9668, April 27, 1904.

THE gas producer is operated in a similar manner to a blast-furnace, the steam being introduced separately into the air blast and at a point above the air blast. Part of the hot gases are removed at a point immediately above the hottest zone, but below the steam inlet. These arrangements, the upper part of the producer which may be regarded as the principal seat of the decomposition of ammonia, does not become too hot, and the decomposition of ammonia by excessive heat is avoided. If it is desired to run off the ash as slag, any fluxing required is charged by means of suitable hoppers into the hottest zone and not into the top of the producer —J.

*Gas Producing Apparatus; Construction and Use of* —, for use with Fuels of a Bituminous Nature. H. G. Hills and H. Lane, Hyde, Cheshire. Eng. Pat. 10,733, May 10, 1904.

THE "producer" part of the apparatus consists of a vertical iron shell lined with refractory material, and



t the top with a hopper closed by a lid, whilst its extremity dips into a vessel containing water. The part communicates with a separate vaporiser by a pipe. Inside the bottom of the producer is an annular grate composed of several hollows connected to "up take" and "down take" embedded in the refractory lining of the case. The is enclosed in a sheet-iron jacket, provided with passages" near the top and bottom.

use the apparatus, a fire is lighted in the prod and fuel fed in from above. The products of comp pass downwards, and flow through the annular tive grate, heating it. They then pass to, and external vaporiser which is divided into two com its by a central plate, and are then led to a chimney nee an initial draught. The air required for com enters the sheet-iron jacket surrounding the prod and gets heated in its passage downwards. It then in the bottom belt passage and passes into the r, where its temperature is raised by coming into with surfaces heated by the outgoing products of ion. It is here saturated with moisture, by allowing t of water, regulated by suitable means, to flow spiral cut on the internal surface of the vaporiser, ses to the upper belt passage of the producer. o belt passage it passes down the "down takes" e grate, and through the "up takes" to the e producer, which it reaches in a very hot condition. en passed down through the fuel, and drawn off ottom, as before described. The chimney is only to provide an initial draught, and may be replaced for drawing off the products of combustion.

—L. F. G.

arts; Impts. in —. R. Dempster and Sons, Elland, Yorks. and F. Scott, Galashiels, N.B. Pat. 10,926, May 12, 1904.

ate the disadvantages of a covered subway in the furnaces of gas-retorts, the roof of the subway sed with and replaced by a travelling platform de size and construction, arranged level with the floor and adapted to run along rails supported irons bolted to the buckstays or brackets, thus access to the mouths of the retorts. The platy be provided with ball-bearings and be fenced ll as the subway, to prevent accidents.—R. L.

d other Impurities from crude Illuminating, g, or Power Gases; Method of Extracting —. eritt, Ilkley. Eng. Pat. 13,316, June 13, 1904.

IR of (circular) iron wire screens are spaced about of an inch apart by metal rings at their circum- kept taut, and fixed vertically in the central of a horizontal iron vessel. The gases to be traverse the screens at right angles, and are ntermittent puffs of exhaust steam issuing from gement of steam ports or orifices in the upper of the metal rings above referred to. The tarry ; thus deposited on, and washed down from the and drawn off by sealed pipes "in the usual"—L. F. G.

proved Process for the Purifying or Desulphurising hing —. J. Marschal, Bruxelles.—St. Gilles, m. Eng. Pat. 28,765, Dec. 29, 1904.

ETTED hydrogen can be removed from crude gas by means of ozone either by causing the ozone irectly on the gas, or by previous "causticising" (ering active) of ammonia water by ozone, or by ultaneous use of the two processes. Ozone or air is conveyed into a column provided with discs, o a distilling column, which receives the crude water. The latter gives off its sulphur in the an impalpable powder which settles down. The water is decanted and may be used again for igation of gas.—R. L.

s; Arc Lamp —. R. Fleming, Lynn (Mass.), S. Eng. Pat. 7298, March 26, 1904. Under t. Conv. March 26, 1903.

odes are formed of iron tubes filled with magnetic e, the free end being fused so as to render it ig and enable the arc to be readily started.

Tubes of other metals may be used, filled with the corres- ponding oxides, or with the salts used for making flame carbons.—C. S.

Electrodes; Arc Light —, and Methods of Making Same. J. T. H. Dempster, Schenectady (N.Y.), U.S.A. Eng. Pat. 7299, March 26, 1904. Under Internat. Conv., March 26, 1903.

AN iron tube or shell is filled with a core prepared from about 80 per cent. of magnetic iron oxide ( $\text{Fe}_3\text{O}_4$ ), 18 per cent. of red oxide of iron ( $\text{Fe}_2\text{O}_3$ ), and 2 per cent. of substances capable of lowering the fusing point of the mixture (preferably potassium titanate and caustic potash). The mixture is made into a plastic mass with a little water, and 5 per cent. of glycerin or other liquid of low volatility; and the moulded cores are dried, baked to expel the glycerin, and fired at about  $1200^\circ\text{C}$ . in crucibles packed with granular material, to prevent undue reduction and distortion. When introduced into the outer shell, the arc end of the pencil is fused over to make it conductive; or the pencils may be exposed to fusing heat in the muffle.—C. S.

Electrodes for Arc Lamps, and Method of Making Same. W. S. Weedon, Chester (Pa.), U.S.A. Eng. Pat. 26,921, Dec. 9, 1904. Under Internat. Conv., Dec. 10, 1903.

THE electrodes are made of titanium sub-oxide, by heating a mixture of seven parts of rutile with rather more than one part of carbon to  $1500^\circ$ — $2000^\circ\text{C}$ ., the mass being moulded into pencils with the aid of water and glycerin. Owing to the high luminosity of the arc, the positive electrode may consist of copper or other good conducting material of sufficient dimensions to prevent injurious oxidation.—C. S.

#### UNITED STATES PATENTS.

Furnace; Siemens Regenerative —. A. Kurzwehnart, Zuckmantel, Austria-Hungary. U.S. Pat. 786,770, April 4, 1905.

SEE Eng. Pat. 8311 of 1904; this J. 1904, 816.—T. F. B.

Gas-Producer. C. Whitfield, Kettering. U.S. Pat. 786,474, April 4, 1904

SEE Fr. Pat. 321,672 of 1902; this J., 1903, 205.—T. F. B.

Gas-Furnace. J. C. Swindell, Allegheny, Pa. U.S. Pat. 787,131, April 11, 1905.

THE furnace as shown in the figure consists of a combustion chamber placed below the furnace-chamber. From the combustion-chamber the waste gases pass downwards through a flue to a horizontal waste-gas channel below, in flowing through which, they heat the incoming air, which enters through a channel adjacent to the horizontal waste-gas channel.—W. H. C.

Electrode for Arc-Lamps and Method of Making Same. J. L. Roberts, New York. U.S. Pat. 786,518, April 4, 1905.

THE electrode consists of a metallic tube filled with a rod or roll of wire-gauze, the interstices of the latter being filled with a pulverised refractory material, containing chromium the particles of which are bound together by means of some "carbonizable" substance.—W. H. C.

#### FRENCH PATENTS.

Fuel; Manufacture of Agglomerated —. E. P. L. Mors and A. D. J. A. Nobécourt. Fr. Pat. 348,289, Feb. 3, 1904.

IN order to obtain a porous block of fuel which will retain its shape until consumed, the fine coal is agglomerated with such materials as glue, gums, starch, &c., with the addition at the time of agglomeration, of either wood, sawdust, peat, "fat" coal, and alkali carbonates or nitrates, the last-named being added in such proportions that a clinker which is partly porous is obtained. The blocks are either heated or partly carbonised before use in order to obtain a block full of cavities separated by only thin partitions of combustible matter.—W. H. C.

Combustible; New Agglomerated —. G. M. Larondie. Fr. Pat. 348,475, Feb. 10, 1904.

PAPER, rags, or wood are sprinkled with water and allowed to rest for 48 hours. The mass is then placed in a mixer, and treated with a 5 per cent. solution of sodium carbonate till it forms a fairly thick paste. The paste is transferred

to another mixer and treated with a 1 per cent. solution of hydrochloric acid, till stiff. Ten parts of this product are then mixed with 90 parts of fine coal, and sprinkled during mixing with a 1 per cent. solution of commercial nitric acid, which partially converts the cellulose of the paper, &c., into pyroxylin. The quantity of nitric acid required must be exactly calculated, so as to form only the compound  $(C_{12}H_{15}(NO_2)_5O_{15})_n$ . The mass is then dried and pressed into moulds.—L. F. G.

**Fuel; Artificial** —. C. H. Carpenter and S. L. Davis. Fr. Pat. 348,515, Nov. 19, 1904.

SEE Eng. Pat. 24,336 of 1904; this J., 1905, 189.—T. F. B.

**[Fuel] Briquettes; Manufacture of** —. W. Simpkin and J. B. Ballantine. Fr. Pat. 348,578, Dec. 5, 1904. Under Internat. Conv., June 23, 1904.

SEE Eng. Pat. 14,213 of 1904; this J., 1905, 189.—T. F. B.

**Combustible**. E. La Combe. Fr. Pat. 348,606, Dec. 6, 1904.

FIFTY to 40 parts of crude naphthalene, 40 to 50 parts of coal dust, and 10 parts of rosin are mixed together by suitable means. This mixture melts at 50° C., and becomes very liquid at 65° C. For use as a fuel it is fed into the furnace in the solid condition, or sprayed in when melted.—L. F. G.

**Combustible; Artificial** — and **Process for Obtaining same**. W. B. Hartridge. Fr. Pat. 348,627, Dec. 7, 1904. Under Internat. Conv., Dec. 9, 1903.

SEE Eng. Pat. 26,974 of 1903; this J., 1905, 78.—T. F. B.

**Coke Ovens**. H. Koppers. Fr. Pat. 348,391, Dec. 1, 1904.

SEE Eng. Pat. 18,262 of 1904; this J., 1904, 1021.—T. F. B.

**Alcohol; Process for Carburetting** — for use as an **Illuminant without a Mandle**. A. M. Villegoureux. Fr. Pat. 348,544, Feb. 13, 1904.

ALCOHOL for use as an illuminant is prepared by mixing together 35 parts of pentane or other light hydrocarbon, 15 parts of benzine, and 50 parts of alcohol.—L. F. G.

#### GERMAN PATENTS.

**Coal in Lumps from Anthracite Coal Slime and Dust; Process for the Manufacture of** —. C. Hoeke and G. Heine. Ger. Pat. 153,878, Oct. 9, 1902.

ANTHRACITE coal slime or dust is mixed with a small proportion of bituminous coal and the mixture heated in a rotating furnace, whereby the bitumen of the bituminous coal acts as an agglomerant and causes the formation of irregular lumps of coal. The furnace is so constructed that the part which contains the mixture while it is still moist (soft) rotates slowly, whilst one end rotates quickly.—A. S.

**Coke Oven**. M. Kuhlemann. Ger. Pat. 154,488, 1902.

IN horizontal coke ovens with vertical heating flues is made for the construction of the heating flues, the flues alternately inclined in opposite directions so that the heating gases pursue a zig-zag course. Claim is also made for the construction of the walls of the heating flue in the form of a series of steps.—A. S.

**Gases; Device for the Introduction of Steam into** —. F. Burgemeister. Ger. Pat. 154,028, 1903.

INSIDE the steam-supply pipe, before it opens into the furnace, is arranged an endless screw, so that the steam is intimately mixed with the gas before condensation in the former can take place.—A. S.

### III.—DESTRUCTIVE DISTILLATION OF TAR PRODUCTS, PETROLEUM AND MINERAL WAXES.

**Pitches from Stearin; Notes on** —. E. Donat. Page 505.

**Ammonia; Decomposition of** — at **High Temperature**. A. H. White and W. Melville. VII., page 505.

#### ENGLISH PATENT.

**Tar Oils; Treatment of Heavy** — for the **Manufacture of Pitch or of a Special kind of Tar**. Rud. Rütge Fabrik. f. Theerprodukte, Charlottenburg, C. Eng. Pat. 23,680, Nov. 2, 1904. Under Internat. Conv., July 1, 1904.

SEE Fr. Pat. 347,498 of 1904; this J., 1905, 326.—

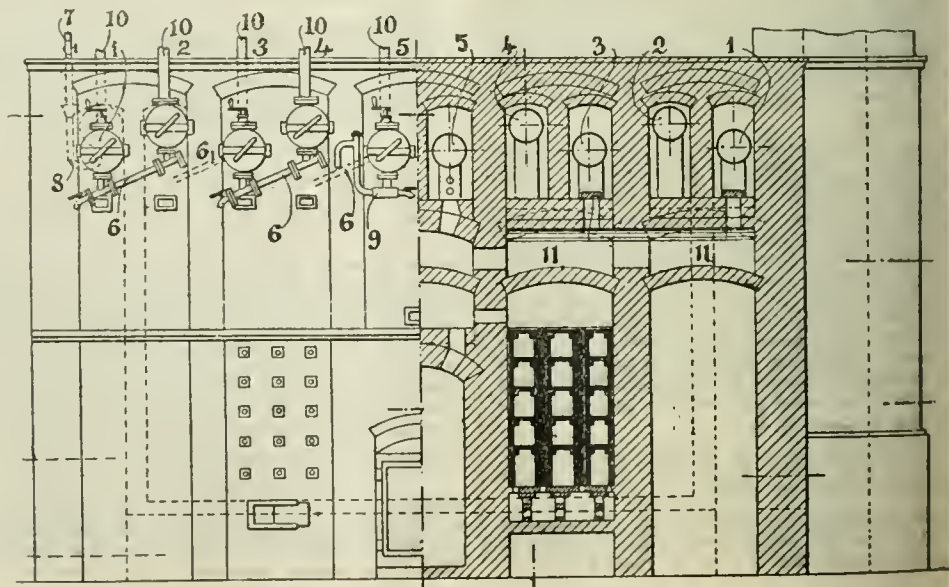
#### UNITED STATES PATENT.

**Wood Distilling Plant**. C. M. Palmer, New London, Conn. U. S. Pat. 786, 144, March 28, 1905.

A HORIZONTAL retort is provided with rails along which run cars which carry the wood to be distilled. The retort is provided with a perforated horizontal steam-inlet at one end of the retort is closed by a cap, which is screwed in position during distillation.—T.

#### FRENCH PATENTS.

**Distillation [Tar]; Continuous** —. E. S. Fr. Pat. 348,267, Nov. 26, 1904.





ues of horizontal tubular retorts 1, 2, 3, 4 5 are as shown, in suitable heating chambers above a pier, from which the hot gas passes first under the retort 5 of each series, and then under 4, 3, 2, 1 in the direction to that taken by the material to be dyed. The retorts are set with a slight inclination, in the directions, the lower end of one retort being connected by the pipes and valves 6, 6 with the upper end of the next in the series. The tar is fed into retort 1, by a valved pipe 7 and the funnel and siphon pipe 8, and through the retorts 1, 2, 3, 4, 5 successively, in a stream over the portions of the retorts that are most highly heated, the residue (pitch) being run out of the retort 5, continuously by the valved siphon pipe 9. Different fractions are led away to separate condensers receivers by the pipes 10, 10. One producer serves two re batteries of retorts, and the regulation of the heat is controlled by altering the amount of secondary air and by admitting a portion of the hot gas directly to the retorts by the ports 11, provided with dampers closed from without.—W. H. C.

*ions; Preparation of Hydrocarbon —, and their Application for the Degreasing of Textiles.* E. Saint-ve and E. de Grousseau. Fr. Pat. 348,501, Nov. 1904.

**R-SOLUBLE** emulsions of hydrocarbons or their derivatives, are obtained by incorporating the hydrocarbon with an aqueous emulsion "of an albuminoid such as carrageen" (obtained from seaweed of the *fucus* type) or from alkaloidal compounds, such as emulsine (Panama wood). One kilo. of emulsine or carrageen added with 75 litres of water, the solution is filtered and heated to about 20° C., and 30 kilos. of the substance which is intended for scouring textiles, a salt such as an ammonium chloride, sulphate, carbonate, or silicate may be added to the emulsion; for removing grease surfaces, a sandy substance may be added. The resulting emulsions are stated to be miscible with water in all proportions, even very hard waters. Compare Fr. Pat. 346,831 of 1904; this J., 1905, 238.—T. F. B.

*a; Paraffin [Wax] —.* M. F. L. Colignon. Fr. Pat. 348,277, Nov. 16, 1904. XIII. A., page 506.

#### IV.—COLOURING MATTERS AND DYESTUFFS.

*Hydroxyanthraquinones and their Sulphonic Acids; Mordant-Dyeing Properties of the —.* G. v. Georgi. Z. Farben-u-Textil-Ind., 1905, 4, 185—192.

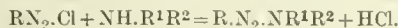
In consequence of Möhlau and Steimmig's criticism of his researches on this subject (this J., 1902, 1530), the author adduces further evidence in support of his previous conclusions. The theory advanced by these authors is, that if a hydroxyl group is adjacent to the chromophoric element in an aromatic hydroxy compound, the latter will act as a mordant dyestuff, is in the author's view of general acceptance. Not only have the mordant effects exhibited by hydroxyls when in the  $\alpha$ -position been disregarded, but the fact has been overlooked, that quinizarin, in spite of the attachment of its hydroxyl in ortho-position to the chromophoric carbonyl group, possesses inferior dyeing properties to hystazarin in which the hydroxyl is in the  $\beta$ -position. From a comparison of the dyeing properties of trihydroxyanthraquinones (quinizarin), it is inferred, that the most essential difference is exhibited by 1,2,3-trihydroxyanthraquinone (anthraquinone), whilst the 1,2,4-derivative (purpurin) displays the dissimilarity. Of the remaining compounds, the 1,2,5- and 1,2,8-derivatives are further removed from

alizarin than the 1,2,6- and 1,2,7- types, whilst the changes are more marked in the 1,2,5- than the 1,2,8- compounds, the former giving with alumina a bluer red than alizarin. 1,4,5-Trihydroxyanthraquinone gives paler shades than 1,4-dihydroxyanthraquinone (quinizarin). 1,4,5-Tetrahydroxyanthraquinone is practically devoid of dyeing properties. It is shown, that the 1,5- and 1,8- positions unfavourably influence the mordant-dyeing action. The introduction of the sulphonic acid group has a beneficial effect on the mordant-dyeing properties of hydroxyanthraquinones. It facilitates the formation of lakes, and is capable of acting as an auxochrome group. The sulphonic acids of quinizarin, xanthopurpurin, anthrarufin, ehrysazin, and anthraflavic acid have been prepared and their dyeing properties investigated. In each case, the sulphonated compound was found to possess more powerful dyeing properties, the most striking instance being that furnished by anthrarufin, which having little or no dyeing action, is transformed into a real dyestuff by the introduction of the sulphonic acid group into its molecule.

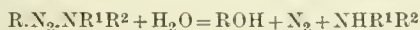
—D. B.

*Diazo-amino Compounds, Secondary —.* L. Vignon and A. Simonet. Comptes rend., 1905, 140, 1038—1040.

The authors prepared a number of secondary diazoamino compounds by the action of diazo compounds on fatty and aromatic secondary amines, according to the equation.



The reaction takes place very easily if the diazo-compounds are from aniline, its substitution-products, the toluidines, or the naphthylamines are used. The reaction proceeds less easily with the xylidines and not at all with aromatic amino-acids. Sulphanilic acid gives, not the diazo-amino compound, but the corresponding azo derivative. Secondary diazoamines are unstable, with the exception of those derived from fatty secondary amines. The compound  $\text{C}_6\text{H}_5\text{N}_2\text{N}(\text{C}_2\text{H}_5)_2$  is a red oil, boiling at "258—240° C." which can, when dry, be distilled without decomposition. Secondary diazoamines can be converted into the corresponding azo compounds in presence of excess of an amine, which may be either primary or secondary. When heated with dilute acids they evolve nitrogen with formation of a phenol and the secondary amine, according to the equation:



In this reaction nothing corresponding to the migration of the hydrogen atom in the case of the primary diazoamines is observed when secondary diazoamines are used. All the diazoamines described are red to yellow substances, some of which could not be solidified but were obtained as thick oils. The compounds obtained by the action of diazo-benzene on monomethyl-, monoethyl- and monobenzylaniline, dibenzylamine, and diethylamine are described.—E. F.

#### ENGLISH PATENTS.

*Amidothioaliphyl Derivatives; Manufacture of New —, and of New [Azo] Dyestuffs therefrom.* O. Imray, London. From Soc. Chem. Industry in Basle, Basle, Switzerland. Eng. Pat. 7363, March 28, 1904.

SEE Fr. Pat. 337,329 of 1903 and Addition thereto; this J., 1904, 486 and 783.—T. F. B.

*Dyes, Mono-azo [Azo Dyestuffs]; Manufacture of —.* H. H. Lake, London. From K. Oehler, Offenbach-on-Maine, Germany. Eng. Pat. 7863, April 5, 1904.

SEE U.S. Pat. 767,069 of 1904; this J., 1904, 863.—T. F. B.

*Colouring Matters [Pyrene Dyestuffs]; Manufacture of Compounds suitable for use in the Preparation of —.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 9675, April 27, 1904.

SEE Fr. Pat. 342,518 of 1904; this J., 1904, 980.—T. F. B.

*Dyes, Sulphur [Sulphide Dyestuffs]; Manufacture of Green* — G. B. Ellis, London. From Chem. Fabr. vorm. Sandoz, Basle, Switzerland. Eng. Pat. 11,863, May 24, 1904.

SEE Fr. Pat. 343,377 of 1904; this J., 1904, 1026.—T. F. B.

*Dyestuffs derived from Dyestuffs of the Oxazine Class; Manufacture of New* — O. Murray, London. From Dye Works formerly L. Durand, Huguenin and Co., Basle, Switzerland. Eng. Pat. 3497, Feb. 20, 1905.

BLUE to yellowish-green dyestuffs are obtained by treating oxazines, especially galloxyanines and their derivatives with formaldehyde, in suitable neutral acid or alkaline media. The products can be used either for dyeing or printing. With chromium mordants greenish-blue to yellowish-green shades are obtained, very fast to light and to fading. The best defined products are obtained by using equimolecular proportions of the oxazine and formaldehyde. For example, 37 kilos. of the galloxyaniline obtained from nitrosodimethylaniline and gallamic acid are dissolved in hot water, 12 kilos. of 40 per cent. formaldehyde added, and the whole heated to 100° C. for 10–12 hours, or until the liquid becomes plainly greenish. The product is then salted out. The above-described dyestuffs from oxazines and formaldehyde are converted into blue to green dyestuffs by heating with water to 100°–200° C. in presence or absence of acids. The products so obtained are more easily soluble in water than the original compounds. Their alkaline solutions also oxidise more rapidly in the air, and the tints obtained on dyeing or printing are bluer. On wool, with a chromium mordant, they yield greenish-blue shades. Dyestuffs of either of the above-described new classes are further modified by the action of acid, neutral or alkaline reducing agents. The products so obtained dye more evenly and yield bluer and brighter shades than the original compounds. An excess of reducing agent does no harm. Tin, zinc, aluminium, hydrosulphites and their formaldehyde compounds, alkali or hydrogen sulphides, titanium chloride or dextrose may all be used. The solutions of the products in water are oxidised by air. They dye wool from an acid bath, and other fibres when chrome-mordanted.—E. F.

*Lakes; Manufacture of Colouring Matter* — J. Y. Johnson. From Badische Anilin u. Soda Fabrik. Eng. Pat. 10,895, May 11, 1904. XIII. A., page 506.

#### UNITED STATES PATENTS.

*Dyestuff, Anthracene, and Process of Making same; Violet* — O. Bally, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 786,085, March 28, 1905.

ON condensing  $\beta$ -aminoanthraquinone or its derivatives with glycerin in presence of sulphuric acid, compounds are obtained which dissolve in concentrated sulphuric acid to fluorescent solutions, and which yield dyestuffs similar to Indanthrene on melting with alkali hydroxide. The compound obtained from  $\beta$ -aminoanthraquinone gives a violet dyestuff on melting with alkali hydroxide.—T. F. B.

*Dyestuff, Azo; Blue-Red* — P. Julius and E. Fussenegger, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 786,767, April 4, 1905.

SEE Addition of Oct. 28, 1904, to Fr. Pat. 346,008 of 1904; this J., 1905, 329.—T. F. B.

*Dyestuff, [Azo]; Claret-Red Mordant* —, and Process of Making same. A. L. Laska, Assignor to the Firm of K. Oehler, Anilin- und Anilinfarbenfabrik, Offenbach-on-the-Maine, Germany. U.S. Pat. 787,046, April 11, 1905.

SEE Eng. Pat. 28,596 of 1904; this J., 1905, 328.—T. F. B.

*Dyestuff, Azo; Orange Red* — P. Julius and E. Fussenegger, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 787,767, April 18, 1905.

SEE Fr. Pat. 346,007 of 1904; this J., 1905, 84.—T. F. B.

*Dyestuff, Azo; Blue-Red* — P. Julius and E. Fussenegger, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 787,767, April 18, 1905.

SEE Fr. Pat. 346,008 of 1904; this J., 1905, 84.—T. F. B.

*Dyestuffs [from Naphthazarin]; Process of Making Black* — R. Bohn, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 787,824, April 18, 1905.

SEE Eng. Pat. 2468 of 1904; this J., 1905, 23.—T. F. B.

*[Aniline Black]; Electrolytic Method [of Producing]* — A. S. Ramage, Detroit, Mich. U.S. Pat. 787,824, April 11, 1905.

AN aqueous solution of an aniline salt and a metal is subjected to electrolysis, an insoluble anode is used. The aniline is oxidised at the anode to a black, and the residual liquor is used for the production of further quantities of the aniline salt.—T. F. B.

#### FRENCH PATENTS.

*Indigo Pastes; Process for Preserving Fermentable* — Badische Anilin und Soda Fabrik. Fr. Pat. 346,007, Feb. 4, 1904. Under Internat. Conv., Jan. 13, 1904.

SEE Eng. Pat. 3108 of 1904; this J., 1905, 24.—T. F. B.

*Dyestuff [Azo]; Preparation of a Mono-azo — for the Manufacture of Lakes*. Soc. Badische Anilin und Soda-Fabrik. Fr. Pat. 348,588, Dec. 5, 1904.

*p*-CHLOROANILINE is diazotised and combined with  $\beta$ -naphtholdisulphonic acid R. The product is soluble in hot water, but the corresponding barium salt is insoluble. The product forms lakes which are distinguished by brilliancy and by almost complete fastness to light.—E. F.

*Lakes [from Azo Dyestuffs]; Production of* — Soc. Badische Anilin und Soda-Fabrik. Fr. Pat. 348,426, Dec. 5, 1904. XIII. A., page 506.

### V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

*Hydrosulphites; Preparation of* — J. J. Billy. VII., page 496.

#### ENGLISH PATENTS.

*Wool; Lubrication of — in the Manufacture of Yarn or Cloth*. J. J. Crosfield, Frodsham, Cheshire, and K. E. Markel, Bewsey, Warrington. Eng. Pat. 9946, April 30, 1904.

THE crude oleic acid commonly used for the lubrication of wool previous to its manufacture has the disadvantage of becoming solid at or about 0° C.; it is proposed to substitute for it ricinoleic acid, which, besides possessing all the advantages of oleic acid, is free from the drawback. It may be employed alone, or in conjunction with other substances employed for the purpose. A mixture of 70 parts of ricinoleic acid with 30 parts of olive oil or neatfoot oil has been found a very satisfactory lubricant.—T. F. B.

*Wool; Potash Leaching Apparatus for Raw Wool*. E. F. Bernhardt, Leisnig, Saxony. Eng. Pat. 9946, May 21, 1904.

SEE Fr. Pat. 345,718 of 1904; this J., 1905, 85.—T. F. B.



*Bleaching, Boiling and Rinsing Textile Fabrics and Other Goods; Apparatus for* — F. Scharmann, Bocholt, Germany. Eng. Pat. 25,703, Nov. 25, 1904. Under Internat. Conv., Feb. 26, 1904.

Fr. Pat. 340,792 of 1904; this J., 1904, 821.—T. F. B.

*and Bleaching Textile Materials and Fabrics; Apparatus for* — F. Scharmann, Bocholt, Germany. Fr. Pat. 25,704, Nov. 25, 1904. Under Internat. Conv., Feb. 26, 1904.

Fr. Pat. 340,736 of 1904; this J., 1904, 821.—T. F. B.

#### UNITED STATES PATENTS.

*Pressing Machine.* H. W. Butterworth, Assignor to H. Butterworth and Sons, Co., Philadelphia. U.S. Pat. 786,264, April 4, 1905.

The invention relates to a mercerising machine, comprising a vat, a pair of pressure-rollers for applying pressure to the fabric as it enters the machine, a series of vertical pressure-rollers geared together and having points of contact below the level of liquid in the vat, squeezing-rollers arranged at a higher level for forcing the excess of liquid from the fabric as it leaves the machine. The distance between the pressure-rollers in the vat may be varied, and therefore also the extent of pressure on the fabric which is drawn through the rollers. The latter are carried on a pivoted frame which is journaled to the vat adjacent to the squeezing-rollers and is adjustably supported so as to vary the pressure of the pressure-rollers in the fluid. Power devices are provided for positively rotating all the rollers at the same speeds, and tension devices for putting the fabric under tension immediately prior to its being drawn by the pressure-rollers.—B. N.

*Machine for Treating and Utilising* — [Electrically] E. C. Patamore. U.S. Pat. 786,595, April 4, 1905. XI. A., page 503.

#### FRENCH PATENTS.

*Carbon Emulsions; Preparation of* —, and their application for the Degreasing of Textiles. E. Saint-hilaire and E. de Grousseau. Fr. Pat. 348,501, Nov. 15, 1904. III., page 493.

*Bobbins; Degumming, Dyeing, Bleaching, &c.* — L. Détré. Fr. Pat. 348,368, Dec. 1, 1904.

The invention relates to the contraction of the fibre which occurs during degumming, dyeing, &c., of silk yarns, it has hitherto been impracticable to wind such yarns upon bobbins and treat them in this state with circulating dye, &c., in the manner frequently adopted with yarns of other fibres. To enable this to be accomplished, the silk yarns are wound upon the bobbins, simultaneously, and alternately in alternate layers with metallic wires, threads, or bands composed of fibres, e.g., cotton, which are not liable to contraction under the influence of the treatment employed. Bobbins of silk yarns are thus obtained which remain permeable throughout the operation of degumming, &c., to which they are subjected.—E. B.

*Improvements in Weighting* — A. Bnssy. Fr. Pat. 348,291, Feb. 3, 1904.

The invention relates to a process for weighting silk by the use of tin salts. The silk is first impregnated with some soluble oil, which forms with certain metallic salts soluble oleates on the fibre. It is then washed and treated through a solution of a salt of magnesium, iron, zinc, lead, barium, strontium or calcium. During the washing, the metallic oleate on the fibre is converted into a phosphate or silicate by passing through an alkaline solution or silicate solution. These three operations are repeated as often as necessary to give the desired

amount of weighting, or the first two operations may be repeated several times, and the last performed once only.—T. F. B.

*Logwood Black on Wool; Single Bath Method for Dyeing* — C. L. and J. Vandystadt. Fr. Pat. 348,283, Feb. 2, 1904.

The dye-bath employed is composed (for 100 kilos. of wool) of logwood (about 50 kilos.), fustic extract (2), ferrous sulphate (3), oxalic acid (2), common salt (0.75), sodium nitrate or nitrite (0.25), hydrochloric acid (1) and copper sulphate (1.75).—E. B.

*Indigo and Analogous Compounds; Process for Reducing* — Badische Anilin und Soda Fabrik. Fr. Pat. 348,360, Nov. 29, 1904. Under Internat. Conv., Oct. 29, 1904.

It is found that indigo and its homologues and their derivatives may be reduced to indigo white by means of iron and alkali hydroxide solutions of strength not less than 10° B.; the reaction commences at a temperature of about 50° C. 250 kilos. of pure indigo are slowly added to a solution of 110 kilos. of caustic soda in 640 litres of water, containing 60 kilos. of iron dust, the mixture being heated to 75° C. A 30 per cent. solution of indigo white is obtained by filtering the reduced mixture *in vacuo*.—T. F. B.

*Tissues or Paper; Coating with a Layer of Artificial Silk* — L. Richard and J. Jacquinet. Fr. Pat. 348,354, Nov. 29, 1904.

A thin sheet of polished metal, e.g., aluminium, or of any other flexible material not attacked by a solution of nitro-cellulose in a mixture of alcohol and ether, is passed through such a solution into a chamber, where the solvents are evaporated. The films thus obtained are denitrated, washed, rendered "incombustible," and dyed while adhering to the surfaces of the lamina upon which they have been formed. A dyed tissue, or a coloured sheet of paper is next fastened with gelatin to each side of the latter. The tissues, or the sheets of paper with the films adhering to them, are then detached from the metallic or other support. When a cotton tissue is employed, a fabric resembling it is stated, a tissue woven with a silk face and cotton back is produced.—E. B.

*Colour Effects, Mixed, on [Raised] Tissues; Method and Apparatus for Producing* — C. Kübler. Fr. Pat. 348,398, Dec. 1, 1904.

A solution of a dyestuff or mordanting compound is supplied by furnishing rollers or by an endless travelling band to the revolving cards of a raising machine. From these it is transferred to a tissue, a nap being at the same time raised upon the surface of the latter by the action of the cards. The nap is thus dyed or mordanted for dyeing in a colour or colours different from that, or those, of the body of the tissue.—E. B.

#### GERMAN PATENT.

*Adhesive; Method for the Preparation of an* — H. Hey. Ger. Pat. 155,741, May 6, 1903. XIV., page 507.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

#### FRENCH PATENT.

*Papers with Designs of all kinds; Process for Making Lustrous* —, Coloured and Dyed Papers, &c. Soc. Hennessen et Jansen and Soc. Spix et Lindermann. First Addition, dated Dec. 2, 1904, to Fr. Pat. 343,856, June 10, 1904.

SEE Eng. Pat. 26,532 of 1904; this J., 1905, 331.—T. F. B.

## VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

*Hydrofluoric Acid II.* [In Making Beet Sugar for the Removal of Rust from Iron, and in the Determination of Iron and Aluminium]. E. Denssen. Z. anorg. Chem., 1905, 44, 408—430. (For Part I., see this J., 1905, 440.)

In the inversion experiments it was found that the direct polarimetric examination of solutions containing hydrofluoric acid was comparatively easy, especially if the closing plates for the polarisation-tube were made of fluor-par.

The inversion-constant of N/1 hydrofluoric acid is only 5.7 at 25° C., but is 22.26 at 35° C., and increases with rise of temperature. In the diffusion apparatus for the extraction of beet-juice, the temperature varies between 20° and 90° C., so that if hydrofluoric acid were added in sufficient quantity to exercise an efficient bactericidal effect, a not inconsiderable quantity of sucrose would be converted into invert sugar.

Verhieses' proposal to use hydrofluoric acid as an antiseptic in the manufacture of beet-sugar appears to hold out little prospect of success.

The author confirms Stahl's statement that commercial hydrofluoric acid is more efficient than hydrochloric or sulphuric acid in removing scale or rust from iron objects. If iron scale be treated with hydrofluoric acid, the scale being maintained in excess, a decrease in the amount of dissolved iron takes place after several hours' agitation, owing to the formation of a sparingly soluble iron oxyfluoride. A sparingly soluble copper oxyfluoride is formed in a similar manner.

For the determination of iron and aluminium in a strongly ignited mixture of a small proportion of ferric oxide with a large proportion of alumina, Hillebrand has recommended fusing with potassium pyrosulphate in a platinum crucible, dissolving in dilute sulphuric acid, precipitating the dissolved platinum by hydrogen sulphide, expelling the excess of hydrogen sulphide from the filtered solution by means of carbon dioxide, and titrating the iron with permanganate. The author finds that the fusion can be completed in a few minutes, and without the platinum being attacked, if potassium hydrogen fluoride, K.F.F.H., be used in place of potassium pyrosulphate. The titration with permanganate is, however, inaccurate in presence of any considerable quantity of free hydrofluoric acid, so that, after the fusion, the greater portion of this acid must be expelled by heating with dilute sulphuric acid. The solution of the sulphates is then reduced with sulphurous acid, the excess of the latter expelled by means of carbon dioxide, and the iron titrated with permanganate.—A. S.

*Ammonia; Decomposition of — at High Temperatures.* A. H. White and W. Melville. J. Amer. Chem. Soc., 1905, 27, 373—386.

THE temperature of initial decomposition of ammonia is found to be about 450° C. The amount of decomposition when passed through a hot tube, is not affected by dilution with an inert gas such as hydrogen or nitrogen, providing the rate of flow of the gas through the tube remain the same. This confirms the work of Deville and Troost (Comptes rend., 56, 895), and of Perman and Atkinson (this J., 1904, 915). The introduction of carbon monoxide and of aqueous vapour increases the rate of decomposition somewhat. The formation of cyanogen was small. The observations of Ramsay and Young (this J., 1884, 157) as to the influence of the nature of the hot surface on the rate of decomposition of the ammonia, are fully confirmed. It is concluded that, in the destructive distillation of coal, decomposition of the ammonia may be diminished by keeping the temperature low, and by diminishing as far as possible the duration of contact of the hot gases with rough substances such as the coke or retort. The high yield of ammonia in the Mond gas process is attributed to the lower temperature of working and to the rapid removal of the gases.—T. F. B.

*Hydrosulphites (Hyposulphites); Preparation of Bility.* Comptes rend., 1905, 140, 936—937.

THE author finds that the production of sodium hydrosulphite according to the Badische Co.'s process by action of sulphur dioxide upon sodium (this J., 1903, only takes place in presence of absolute alcohol, and the presence of ether as stated. This reaction depends on the presence of some solvent which is attacked by metal. Magnesium hydrosulphite is formed by the action of dry sulphur dioxide upon magnesium in presence of absolute alcohol. The hydrosulphite is soluble in absolute alcohol, in the form of an acid salt, in presence of excess of sulphur dioxide, but is deposited when the excess of the latter is removed *in vacuo*. When the solution is evaporated to dryness in the cold, a double compound of magnesium hydrosulphite and alcohol, insoluble in absolute alcohol, is obtained. The mechanism of the reaction is explained by the observation that magnesium is capable of combining with alcohol to form an alcoholate evolution of hydrogen. The latter forms magnesium hydride which reacts with the sulphur dioxide. Calcium, aluminium, and iron also form hydrosulphites slowly at ordinary temperatures when sealed up in the presence of alcohol saturated with sulphur dioxide.—J. F.

*Hydrofluosilicic Acid; Behaviour of — to Various Reagents.* A. Gawalowski. XXIII., page 513

### ENGLISH PATENTS.

*Sulphuric Anhydride; Apparatus for the Manufacture of — [by the Contact Process].* G. Eschellmar, Harmuth, and the Tov Tentelevskago Xim Zavoda, St. Petersburg. Eng. Pat. 20,952, Sep. 1904.

SEE Addition, dated Oct. 4, 1904, to Fr. Pat. 321, May 20, 1902; this J., 1905, 277.—E. S.

*Arc, Mercury Vapour; Methods of Conducting Chemical Reactions by means of a —.* E. A. Carolan, General Electric Co. Eng. Pat., 10,881, May 11, XI. A., page 503.

### UNITED STATES PATENT.

*Boron; Production of —, by Electrolysis.* J. A. Broadwell. U.S. Pat. 785,962, Mar. 1905. XI. A., page 503.

### FRENCH PATENTS.

*Sodium Perborate; Process of Preparing —.* De Gold und Silber-Scheide-Anstalt vorm. Rössler. Pat. 348,456, Oct. 14, 1904.

SEE Eng. Pat. 22,004 of 1904; this J., 1905, 197.—T.

*Vanadium; Treatment of the Ores of —, by Bisulphates.* A. H. Perret. Fr. Pat. 348,633, 1904.

THE ores are treated with a fused alkali bisulphate the mass is further heated to set free sulphuric anhydride which is collected. The residue is exhausted with water, and to the filtered solution, ammonium chloride is added. The precipitate is collected and calcined to obtain crude vanadic anhydride.—E. S.

*Oxygen and Nitrogen from Liquid Air; Process of Separation of —.* Société pour l'Exploitation des Procédés Georges Claude. Second Addition, Feb. 12, 1904, to Fr. Pat. 328,245, of Jan. 3, 1903, 950).

IN the process described in the main patent for the separation of oxygen and nitrogen by partial liquefaction and backward return of the liquid formed, it is now found that two or more such returns may be made, with an adjustment of the intervening pressures. Arrangements are made for maintaining a partial vacuum, in order to reduce the degree of compression required for the liquefaction of the gas. The tubular system in which the process is carried out, consists of a series of vertical



versing a number of vessels, in which the liquid air is by overflow tubes successively from vessel to vessel, whereby a methodical application is made of the principle of the partial liquefaction of air with backward return. (also first Addition, dated June 5, 1903, to the same Pat.; this J., 1903, 1292.)—E. S.

# GERMAN PATENTS.

*Nitric Acid; Process for the Preparation of* — H. H. Nidenführ. Ger. Pat. 155,095, May 29, 1903.

It is made for the placing of a draught-producing piece between the condensing apparatus for the nitric vapours, connected directly to the still, and a filter apparatus intended for the oxidation and condensation of the lower oxides of nitrogen. The gases are entering the last-mentioned part of the plant, or are entering the draught-producing device, may be led. The process is worked in such a manner that a moderate vacuum is maintained in the condensing apparatus for the nitric acid, whilst that portion of the plant which is beyond the draught-producing device, and which of smaller dimensions, is kept under a slight pressure. It is stated that the condensing apparatus for the nitric acid can be maintained at a temperature so high that nitric acid readily gives off any oxides of nitrogen it contains, so that the strongest commercially pure acid is obtained in this portion of the plant.—A. S.

*Nitric Acid; Method for the Purification of* — by Distillation. J. Waldbauer. Ger. Pat. 155,006, Dec. 1, 1902.

Nitric acid is purified by distillation in iron vessels heated externally. The stills are filled with granular material to which the acid is allowed to flow, the rate of supply being so regulated that as the acid traverses the granular material, it is evaporated, and only vapour comes in contact with the walls of the still. In packing the still it is preferable to use a layer of fine sand next to the walls, a layer of coarse sand, and in the centre, a core of iron on to which the acid is allowed to flow.—A. S.

*Ammonium Potassium-Magnesium Carbonate* — Salzbergwerk Leu-Stassfurt. Ger. Pat. 155,007, May 2, 1901. Addition to Ger. Pat. 143,409 of April 13, 1900 (this J., 1903, 949).

The decomposition of the potassium-magnesium carbonate effected in closed vessels, so that the magnesium carbonate trihydrate is formed in presence of carbon dioxide. It is stated that by preventing the escape of carbon dioxide, the conversion of the crystalline magnesium carbonate trihydrate into amorphous salts containing less water of hydration is avoided, and that the temperature at which the decomposition is effected can be raised from 100°C., which is given as the upper limit in the main patent, up to the boiling point.—A. S.

*Zinc Chloride Solutions; Method of Enriching* — L. Köpfner. Ger. Pat. 155,065, May 1, 1902.

Zinc sulphite and lead chloride are dissolved in a hot dilute solution of zinc chloride, whereby the lead is precipitated as sulphite, whilst the zinc goes into solution as chloride. The dilute zinc chloride solution is obtained in several processes for the lixiviation of zinc ores, the zinc sulphite produced when zinc ores are extracted with sulphurous acid, and the lead chloride is obtained by the treatment of ores containing lead with chlorine and certain chlorides.—A. S.

## III.—GLASS, POTTERY, AND ENAMELS.

*Coloration of* — by Natural Solar and other Radiations. W. Crookes. Proc. Roy. Soc., 1905, 74, 524—528.

Two samples of glass coloured an intense purple by the action of light are described. Both samples were originally white, and became coloured by exposure to the sun's rays, one at Uyuni, in Bolivia; the other at Iquique, in

Chile. It was found that both samples contain manganese, and that the colour could be discharged by heating them to their softening points in covered crucibles. The bleached glass speedily became coloured again on exposure to radium rays. The colour is probably due to the manganous compounds in the glass being converted into manganic salts at the expense of the oxygen of the ferric salts present, under the influence of intense solar radiation. The author believes that the high altitude at which both samples of glass were exposed, has some influence on the phenomenon, in that it allows of many rays, which would otherwise be absorbed by the atmosphere, to act on the glass. Judd, on the other hand, points out that green glass at the low elevation of Kew, in time becomes first colourless and then purple; the original green colour is due to ferric oxide, and manganese is always present.

—A. G. L.

*Colours, Lead [Pottery]; Non-Poisonous Fusible* — E. Berdel. Sprechsaal, 1905, 38, 345—346; 393—395; 438—440.

Attempts made to replace part of the alkali and lead by zinc and bismuth were unsuccessful, the products being poisonous. The following fluxes, however, proved able to withstand the German test for non-poisonous lead glazes, namely, that the solution obtained by boiling the glaze for half an hour in a 4 per cent. solution of glacial acetic acid shall not give any precipitate with sulphuretted hydrogen.

Calcined sodium carbonate 10.6—31.8 parts, Norwegian felspar 83.4, red lead 114—171, quartz 96—99, crystallised boric acid 49.6—55.8 parts. The resulting glazes fuse at Seger cone 022—020.

Calcined sodium carbonate 10.6—15.9 parts, Norwegian felspar 83.4, red lead 136.8—148.2, barium carbonate 19.7, quartz 90—99, crystallised boric acid 49.6—62.0 parts. These fluxes are not quite so soft as those of the first group, but fuse at Seger cone 020—018.

Red lead 182.4—205.2 parts, barium carbonate 19.7—39.4, burnt Zettlitz kaolin 33.3, quartz 132.0, crystallised boric acid 49.6 parts. The omission of alkali gave higher fusing temperatures, viz., Seger cone 015.

Red lead 193.8—205.2 parts, barium carbonate 19.7—29.5, burnt Zettlitz kaolin 11.1, quartz 177.0, crystallised boric acid 49.6 parts. The still higher fusing point of this group (Seger cone 05) renders it unsuitable for ordinary fusible colours.

For purple, 4.5 per cent. of 15 per cent. gold purple was employed, with the foregoing fluxes, the more fusible mixtures being fritted at Seger cone 019 and the finished colour fired on the porcelain at cone 017. With the less fusible fluxes the corresponding temperatures were cones 015 and 014 respectively. The resulting fine red stood the test in all cases.

For yellowish red to salmon-red colours, three parts of flux were mixed with one of a pigment consisting of chromic oxide 25.5 parts, alumina 17.0, ferric oxide 26.7 and zinc oxide 40.5 parts (fired at cone 9 in an oxidising atmosphere, ground and washed). The frit was prepared at the temperature of cone 019, and the colour fired on the ware at cone 017 for the first two groups of fluxes, and 014 for the others. No trace of lead could be extracted under the conditions of the test.

The pigment for black was compounded of chromic oxide 76.5 parts, cobalt oxide 18.0, ferric oxide 12.0, manganese oxide 3.8, and nickel oxide 6 parts, triturated, and fired in the hottest part of the porcelain kiln, in a reducing atmosphere. The best results were obtained with one part of pigment to four of flux, the fritting and firing being the same as for the other colours mentioned. These colours also stood the test perfectly.

For green the pigment consisted of 76.5 parts of chromic oxide and 51 of alumina, fired as in the case of black. Mixed with flux, the colour proved more readily fusible than its composition indicated. No lead could be extracted from the fired mixtures of one part of pigment to three, four and five parts of flux respectively. The smallest proportion of flux gave a matt surface, the next a handsome lustrous green, and the other a lustrous but somewhat lighter shade. The fritting temperatures for the fusible and refractory fluxes were

cone 019 and 015, and the firing temperatures 017 and 014.

To obtain the pigment for blue, 51 parts of alumina were mixed with 61 of cobalt phosphate, ground, and fired in the hottest part of the porcelain kiln. With three parts of flux to one of pigment, a matt colour was obtained, which on testing gave a blackish precipitate, consisting mainly of cobalt sulphide. Increasing the proportion of flux to five parts, on the other hand, led to the solution of the cobalt oxide and a total loss of tone. The best results were obtained with  $4\frac{1}{2}$  parts of flux, fritted and fired at the same temperatures as for green, the colour being a beautiful, deep, lustrous blue yielding no trace of a lead precipitate under the test.—C. S.

*Tungstic Anhydride as a Ceramic Colouring Agent; Properties of* —. A. Granger. *Comptes rend.*, 1905, 140, 935—936.

THE difficulty hitherto experienced in utilising tungstic anhydride as a yellow colouring agent in ceramics has been the tendency shown by the coloured glazes to become opalescent or opaque on firing. Lead glazes and baryta glazes generally show this defect when mixed with tungstic anhydride, but with suitable mixtures it is quite possible to prepare such glazes perfectly transparent. For instance, to a glaze of the general formula  $\text{MO} \cdot 2\text{SiO}_2$ , 0.1 mol. of alumina was added; 0.5 mol. of silica was then replaced by boric anhydride, and a further 0.1 mol. of silica was replaced by tungstic anhydride. The bases employed were soda, lime and lead oxide in the ratios  $\text{Na}_2\text{O}:\text{CaO}:2\text{PbO}$ . The basic glaze so produced was readily fusible and quite transparent; it had a yellowish colour. A glaze with similar properties was also prepared by replacing the lead oxide by baryta. A glaze of this nature, however, became opaque on firing, when the proportions of alumina and silica were increased by about one-third.—J. F. B.

#### ENGLISH PATENTS.

*Quartz Glass; Manufacture of* —. J. Y. Johnson, London. From W. C. Heraeus, Hanau, Germany. Eng. Pat. 3906, Feb. 24, 1905.

To avoid formation of air-bubbles in the fused glass, pieces of rock-crystal, ranging in size from that of a hazel-nut to that of a walnut, are very slowly and carefully heated to a temperature of  $600^\circ\text{C}$ ., and then, piece by piece, at once subjected to a vitrifying temperature, either in an oxyhydrogen blow-pipe flame or else in a furnace. In the first case, the vitrified pieces must be separately stoved: in the second case, each piece must be allowed to fuse and unite completely with the main mass before the next piece is introduced.—A. G. L.

*Quartz Glass; Moulding Hollow Vessels of* —. J. Y. Johnson, London. From W. C. Heraeus, Hanau, Germany. Eng. Pat. 4663, March 6, 1905.

A THICK-WALLED cylinder closed at one end is first obtained, either by drilling a hole into a cylindrical piece of quartz glass, or else by forcing a piece of softened quartz glass into a cylindrical mould by means of a plunger having a conical projection. The open end of this cylinder is then attached to a tube of quartz glass, after which the cylinder is further worked as usual in the blow-pipe flame.—A. G. L.

*Glass; Process and Apparatus for the Manufacture of* —. S. O. Richardson, jun., Toledo, U.S.A. Eng. Pat. 9776, April 28, 1904.

SEE U.S. Pat. 766,771 of 1904; this J., 1904, 866.—T. F. B.

#### UNITED STATES PATENT.

*Furnace; Glass-Melting* —. E. Baudoux, Genappe, Belgium. U.S. Pat. 787,553, April 18, 1905.

SEE Eng. Pat. 19,067 of 1904; this J., 1905, 91.—T. F. B.

#### FRENCH PATENTS.

*Glass; Manufacture of Transparent* —. G. Hall. Fr. Pat. 347,897, Nov. 14, 1904.

To obtain a determined degree of tenuity in the covering on the glass, the covering itself having been applied by the usual process described in the specifications as well-known, the excess of the metal is removed by treatment with an acid solution of known strength, which is allowed to act for a definite time.—A. G. L.

*Ceramic Objects of Art; Manufacture of* —. S. St. Fr. Pat. 348,061, Oct. 1, 1904.

WELL-WASHED clay is moulded to the desired form. The objects are partly dried and polished with oiled plates. The drying is then completed, after which the articles are burnt in a closed muffle, and exposed to a smoky flame, and after cooling, are rubbed with wax. To impart a different colour, the articles may, after first burning, be again heated after bedding them in shavings in a closed muffle, the cooled articles being then exposed to the action of a very smoky flame, cooled and polished with wax. A design in relief may also be produced on the burnt articles, the design being then covered with well-washed clay, dried, and burnt, using a smoky flame. After cooling, the covering clay is removed, when the design will show in the original colour of the clay.—A. G. L.

*Pottery; Application to Culinary — of Ceramic Enamel of all Colours. Transparent or Opaque; and Application below or on top of these Enamels of Ornamentation of all Colours.* L. J. Boissonnet. Fr. Pat. 347, Oct. 31, 1904.

THE articles are made as usual of pure clay, burnt at  $990^\circ\text{C}$ . They are then covered with a layer of potassic silicate, and steamed, to give hardness to the enamel. The design is then produced on them as usual, different metallic oxides, mixed with gum, being used for different colours, after which the enamel is applied in a suitable composition for this is as follows: Borax, 10 parts; boric acid, 20; silica, 5; porcelain glaze, calcium carbonate, 30. To produce a coloured enamel 80 parts of this are mixed with 20 of a coloured metallic oxide; for an opaque enamel, 2 per cent. of zinc oxide is added. The whole is then again burnt, gently for the 12 hours, and then for 18 hours at about  $1100^\circ\text{C}$ ., and allowed to cool for 72 hours.—A. G. L.

#### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

*Cement, Portland; Spontaneous Decomposition of Calcium Silicates; and the connection between Felite and Belite in* —. H. Kappen. *Tonind. Zeit.*, 1905, 9, 370—373.

IN mixtures of limestone and blast-furnace slag the latter has a tendency to disintegrate spontaneously with proportions of silica over 24 per cent.; and the constituent of the disintegrated mass is felite, although Törnebohm regarded belite (the hydraulic modification of bicalcium silicate) as the prime cause of the phenomenon. On examining granulated blast-furnace slag, it is found to consist chiefly of gehlenite (a calcium aluminium silicate) and felite, the former crystallising out while the mass is still fluid, whereas the crystallisation of felite does not begin until the mass is apparently solid, the result being that the liberation of heat and the sudden expansion produce disintegration. As the constituents of felite are present in the same proportions of solution in cement clinker is shown by the fact that crystals of spinel are found therein, embedded in the granules. The author has found that felite consists of the non-hydraulic modification of bicalcium silicate, and that its predominance in blast-furnace slag precludes the possibility of obtaining a useful cement from that material, unless mixed with an alkaline adjunct, such as lime, Portland cement, Roman cement, &c.

Owing to its relatively low sp. gr. (always below 3.0) felite, when present, falsifies the result of the determination of light substances in cement by means of methylene iodide.



proportion of belite to felite in cement clinker depends on the kiln temperature employed, a low temperature favouring the production of belite, whilst felite is increased when higher temperatures are used. Thus the same mixture will give a large proportion of belite fired in a ring kiln, but felite alone when fired in the rotary kiln. In the latter case, however, the cement is protected from disintegration by the influence of the rapid firing, which both retards the development of the felite crystals and minimises the expansion. On the other hand, cement materials are imperfectly mixed, the resulting mass will burst, even though only the central portion has gone through disintegration in cooling. Pure bicalcium silicate, prepared by prolonged heating to incipient fusion or actual fusion, disintegrates on cooling, the disintegration powder consisting entirely of felite. The difficulty in the way of producing the hydraulic cement, belite, is due to the fact that the difference between its fusing point and crystallisation point is very small; and when the belite crystals have been destroyed by fusion, they do not re-form, but are replaced by felite.

—C. S.

*Stones; New Method for the Determination of Magnesium Carbonate in* —. W. F. Koppeschaar. *Chim.*, page 613.

*[in Portland Cement]; Alkaline Reaction of Free — Absolute Alcohol*. E. Drexel. *XXIII.*, page 613.

## ENGLISH PATENTS.

*Manufacture of* —. S. McFarlane, Leeds. Eng. Pat. 6631, March 18, 1904.

A mixture of white Portland cement and calespar is milled and consolidated, after which the surface of the mass is polished by passing over it first an iron plough or bar, and then a specially prepared steel plough or bar having a highly polished face. Lampblack or colouring matter may be added to the mixture.

—A. G. L.

*Glazing Matter and the like on Tiles, Brick and other Articles; Machine for Applying* —. E. Goldsmith, Middletown, Ohio. Eng. Pat. 8619, April 14, 1904.

A glazing matter or the like is raised from a container by a circumference of a drum or endless band, and then transferred to a transferer, e.g., a rotating cylinder, for application to the brick or other article. The cylinder does not touch the drum, but dips into a collection of the matter set up in a shallow container formed by a wedge-shaped wiper behind the drum and pushed back the material. To assist the action of this wiper, a roller may be placed close to it in contact with the drum, so as to keep the descending side of the latter clean. The transferring cylinder is preferably provided with an absorbent surface, e.g., felt or sponge-rubber, covered by wire-gauze. To avoid difficulties caused by irregularities of speed, a second wire-gauze envelope is freely placed over the first. In another form of cylinder, it is provided with longitudinal grooves covered by wire-gauze, over which is placed a layer of bent material, and then another envelope of wire-gauze, so as to allow any air-bubbles to escape inwards through the grooves.—A. G. L.

*Building Materials, Heat Insulating Materials and the like; Manufacture of* —. H. H. Lake, London. Eng. Pat. 9680, April 27, 1904.

A mixture is mixed with readily combustible materials, but little ash, such as cork or chaff, silicated clay, or such water-glass and silicated magnesia, obtained by precipitation from a magnesium salt solution, are added. The mixture may be added an acid for separating silicic acid, but generally this may be omitted, the carbon dioxide being evolved during the subsequent firing functioning as the gas. After the mixture has dried in the air, it is moulded into building stones and the like, and burnt to a sintering temperature. The soluble salts may then be removed by lixiviating. A suitable composition is the following: Kieselguhr, 170 lb.; clay, 40; cork, 110; water-glass, 9; and magnesium chloride, 9.—A. G. L.

*Bricks; Impts. in* —. J. T. South, Brighton. Eng. Pat. 9706, April 28, 1904.

THE brick is made by mixing and moulding with water, Portland or other cement, coal ash or sand or grit, alum or "dissolved flint" (i.e., a solution of ordinary flint in hydrofluoric acid), or copperas or green vitriol, or carbon and "soda" in equal parts, and a suitable pigment. After removal from the moulds, the bricks are stacked with free access of air until "matured," which requires about 14 days. Suitable proportions are (1), Portland cement, 5 cwt.; coal ash or sand or grit, 30 cwt.; chalk, 9 cwt.; dissolved flint, 14 lb.; a suitable pigment. (2), Portland cement, 5 cwt.; coal ash, 30 cwt.; chalk, 6 cwt.; sand, 3 cwt.; alum or copperas, 2 lb.; a suitable pigment. (3), Portland cement, 5 cwt.; coal ash or sand or grit, 30 cwt.; chalk, 9 cwt.; carbon, 1 lb.; "soda," 1 lb.; a suitable pigment.—A. G. L.

*Varnishes and Paints for Waterproofing, Disinfecting and like Purposes, also for Indurating Building Materials; Manufacture of* —. J. Hargreaves. Eng. Pat. 11,398, May 18, 1904. *XIII. A.*, page 506.

## UNITED STATES PATENT.

*["Siloxicon"] Refractory Bodies; Method of Making* —. E. G. Acheson, Stamford, Assignor to North American Trust Co., New York. U.S. Pat. 787,869, April 18, 1905.

SEE Eng. Pat. 3629 of 1903; this J., 1903, 743.—T. F. B.

## FRENCH PATENTS.

*Wood; Process of Staining and Impregnating* —. G. Matschak and F. Wanecek. Fr. Pat. 348,477, Oct. 31, 1904.

THE very thoroughly dried wood is immersed in a solution of the colouring matter in commercial acetone or in acetone mixed with alcohol, mineral oil, or turpentine. After the wood is removed from the solution, the solvent is allowed to evaporate, either freely, or else by heat, the acetone, &c., being condensed and recovered.

—A. G. L.

*Impregnating Porous Cellular and Fibrous Substances; Process and Apparatus for* —. J. H. West. Fr. Pat. 348,572, Dec. 5, 1904. Under Internat. Conv., Dec. 8, 1903.

SEE Eng. Pat. 26,899 of 1903; this J., 1905, 92.—T. F. B.

*Plaster; Process of Treating Gypsum to obtain, as desired, a Slow or Quick-Setting* —. L. Périn. Fr. Pat. 348,104, Nov. 10, 1904.

IN order to obtain a plaster with any required rate of setting, a fixed weight of gypsum is treated in a cylinder, with heat derived from a furnace or producer yielding a constant amount of heat in unit of time, for a definite time depending upon the hygrometric state and on the hydrate to be obtained, whereby a product is obtained intermediate between the gypsum with two molecules of water and the anhydrous calcium sulphate, the amount of water of crystallisation in the product determining the rate of setting.—W. C. H.

*Plaster; Manufacture of Articles by Agglomeration of Coarse or Fresh — by Pressure and without Mixing*. E. M. Paupy, *née* Vignaudon. Fr. Pat. 348,236, Nov. 24, 1904.

COARSE or refuse plaster, either with fresh, or a mixture of fresh and old plaster, is consolidated, in a slightly moist condition, with or without the addition of other bodies, by strong pressure and without the ordinary mixing. The claims also include products thus obtained.

—W. C. H.

*Building Materials; Refractory* —. E. Hachon—Doucet. Fr. Pat. 347,880, Nov. 12, 1904.

BLAST furnace-slag, preferably finely ground, is mixed with argillaceous materials and burnt, the product obtained being used like cement.—A. G. L.

*Stone; Manufacture of Artificial* —. J. Staudt. Fr. Pat. 348,601, Dec. 6, 1904.

MATERIALS, such as chalk, quartz, clay, &c., are

powdered and mixed with drying or other oils, fats, wax, &c., the admixture being aided by adding a volatile solvent if necessary. The mixture is thickened by heating at a temperature varying from 60° to 140° C., in a current of air, and is then exposed to the action of the air, when it falls to a light powder, which is moulded under pressure, and heated for 12 to 24 hours at a temperature of 120° to 180° C.—A. G. L.

#### GERMAN PATENTS.

*Wood; Process for the Uniform Impregnation of — with a Limited Quantity of Tar Oil.* O. Heise. Ger. Pat. 154,901, July 17, 1903.

THE wood is impregnated with a small quantity of tar oil in the usual manner, and is then subjected under pressure to the action of another liquid, such as hot water, which has no chemical action on, and is not a solvent of, the tar oil.—A. S.

*Stone or Wood; Process for the Manufacture of Artificial —.* W. Gutzeit. Ger. Pat. 154,625, March 4, 1904.

A PLASTIC mass of sand, lime, slag, and the like is mixed with an organic binding agent such as milk, sugar solution, vinasse, molasses, viscose or other analogous derivative of cellulose, albumin solution or similar substances, the mixture is formed into the desired shapes and exposed to the action of a mixture of superheated steam and fire gases under strong pressure. It is stated that the reactions produced by the organic substances on superheating accelerate the hardening of the plastic mass, and increase the toughness of the product.—A. S.

*Cement, Sord; Process for the Manufacture of —.* J. Abel, F. Janson and E. Roelke. Ger. Pat. 154,976, Oct. 6, 1903.

CRYSTALLISED magnesium chloride is heated, with evolution of hydrochloric acid, until a mixture of magnesia and magnesium chloride in the desired proportions is obtained.—A. S.

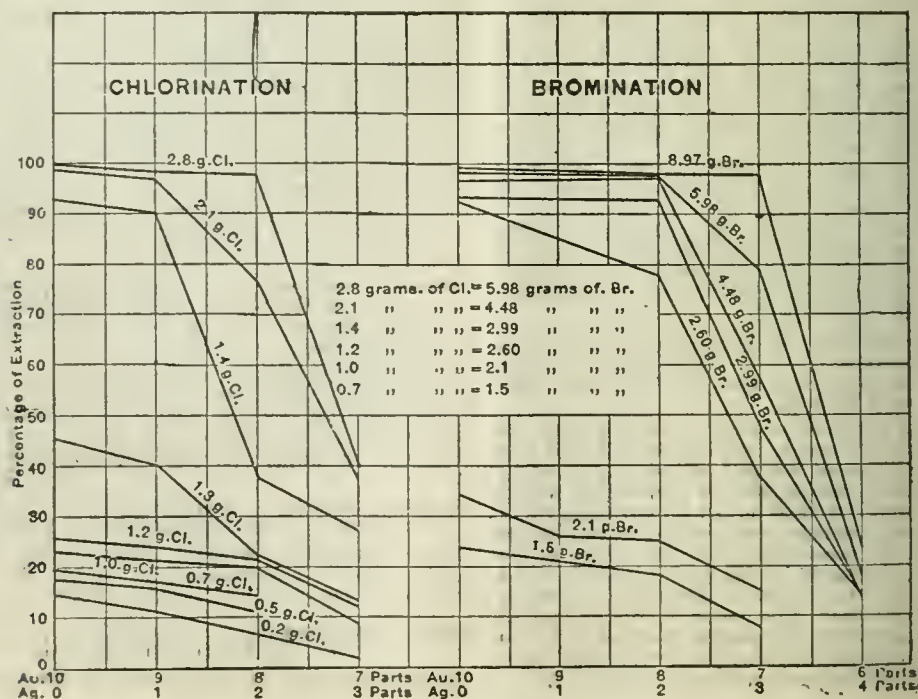
### X.—METALLURGY.

*Gold; Effect of Silver on the Chlorination and Bromination of —.* H. O. Hofman and M. G. Magnuson. Bull. Amer. Inst. Mining Eng., 1905 [2], 421—433.

EXPERIMENTS were made to ascertain the relative solv action of chlorine-water and bromine-water on gold alloys of gold and silver. The charge consisted of 5 ass. tons of the ore (a mixture of 5 A.-T. of quartzite crushed to 40-mesh size with 10 mgrms. of the gold or gold-silver alloy in the state of fine powder), 150 c.c. of water, and varying quantities of chlorine (bleaching powder or sulphuric acid) or bromine; and the time of extraction was 5½ hours. With pure gold, solutions containing 2.1 and 1.4 grms. of chlorine gave extractions of 99.8 and 92.5 per cent. respectively of the gold. These results confirm those obtained in practice, and show that a satisfactory extraction of gold by the barrel-chlorination process can only be attained by the use of supersaturated solutions of chlorine, the degree of supersaturation required varying with the character of the ore. A solution containing 2.8 grms. of chlorine extracted a satisfactory proportion of gold from gold-silver alloys containing as much as 20 per cent. of silver, but with decrease of chlorine below a certain amount (2.1 gm.) and the increase of silver above 10 per cent., the percentage of gold extracted diminished rapidly. With bromine, solutions containing 8.97, 5.98, 4.48, 2.99, 2.60 grms. gave extractions of 99.8, 98.2, 96.6, 93.2, 92.2 per cent. respectively of gold. The proportion of gold extracted from gold-silver alloys containing 20 per cent. of silver was not more than 1 per cent. less than from pure gold with solutions containing 8.97, 5.98, 4.48, 2.99 grms. of bromine, but with 2.6 grms. of bromine extraction was only 77.6 per cent. as against 92.2 per cent. from pure gold. With an alloy containing 30 per cent. silver, the solution containing 8.97 grms. of bromine extracted 97.7 per cent. of the gold, whereas the strongest solution of chlorine (2.8 grms.) only dissolved 40.3 per cent. The comparative solvent action of chlorine and of bromine on gold and gold-silver alloys is shown in the curve diagram (see Fig.); on the whole, bromine appears to be the more efficient solvent.—A. S.

*Gold Bullion and Cyanide Precipitates; Refining — with Oxygen Gas.* T. Kirke Rose. Inst. of Mining Metall., April 13, 1905.

THE results of a large number of experiments, which set out in detail, show that base metals can be removed from gold and silver bullion by the passage of a current of oxygen or air. Losses due to volatilisation and spir





significant, and those due to the slag can be kept stopping the process before the refining is complete. Fluxes required are borax and silica, and a slag of the composition  $\frac{2}{3}(\text{Na}_2\text{O} \cdot \text{B}_2\text{O}_3) + 6\text{RO} \cdot \frac{2}{3}(\text{B}_2\text{O}_3)$  appears to fulfil requirements except that of cheapness. If 20 per cent. of the borax and the silica in the flux be omitted, it becomes somewhat pasty, but it is probable that as 90 per cent. of the borax could be replaced by silica. Most of the gold in the slag can be recovered by concentration, but the silver cannot be obtained in this way. The greater part of the valuable metals in the slags recovered by fusion with carbon and iron, the lead being reduced, and carrying down the gold and silver. The cost of treatment by air appears to be less than by other refining processes, but it is necessary to estimate the relative losses on the working scale. The method would appear to be very suitable for the treatment of zinc-box precipitates, from which a portion of the zinc has been separated previously by volatilisation, in order to save fluxes and to avoid pasty slags.—A. S.

*of Copper and Bismuth* A. H. Hiorns. Paper read before the Faraday Society, April 4, 1905.

Experiments were carried out like those on copper-alloys (this J., 1904, 547). At the extremes are pure copper and pure bismuth, intermediate are solutions of bismuth in copper and copper in bismuth. The eutectic points occur at 243° C. and 1020° C.; there is a eutectic point (between solutions of copper in bismuth and bismuth in copper) at 858° C. As the proportion of bismuth rises from 30 to 43 per cent. there is practically no change in the freezing-point; no indication exists of the two compounds here possible ( $\text{Cu}_3\text{Bi}_2$  or  $\text{Cu}_2\text{Bi}$ ), which are isomorphous with bismuth. Copper in small percentages of bismuth consists of polygonal grains bounded by a thin line of bismuthide, along which the eutectic occurs. At 2 per cent. of bismuth a eutectic structure is shown, and as the bismuth increases, the grain boundaries widen, and the interior is eutectic in character. At 10 per cent. of bismuth the whole surface is composed of the two solutions, light grey and light red, and at 67 per cent. a set of dark blue grains (perhaps  $\text{Cu}_3\text{Bi}_2$ ) appears in addition. At 70–90 per cent. the red solution is seen as a eutectic; at 97.2 per cent. the surface is eutectic, and from 98 per cent. onwards the structure is that of bismuth.—J. T. D.

*for Furnaces; Refractory Materials for* —. Gilbert Scott. Paper read before the Faraday Society, April 4, 1905.

Refractory material must—1. Conduct heat badly; 2. be mechanically strong over a wide range of temperature; 3. withstand the reducing action of the atmosphere, especially of carbon; 4. be a non-conductor of electricity even at high temperatures, if to be used in an electric furnace.

The author classifies refractory materials in four groups, with the second and third groups:—

1. Carbon.—For the highest temperatures.

2. Siliceous Carbides.—a. *Carborundum*—An excellent abrasive; binding material sodium silicate or fire-clay. b. *Silicicon*—Almost self-binding, but it is well to use alumina or non-alkaline clay for making up articles which are to be baked before use, or sodium silicate or coal-tar pitch. It is very refractory, chemically inert, and does not soften at 3000° C., forming siliceous carbide. c. *Silicicon Carbide*—Conducts heat rather well, and is suitable only as a wash, binding with glue, or as a silicate or tar.

3. Crystallised Magnesite.—Ordinary calcined magnesite is the best material for basic open-hearth furnaces and cement kilns, being free from moisture and resistant to corrosion. By charging magnesite into an ordinary calcium carbide furnace, thoroughly crystallised magnesite can be obtained; 300 h.p. for 24 hours yielded 3 cwt. This, used as a wash over the brick lining of a calcium carbide furnace,

lengthened the life of the bricks before repairs were needed from 5 to 200 hours.

4. *Ordinary Fire-bricks*.—For the lower range of furnace temperatures.—J. T. D.

*Hydrofluoric Acid [Use of — for the Removal of Rust from Iron, &c.]* E. Deussen. VII., page 496.

#### ENGLISH PATENTS.

*Iron Ore [Briquettes] or Iron Wastes or Iron Sand or Mixtures thereof; Manufacture of Briquettes from Powdered — for Reduction in Furnaces*. T. Rouse and H. Cohn, London. Eng. Pat. 7478, March 29, 1904.

The powdered iron ore or the like is formed into briquettes by the aid of a 0.5 per cent. solution of alum, to which has been added 2 per cent. by volume of commercial water-glass.—J. H. C.

*Furnaces [for Iron Manufacture]; Reverberatory* —. V. Defays, Brussels. Eng. Pat. 7602, March 30, 1904.

SEE FR. Pat. 337,589 of 1903; this J., 1904, 493.—T. F. B.

*Metals [Iron]; Process of Refining* —. J. B. Nau, New York. Eng. Pat. 9482, April 25, 1904.

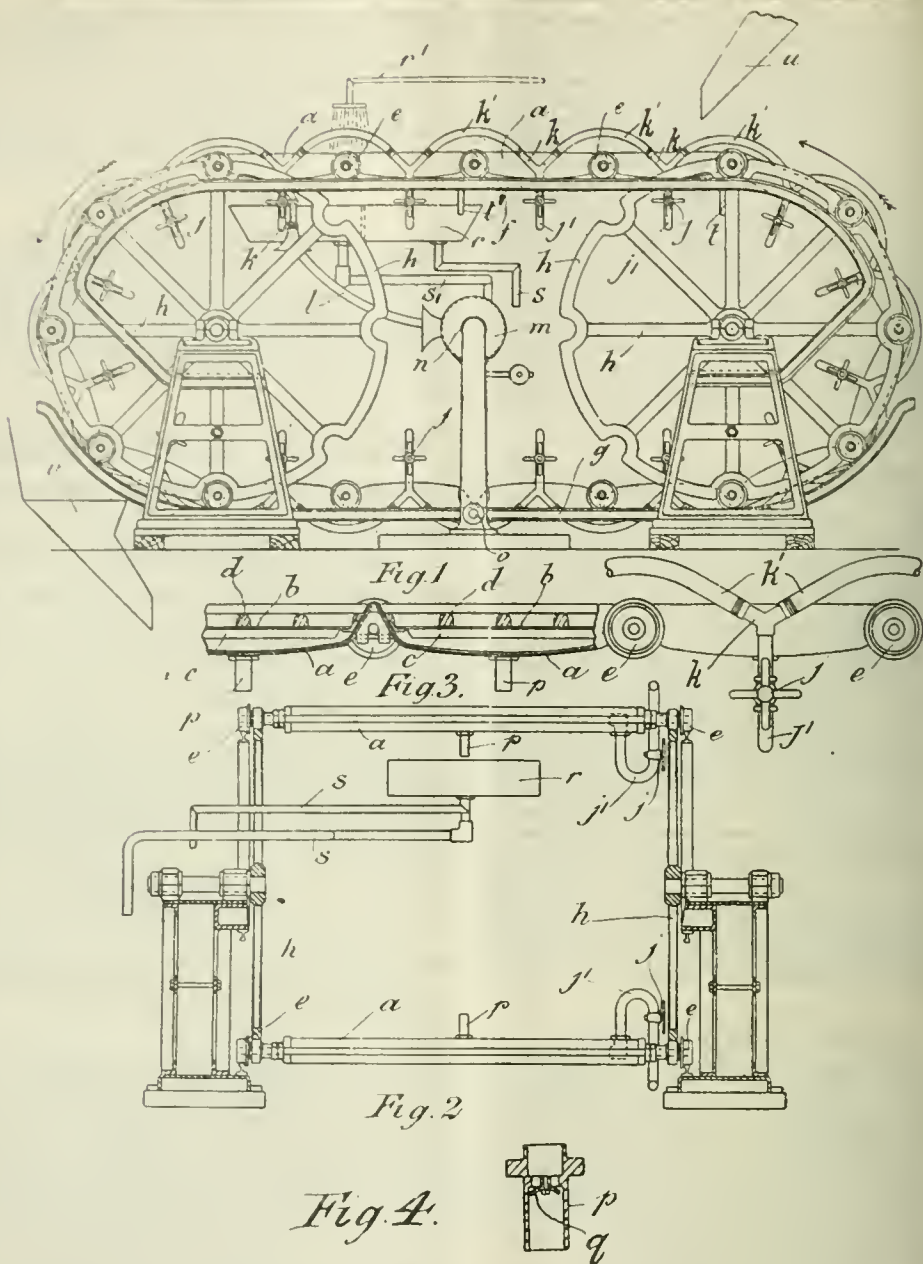
SEE U.S. Pat. 786,048 of 1905; this J., 1905, 445.—T. F. B.

*Steel; Manufacture of —, by the Basic Bessemer Process*. O. Massenez, Wiesbaden. Eng. Pat. 19,053, Sept. 3, 1904.

Certain disadvantages in the ordinary process are obviated by adding to the molten pig-iron in the converter, lime or oxides of iron or manganese, or mixtures of the same, with or without addition of fluor-spar or other fluxes. The first formed slag, which contains very little phosphoric acid, having been removed, a further quantity of lime is added, amounting to about 10 per cent. by weight of the charge, which takes up all the phosphoric acid. By this process, pig iron containing more than 1 per cent. of silica and less than 1.8 per cent. of phosphorus may be advantageously treated.—J. H. C.

*Slimes, Gold-bearing; Apparatus for the Separation of Liquids from Solids, particularly applicable to the Treatment of —*. R. K. Evans, London. Eng. Pat. 3962, Feb. 17, 1904.

EACH filtering element consists of a shallow box *a*, provided with a perforated plate *b*, on which the filtering medium is laid, the plate *b* being supported by the bars *c* and kept in position by the grids *d*. The boxes are arranged so as to form an endless band having rollers *e* adapted to run on the tracks *f* and *g*, and moved forward in the direction of the arrows, at a low speed by the wheels *h*, *h*. The gold-bearing slimes are fed from the shoot *u* on to the surface of the filtering medium, and as the boxes move forward, suction is applied to the interior by the pipes *j*<sup>1</sup>, controlled by the valves *j*, which are opened by the projection *t*. The pipes *j*<sup>1</sup> are connected together by the branches *k* and the flexible pipes *k*<sup>1</sup>. At one point the pipe *k* is attached to a flexible tube *l*, coiled round the spring drum *m*, and communicating through the joint *n* and the pipe *o* with the exhausting apparatus. The object of the spring drum *m* is to allow the connection *l* to be varied in length to suit the position of the joint with *k*, as the band moves round the track. The suction draws the liquid in the slimes through the filter into the box, and when the latter has travelled further towards the left, the valve *j* is shut by the projection *t*<sup>1</sup> and the liquid is discharged, through the pipe *p*, which has hitherto been closed by the flap valve *q* (Fig. 4) held up by the vacuum in the box, into the trough *r*, and it flows away by the pipe *s*. Washing water can then be run on to the residue through the pipe *r*<sup>1</sup>, and passes through it into the box *a*, and away by the second compartment of the trough *r*<sup>2</sup> and the pipe *s*<sup>1</sup>. When the filter-box *a* arrives opposite the shute *v*, the washed deposit is discharged, and in order to facilitate this, a regulated charge of compressed



air may be delivered behind the deposit by a similar series of pipes to  $j$ ,  $j^1$ ,  $k$ , which serve to apply the vacuum, but placed on the opposite side of the box  $a$ , and not shown in the figures.

A modification of the apparatus is described in which the use of flexible connecting pipes is avoided.—W. H. C.

*Furnace applicable for use in Roasting Ores and for other Purposes; Rotary* — F. Heberlein, London, and W. Hommel, Lee, Kent. Eng. Pat. 10,682, May 9, 1904.

SEE U.S. Pat. 781,824 of 1905; this J., 1905, 242.—T.F.B.

#### UNITED STATES PATENTS.

*Furnace; Roasting* — W. R. Ingalls, Lynn, Mass. U.S. Pat. 786,567, April 4, 1905.

THE furnace has two or more superposed hearths and a system of flues placed beneath the hearths in which gas

is burnt, so that the products of combustion circulate throughout the system. The rotary stirring apparatus consists of a central vertical shaft and a series of horizontal arms, all being made hollow, so that a cooling medium may circulate through the system.—J. H. C.

*Furnace; Roasting* — C. H. Repath and F. E. M. Assignors to F. Klepetko, New York. U.S. Pat. 786,599, April 4, 1905.

IN a furnace having a number of superposed hearths, a fire-chamber is arranged beneath the bottom hearth, the series, and independent flues, provided with central dampers, and located within the walls of the furnace lead from the fire-chamber to the several hearths. A central hollow stirring shaft passes through the furnace and carries hollow arms which extend into the hearths, these arms being provided with openings for delivering air to the hearths during the roasting operation.—A





electrolyte is thus placed out of contact with the electrodes during the period of inactivity of the accumulator.—B. N.

#### GERMAN PATENT.

*Electrodes [for Accumulators]; Process for the Preparation of Positive* —. R. Goetze. Ger. Pat. 155,105, June 13, 1902.

THE preparation of positive electrodes for accumulators by forming a layer of spongy lead electrolytically from lead peroxide, is carried out in a solution of a salt such as zinc sulphate. The layer of spongy lead produced becomes impregnated with this solution, and on drying, the salt is left behind in a state of fine division between the particles of lead, whereby, it is stated, the electrode may be kept for a long time in the dry state without losing its activity.—A. S.

#### (B).—ELECTRO-METALLURGY.

*Metals of the Alkalies and Alkaline-Earths; Position of the — in the Potential Series at High Temperatures.* H. Dancel and L. Stockem. Z. Elektrochem, 1905, 11, 209–211.

IN the electrolytic separation of metals it is often desirable to work at as low a temperature as possible, when such disadvantages as volatilisation of the metal, destruction of plant, &c., are partially obviated. To effect this, a mixed electrolyte may be used instead of a simple salt, on account of its lower melting point; but the method requires a knowledge of the relation the various metals, present in the mixture, bear to one another in the potential series. From the authors' experiments, it appears that in the case of sodium and potassium, which at low temperatures are electropositive to calcium and strontium, a rearrangement takes place at higher temperatures; and at 800° C. calcium is electropositive to sodium, but still electro-negative to potassium. Thus, on electrolysis of a bath of calcium chloride mixed with sodium chloride at a red heat, sodium free from calcium is obtained; whereas, from a mixture of calcium chloride and potassium chloride, potassium containing considerable quantities of calcium separates.

In a similar way, potassium becomes intermediate between calcium and strontium, since at 800° C. it is electro-negative to the latter.—B. J. S.

*Lead; Electrolytic Purification of — in Hydrofluosilicic Acid Solution.* H. Scnn. Z. Elektrochem., 1905, 11, 229–245.

THE author gives an account of an exhaustive investigation of Bett's method for purification of lead by electrolysis (see Eng. Pat. 7661 of 1902; this J. 1902, 980), using an electrolyte of lead hydrofluosilicate containing gelatin. To avoid the formation of crystals on the cathode, and to obtain a uniform precipitate, the electrolyte should contain 4–8 per cent. of lead, 11 per cent. of hydrofluosilicic acid, and 0.1 grm. of gelatin per litre; the current density being 0.5–1 ampère per sq. dm. For cadmium, the same solution can be used, but it should contain 2.5 per cent. of the metal, and 0.3 grm. of gelatin per litre.

Lead may also be obtained from its alloys with other metals, e.g., copper, bismuth, antimony and platinum, by electrolysis in a similar manner. The alloy is used as the anode, and under suitable conditions of current density, which the author describes, pure lead is deposited on the cathode. During the process of electrolysis the solution is partially decomposed, and a mixture of silica and lead fluoride separate as a mud at the anode. Excessive current density results in the deposition of impurities with the lead, and also causes a loss by increasing the amount of lead separating in the anode mud.—B. J. S.

*Slime [Copper and Lead]; Electrolytic Treatment of Electrolytic* —. A. G. Betts. Electrochem. and Met. Ind., 1905, 3, 141–145.

THE problem of treating the slime from the refining of copper and lead has been investigated by the author

who proposes the following electrolytic treatment. The slime consists chiefly of finely-divided copper, antimony, arsenic, lead, bismuth and gold, with times iron, sulphur, selenium and tellurium. In refining, arsenic, antimony and bismuth occur slimo in the form of oxides. A solution of ferric sulphate of about 4 per cent. strength, is used as a leaching and the copper, which dissolves, is subsequently removed by electrolysis, the ferrous sulphate being simultaneously oxidised back again to the ferric salt. Antimony and the metal obtained by electrolysis of the antimony trifluoride between lead electrodes, using 10–20 ampères per sq. ft. of cathode surface, at 2.6–2.8 volts, the anodes being surrounded with cotton cloth, efficiency attains 92 to 95 per cent. The residue is mixed with soda ash and lead, and smelted to bullion. The electrolytic parting of the bullion is effected in a solution of the silver salt of methylsulphuric acid, a trace of gum arabic or gelatin being added, the silver deposit to retain a solid form without projecting. The copper and bismuth of the anodes accumulate in a solution which, from time to time, is worked up by precipitating the remaining silver with copper and copper and bismuth with lead. The precipitate of copper and bismuth can be treated with ferric sulphate, bismuth oxide melted to metal. A special form of apparatus is suitable for depositing the copper and regenerating the ferric sulphate is described.—R. S. H.

#### ENGLISH PATENT.

*Etching of Metal Plates; Process for the —, by Electrolysis.* O. C. Strecker, Darmstadt, Germany. Eng. Pat. 21,374, 1904.

THIS invention relates to a process for the deep etching of zinc by electrolysis, for the purposes of printing pressions from the zinc plates. The zinc is first prepared in the usual or in a special manner, and then arranged as an anode in a bath of zinc acetate, formate or other zinc salt. By using a current strength of at least 2 ampères per sq. dm. of "one-side metallic surface" at the anode and cathode, impure zinc may be used, the impurities separating as a slightly adherent soft deposit on the anode, whilst the zinc is deposited at the cathode in a firmly adherent form, thus keeping the bath clean and constant. The zinc plate, or other metal plate with zinc, may be in the form of a cylinder, the axis of which is rotated during the process. With zinc plates, the latter are first treated in an electrolytic bath under the above conditions, so as to remove the surface layer of the metal and, after washing, they are treated for printing purposes and again exposed as anode in the above manner.—B. N.

#### UNITED STATES PATENTS.

*Electroplating Apparatus.* L. Potthoff, Flushing, N. Y. U.S. Pat. 786,776, April 4, 1905.

THE material to be treated is conveyed through a means of a travelling belt, the latter being provided with pins which move the material through the solution. The material is supported in a suitable manner, and is in contact with a relatively fixed conductor, an arrangement being provided to automatically change the point of contact of the work with the moving and supporting means and the cathode conductor. The anode consists of bars or rods of the metal to be deposited, the bars being surrounded with porous wrapping, the thickness of which depends on the voltage used. The bars are carried by the material, and make contact with a relative conductor as they move along. The electrolyte is circulated in a direction longitudinally with the material, the latter may be tubular in form, and is fed into and out of the solution in an inclined manner so as to expel the electrolyte.—B. N.

*Deposition-Tank [Electrolytic].* I. E. Lewis and J. Corey, London. U.S. Pat. 786,978, April 11, 1905.

THIS invention relates to an electrodepositing apparatus



particularly applicable for printers' electrotyping, consists of a circular electrolytic vessel with an inner negative electrode carrier in a position coincident with the top annular edge of the vessel. Teeth upon the carrier engage with gear for rotating the carrier. The carrier has an annular groove on the under face, and the electrodes, respectively disposed in a horizontal and vertical position, are mounted upon the edge of the vessel and run in the annular groove for preventing lateral displacement of the carrier. The carrier is provided with a wedge-shaped flange, and hooks, with their extremities inclined to the inclined face of the flange, carry the electrodes or moulds.—B. N.

## FRENCH PATENTS.

*Electrolytic Treatment of —, by Electrolysis.* A. Eybert. Fr. Pat. 348,294, Feb. 4, 1904.

The process is applicable to minerals in which the metal is present in the native state or in the condition of oxide. The mineral is powdered and made into a paste with the electrolyte, the nature of the latter depending on the metal to be treated. The paste is placed in boxes with insulated walls, which are so disposed in a containing vessel that they are parallel to each other, and so as to form anode and cathode compartments in which the electrodes are placed parallel to the boxes. With zinc, zinc sulphate is used as the electrolyte, and zincate is formed in the anode compartments and zincate in the cathode compartments. The electrodes are separately purified and then mixed, thus forming the oxide or hydroxide of the metal, and regenerating the sodium sulphate. The former is afterwards washed in order to obtain the pure oxide of the metal.—B. N.

*Plating Silver, Gold or other Metals on —.* H. H. Hénique, Marret and Bonnin and E. Naviaux. Fr. Pat. 348,399, Feb. 8, 1904.

The invention relates to a process of plating silver, gold, or metals on aluminium by the aid of a thick paste, which, in the case of silver, consists of 10 parts of tartar, 10 parts of silver nitrate or other salt of silver, and 150 parts of sodium chloride mixed with a small quantity of water. The paste is spread on the metal which is then vigorously rubbed with a cloth; the metal is afterwards heated to 250° or 300° C. in a furnace and finally passed between the cylinders of a mill.—B. N.

gr. at 1° F.	Iodine value.	Saponification value.	Unsaponifiable matter.	Free fatty acids.	Reichert value.	Refractive index.	Fatty Acids.		
							M.pt.	Iodine value.	Mean molecular weight.
0.9259	159.0	18.18	0.68	0.42	0.55	1.4792	22.5° C.	164	287
0.9291	168.5	19.14	1.60	1.10	0.85	1.4811	25° C.	171	290
0.9270	146.8	18.48	2.40	1.19	0.88	1.4781	22° C.	154	287
0.9290	155.0	18.81	4.60	1.65	1.12	1.4802	24.5° C.	160	291

—A. S.

*Stearin ; Notes on —.* E. Donath. Chem. Ztg. Fett-u. Harz-Ind., 1905, 12, 42—44; 73—75.

Stearins of various origin are sold under the name "stearin pitch." In the candle industry the crude fatty acids when distilled with superheated steam leave 2 to 7 per cent. of stearin tar or stearin goudron, and this when washed with similar residues and again distilled at 300° C., leaves a final black viscid residue amounting to 2 to 3 per cent. on the original fatty acids. This stearin pitch is used in the manufacture of lubricating greases, of varnishes and of waterproof paper (Ger. Pat., 122,893 of 1901). &c. The commercial products sold under the same name are obtained from the distillation of fatty acids separated from washings. They are brownish to black pitchy substances, differing materially in characteristics from the stearin pitch. When examined by the method described by the author and Margosches (this J., 1904, 541)

*Aluminium and other Metals and their Alloys ; [Electrolytic] Process for Manufacturing —.* H. S. Blackmore. Fr. Pat. 348,498, Nov. 15, 1904.

SEE U.S. Pats. 786,185 and 786,244 of 1905; this J., 1905, 447.—T. F. B.

*Ores ; Apparatus for the Magnetic Separation of —.* G. Gröndal. Fr. Pat. 348,535, Nov. 28, 1904.

A VERTICAL cylindrical electro-magnet is constructed with the actuating coil enclosed by iron pieces, the lower (polar) parts of which converge in the form of a pair of concentric rings. The central, hollow part of the magnet is occupied by a rod carrying at its lower extremity a disc, which is caused to rotate rapidly immediately below the magnet poles. Below the disc is a funnel having within it a conical fixture to upwardly disperse a flow of the finely-divided ore suspended in water, which is injected through a tuyère. A second funnel encloses the former, which second funnel is within a third funnel, the three funnels having separate outlets, each independent of the other. The working of the apparatus is such, that the outlet to one funnel receives the waste ore, whilst the ore retaining more or less of the magnetic particles, is received by the outlets to the other funnels. The metallic particles which collect on the revolving disc are whirled off as they collect, and are caught by a collecting frame. Provision is made for receiving the concentrates.—E. S.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*Cod-Liver Oil Standards.* E. J. Parry. Chem. and Drug., 1905, 66, 491—492.

THE author discusses the standards for cod-liver oil intended for medicinal purposes, and states that some of Mann's figures, especially those relating to the proportion of unsaponifiable matter, cannot be accepted as correct (see this J., 1903, 1356; also Chem. and Drug., 1904, 65, 883). The following limits are suggested:—Sp. gr., 0.924—0.931; free acid, not more than 1.0 per cent.; saponification value, "19.9—19.34 per cent."; unsaponifiable matter, not more than 1.5 per cent.; iodine value (Hübl), 155—170; Reichert value, not above 0.7. In the following table the maximum and minimum values obtained in the examination of (1):31 "high-class pale oils," and (2):8 "oils of doubtful purity" are shown:—

gr. at 1° F.	Iodine value.	Saponification value.	Unsaponifiable matter.	Free fatty acids.	Reichert value.	Refractive index.	Fatty Acids.		
							M.pt.	Iodine value.	Mean molecular weight.
0.9259	159.0	18.18	0.68	0.42	0.55	1.4792	22.5° C.	164	287
0.9291	168.5	19.14	1.60	1.10	0.85	1.4811	25° C.	171	290
0.9270	146.8	18.48	2.40	1.19	0.88	1.4781	22° C.	154	287
0.9290	155.0	18.81	4.60	1.65	1.12	1.4802	24.5° C.	160	291

—A. S.

they will be found to occupy a position midway between true stearin pitch and wool pitch, and the author therefore proposes to describe them as "stearin wool pitch." His observations supplement those of Holde and Marcusson (this J., 1900, 1904). The mineral matter in fat pitches invariably contains copper and iron, whilst stearin wool pitch yields a much larger proportion of ash, containing, in addition to iron, considerable quantities of calcium sulphate.—C. A. M.

*Soaps ; Composition of Commercial — in relation to Spraying.* L. L. van Slyke and F. A. Urner. XVIII. C., page 511.

*Glycerol ; Esterification of —.* M. P. S. Guédras. XXIV., page 515.

## ENGLISH PATENTS.

*Fatty Acids such as are used in the Manufacture of Candles, Lamp Oils, Cooking-fats, Ointments, Soaps and the*

*like; Production of* —. C. Dreymann, Turin, Italy.  
Eng. Pat. 10,466, May 6, 1904.

SEE Fr. Pat. 343,158 of 1904; this J., 1904, 988.—T. F. B.

*Wool; Lubrication of — in the Manufacture thereof into Yarn or Cloth.* J. J. Crossfield and K. E. Markel.  
Eng. Pat. 9946, April 30, 1904. V., page 494.

#### UNITED STATES PATENTS.

*Soap; Process of Making Neutral* —. A. P. Horn, Hamburg, Germany. U.S. Pat. 786,496, April 4, 1905.

SEE Fr. Pat. 345,485 of 1904; this J., 1904, 1226.—T. F. B.

*Soap and Method of Making same.* H. Giessler and H. Bauer, Stuttgart, Germany. U.S. Pat. 786,556, April 4, 1905.

SEE Eng. Pat. 22,580 of 1903; this J., 1904, 327.—T. F. B.

#### FRENCH PATENTS.

*Soap mixed with Boric Acid; Manufacture of* —. H. Lenique. Fr. Pat. 348,333, Feb. 6, 1904.

FROM 2 to 6 per cent. of boric acid in the form of a fine powder is incorporated with the soap paste.—W. P. S.

*Soap containing Boric Acid; Manufacture of* —. H. Lenique. First Addition, dated Feb. 8, 1904, to Fr. Pat. 348,333, Feb. 6, 1904. (see preceding abstract).

A SHAVING soap is prepared by mixing pasty soap with from 4 to 6 per cent. of finely-powdered boric acid.

—W. P. S.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

#### (A).—PIGMENTS, PAINTS.

##### ENGLISH PATENTS.

*Lakes; Manufacture of Colouring Matter* —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 10,895, May 11, 1904.

LAKES very fast to water may be made from acid dyestuffs by substituting for a portion of the basic aluminium salt, as defined in Fr. Pat. 342,903 of 1904 (this J., 1904, 989), zinc oxide or hydroxide, magnesium oxide or calcium hydroxide, providing that the amount of acid radical present is between one-sixth and one-twenty-fourth that necessary to form a normal salt with the bases present. For example, a reddish-yellow lake is prepared by adding 12 parts of aluminium chloride to a solution in water of five parts of Naphthol Yellow S, with which has been incorporated 20 parts of zinc oxide. (Compare Eng. Pat. 9861 of 1904; this J., 1905, 448).—T. F. B.

*Lakes [from Azo Dyestuffs]; Manufacture of New Colour* —. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,634, June 29, 1904.

SEE Fr. Pat. 344,395 of 1904; this J., 1904, 1085.—T. F. B.

*Varnishes and Paints for Waterproofing, Disinfecting, and like Purposes, also for Indurating Building Materials; Manufacture of* —. J. Hargreaves, Widnes. Eng. Pat. 11,398, May 18, 1904.

VARNISHES suitable for waterproofing and indurating brickwork, mortar, &c., are prepared by dissolving saponifiable rosin (which forms an insoluble rosinate with the lime) in one or more of the products of distillation of coal tar, with the addition of a mineral oil, if desired, to increase the rapidity of drying, and also with a small quantity of mineral wax. Antiseptic varnishes are obtained by using naphthalene, or carbolic or cresylic acid in the manufacture. One part of rosin may be dissolved in two parts of anthracene oil containing about 10 per cent. of its weight of naphtha, petroleum spirit, &c.;

about 1 per cent. of paraffin wax may be added to the coat of varnish from cracking; 1½ lb. of naphtha and 1 lb. of carbolic acid may also be added to each of the varnish. The varnish may also be mixed with saponifiable oil. Paints are obtained by adding suitable pigments to the above varnishes.—T. F. B.

#### UNITED STATES PATENT.

*Paint.* L. A. Dreyfus, Assignor to Muralo Co., Brighton, N.Y. U.S. Pat. 786,348, April 4, 1905.

THE invention relates to a cold-water paint composed of a basic material, a binding or adhesive material, a volatile, non-saponifiable, non-oxidising oleo material, such as a non-volatile petroleum product, is not a solvent of the adhesive material, a volatile solvent of the petroleum product, and colouring matter.

Claim is also made for a dry paint composition consisting of a powdered mineral base, vasoline, a comminuted animal adhesive and lime.—A. S.

#### FRENCH PATENTS.

*Paint; Paraffin [Wax]* —. M. F. L. Colignon. Fr. Pat. 348,277, Nov. 26, 1904.

A SOLUTION of paraffin wax in mineral oil is used instead of the ordinary drying oils for the manufacture of such paints. Such paints have the advantage of being very stable in air, not being resinsified like those prepared in the ordinary manner. Their covering power is also stated to be superior to ordinary oil paints. (Compare Eng. Pat. 22,732 of 1904; this J., 1905, 448).—T. F. B.

*Lakes [from Azo Dyestuffs]; Production of* —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 348,426, March 23, 1904.

LAKES of various colours are produced by precipitating on a substratum the dyestuffs obtained by combining a diazonium, diazo-azonium, or tetrazonium compound with acetyl derivatives of *peri*-aminonaphtholsulphonic acids. For example, the lake obtained from diazoaniline-*o*-sulphonic acid and 1.8-benzoylamino-naphthol-4.6-disulphonic acid is yellowish red; that from *para*-aniline and the same aminonaphthol derivative, red; the lake derived from aminoazobenzene-disulphonic acid and 1.8-benzoylamino-naphthol-3.6-disulphonic acid is bluish-violet, whilst that from dianisidine and 2-naphthol-1-acetamino-8-naphthol-3.6-disulphonic acid is blue.—T. F. B.

*Dyestuff [Azo Dyestuff]; Preparation of a Monaz suitable for the Manufacture of Lakes.* Badische Anilin und Soda Fabrik. Fr. Pat. 348,588, Dec. 5, 1904. IV., page 494.

#### (B).—RESINS, VARNISHES.

*Pitches from Stearin; Notes on* —. E. Donnan. XII., page 505.

#### (C).—INDIA-RUBBER, &c.

*Caoutchouc from a New Species of Euphorbia.* H. J. Comptes rend., 1905, 140, 1047—1049.

THE only caoutchouc-yielding species of *Euphorbia* hitherto known was *E. Intisy*, which grows in the scrub in the South of Madagascar; the new species described has received the name of *E. elastica*; it is a native of Madagascar, being found in the north. This tree is somewhat scarce, and grows in colonies preferring very dry, calcareous soils. The yield of rubber is large; from a tree 12 metres in height 342 grms. of caoutchouc were obtained by transverse incisions without felling. The caoutchouc is of good quality when prepared; in the crude state it contains about 89 per cent. of real caoutchouc, 9.5 per cent. of resins and 1.03 per cent. of ash. The coagulation of the latex takes place easily by simple boiling; alcohol and sulphuric acid coagulate less rapidly, but a decoction of certain roots has



good results as a coagulant. One litre of latex yields 320 grms. of caoutchouc. This is the best rubbering tree in Madagascar, yielding a larger quantity of greater richness than any other plant in the — J. F. B.

#### UNITED STATES PATENT.

*Caoutchouc Substitute; Manufacture of a —*. H. Spatz, Meberg, Germany. U.S. Pat. 786,527, April 4, 1905. The substitute for caoutchouc is prepared by dissolving "colophonium" in castor oil, heating the solution sulphur to a high temperature, passing ozone through it, and treating the product with sulphur chloride in presence of a solvent and of calcium carbonate. — A. S.

### XI.—TANNING, LEATHER, GLUE, SIZE.

#### GERMAN PATENT.

*Leather; Method for the Preparation of an —*. H. Hey. Ger. Pat. 155,741, May 6, 1903.

Leather is treated with agar-agar with ozone, an adhesive is obtained which is readily soluble in hot water and furnishes a coating after drying. The dried coating is insoluble in water, and the product can be used as an addition "finishing" for textiles, and in the preparation of graphic papers. — A. S.

### XVI.—SUGAR, STARCH, GUM, Etc.

*Starch and Dextrose; Influence of Inorganic Substances on the Rotation of —*. E. Rimbach and O. Weber. XIV., page 515.

*Groups in Hydrazones; Reciprocal Replacement —*. E. Votocsek and R. Vondracek. XXIV., page 516.

*Starch; Reversion of "Artificial" —*. E. Roux. Comptes rend., 1905, 140, 943-946.

The author has studied the relative rapidity with which starches of his "artificial" starches (see this J., 1905, prepared from amylocellulose, revert on standing at different temperatures. Three types of "artificial" starches of different degrees of conversion, completely soluble at 150°, 120° and 100° C. respectively, were compared with ordinary potato starch. The solutions were prepared at a concentration of 3.3 per cent. by heating for 10 minutes at 100° C. and for 4 minutes at 150° C. The reversion was more rapid the less soluble the type of starch employed; in the case of the most soluble at 150° C., 43 per cent. had reverted after 10 minutes, whereas in that soluble at 100° C., only 1.8 per cent. had reverted. All the "artificial" starches reverted more rapidly than ordinary starch. The presence of acids in certain proportions accelerates the reversion of solutions of "artificial" starch; in the case of a solution of the most soluble type, maximum reversions, after 5 days at 0° C., were obtained in the presence of 1 per cent. of sulphuric acid, and of 0.02 per cent. of potassium. The solutions of these "artificial" starches do not revert when maintained at 100° C., but at 150° C. a slight precipitation of unsaccharifiable matter takes place. The reverted product can only be dissolved at the same temperature as that at which the original starch was soluble, and possesses the same properties as the latter; the reversion is, therefore, considered as a return to the initial state. — J. F. B.

*Sulphuric Acid [Use of — in the Manufacture of Beet Sugar]*. E. Deussen. VII., page 496.

*Sugar in the Presence of Milk Constituents; Removal of —*. F. Watts and H. A. Tempney. XII., page 514.

*Carbohydrates; Action of Hydrogen Peroxide on — in presence of Ferrous Sulphate*. R. S. Morrell and A. E. Bellars. XXIV., page 515.

*Dextrose; Conversion of — into Methylimidazole*. A. Windans and F. Knoop. XXIV., page 515.

*Starch; Influence of the State of Liquefaction on the Conversion of — by Saccharifying Diastases*. A. Fernbach and J. Wolf. XVII., page 508.

*Saccharin [Benzoylsulphonic imide]; Determination of —*. C. Proctor. XXIII., page 514.

#### UNITED STATES PATENTS.

*Sugar-Cane; Process of Macerating —*. M. Lorenz, Honolulu. U. S. Pat. 787,102, April 11, 1905.

The sugar cane is passed through a series of several crushing mills in succession, and is macerated after each crushing with heated juice derived from the next crushing mill in the series. Previous to the last crushing the cane is macerated with water only. — J. F. B.

*Sugar-Juice; Apparatus for Extracting — [from Bagasse]*. J. Rigney, New York. U.S. Pat. 786,154, March 28, 1905.

The apparatus consists of a vertical stand-pipe communicating at the bottom with a short horizontal cylinder. The bagasse is fed into the latter through a hopper, and is forced by a piston to the bottom of the vertical pipe. The latter is provided internally with a vertical shaft carrying pitched blades, which elevate the bagasse, as a loosened mass, through the vertical pipe. The top of the stand-pipe is constricted and fitted with squeeze blades, which discharge the bagasse in a compressed state through an annular opening. A stream of water is introduced at the top of the stand-pipe and flows downwards, extracting the sugar from the ascending material and being drawn off at the bottom through a screened opening, which is maintained clear by the action of a scraper blade attached to the shaft. — J. F. B.

*Masseculite; Process of Preparing —*. H. Roy, Paris. U.S. Pat. 786,601, April 4, 1905.

SEE Fr. Pat. 337,227 of 1903; this J., 1904, 616. — T. F. B.

#### FRENCH PATENTS.

*Juice from Beetroots and Saccharine Plants; Extraction of —*. C. Steffen. Fr. Pat. 348,494, Nov. 11, 1904.

Fresh beetroot pulp is mixed with heated crude juice and passed through the filter-presses; the pressed residues are again pulped with a hot juice of a lower degree of purity than the first juice, prepared by diluting molasses or drainage syrups with saccharine washing liquors. The mixture is again pressed and the resulting juice is utilised for heating a further quantity of fresh pulp. — J. F. B.

*Sugar Manufacture and Refining; Heating Apparatus for Boiling Pans for —*. Soc. anon. des Constructions Mecan. de St. Quentin. Fr. Pat. 348,508, Nov. 18, 1904.

The usual steam coils of the vacuum pans are replaced by a series of steam drums disposed independently of each other at different heights. These drums have the form of truncated cones or pyramids, and are pierced by a number of tubes through which the juice circulates, thereby increasing their heating surfaces. The steam-drums are so constructed that no part of their surface is in a horizontal position, so that solid sugar cannot accumulate on them. An ordinary steam coil for graining purposes is provided at the bottom of the pan. — J. F. B.

#### GERMAN PATENT.

*Sugar Lump; Process for the Preparation of — from Air-dry Crystal Sugar by Treatment with Steam*. A. Lewenberg. Ger. Pat. 154,987, March 18, 1902.

In the usual process for the preparation of lump sugar from air-dry crystal sugar, the steam comes directly in contact with the cold sugar. The patentee claims that

if the crystal sugar be warmed with hot air before allowing it to come in contact with the steam, then by varying the temperature and pressure of the steam, the amount of the latter condensed and thereby the quantity of syrup produced can be exactly regulated.—A. S.

## XVII.—BREWING, WINES, SPIRITS, Etc.

*Barley; Causes of Germination of* — W. Windisch and K. Schönwald. *Woch. f. Bran.*, 1905, 22, 200—201.

The authors criticise adversely the theory propounded by Nilson (this J., 1904, 379) that the germination of barley is fundamentally dependent upon the activity of the bacteria on the surface of the corns. Having pointed out in a previous paper that Nilson's experiments were carried out without proper control, the authors show that barley can be completely sterilised, without destroying its vitality, by treatment with a solution of mercuric chloride in absolute alcohol. One gram. of mercuric chloride was dissolved in a litre of alcohol and various samples of barley were immersed in this solution for eight days. Control tests, made from time to time, by transferring a few of the corns to sterile wort showed that all the samples were absolutely free from micro-organisms after only 24 hours' immersion. The barley was then washed with sterilised water and steeped in aseptic germinating funnels in sterilised water. After steeping, all the samples germinated in a perfectly satisfactory manner, whilst control tests in sterile wort showed that only a small proportion of the germinated corns had become infected during the process. The germinative energy of the treated samples was slightly lower than that of the original barleys, but the total germinative capacities of the barleys were practically unaffected by the treatment.—J. F. B.

*Starch; Influence of the State of Liquefaction on the Conversion of* — by *Saccharifying Diastases*. A. Fernbach and J. Wolff. *Comptes rend.*, 1905, 140, 1067—1069.

THE phenomenon of the saccharification of starch, like that of the coagulation (see this J., 1905, 99), depends largely on the state of liquefaction. The superposition of the liquefying and saccharifying processes, which results when malt diastase is employed, can be avoided to a large extent by using an infusion of barley, which is almost devoid of liquefying diastase. An extract of barley was allowed to act for five hours at different temperatures upon two portions of a potato starch paste, one of which had been prepared at 100° C., whilst the other was liquefied under pressure at a temperature of 140°—145° C. for two hours. The converted products were then analysed by precipitating the unsaccharified starch by excess of baryta water, and determining the dextrins and sugars in the filtrates. In the case of the liquefied starch, the quantity of conversion products was greater than in that of the ordinary paste. The liquefaction of the starch paste by a limited quantity of malt extract at 70° C. had the same effect as liquefaction by heating under pressure. A mixture of barley extract with a minute quantity of malt extract, insufficient for the complete saccharification of the starch, saccharifies far more energetically than either of the constituents separately.

The pastes of the cereal starches are saccharified by barley diastase far more easily and completely than potato starch paste; it is concluded therefore that the natural state of liquefaction of the cereal starches approaches that of potato starch liquefied artificially.—J. F. B.

*Yeast; Respiration and Fermentation of Different Species of Dead* — Warschowsky. *Centrabl. Bakt.*; through *Brewers' J.*, 1905, 41, 270.

THE author has studied the relation between the production of zymase and the species and environment of the yeast producing it, the quantity of gas furnished by the zymase being taken as a measure of the enzymic process. The yeasts were grown in various nutrient media, including Laurent's solution of triple strength, with 4.55 per cent. of

mannitol in one case, and 2.3 per cent. of glycerol in another, whilst in a third, the normal solution was used, the potato being replaced by ammonium phosphate, with the addition of 4.5 per cent. of dextrose. The resulting yeast cultures were killed by means of acetone, and the products tested for the presence of zymase. The results show that when yeasts capable of setting up alcoholic fermentation were cultivated in fermentable media, zymase was produced, but no zymase was formed when the yeasts grown in media containing no fermentable carbohydrate. *S. Pombé*, however, formed no zymase when grown in a fermentable medium in which the source of nitrogen was ammonium phosphate.—J. F. B.

*Vinegar; Chemistry of Home-made Cider* — van Slyke. *New York Agric. Exp. Station, Bulletin No. 258*, 439—494.

ANALYSES of apple juices representing 83 varieties of American-grown apples are given, and the changes in the composition of the juice undergoes during alcoholic and acetic fermentations have been studied under various conditions. The chief factor in the production of vinegar of standard strength is the percentage of sugar in the juice; unripe and over-ripe apples are deficient in sugar. At the temperature of an ordinary cellar, most of the sugar is converted into alcohol in five to six months; addition of yeast hastens the fermentation. For a successful acetic fermentation, the necessary conditions are the presence of a proper ferment, an abundant supply of air and a high temperature. At cellar temperatures acetic fermentation requires about 18 months. Decantation of the liquid after alcoholic fermentation favours acetic fermentation. A vinegar of standard quality should contain at least 4.5 per cent. of acetic acid. With careless storage at a high temperature, the acetic acid is liable to destruction by other organisms which only act in the presence of air; this can be prevented by decanting the vinegar into clean barrels, filled to the top and corked. These organisms also cause a decrease in the solid extract. The malic acid of the juice disappears almost entirely during acetic fermentation, but the decrease is less marked when the apple juice has been sterilised. The solid extract very frequently decreases to a point below 2 per cent. during fermentation, but under normal conditions there is a subsequent increase due to evaporation. A normal vinegar containing more than 4.5 per cent. of acetic acid may contain less than 2 per cent. of solids.

In making cider vinegar only clean ripe apples, yielding a juice containing at least 8.5 per cent. of sugar, should be used; the grinding and pressing should be effected under conditions of great cleanliness, and a second pressing of watered pomace is to be avoided. The barrels are sealed and then filled about three-quarters full of the bung holes being loosely plugged with cotton. The temperature of the cellar should be 65°—70° F. If a fairly rapid fermentation is desired, a certain proportion of pressed yeast may be added. When the alcoholic fermentation is complete, the clear liquid should be decanted, the barrel should be washed out, and the liquid returned to it, with the addition of two or four quarts of sound vinegar containing some "mother." The temperature should be maintained between 65° and 75° F. The bung should be left out until the vinegar contains a standard proportion of acid. Finally the vinegar should be decanted into clean barrels and stored with exclusion of air.—J. F. B.

*Starches; Reversion of "Artificial"* — E. J. XVI., page 507.

### ENGLISH PATENT.

*"Beverages, Fermented"* — [Ginger Beer]. W. and T. Dempster, both of Perth. *Eng. Pat.* 4, March 5, 1904.

To obtain a beverage containing less than 2 per cent. of proof spirit, and of which the alcoholic strength will increase on keeping, the ingredients are treated in the usual way, and fermented until the required quantity of alcohol is produced. After straining, carbon dioxide



l in and the liquid filtered under pressure into The corked or stoppered bottles are then pas- in the usual way.—W. P. S.

UNITED STATES PATENT.

*Process of Manufacturing Non-Alcoholic* —. App. Leipsic, Germany. U.S. Pat. 786,771, April 4, 1905. g. Pat. 11,223 of 1903; this J., 1903, 921.—T. F. B.

FRENCH PATENTS.

*Manufacture of Dried* —. H. Hahn. Fr. Pat. 348,573, Dec. 5, 1904.

Yeast, after washing and pressing, is placed in a closed drying vessels, each composed of an outer and an inner container, the latter being provided with a wire sieve bottom, through which air is forced to pass the mass of yeast. The air is pumped through a wool filter; it then passes through a charcoal filter, and is compressed in a reservoir. From the reservoir the sterilised air passes through a worm immersed in a vessel of hot water, and through another worm immersed in a vessel of cold water, and from either of these it passes to the drying vessels. The yeast is first partially dried by a current of cold air at a temperature of 14° C.; then the drying proceeds, the temperature of the air is gradually increased until the final drying is effected at a temperature of 35° C. The dried yeast falls through the bottom of a box below.—J. F. B.

*Preparation and Converting; Process of* —. C. H. Caspar and P. Fitzgerald. Fr. Pat. 348,597, Dec. 6, 1904. g. Pat. 776,999 of 1904; this J., 1905, 39.—T. F. B.

III.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

*Cheddar; Relations of Casein and Paracasein to Acids and their Application to* —. J. van Slyke and E. B. Hart. New York Agric. Stat. Bull., 1905 [261], 1—37. (See this J., 1903, 922, 1253.)

Free from ash or nearly so, was obtained by pre-paring dilute skimmed milk with acids, the excess of acid together with inorganic matter, being removed by filtration and trituration with water. The required several days. From this casein free curd, preparations were made in which the proteid combined with about 2.4 per cent. of calcium oxide, or basic calcium-casein. One such preparation was made by triturating the proteid with calcium carbonate, and another by dissolving the casein in lime-water and making the solution neutral to phenolphthalein by addition of acid. By rendering the lime-water neutral of the proteid neutral to litmus, neutral calcium-casein was obtained containing about 1.5 per cent. of calcium oxide. These two calcium compounds are not precipitated by rennet, but neutral calcium-casein after treatment with rennet is coagulated at ordinary temperature by soluble calcium salts. Calcium chloride coagulates both compounds on warming to 35° to 15° C. The authors consider that casein is probably present in cow's milk as neutral calcium-casein.

Casein free from bases mentioned above is plastic and readily soluble in 5 per cent. sodium chloride solution, and in hot 50 per cent. alcohol, and is identical with the compounds formerly regarded by the authors as mono-salts. Similarly, the compounds which were previously called casein di-salts, are really compounds formed by the combination of acids with free

preparation of paracasein free from bases—obtained by treating milk with ammonium oxalate, filtering, acting with rennet for 2 hours at 37° C., diluting and pre-paring with hydrochloric acid—was dissolved in lime-

water, and from this solution basic calcium-paracasein, containing 2.40 per cent. of calcium oxide, and neutral calcium-paracasein, with 1.5 per cent. of calcium oxide, were prepared. These compounds so closely resembled those of casein in their properties that it is probable they are chemically alike, paracasein only differing from casein by consisting of a larger molecular aggregation. Free paracasein appears to be identical with the compounds previously called paracasein mono-salts.

The compounds dissolved by a warm 5 per cent. sodium chloride solution and hot 50 per cent. alcohol, from fresh Cheddar cheese which has been previously extracted with water, appear to consist of free paracasein, instead of paracasein mono-lactate as previously stated by the authors.

As regards the chemical changes in calcium-casein when milk becomes sour or is acidified, it is found that the acid first combines with the bases of some of the inorganic salts of the milk, and then with the calcium that is combined with the casein, liberating free casein. When more acid is added, the free casein combines with it. The coagulum obtained by the addition of rennet to milk is calcium-paracasein, either mixed or loosely combined with soluble calcium salts. While lactic acid is being formed in the process of cheese-making, it combines with the calcium of the calcium-paracasein, forming free paracasein and calcium lactate.

It is suggested that, to avoid confusion, the following nomenclature be used:—(1) That the compound existing in cow's milk be called calcium-casein; (2) that only the free proteid be called casein; (3) that the compound containing 2.4 per cent. of calcium be called basic calcium-casein; (4) that a compound formed by precipitation and combination with an acid be called a casein salt of that acid; (5) that the same nomenclature be applied to paracasein bodies, with the following addition—calcium-paracasein should be applied to the uncoagulated form and the term coagulated calcium-paracasein to the coagulated modification.—W. P. S.

*Milk referred to the Government Laboratory in connection with the Sale of Food and Drugs Acts; Analysis of Samples of* —. T. E. Thorpe. XXIII., page 513.

*Cane Sugar in the presence of Milk Constituents; Inversion of* —. F. Watts and H. A. Tempaay. XXIII., page 514.

*Salicylic Acid in Foodstuffs; Colorimetric Determination of* —. F. T. Harry and W. R. Mummary. XXIII., page 514.

*Saccharin; Determination of* —. C. Proctor. XXIII., page 514.

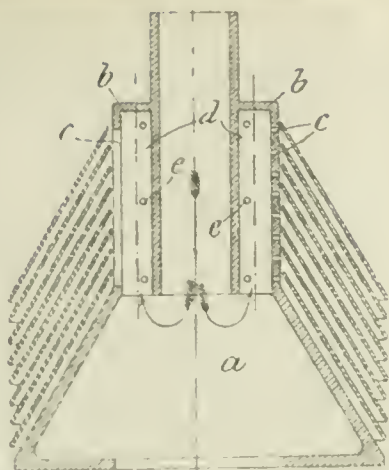
ENGLISH PATENTS.

*Cream-Separators; Impts. in* —. P. H. Watts, Dursley, Glos. Eng. Pat. 11,732, May 21, 1904.

A NUMBER of cones are placed in the drum of the separator, the cones being corrugated or ribbed. The corrugations commence at or near the base of the cones, and increase in depth towards the upper part, where they form two different inclines with suitable filling and exit provisions. The cones are separated from each other by projecting pieces, and may be provided with the usual holes. In shape, the corrugations may be straight or curved from the vertical.—W. P. S.

*[Milk] Separators; Impts. in Centrifugal* —. B. A. O.

Prollius, Copenhagen. Eng. Pat. 14,960, July 4, 1904. THE milk is fed into the inlet chamber *a*, and rises through a series of inlet tubes *b*, the centres of which are arranged in a circle about the axis of the apparatus. The tubes *b* are provided with slots or holes *c* which open into the nest of conical separating plates and with other openings *e* for the purpose of allowing the layers of air *d*, which form owing to the centrifugal force, and which prevent the tubes *b* from becoming completely filled with liquid, to communicate with the exterior of the tubes *b* and so regulate the pressure. The following advantages are claimed:—



1. Owing to the equalising of the pressure, an even feeding of the milk on to the conical plates is secured.

2. The separated cream particles do not adhere either to the inside or outside of the inlet tubes.

3. The same pressure is always maintained in the air-ducts within the milk-way and the cream-way.—W. H. C.

[Milk] Separators, Impts. in Centrifugal — B. A. O. Prolius, Copenhagen. Eng. Pat. 14,961, July 4, 1904.

GROOVES of approximately V-shaped cross section are formed at the inner edge of the separating plates, and merged into the inclined surfaces so that when the plates are assembled in the bowl of the centrifugal machine, exact centering and proper relative distance between them is assured. Further the grooves are arranged opposite the outlets of the milk-supply tubes, in order that the liquid may flow through the grooves and be spread uniformly over the plates.—W. H. C.

Food and Beverages; Sterilisation of — C. C. L. G. Budde, Copenhagen. Eng. Pat. 13,651, June 16, 1904.

A CONSIDERABLE quantity of hydrogen peroxide is added to the beverage, &c., to be sterilised, which may then be heated to 40° C., in a closed vessel to prevent loss of carbon dioxide. The excess of hydrogen peroxide is afterwards destroyed by the addition of powdered charcoal, or platinum and similar metals in a finely-powdered or colloidal state. These are removed by filtration, or allowed to settle, before the beverage is bottled.—W.P.S.

#### UNITED STATES PATENT.

Milk Powder containing Cream; Process of Obtaining a — C. H. Campbell, Philadelphia, Pa., Assignor to National Nutrient Co., Jersey City, N.J. U.S. Pat. 786,626, April 4, 1905.

SKIMMED milk is concentrated at a moderately low temperature by forcing a current of air through it, until it is reduced to about one-sixth of its original volume. Cream is now added, and the mixture dried at a temperature below 150° F. The product has a flavour of cream. —W. P. S.

Milk or other Liquids; Process of Sterilising — C. de Jong, Amsterdam. U.S. Pat. 786,819, April 11, 1905.

SEE Eng. Pat. 5446, 1903; this J., 1904, 201.—W. P. S.

Milk; Condensed — S. R. Kennedy, Assignor to the American Dairy Products and Manufacturing Co., Philadelphia, Pa. U.S. Pat. 787,044, April 11, 1905.

A PRODUCT is claimed consisting of milk condensed to a thick syrup and containing the usual constituents of condensed milk, except the sugar and salts, which are present only in a greatly reduced proportion. (See also U.S. Pat. 772,517, 1904; this J., 1904, 1105.)—W. P. S.

#### FRENCH PATENTS.

Cereals or other Analogous Matters or their Grist; Apparatus for Extracting Liquid or Volatile Oils from, and Drying — W. J. Wells. Fr. Pat. 348,523, Nov. 2, 1904.

SEE Eng. Pat. 23,183 of 1904; this J. 1905, 427.—T. F. B.

Condensing [Evaporating Albuminous] Liquids; Apparatus for — H. W. Southworth. Fr. Pat. 348,523, Nov. 24, 1904.

SEE Eng. Pat. 24,870 of 1904; this J., 1905, 123.—T. F. B.

Milk Powder or Food; Manufacture of a — Raveau. Fr. Pat. 348,640, Dec. 8, 1901.

MILK is evaporated by passing it between two thin porcelain or stone-ware cylinders heated to a temperature of 120° C. The dry powder obtained is mixed with sugar, vanillin, coffee extract, &c.—W. P. S.

#### GERMAN PATENTS.

Juices, Animal or Vegetable; Obtaining Dry Preparation of —, for Alimentary or Medicinal Purposes — Meyer. Ger. Pat. 154,732, Dec. 2, 1902.

DRY preparations of animal or vegetable juices or extracts are produced by adding to the juice the necessary quantity of a salt from which the water of crystallisation has been removed.—T. F. B.

Albumin Solutions; Method for the Preparation of — W. Holschmidt. Ger. Pat. 154,935, Dec. 10, 1902.

ALBUMIN or a substance containing albumin is subjected to the action of an acid capable of forming hydrates, as sulphuric acid, the acid being employed in a partially hydrated condition. The substance is mixed with a quantity of the acid to form a plastic, dough-like mass, and it is stated that with an acid capable of forming hydrates, such as sulphuric acid, a gradual liquefaction takes place, even in the cold, with formation of albumin, albumoses and peptones.—A. S.

#### (B).—SANITATION; WATER PURIFICATION

##### ENGLISH PATENT.

Sewage; Treatment of — [Charcoal Filters]. Wanklyn and W. J. Cooper, New Malden. Eng. Pat. 8857, April 18, 1904.

LARGE or small masses of wood charcoal are placed in sewage channels to form a series of floating filters. The pieces have drifted into position, more charcoal is placed on them, so that part of the filter is forced to the surface of the sewage, which must flow from the or channel at the top. The charcoal may be packed in bags provided with ropes by means of which they are drawn out of the sewage from time to time for purpose of revivification.—W. P. S.

##### FRENCH PATENT.

Water; Purification of —, by Continuous Precipitation and Decantation. E. Declercq. Fr. Pat. 348,375, 30, 1904.

THE water, after being mixed with regulated quantity of precipitating reagents, enters the lower part of a tank having a conical bottom. The water here encounters the sediment of previous precipitations which considerably increases the rapidity of the formation of the fresh precipitate. As the latter collects it is drawn off by means of a vertical covered pipe extending about half the height of the interior of the tank, whilst the clear water overflows at the top of the tank, first passing over the edge of a basin-shaped baffle plate.—W. P. S.

##### GERMAN PATENT.

Water; Process for the Separation of Iron from — G. Bruhns. Ger. Pat. 154,792, Oct. 18, 1902, Added to Ger. Pat. 145,797, March 16, 1902.

ACCORDING to the main patent, the water was passed



filters composed of an organic or inorganic porous substance impregnated with manganese in a state of fine division. It is now found that manganese peroxide can be replaced by other oxidized oxides of manganese.—A. S.

### (C).—DISINFECTANTS.

*Composition of Commercial — in Relation to Spraying [Fruit Trees].* L. L. van Slyke and F. A. New York Agric. Expt. Stat., 1904, Bull. No. 427-438.

variable results obtained on spraying fruit trees. The variations of commercial whale-oil soaps are due to the composition of such soaps. In nine examined by the authors, the proportion of water from about 11 to 55 per cent., and that of free alkali 0.1-30 per cent. The authors recommend that the soap prepared by the user, and the following formula be used:—Caustic soda, 6 lb.; fish oil, 22 lb.; water, 100 lb. A solution of 1 lb. of a soap prepared in this way in 100 lb. of water gave good results when used for spraying apple, pear, plum, currant cherry and peach trees, containing up to 5 per cent. of free alkali had no effect on the foliage of the trees.—A. S.

### ENGLISH PATENT.

*Processes and Paints for Waterproofing, Disinfecting, and other purposes, also for Indurating Building Materials; and the Manufacture of —.* J. Hargreaves. Eng. Pat. 18,518, May 18, 1904. X111. A., page 506.

### UNITED STATES PATENT.

*Compound for Firemen's Use.* W. M. Mitchell, Louisville, Ky. U.S. Pat. 786,543, April 4, 1905. The preparation consists of a mixture of menthol, terebene, and ammonia.—W. P. S.

## IX.—PAPER, PASTEBOARD, Etc.

### UNITED STATES PATENTS.

*Machine for Making Paper and Process for —.* R. Binns, Windham, Conn. U.S. Pat. 785,704, March 28, 1905.

The paper-making machine of the cylinder type, the "making" cylinder is so arranged as to form a vat for the pulp. The web of paper is thus dried by percolation on the rising surface of the vat below the level of the liquid in the vat; it is then on an endless felt in the usual way.—J. F. B.

*Machine.* K. E. Rogers, S. Mauchester, Conn. U.S. Pat. 786,996, April 11, 1905.

The machine consists of a non-rotating suction-box which extends obliquely under the surface of the pulp vat in a vat. A wiper-fabric belt, supported by rollers inside and outside the vat, passes around the suction-box and emerges in a plane parallel to the perforated upper surface of the latter. The pulp is caused to adhere to the belt in a continuous web under the influence of the suction inside the box, and the web is transferred to an endless felt and finished in the usual way.—J. F. B.

*Process.* C. de Büren, Geneva, Switzerland. U.S. Pat. 786,343, April 4, 1905.

The process of about 70 per cent. of "pure celluloid," or 70 per cent. of a lead salt having a sp. gr. greater than 3, such as lead carbonate, is claimed as a new process for the manufacture of golf balls.—A. S.

### FRENCH PATENT.

*Artificial; Method of Coating Tissues or Paper with Celluloid.* L. Richard and J. Jacquin. Fr. Pat. 448,354, Nov. 29, 1904. V., page 495.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Lithium Citrate.* D. B. Dott. Pharm. J., 1905, 74, 440

The British Pharmacopœia has previously been shown to be inaccurate in describing lithium citrate as deliquescent, and in regard to the temperature at which the salt loses the whole of its water. The author now points out that the official statement that lithium citrate loses 19 per cent. of moisture at 100° C. is also quite incorrect. Direct experiments showed that the loss of moisture near 100° C. amounted to about 24.7 per cent., corresponding to four molecules of water.—A. S.

*Glycerolphosphoric Acids; Relation between Natural and Synthetical —.* F. B. Power and F. Tutin. Chem. Soc. Trans., 1905, 87, 249-257.

The authors confirm the statement of Carré (see this J., 1901, 35) that when glycerolphosphoric acid,  $C_3H_5(OH)_2O.PO(OH)_2$ , is prepared at temperatures above 110° C., it is associated with varying amounts of the di-ester

$C_3H_5(OH) < \overset{O}{\parallel} PO(OH)$ . It is to this fact that the

discrepancies of statement respecting the composition and characters of the salts of glycerolphosphoric acid are due (compare this J., 1895, 60; 1898, 66, 179, 266, 368). The authors prepared the calcium, strontium, barium, lithium, manganese, and zinc salts of glycerolphosphoric acid under conditions which excluded the formation of the di-ester. The calcium, strontium and barium salts, after drying in a vacuum, were all nearly anhydrous. The calcium salt,  $C_3H_5(OH)_2O.PO.O_2Ca$ , forms tufts of crystalline leaflets when its cold saturated solution is heated; it is soluble in 22.4 parts of water at 16° C., in 25.2 parts at 25°; and in 108.6 parts at 100° C. Lithium glycerolphosphate when air-dried contains 6.9 per cent., or between one-half and one molecule of water. Zinc glycerolphosphate unlike the other salts mentioned is more easily soluble in hot than in cold water; it readily crystallises in colourless glistening plates when its hot concentrated solution is cooled. On heating at 125° C. it appears to be converted into a basic salt insoluble in water.

The authors also criticise the recently published work of Willstätter and Lüdecke (Ber., 1904, 37, 3573) in which the barium and calcium salts of the natural and synthetical glycerolphosphoric acid were compared, and the conclusion drawn that the differences between them are not those which are usually observed in the case of optically active and racemic compounds. These differences consisted in the amount of metal contained in the respective salts, in the varying amounts of water believed to be retained by them when dried at certain temperatures, and in their relative solubility. It is stated that the conclusions of Willstätter and Lüdecke cannot be accepted, inasmuch as their synthetical glycerolphosphoric acid was prepared under conditions which have been proved to afford some of the di-ester, and the discrepancies they have observed are, to a large extent, due to the contamination of their salts of the synthetical acid with those of the di-ester, rather than to the amount of water retained by them when subjected to heat. (See also this J., 1896, 556; 1897, 553; 1898, 73, 78, 386, 500, 598, 864; 1899, 603; 1900, 80.)—A. S.

*Linin.* J. S. Hills and W. P. Wynne. Chem. Soc. Trans., 1905, 87, 327-331.

The authors believe the active principle of *Linum catharticum* ("purging flax"), a small indigenous herb, to be a glucoside, which on hydrolysis with dilute acids or with lime yields dextrose and a substance apparently identical with Schröder's linin (Neues Rep. Pharm., 1861, 10, 11). The best yield of linin is obtained by digesting the dried herb with one-fifth of its weight of slaked lime and ten times its weight of water at 80°-90° C., for six hours, concentrating the filtered solution to about one-tenth of its volume, and boiling for five minutes with hydrochloric acid. The greater part of the linin separates in a crystalline form on cooling, and the remainder

can be obtained by extraction with ether. With 500 grms of the herb, the yield of linin was 0.135 per cent., and with 21.5 kilos., 0.126 per cent. The crude linin was purified by crystallisation from absolute alcohol, solution in ethyl acetate and precipitation with light petroleum. The pure compound forms long glistening needles melting with decomposition at about 205° C.; the melting-point, however, varies with the rate of heating. Linin has the composition  $C_{23}H_{24}O_6$ , is fairly easily soluble in chloroform and acetic acid, sparingly soluble in methyl and ethyl alcohols, acetone, ether and benzene, and insoluble in light petroleum, water, and hydrochloric acid. It dissolves in a boiling, dilute solution of sodium hydroxide, and is reprecipitated unchanged by addition of hydrochloric or sulphuric acid. It yields oxalic acid on oxidation with nitric acid or potassium permanganate, and it contains four methoxyl groups. It has properties remarkably similar to those of picropodophyllin (this J., 1898, 268). A mixture of equal parts of linin (m. pt., about 205° C.) and picropodophyllin (m. pt., 227° C.) melts at 184° C.—A. S.

*Saccharin; Determination of*—C. Proctor.  
XXIII., page 514.

*Cod Liver Oil Standards.* E. J. Parry. XII., page 505.

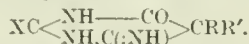
#### ENGLISH PATENTS.

*Barbituric Acid; Manufacture of Derivatives of*—C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 11,259, May 16, 1904.

DIALKYLTHIOBARBITURIC acids of the constitution  $CS:(NH.CO)_2:CR_2$ , are prepared by condensing thiourea with dialkylmalonic esters in presence of metal alcoholates.—T. F. B.

*Pyrimidine Derivatives; Manufacture of*—H. E. Newton, London. From Farbenfabr. vorm F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 12,091, May 27, 1904.

In U.S. Pat. 744,732 of 1903, (see this J., 1904, 35) and Eng. Pat. 21,833 and 22,967 of 1903 (this J., 1904, 76) processes were described for the preparation of pyrimidine derivatives of the general formula—



where X represents O, NH or S, and R and R' alkyl radicals. It is now found that the condensations therein described can be carried out in presence of alkali amides or alkali metals instead of with alkali alcoholates. The condensation of alkyl cyanoacetic esters with guanidine may also be brought about without the use of a condensing agent, the 2,4-di-imino-5-alkyl-6-oxypyrimidine being produced by heating an alcoholic solution of the two components for some hours at about 100° C.—T. F. B.

#### UNITED STATES PATENT.

*Carbon Tetrafluoride Gas; [Electrolytic] Manufacture of*—J. A. Lyons and E. C. Broadwell. U.S. Pat. 785,861, March 28, 1905. XI. A., page 503.

#### FRENCH PATENTS.

*Metals, Colloidal; Preparation of Organo-metallic*—J. Bonnet. Fr. Pat. 348,330, Feb. 5, 1904.

COLLOIDAL metals are prepared by mixing a solution of a metallic salt (e.g., of copper, iron or manganese) with one of albumin, gelatin, dextrin, &c., in presence of a small quantity of alkali. The solution should be made with distilled water free from oxygen, and in absence of air. Such a solution may be prepared by adding 1 or 2 c.c. of a 1 to 5 per cent. manganese chloride solution to 1 litre of the solution of albumin, &c., and then adding a few c.c. of decinormal sodium hydroxide solution. The solution thus obtained is colourless, and possesses energetic oxidising power. If the preparation be made in air, or if the above solution be kept in air, it turns brown, and gives indications of the presence of manganese dioxide, which, however, is not precipitated.

If the solution is heated to 100° C., it loses its power of oxidation. The colloidal compounds may be obtained in solid form by precipitation with alcohol, or by evaporation *in vacuo*.—T. F. B.

*Pinene Hydrochloride; Process for Purifying Solid*—J. Schermer and L. Morane. Fr. Pat. 348,618, 15, 1904.

CRUDE pinene hydrochloride, obtained by passing hydrochloric acid gas through turpentine oil, is washed with dilute alkali and then with water. It is then subjected to a treatment with some oxidising agent, e.g., permanganate two to three parts of permanganate in aqueous solution being used for every 100 parts of the hydrochloride. Oxidation of the impurities may be carried out in cold, but it proceeds more rapidly at higher temperature. The manganese dioxide formed (which imparts a brown colour to the product) is removed by treatment with sulphur dioxide, and the product is then washed and dried. Pinene hydrochloride purified in this way is stated to be quite stable, not becoming acid on keeping. (See Fr. Pat. 328,009 and addition thereto; this J., 1903, and 1904, 336.)—T. F. B.

*Citral Series; Process for the Transformation of Perfumes of Compounds of the*—E. Knoevenagel. Fr. Pat. 348,484, Nov. 8, 1904. Under Internat. C. Nov. 10, 1903.

See Eng. Pat. 23,578 of 1904; this J., 1905, 209.—T.

#### GERMAN PATENTS.

*Juices, Animal or Vegetable, for Alimentary or Medical Purposes; Obtaining Dry Preparations of*—Meyer. Ger. Pat. 154,732, Dec. 2, 1902. XVII. A. page 510.

*Lecithin; Process for Obtaining Preparations of Containing Iodine*. J. D. Riedel. Ger. Pat. 153, April 28, 1903.

An iodo derivative of lecithin is produced by the action of iodine monochloride, or a substance having a similar action, on lecithin. A solution of 5 kilos. of lecithin in three litres of alcohol is shaken with 10 litres of 10% iodine solution at a temperature of 40°–50° C.; the solution is cooled, filtered, and evaporated *in vacuo*. The product contains up to 20 per cent. of iodine.—T. F. B.

*Bromolecithin; Process of Preparing*—Act. f. Anilinfabr. Ger. Pat. 156,110, July 28, 1903.

BROMOLECITHIN is prepared by the action of bromine on lecithin, which is capable of taking up 50 per cent. weight of halogen.—T. F. B.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

#### ENGLISH PATENTS.

*Emulsions, Photographic Sensitive; Base or Support for*—J. Findlay, Ilford. Eng. Pat. 5948, May 11, 1904.

A NON-INFLAMMABLE base or support for use in preparing "flat" or "roll" films for photographic purposes may be prepared as follows:—7½ kilos. of glacial acetic acid containing 90 grms. of chloral hydrate are warmed with 1 kilo. of mono- or di-nitro-cellulose and 2.5 kilos. of clear, hard gelatin or glue until solution is complete. Eight litres of a 2 per cent solution of equal parts of gum dammar and gum storax in 70 per cent. alcohol are then incorporated with the solution, and the mixture poured into suitable moulds, or on to slabs. When the sheets or films are dry, they are rendered non-inflammable by immersion in an alkaline solution of shellac, prepared, for example, by dissolving one part of borax and one part of gum shellac in 10 parts of water.—T. F. B.



pers, *Photographic; Impts. in* ——. H. Lüttke, Arndt and E. Löwengard, Wandsbek, Germany. U.S. Pat. 23,729, Nov. 2, 1904.

U.S. Pat. 347,396 of 1904; this J., 1905, 346.—T. F. B.

## UNITED STATES PATENTS.

*ing-Film for Photographs; Transparent Paper* ——. J. E. Thornton and C. F. S. Rothwell, Assignors to J. O'Brien, Manchester. U.S. Pat. 786,534, April 4, 1905.

U.S. Pat. 17,446 of 1899; this J., 1900, 689.—T. F. B.

*or Film; Photographic* —— *for Daylight Development and Fixing*. J. E. Thornton and C. F. S. Rothwell, Assignors to J. O. O'Brien, Manchester. U.S. Pat. 786,535, April 4, 1905.

U.S. Pat. 17,292 of 1899; this J., 1900, 689.—T. F. B.

*[Photographic]; Self-Developing Sensitive* ——. J. E. Thornton and C. F. S. Rothwell, Assignors to J. O'Brien, Manchester. U.S. Pat. 786,536, April 4, 1905.

U.S. Pat. 17,738 of 1899; this J., 1900, 689.—T. F. B.

*ing [Manganese] Pictures; Process of Producing* ——. O. Gros and J. Friedlaender, Leipzig, Germany. U.S. Pat. 786,640, April 4, 1905.

U.S. Pat. 343,583 of 1904; this J., 1904, 1044.—T. F. B.

*ping Photographic Plates or the like in Open Daylight; Process of* ——. J. N. Ludwig, Mainz, Germany. U.S. Pat. 787,103, April 11, 1905.

U.S. Pat. 3023 of 1902; this J., 1902, 639.—T. F. B.

## FRENCH PATENT.

*raphic Reproductions in Colour; Carbon Paper* ——. C. L. A. Brasseur. Fr. Pat. 348,413, 1, 1904.

Fr. Pat. 778,947 of 1905; this J., 1905, 152.—T. F. B.

## GERMAN PATENT.

*ive; Method for the Preparation of an* ——. H. Hey. Ger. Pat. 155,741, May 6, 1903. XIV., page 507.

## XXII.—EXPLOSIVES, MATCHES, Etc.

## UNITED STATES PATENT.

*is; Process of Making* ——. J. H. Christensen, Copenhagen. U.S. Pat. 786,629, April 4, 1905.

U.S. Pat. 11,990 of 1903; this J., 1904, 455.—T. F. B.

## FRENCH PATENT.

*ive [Chlorate]*. N. Evangelidi. Fr. Pat. 348,404, Aug. 27, 1904.

Fr. Pat. 20,106 of 1904; this J., 1904, 1239.—T. F. B.

## XXIII.—ANALYTICAL CHEMISTRY.

## INORGANIC QUALITATIVE.

*fluosilicic Acid; Behaviour of* —— *to certain reagents*. A. Gawalowski. Z. anal. Chem., 1905, 44, 194.

Aqueous solution of hydrofluosilicic acid behaves with reagents as follows:—Dilute sulphuric acid—white precipitate, insoluble in nitric acid; hydrochloric acid—precipitate, somewhat soluble in hot water and acid; potassium chromate—yellow precipitate, soluble in nitric acid; potassium bichromate—orange precipitate; potassium chlorobichromate—orange precipitate.—C. E. F.

*Lime [in Portland Cement]; Alkaline Reaction of free* —— *in Absolute Alcohol*. E. Drexel. Tonind. Zeit., 1905, 29, 311. (See also this J., 1905, 210.)

In the author's opinion no colour reaction between Portland cement and a solution of phenolphthalein in absolute alcohol can be due to the presence of free lime, since if the lime remain undissolved no hydroxyl ions are formed, and even if the lime deprived the alcohol of the elements of water, it would be necessary for the resulting calcium and hydroxyl to be present in a state of dissociation, which is not the case. Furthermore, any such power of decomposing alcohol would presumably be shared by the calcium oxide molecule combined with silica, so that the colour reaction would not necessarily be an indication of the presence of free lime.—C. S.

## INORGANIC QUANTITATIVE.

*Acidimetry; Sodium Carbonate and Sodium Oxalate as Standard Substances in* ——. S. P. L. Sørensen and A. C. Andersen. Z. anal. Chem., 1905, 44, 156—184.

The value of sodium oxalate as a standard in acidimetry has been shown by Sørensen (this J., 1900, 1041; 1903, 1015). Lunge (Z. angew. Chem., 1904, 17, 225—265) has commented favourably on the use of sodium oxalate, but states that it gives results differing by 0.1 per cent. from the results obtained by the use of sodium carbonate. The authors find that the results obtained by the two methods are almost identical, the differences never reaching 0.1 per cent. Any small difference is due to the impossibility of preparing sodium carbonate quite pure (from bicarbonate). The method for using sodium oxalate is as follows:—A specimen of pure sodium oxalate, which has been heated to 240° C. and then exposed to ordinary air, is weighed into a platinum crucible and heated by means of a spirit lamp—a gas flame should not be used. The residue, on cooling, is treated with N/10 hydrochloric acid in slight excess, the solution is boiled, some phenolphthalein added, when it is again boiled, whilst a current of air, freed from carbon dioxide, is being passed through. When cold, the liquid is titrated with N/10 sodium hydroxide solution, using phenolphthalein as indicator. The numbers obtained by standardising hydrochloric acid with sodium oxalate differ by 0.05 per cent. from the value got by a gravimetric determination of the chlorine in the acid, or by weighing the hydrochloric acid in the solution. According to Lunge methyl orange has the advantage of not being acted on by carbonic acid; the authors find that this is not the case, and recommend that in exact work the same amount of carbonic acid should be present in any solution which is being analysed as in the solution when the standardisation was carried out.

—C. E. F.

*Limestones; New Method for the Determination of Magnesium Carbonate in* ——. W. F. Koppeschaar. Z. anal. Chem., 1905, 44, 184—187.

The bulk of the calcium is precipitated as sulphate. Fifty grms. of the limestone are treated with 500 c.c. of 2N-hydrochloric acid until dissolved; 50 c.c. of concentrated sulphuric acid are then added, and the calcium sulphate filtered off through a Büchner funnel. The filtrate, after being made alkaline with ammonia, is treated with 5 grms. of ammonium oxalate and filtered. The magnesium is precipitated from the filtrate by adding 4 grms. of sodium phosphate.—C. E. F.

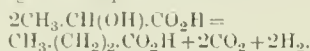
*Hydrofluoric Acid [Use of* —— *in the Determination of Iron and Aluminium]*. E. Deussen. VII., page 496.

## ORGANIC—QUANTITATIVE.

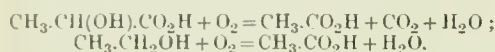
*Milk referred to the Government Laboratory in connection with the Sale of Food and Drugs Acts; Analysis of Samples of* ——. T. E. Thorpe. Chem. Soc. Trans., 1905, 87, 206—225.

SAMPLES of milk referred by magistrates to the Government Laboratory for examination, are invariably sour when received, and it has been of importance therefore

to determine the influence of the changes which occur during the process of souring on the amounts of fat and non-fatty solids in the milk. With regard to the fat, it was found that bacteria which produce steatolytic enzymes do not develop to any considerable extent in sour milk, and that any alteration in the amount of fat caused by fermentation is so small as to be negligible. The somewhat complicated changes which take place in the non-fatty solids of milk during the souring process were examined in detail. The partial conversion of the lactose into lactic acid does not involve any change in weight, but comparative experiments with fresh milk, and milk which had been kept for varying periods of time, showed that concurrently with the formation of lactic acid, there are produced substances which are either gaseous at ordinary temperatures, or are volatilised during the operation of determining the non-fatty solids. Among the compounds detected were *n*-butyric acid, acetic acid and ethyl alcohol. Butyric acid is formed from lactic acid according to the equation:



The production of each molecule of butyric acid thus involves the loss of two molecules each of carbon dioxide and hydrogen. Acetic acid may be produced by the oxidation of lactic acid or of ethyl alcohol. In the first place there is a loss of one molecule each of carbon dioxide and water, and in the second case, of one molecule of water only for each molecule of acetic acid formed.



The ethyl alcohol may be produced in various ways, but in any case the formation of each molecule of alcohol is associated with the production of one molecule of carbon dioxide, so that the total loss of weight in the lactose due to the production of alcohol and carbon dioxide is  $\frac{2}{3}$  times the weight of alcohol produced.

With regard to the proteid substances contained in milk, the losses caused by the changes which take place during the process of souring are almost negligible. The only loss which it is necessary to take into consideration is that due to the formation of a small quantity of ammonia. In considering the influence of these changes, it is pointed out that most of the samples dealt with in practice are only fermented to a relatively small extent; they are between three and six weeks old, have been preserved in sealed bottles containing only a limited quantity of air, and the total diminution in weight of the non-fatty solids, due to the formation of volatile products, is usually only a few tenths of 1 per cent. (from 0.2 to 0.5 per cent.). Further, in determinations of the non-fatty solids in the same sample of fresh milk by different persons, the results may frequently differ by 0.1—0.2 per cent. The following scheme of analysis is adopted in the Government Laboratory. The sample of milk is thoroughly mixed with a wire whisk, and about 10 grms. are weighed out into a flat-bottomed platinum capsule, which has been tared along with a short glass rod having a flattened end. The milk is neutralised with N/10 solution of strontia, using phenolphthalein as indicator, and is evaporated over the water-bath until the residue, which towards the end should be dried at a very gentle heat and with constant stirring, attains the consistency of dry cheese. The residue is then triturated with 20 c.c. of dehydrated ether, the solution passed through a filter which has previously been dried, and weighed in a weighing-bottle, and the maceration of the milk solids is continued with eight successive quantities of ether. Before it is quite dry, the residue is transferred, as far as practicable, to the weighing-bottle, the filter-paper, washed free from fat, is replaced in the bottle, and the whole, with the platinum capsule, is dried at 100° C. for three hours, weighed, then heated at 100° C. for a further two hours, and again weighed. From the weight of non-fatty solids thus obtained, 0.00428 gm. is deducted for each c.c. of N/10 solution of strontia used for neutralising the milk. The ethereal solution of the fat is received in small tared flasks, the ether is distilled off, and the dried fat is weighed. For the determination of the ethyl alcohol, 50, 75, or 100 grms.

of the milk are distilled, the distillate is neutralised with N/10 solution of sodium hydroxide, redistilled, and sp. gr. of the distillate, diluted to a convenient  $\frac{1}{10}$ , determined in a 50-grm. pycnometer. The percent by weight of alcohol, multiplied by  $\frac{2}{3}$  gives the percent amount of lactose which has disappeared in the production of the alcohol. For the determination of volatile acid, 10 grms. of the milk, contained in a platinum capsule, are neutralised to the extent of one-half of total acidity with N/10-solution of sodium hydroxide, and a little phenolphthalein is added. The mixture is evaporated to dryness on the water-bath with frequent stirring, and after treatment with about 20 c.c. of hot distilled water, the solution is neutralised with N/10-solution of sodium hydroxide. The difference between the original acidity of the milk and that of the evaporated portion may, in most cases, be regarded as acetic acid. The production of each molecule (60 parts) of this acid denotes a loss of 62 parts of the original lactose. In relatively infrequent cases where the butyric stage of fermentation has become pronounced, the volatile acids are separated by distillation from the quantity of milk which has been taken for the determination of the alcohol. A portion of the mixed aqueous acids is neutralised with barium hydroxide solution, evaporated, and the residue dried. From the percentage of barium contained in mixed salts, the proportions of the two acids are calculated. Each molecule (88 parts) of butyric acid found indicates a loss of 92 parts of lactose. To determine a small quantity of ammonia formed, 2 grms. of the milk are made up to 100 c.c. with distilled water free from ammonia, and filtered through a carefully-washed filter. In 10 c.c. of the clear filtrate diluted to 50 c.c. with distilled water, the ammonia is determined by Nessler's method, a solution of ammonium chloride containing 0.01 mgrm. of ammonia per c.c. being used as a standard.—A.

*Cane Sugar in the Presence of Milk Constituents; Inversion of —.* F. Watts and H. A. Tempany. *Analyst*, 1905, 30, 119—123.

THE authors find that solutions of cane sugar containing whey are not completely inverted by citric acid when boiled for ten minutes only. To obtain satisfactory results, the boiling should be continued for 40 minutes. The retarding influence is not due to the lactose, the latter having no effect on the rate of inversion of cane sugar, but to some other constituent of the milk. It is further shown that citric acid does not invert lactose even after boiling for two hours.—W. P. S.

*Salicylic Acid in Foodstuffs; Colorimetric Determination of —.* F. T. Harry and W. R. Mummery. *Analyst*, 1905, 30, 124—127.

THE method is based upon the fact that lead tannate is insoluble in alkalis, whilst lead salicylate is readily soluble. In the case of jam, fruit pulp, or the like, 50 grms. of the crushed sample are placed in a 300 c.c. flask, a little water is added, then 15 to 20 c.c. of a saturated solution of lead acetate, and the whole rendered alkaline by the addition of about 25 c.c. of sodium hydroxide solution (40 grms. per litre). From 15 to 20 c.c. of approximately N/1 hydrochloric acid solution are now added, and the mixture diluted to the mark. The partial neutralisation of the alkali is necessary to obtain complete solution of the lead salicylate. The contents of the flask are filtered, 200 c.c. of the filtrate are acidified with hydrochloric acid, again filtered if necessary, and extracted three times with ether. The ether is distilled off, the residue of salicylic acid dissolved in a little alcohol, made up to a volume of 100 c.c., and determined colorimetrically with ferrous chloride. Alcoholic liquors must be boiled, after the addition of alkali, to remove the alcohol, and the residue then neutralised, before proceeding with the determination.—W. P.

*Saccharin [Benzoyl Sulphonic Imide]; Determination of —.* C. Proctor. *Chem. Soc. Trans.*, 1905, 7, 242—249.

THE author finds that Reid's process for the determination of saccharin (this J., 1899, 868) gives accurate results.



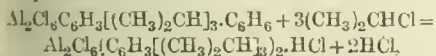
analysis of commercial saccharin, salts of saccharin, ureas containing saccharin, and the intermediate ureas obtained in the manufacture of saccharin. In the course of the investigation, it was observed that real saccharin [o-benzoyl sulphonic imide] and para-saccharin (n-phenyl sulphonic imide) liberate iodine quantitatively in a solution containing potassium iodide and iodate, the following method for the determination of the two kinds has been based on this fact. When the sample consists only of the uncombined ortho-saccharin, or without admixture of p-saccharin and traces of sulphone-amides, 0.5—1 gm. is weighed into a tared flask, and treated with 50—75 c.c. of recently distilled water, a crystal or two of potassium iodide and 10 c.c. of a 5 per cent. solution of potassium iodate. The mixture is agitated until the saccharin has dissolved and the liberated iodine is then titrated with a solution of sodium thiosulphate. The number of c.c. of thiosulphate solution required multiplied by 3 expresses the result as grms. of real saccharin. To obtain the amount of p-benzoyl sulphonic imide, the number of c.c. of N/10-acid required to neutralise the iodine produced in Reid's process (see above) from a weight of the sample, must be subtracted from the number of c.c. of N/10-solution of thiosulphate; the difference multiplied by 0.0201 gives the weight of the para-saccharin in grms. In the case of samples containing anhydrous carbonate or consisting of the ammonium or sodium salt of saccharin, 0.5—1 gm. of substance contained in a small capsule is heated on the steam-bath with about 10 c.c. of pure concentrated hydrochloric acid, until the acid is removed, and the residue dried for about 24 hours, and then treated with potassium iodide and iodate as before.—A. S.

#### IV.—SCIENTIFIC & TECHNICAL NOTES.

*Aluminium Chloride Catalysts ["Ferments"]*; *Comparisons of — with Hydrocarbons and with Hydrogen Chloride*. G. Gustavson. *Comptes rend.*, 1905, 140, 1941.

INVESTIGATING his studies on the aluminium chloride catalysts "ferments" (see this J., 1903, 713) which are produced by the combination of aluminium chloride with benzene or in alkyl chloride, the author finds that these bodies possess the property of combining simultaneously with hydrocarbons and with hydrogen chloride. When isopropyl chloride is added gradually to a mixture of the finely powdered aluminium chloride at a low temperature, the reaction is completed in two stages:—according to the equation:  $\text{Al}_2\text{Cl}_6 + 2\text{C}_6\text{H}_6 + 3(\text{CH}_3)_2\text{CHCl} = \text{Al}_2\text{Cl}_6\text{C}_6\text{H}_5[(\text{CH}_3)_2\text{CH}]_3\text{C}_6\text{H}_5 + 3\text{HCl}$  the first being a combination of the "ferment" with benzene, and the remaining liquid.

On the addition of more isopropyl chloride, according to the equation:



the product solidifying to a yellow crystalline mass composed of a combination of the "ferment" with tri-isopropyl benzene and hydrogen chloride.

This yellow compound is dissociated on heating at 55° C. into two layers, the lower layer consisting of the regenerated "ferment," and the upper layer of tri-isopropyl benzene, hydrogen chloride being evolved.

The yellow combination can be re-formed by saturating the mixture of the "ferment" and the hydrocarbon with hydrogen chloride at a temperature of -10° C. Analogous combinations are produced when other alkyl chlorides or substituted benzenes are employed. It is also possible to obtain mixed compounds of the same character.—J. F. B.

*Preparation; Esterification of —*. M. P. S. Guédras. *Comptes rend.*, 1905, 140, 1034.

In the course of the manufacture of plastic masses composed of casein with the addition of acetic acid and glycerin,

the glycerin being in excess, the author has observed the formation of glycerol monoacetate. The formation of the ester is very rapid, even in the cold, and the rapidity of the reaction can only be attributed to catalytic influence. It is suggested that the casein, owing to its porous structure, plays the part of a "contact" catalyst.—J. F. B.

*Dextrose; Conversion of — into Methylimidazole*. A. Windaus and F. Knoop. *Ber.*, 1905, 38, 1166—1170.

UNDER the action of dilute alkali, dextrose undergoes a series of transformations, leading to the formation of hydroxy-acids such as lactic acid. The authors find that, although ammonia acts only very slowly on dextrose, the latter is readily attacked by zinc hydroxide-ammonia or by other metallic hydroxides which do not form complex compounds with ammonia, e.g., potassium hydroxide and ammonia, the main product in all cases being (α- or β-) methyl-imidazole (methylglyoxaline). An appreciable quantity of saccharin is also formed.—T. H. P.

*Carbohydrates; Action of Hydrogen Peroxide on — in presence of Ferrous Sulphate*. R. S. Morrell and A. E. Bellars. *Chem. Soc. Trans.*, 1905, 87, 280—293.

IN continuation of their previous work (this J., 1902, 506; 1903, 1371; 1904, 993), the authors find that the acidities of the sugar solutions after oxidation are insufficient to account even for the complete formation of one monobasic hexose acid. The greater the acidity of the solution, the smaller was the yield of osazone precipitated by phenylhydrazine in the cold. Among the oxidation products of arabinose and rhamnose, formic and oxalic acids were detected, but the more important ketone-acids which were expected could not be isolated, although qualitative tests seem to leave little doubt of their presence. The authors succeeded in preparing arabinosone from arabinose, and rhamnosone from rhamnose by Fischer's method (this J., 1902, 1302), and also, by using o-nitrobenzaldehyde in place of benzaldehyde, dextrosone and rhamnosone from dextrosazone and rhamnosazone respectively. Radium emanations were found to have no influence on the oxidation of carbohydrates.—A. S.

*Levulose and Dextrose; Influence of Inorganic Substances on the Rotation of —*. E. Rimbach and O. Weber. *Z. physik. Chem.*, 1905, 51, 473—493.

THE influence of inorganic bodies, belonging to various groups of the periodic system, on the rotatory powers of dextrose and levulose is, as a general rule, inconsiderable. The increase of rotatory power, which is observed in the case of optically active hydroxy-acids and polyhydric alcohols by the action of compounds of arsenic, molybdenum and uranium, does not occur in the case of dextrose and levulose. Zirconium salts and substances which liberate hydroxyl ions by dissociation have a more considerable influence on the rotatory powers of these sugars; this is due, however, to the decomposition of the sugar molecule. The velocity of this decomposition, in the case of the action of certain free alkalis and hydrolysed salts on dextrose, is, other conditions being constant, proportional to the concentration of the hydroxyl ions. The chlorides of the elements of the second group of the periodic system cause a considerable increase of the rotatory powers, especially with levulose; compounds of cerium and thorium do the same. The influence of the same inorganic substance on the rotations of the two sugars is sometimes in the same direction and sometimes in an opposite direction. Levulose is generally more sensitive than dextrose. The majority of the changes in rotation observed were due, not to chemical combination, but rather to the influence of the salt on the degree of asymmetry of the active molecule. Only in a few cases, e.g., boric acid, is the conductivity of the inorganic solution increased by the addition of the sugar; it is generally decreased.

—J. F. B.

*Sugar Groups in Hydrates; Reciprocal Replacement of —*. E. Votocek and R. Vondracek. *Ber.*, 1905, 38, 1093—1095.

The authors have recently shown that the hydrazine

residue of the hydrazone of a sugar can be replaced by the action of a suitable substituted hydrazine. From this it would appear that one sugar may replace another from its hydrazone, provided that the newly-formed hydrazone is less soluble than the original one. This supposition has been experimentally verified and it is found that the replacement is accelerated if the solution (in water or dilute alcohol) is slightly acidified with acetic acid. With the diphenylhydrazones, actual deposition of the less soluble compound takes place only after the addition of acetic acid. Further, if two differently substituted hydrazones of two different sugars act upon one another, the least soluble of the four possible hydrazones separates out, the reaction being represented by:  $A_1B_1 + A_2B_2 = A_1B_2 + A_2B_1$ . The authors' experiments have been made with: (1) galactophenylhydrazone and mannose, which yield mannophenylhydrazone and galactose; (2) dextro-methylphenylhydrazone and galactose, which form galactomethylphenylhydrazone and dextrose; (3) dextro-diphenylhydrazone and arabinose, which give arabinosediphenylhydrazone; and (4) galactophenylhydrazone and dextro-methylphenylhydrazone, yielding galactomethylphenylhydrazone and dextro-phenylhydrazone.—T. H. P.

## Prizes.

*New Method of Diamond Cutting Wanted.*  
"Times," April 17, 1905.

The Home Secretary has received, through the Foreign Office, information of a competition instituted by the Government of the Netherlands for the purpose of discovering a new method of diamond cutting which shall do away with the danger of lead poisoning, either by the provision of a new medium for the setting and resetting of diamonds to be cut or by the substitution of a different plan of work. The medium or method must be (a) practicable for all sizes and shapes of diamonds in the following branches of the diamond industry—*viz.*, brilliants, roses, and so-called non-recoupés, now being cut in the Netherlands; (b) such that its use can be learned by the workmen accustomed to the present method of work, without any great difficulty; (c) such that its use will not entail much more time, or considerably greater expense than is usual under present conditions. The Minister of the Interior has appointed a committee of experts to consider the answers submitted, and to award the prize. The answers may be written in English and must be accompanied by samples or objects to enable the committee to form an opinion about the practical value of the invention; also by a legibly written address of the competitor. The answers and the samples or objects must be sent, carriage paid and duty paid, before January 1, 1906, to Professor Dr. L. Aronstein, chairman of the committee, chemical laboratory of the Polytechnic School, Delft, Holland. The prize to be awarded for a complete solution of the problem is 6,000 florins. The committee is empowered to divide the prize among different competitors or to award part of the prize in case of a partial solution of the problem. The committee is also empowered to prescribe certain conditions to be fulfilled by the competitor, before awarding the prize.

## New Books

*DIE CHEMIE AUF DER Weltausstellung zu St. Louis, 1904.* von Dr. Walter Vieweg. Sonderausgabe aus der Sammlung Chemischer und Chemisch-technischer Vorträge. Herausgegeben von Prof. Dr. Felix B. Ahrens. Bd. X. F. Enke, Stuttgart. 1905. Price M. 2.40.

*HYPOCHLORITE UND ELEKTRISCHE BLEICHE* retischer Theil. Theorie der Elektrochemischen stellung von Bleichlauge. von Dr. Emil Wilhelm Knapp's Verlag. Halle a. S. 1905. M. 4.50.

Two volume, containing 110 pages of subject matter and an index of names. The pages are illustrated with curve tables and 10 tables of figures, and are devoted to the following subjects:—I. Introduction, concerned with the ions of H, OH, O, Na, Cl, ClO and ClO<sub>2</sub>. II. Theoretical consumption of Power. III. Mechanism of Production of the ion ClO. IV. Decomposition potential NaCl solution. V. Reactions of Superposition. VI. Analytically formulating the Dependence of Chlorine on the Duration of Electrolysis. VII. Consumption of Salt. VIII. Mechanism of the Bleaching Process. IX. Conditions for a high degree of Chlorine Effect. X. The Electrodes.

*FORTSCHRITTE IN DER FABRIKATION DER ANORGANISCHEN SÄUREN, DER ALKALIEN, DES AMMONIAKS, UND ANDERER INDUSTRIEZWEIGE.* An der Hand der chemisch geordneten Patentliteratur. Dargestellt von VICTOR HÖBLING, K. K. technischem Rath, ständlichem Mitglied des K. K. Patentamtes, &c. 1895—1905. Julius Springer's Verlag, Berlin. 1905. Price 1 Mark. Bound, M. 32.40.

QUARTO volume containing 753 pages of subject matter and alphabetical indexes of names and subjects. The work is quite similar in character to that of Friedländer on "Die Fortschritte der Theerfarbenfabrikation und verwandter Industriezweige," consisting of a classified collection of abstracts of German patents granted and issued between the years 1895—1903, relating to the Manufacture of Inorganic Acids, Alkalis and Ammonia and to Allied Branches of Chemical Industry. In this work of illustrated patent specifications, the illustrations reproduced in these abstracts. The work is divided into two parts:—PART I, dealing with Sulphur and the Sulphuric Acid, Nitric Acid and Nitrites, and Hydrochloric Acid. PART II, Sodium Carbonate (Soda Ash and Soda Crystals), Bicarbonate and Carbonic Acid, Caustic Soda (Chlorine, Hypochlorites and Chlorates, Ammonia). An Index of the numbers of German Patents is given at the end of the work, the numbers being given in order, and the pages of the work on which the corresponding abstracts appear.

*INDUSTRIAL ALCOHOL COMMITTEE. MINUTES OF EVIDENCE.* [Cd. 2,477.] Price 2s. 4d.

This publication contains minutes of the evidence given before the Departmental Committee on Industrial Alcohol and appendixes showing the duties and allowances on British spirits and duties on foreign spirits; regulations for its use for industrial purposes in the United Kingdom, United States, and in the principal European countries together with an abstract of the approximate quantities of unmineralised methylated spirits used in manufacturing operations, &c., in the United Kingdom during 1900, a comparative table of the quantity of spirits, &c., in making methylated spirits, and of the methylated spirits produced for the five years ending March 31, 1905. (This J., 1905, 397—426).

## Trade Report.

### I.—GENERAL.

*GERMAN TARIFF AS MODIFIED BY TREATIES; NEW EDITION.* [Cd. 2414] 1905. Wyman and Sons, Fetter Lane. Price 1s. 10d.

The following statement shows the instances in which modifications, of interest to Chemical Industry, have been made in the rates of duty under the "General Tariff" and under the modified "Conventional" (which comes into force on March 1, 1906):—



Classification under New "General" Tariff.	Existing Tariff.	"General" Tariff.	Conventional Tariff (Modified).
<i>Class I.—Forest Products.</i>			
Tanning bark, ground up or not	free m.pfg.	100 kilos. 1.50	free m.pfg.
Quebracho wood and other tanning woods in blocks, also ground up, grated or otherwise broken up	free	100 kilos. 7.00	100 kilos. 2.00
Sumach, ground or not	free	100 kilos. 3.00	free
Galls and gall-nuts, ground or not	free		
Algarobilla, bablah, dividivi, valonia, acorn-cups, myrobalans and other tanning materials not separately distinguished, whether ground or not; catechu, brown and yellow (gambier), raw or refined; kino	free	100 kilos. 3.00	100 kilos. 2.00
<i>Class I.—Products of Oil Milling, &amp;c.</i>			
Fatty oils, in casks—			
Olive oil, pure	100 kilos. 3.00	100 kilos. 10.00	free
"Lavat" and "sulphur" oils	100 kilos. 3.00	100 kilos. 2.00	free
Castor oil	100 kilos. 2.00	100 kilos. 9.00	100 kilos. 2.00
Other fatty oils	100 kilos. 9.00	100 kilos. 10.00	100 kilos. 9.00
Fatty oils in receptacles other than casks—			
Olive oil, pure	100 kilos. 10.00	100 kilos. 20.00	100 kilos. 10.00
Castor oil in tin receptacles, weighing with the tin, at least 15 kilos.	100 kilos. 2.00	100 kilos. 20.00	100 kilos. 2.00
Oleic acid (oleine)	100 kilos. 3.00	100 kilos. 4.00	100 kilos. 3.00
Oil dregs	100 kilos. 4.00		100 kilos. 4.00
<i>Starch Products.</i>			
Starch, green or dry, ground or not	100 kilos. 12.50	100 kilos. .00	100 kilos. 14.00
<i>Products of Food Industries.</i>			
Margarine	100 kilos. 16.00	100 kilos. 13.00	100 kilos. 20.00
<i>Class II.—Mineral Oils.</i>			
Petroleum, fluid natural mineral tar, brown-coal tar oil, peat oil, shale oil, oil from the tar of bog head or canal coal, and other mineral oils not otherwise enumerated, crude or refined—			
Lubricating oils, residues from the distillation of mineral oils, containing paraffin or of a tarry or pitchy nature—the latter provided they do not sink in water; rosin oil	100 kilos. 10.00	100 kilos. 10.00	100 kilos. 6.00
Other oils—			
Heavy benzine of a sp. gr. of more than 0.75 up to 0.77, inclusive, at 15° C., for driving motors.	100 kilos. 6.00	100 kilos. 6.00	100 kilos. 2.00
Gas oil of a sp. gr. of 0.83 to 0.88, inclusive, at 15° C., for driving motors or for the carburation of hydrogen	100 kilos. 6.00	100 kilos. 6.00	100 kilos. 3.00
<i>Class III.</i>			
Mineral wax (ozokerit) refined, and ceresine (made from mineral wax, mixed or not with paraffin); wax stumps of refined mineral wax and of ceresine	100 kilos. 10.00	100 kilos. 15.00	100 kilos. 10.00
Soft paraffin	100 kilos. 10.00	100 kilos. 10.00	100 kilos. 8.00
Turkey red oil, in casks	100 kilos. 5.00	100 kilos. 5.00	100 kilos. 3.00
Paraffin ointment, vaseline, and vaseline ointment	100 kilos. 10.00	100 kilos. 12.00	100 kilos. 10.00
Axle grease	100 kilos. 3.00	100 kilos. 10.00	100 kilos. 6.00
Other lubricants, manufactured with fats or oils, liquid or solid	As component materials or those most highly taxed	100 kilos. 12.00	100 kilos. 7.50
<i>Class IV.</i>			
Tartaric acid	free	100 kilos. 8.00	100 kilos. 4.00
Citric acid	free		free
Spring salts, natural or artificial and marsh salts	free	100 kilos. 3.00	free
Potash of all kinds, also wool yolk ash	100 kilos. 1.50	100 kilos. 2.00	100 kilos. 1.50
Sodium sulphate and bisulphate	free	100 kilos. 0.25	free
Copper sulphate	free	100 kilos. 2.00	free
Stannic oxide	free	100 kilos. 6.00	100 kilos. 2.00
Calcium acetate	free	100 kilos. 1.00	100 kilos. 1.00
Other acetates and acetone oil	free		free
Tartar, refined	free	100 kilos. 8.00	100 kilos. 4.00
Tartar emetic and other preparations of antimony	free	100 kilos. 8.00	100 kilos. 4.00
Calcium carbide	free	100 kilos. 4.00	free
Other carbides	free		100 kilos. 4.00
White lead	free	100 kilos. 1.00	free
Zinc oxide and lithopone	free	100 kilos. 2.00	free
Chalk, washed	free	100 kilos. 0.40	100 kilos. 0.30
Iron oxide	free	100 kilos. 0.50	free
Other mineral colours	free	100 kilos. 0.50	100 kilos. 0.20
Graphite (in blocks)	100 kilos. 2.00	100 kilos. 1.00	100 kilos. 2.00
Graphite (made up for sale)	free	100 kilos. 6.00	100 kilos. 3.00
Wood spirit and acetone, crude (strength not exceeding 95°)	free	100 kilos. 5.00	free
Vol. oil of oranges, bergamot, &c.	100 kilos. 20.00	100 kilos. 30.00	100 kilos. 20.00
Aniseed oil	100 kilos. 20.00	100 kilos. 30.00	100 kilos. 20.00
Cassia	free	100 kilos. 10.00	100 kilos. 6.00
Glue (solid)	100 kilos. 3.00	100 kilos. 5.00	100 kilos. 3.00
Gall and sumach extracts	free	100 kilos. 14.00	free
Oak, pine, or chestnut extracts—			
Liquid	free	100 kilos. 14.00	100 kilos. 2.00
Solid	free	100 kilos. 28.00	100 kilos. 4.00
Other tanning extracts—			
Liquid	free	100 kilos. 14.00	100 kilos. 4.00
Solid	free	100 kilos. 28.00	100 kilos. 8.00
<i>Class XI.</i>			
Paper stock from wood, straw, esparto, &c., mechanical or chemical	100 kilos. 1.00	100 kilos. 3.00	100 kilos. 1.25
<i>Class XII.</i>			
Crucibles, retorts, muffles, capsules, tubes, cylinders, slabs, blast pipes	100 kilos. 1.50	100 kilos. 2.00	100 kilos. 1.50
Other shaped fireproof products of clay and clayey substances other than bricks, glazed or not	100 kilos. 2.00	100 kilos. 2.00	100 kilos. 1.50
Crucibles of magnesite cement or soapstone	100 kilos. 6.00	100 kilos. 2.00	100 kilos. 1.50

## BRAZIL: EXPORT TRADE OF — IN 1904.

*Id. of Trade J., April 27, 1905.*

The following figures, showing the quantities and values

of certain articles exported from Brazil during the 1904, with corresponding figures for the preceding are extracted from the *Brazilian Review* of 28th Mar

Merchandise.		Quantity.		Value.	
		1903.	1904.	1903.	1904.
				£	£
Rubber .....	Kilos.	31,712,288	31,863,491	9,733,041	11,219,3
Hides and skins .....	"	30,636,175	36,847,320	1,820,481	2,382,2
Gold, bar .....	Gram.	4,322,043	3,871,428	468,591	418,5
Manganese .....	Tons	161,826	208,260	248,010	306,7
Carnauba wax .....	Kilos.	1,925,956	1,995,646	131,906	204,2
Monazite[sands .....	"	3,290,460	4,860,390	74,139	108,8
Sugar .....	Kilos.	21,888,998	7,861,450	198,540	92,4
Cotton seed .....	"	35,535,072	26,600,538	116,707	89,0
Extract of meat .....	"	389,951	278,273	30,177	23,0

## III.—TAR PRODUCTS, PETROLEUM, Etc.

## OZOKERITE.

*Eng. and Mining J., April 13, 1905.*

The principal producing district in the world is Galicia, where in 1904 a total of 2938 tons was mined from the oil-bearing shale in Boryslav and the neighbourhood. A large part of this output was exported to the United States, where crude ozokerite sells at 11.5c. per lb., and refined (ceresin) at 13.5 to 16.5c. per lb., according to quality. The consumption is centred chiefly in the manufacture of candles, ointments and pomades. Under the name of "okonite," a residual product from purifying the crude ozokerite, is an admirable insulating material for electrical cables. For this purpose the ozokerite residuum is mixed with india-rubber. Some shoe blacking is also made from ozokerite, because it gives a glossy surface.

## ACETONE; MANUFACTURE OF — IN INDIA.

*Chem. and Drug., April 29, 1905.*

The manufacture of acetone in India from locally-grown blue gum wood is being taken up by the military authorities. Acetone is the solvent used in the manufacture of cordite at the Government cordite factory at Wellington, in Southern India, and has at present to be imported at a great cost. A large consignment of the Indian timber was sent home early last year for purposes of distillation, and the satisfactory results obtained show that the manufacture of acetone in India is a perfectly feasible project.

## IV.—COLOURING MATTERS, Etc.

## CALICO YELLOW G AND CHROME GREY R. B. G.: U.S. CUSTOMS DECISIONS.

*April 13, 1905.*

Calico Yellow G, a mixture of alizarin and aniline dyes, and Chrome Grey R.B.G., a mixture of logwood extract and aniline dye in acetic acid, were held to be dutiable at 30 per cent. *ad valorem* as "coal tar colours," under paragraph 15 of the tariff.

The claims of the importers that the Calico Yellow G. was free of duty under paragraph 469 as a "dye derived from alizarin" and that the Chrome Grey R. B. G. was dutiable under paragraph 22 as an "extract of logwood" were overruled on the ground that the aniline dye was the component material of chief value in each case.—R. W. M.

## VII.—ACIDS, ALKALIS, Etc.

## SALT PRODUCTION OF SPAIN IN 1904.

*U.S. Cons. Rep. No. 2223, April 4, 1905.*

The salt industry of Spain is daily extending its sphere of operation, and besides supplying domestic wants, estimated at 300,000 tons yearly, exports considerable quantities, amounting in 1904 to 350,000 tons, an increase

of 71,729 and 58,584 tons since 1902 and 1903, respect. This production admits, however, of a still better development, if the public authorities help to keep the clear of all encumbrances. The industry, placed a new basis, governed by modern systems and production is capable, no doubt, of having an era of prosperity before experienced by it.

There are in Spain to-day 209 concessions of rock works, extending over an area of 6,803 acres, of number 54 are in operation and 155 are idle. The territory covered by the former is 2,385, by the latter 4,418.

Spanish production of salt compared with that of the rest of the world ranks sixth in importance, being exceeded by that of the United States, England, Germany, France and Austria-Hungary.

So far Spanish salt has been admitted into the markets of Uruguay, Newfoundland, Russia, Argentina, Brazil, France, Cuba, Norway, Belgium, England, Netherlands, and countries of minor importance, it is regarded as unequalled for salting and tanning.

The salt works of Cadiz alone have contributed 10 per cent., or 221,657 tons, toward the total export of 1904, other parts participating with 128,349 tons. The average production of the sea-salt pans is 300,000 tons, a quantity which could be much increased if no alterations were made and certain tracts now lying waste were made to produce. Two thousand labourers within the radius of this industrial region, and the products distributed among them amount to 236,250 dols. yearly.

## X.—METALLURGY.

## PIG IRON PRODUCTION; BRITISH —.

*Eng. and Mining J., April 13, 1905.*

The total production of pig iron in Great Britain in 1904 was given in the *J.*, of April 29, pp. 463-4. The figures in detail are given in the table below, in long tons:—

	1903.	1904.
Forge and foundry .....	Tons. 3,875,826	Tons. 3,841,000
Hematite .....	3,760,422	3,362,000
Basic .....	991,610	1,192,000
Spiegel and ferro .....	183,346	165,000
Totals .....	8,811,204	8,560,000

Basic is the only grade of iron showing an increase in Scotland, Cleveland, Lincolnshire, North Staffordshire, Shropshire, Nottingham and Leicestershire and in Wales there was an increase of output, while in Durham, West Cumberland and Lancashire, South Wales, Monmouth, Northamptonshire, Derbyshire, South Staffordshire, and South and West Yorkshire there was a decrease.

## IRON ORE OUTPUT OF GERMANY.

*U.S. Cons. Rep. No. 2227, April 8, 1905.*

The gross production of iron ore in the year 1904



any and the Grand Duchy of Luxemburg amounted 103,941 metric tons, against 10,085,634 metric tons in 1903. The yield of the ore-bearing regions varied considerably in the two years. In the Kingdom of Saxony no ore whatever was mined in 1904. The slight gain in gross output of the year was entirely made during the month of December, 1904, and lifted the past year to the position as to productiveness.

#### TANTALUM MINERALS; OCCURRENCE OF—.

*Eng. Mag. Electrotechn. and Met. Ind.*, 1905, 3, 133—134.

In view of the important development of the tantalum industry by Siemens and Halske of Berlin, the author has collected information as to the occurrence of these minerals

in the United States. Llano County, Texas, where *Jergusonite* is found, Mitchell County and other neighbouring localities in North Carolina where mica is mined and further Rockport, Massachusetts, where *columbite* was first discovered are considered the most promising. Attention is directed to the residues from Greenland cryolite which may contain some quantity of these minerals.—R. S. H.

#### MINERAL PRODUCTION OF GERMANY IN 1904.

*Bd. of Trade J.*, April 20, 1905.

According to an advance statement of the Imperial Statistical Bureau showing the mineral and metallurgical production of the German Empire for the year 1904, the output of coal in that year was as follows, the corresponding figures for 1903 being added for purposes of comparison:—

	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
	Metric Tons.	Thousand Marks.	Metric Tons.	Thousand Marks.
.....	116,637,765	1,005,153	120,815,503	1,034,000
.....	45,819,488	107,412	48,632,769	111,999
Total .....	162,457,253	1,112,565	169,448,272	1,145,999

Following table shows the quantity and value of other minerals and salts produced in the years 1903 and 1904:—

	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
	Metric Tons.	Thousand Marks.	Metric Tons.	Thousand Marks.
.....	21,230,650	74,235	22,047,297	76,668
.....	682,853	33,058	715,732	39,479
.....	165,991	14,084	164,440	14,706
.....	772,695	20,449	798,214	21,731
.....	11,467	1,245	10,405	1,206
.....	14,607	819	14,016	925
.....	47,994	520	52,886	591
.....	170,867	1,319	174,782	1,336
.....	87,454	812	91,736	891
.....	60,743	4,184	89,606	5,804
.....	1,095,541	5,056	1,079,868	5,901
.....	1,557,243	21,883	1,905,893	26,565
.....	2,073,720	20,981	2,179,471	21,295

The products of reduction works are stated to be as follows:—

	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
	Metric Tons.	Thousand Marks.	Metric Tons.	Thousand Marks.
.....	31,214	37,841	30,262	36,304
.....	182,548	73,921	193,058	84,650
.....	145,319	33,490	137,580	32,546
.....	4,428	1,105	4,332	1,117
.....	10,017,901	525,007	10,058,273	520,647

The production of refined salt, and of various salts, in refined or commercial form, is shown in the following table:—

	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
	Metric Tons.	Thousand Marks.	Metric Tons.	Thousand Marks.
.....	598,394	14,184	621,064	14,697
.....	280,248	34,140	279,670	33,328
.....	22,990	434	25,730	539
.....	81,196	2,080	73,264	1,896
.....	36,674	5,838	43,714	6,955
.....	23,631	1,854	29,232	2,290
.....	37,844	629	39,412	607

## XII.—FATS, FATTY OILS, Etc.

## PARAFFIN CANDLES: U.S. CUSTOMS DECISION.

April 13, 1905.

The Board of General Appraisers affirmed the assessment of duty at 25 per cent. *ad valorem* as "manufactures of wax" under paragraph 448 of the present tariff, on candles composed of paraffin and stearic acid. The Board expressed the view that the candles were subject to the rate imposed by Germany on products of petroleum imported from the United States.—R. W. M.

## XIII. C.—INDIARUBBER, Etc.

## GUTTA-PERCHA SUBSTITUTE: U.S. CUSTOMS DECISION.

April 4, 1905.

Gutta percha substitute, consisting of a mixture of gutta percha, waxes and resins, and used for insulating wires and cables, was decided to be dutiable at 35 per cent. *ad valorem*, as a "manufacture of gutta percha." The claim of the importer that it was dutiable at 20 per cent. *ad valorem* as a "manufactured article, unenumerated," was overruled.—R. W. M.

## XIV.—BREWING, WINES, SPIRITS, Etc.

## SPIRITS: STATISTICS OF DUTY FREE — ISSUED IN THE VARIOUS DISTRICTS OF GERMANY DURING THE YEAR 1903—04. Z. Spiritusind, 1905, 28, 130.

The statistics show the amount of the three grades of duty-free spirits issued in Germany in the year ending Sept. 30, 1904. The quantities are expressed in hectolitres of absolute alcohol:

	Total.	Completely denatured.	Partly denatured.	Undenatured.
	Hl.	Hl.	Hl.	Hl.
All Germany	1,391,895	984,170	385,946	21,779
Idto, 1902-3	1,278,712	900,190	360,730	17,792

During the year 1903—4 the price of denatured spirit was raised by 10 pfennig per litre.

The partially denatured spirits comprise those used for manufacturing purposes. The bulk of the undenatured spirit was issued to explosives factories, smaller quantities to hospitals, scientific and military institutions.—J. F. B.

## ALCOHOLIC TAX; FRENCH —: U.S. CUSTOMS DECISION.

April 5, 1905.

The United States Circuit Court of Appeals decided that the special taxes on alcohol levied in certain cities and towns of France, but not in all, which are known as octroi and droit de ville and which are remitted on exportation, are not elements of dutiable value under the United States Customs laws.

These taxes are not uniform in amount nor general throughout France; hence are not to be included in the market value of the goods, and when remitted should not be added to the appraised value. Former decisions of the United States Courts have held that the general national tax on alcohol consumed in France is an element of market value, as it applies to the value in all the principal markets of the country of exportation.

—R. W. M.

## XX.—FINE CHEMICALS, Etc.

## CINCHONA BARK; SALTS OF —: U.S. CUSTOMS DECISION. April 13, 1905.

The following compounds were held to be free of duty as "salts of cinchona bark," under paragraph 547 of the present tariff. The assessment of duty at 25 per cent. *ad valorem*, under paragraph 68, as "medicinal preparations," was overruled:—Valerianate of quinine, quinine hypophosphoric, sulphate of quinidia, quinine hypophosphite.

Each of the above substances was found to be produced by the action of an acid upon an alkaloid of cinchona bark. (See also this J., 255 and 359.)—R. W. M.

## Patent List.

N.B.—In these lists, [A.] means "Application for Patent [C.S.]" "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, the asterisk is added. The dates given are (i) in the case of Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journal, in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are inspected at the Patent Office immediately, and to be published within two months of the said dates.

## I.—PLANT, APPARATUS, AND MACHINE.

- [A] 8256. Bök. Centrifugal separators. [A] Sweden, April 26, 1904.\* April 18.  
 .. 8342. Lennox. *See under XVII.*  
 .. 8406. Seitz. Filters.\* April 19.  
 .. 8440. Adams and Cannon. Construction of April 20.  
 .. 8476. Pampe. Process for the combined separation of the head and tail products in continuous periodic distillation and rectification. Appl., April 26, 1904.\* April 20.  
 .. 8484. Bök. Distributing devices for centrifugal separators. April 20.  
 .. 8565. McLean and Paterson. The filter liquids. April 20.  
 .. 8690. Walker (Ray). Evaporating apparatus. April 25.  
 .. 8808. Klepetke. *See under X.*  
 .. 8895. Berberich and Schröder. Method of mechanically mixing or combining liquids or fluids with apparatus therefor.\* April 27.  
 .. 8984. Boulton (Goldman and Co., Inc.). Apparatus for maintaining substances in a heated state and at an approximately constant temperature. April 28.  
 .. 9011. Spooner (Aktiebolaget Separator). Fugal separators for liquids.\* April 28.  
 [C.S.] 10,701 (1904). Dobson. Method of and apparatus for cleaning filtering materials. May 3.  
 .. 4330 (1905) McNeil. Apparatus for separating liquids from vapours. May 3.  
 .. 4331 (1905) McNeil. Apparatus for separating liquids from vapours. May 3.

## II.—FUEL, GAS, AND LIGHT.

- [A.] 6959A (1904). Levis (Gen. Electric Co.). Apparatus and the manufacture thereof. April 27.  
 .. 8162. Woods. Incandescent mantles for gas burners. April 17.  
 .. 8187. Aarts. Process and apparatus for the production of coke, ammonia, illuminating gas, benzol, and other products by the distillation of coal, lignite, turf, and other carbonaceous materials.\* April 17.  
 .. 8227. Heys (Leede Process Co.). Gas production apparatus.\* April 18.  
 .. 8494. Smith. Manufacture of products from gas. April 20.  
 .. 8502. Williams. Gas producers. April 20.  
 .. 8530. Bécigneul. Treatment of gas products and materials for the recovery of useful products with apparatus therefor. [Fr. Appl., July 23, 1904.] April 20.  
 .. 8534. Tangyes, Ltd., and Robson. Gas production apparatus. April 20.  
 .. 8730. Stanf. Gas generators.\* April 25.  
 .. 8788. Wilson. Operating gas producers. April 25.  
 .. 8832. Foster. Production of gas. April 25.  
 .. 8891. Frenet. Filaments for electric lamps. [Belg. Appl., May 7, 1904.]\* April 27.  
 .. 8918. Genty, and Soc. Anon. Etabl. de produits de la Buière. Gas producers. [Fr. Appl., May 9, 1904.]\* April 27.  
 .. 8928. Hemingway and Booth. Apparatus for washing or purifying gas. April 27.



9000. Van Vriesland. Method of making incandescent gas mantles. April 28.  
 9001. Van Vriesland. Incandescent gas mantle. April 28.  
 1591 (1904). Shields. Production of combustible vapour or gas. May 3.  
 1592 (1904). Shields. Gas and similar burners. May 3.  
 8640 (1904). Redman. Apparatus for purifying gas. April 27.  
 9071 (1904). Rouse and Cohn. Manufacture of briquette fuel from coal mine waste or dust coal. April 27.  
 9190 (1901). Weedon. Arc lamps electrodes. April 27.  
 9206 (1904). Bernheim and Wagner. Purification of illuminating gas. May 3.  
 9514 (1904). Redman. Purification of gas. May 3.  
 12,659 (1904). Redman. Gas washers or scrubbers. April 27.  
 12,854 (1904). Robel. Mantles or incandescence bodies for gas lighting. April 27.  
 14,196 (1904). British Thomson-Houston Co., Ltd. (Gen. Electric Co.). Electrodes for arc lighting. April 27.  
 29,170 (1904). Towns. Gas producers. April 27.

## II.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

8187. Aarts. *See under II.*  
 8590. Noerdlinger. Method of distilling tar, heavy oils, and the like. April 22.

## COLOURING MATTERS AND DYESTUFFS.

8185. Johnson (Kalle und Co.). Manufacture of new diazo derivatives of the *o*-aminonaphthol sulphonic acids and of dyes therefrom. April 17.  
 8367. Flürscheim (Flürscheim). Manufacture of chlorides of *p*-nitraniline. April 19.  
 8744. Meyenberg, Weizmann, and The Clayton Aniline Co., Ltd. Manufacture of anthracene derivatives and dyestuffs therefrom. April 25.  
 8908. Ransford (Cassella und Co.). Manufacture of new sulpho-acids and of dyestuffs therefrom. April 27.  
 8978. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of a new *p*-amidophenylethersulphonic acid and of colouring matters therefrom. April 28.  
 9074. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of nitro derivatives of certain aromatic bases. April 29.  
 15,223 (1904). Imray (Basil Chemical Works). Manufacture of indoxyl, its homologues and their derivatives. May 3.

## III.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

- 8342 Lemmox. *See under XVII.*  
 8816. Johnson (Badische Anilin und Soda Fabrik). *See under VII.*  
 8960. Mather. Impts. in and apparatus for treating vegetable fibres producing cellulose and bleaching. April 28.  
 9341 (1904). Morton. Method of and apparatus for printing warps. May 3.  
 13,773 (1904). De Kenkelaere. Process for treating flax, jute, and similar fibres for the purpose of bleaching. April 27.

## VII.—ACIDS, ALKALIS, AND SALTS.

8187. Aarts. *See under II.*  
 8358. Woltereck. Production of ammonia. April 19.  
 8445. Reiss. Manufacture of insoluble aluminium acetate.\* April 20.

- [A.] 8642. Römer. *See under X.*  
 „ 8662. Gebr. Heyl und Co., and Wultze. Process for the production of lead acetate. [Ger. Appl., June 11, 1901.]\* April 22.  
 „ 8721. Westdeutsche Thomasphosphatwerke. *See under XI.*  
 „ 8816. Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable dry hydrosulphites.\* April 26.  
 „ 9017. Chatillon. *See under XIII. A.*  
 „ 9044. Jacques. Manufacture of white lead carbonate. April 29.  
 [C.S.] 13,875 (1901). Levi. Production of alumina and alkali from alkaline silicates of alumina such as leucite. April 27.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 16,657A (1904). Butterfield. Compositions for coating roads, walls, pipes, and other surfaces. April 27.  
 „ 8171. Crowley and Blackman. Refractory compositions applicable to the manufacture of crucibles and like articles. April 17.  
 „ 8172. Hutchinson. Utilisation of clinker, cinder, and “flue dust” residue of towns refuse after burning in making paving material of said residue in combination with coal, wood, or petroleum tar. April 17.  
 „ 8285. Bruhm. Preliminary treatment of blast furnace slags for the production of cementitious material. [Ger. Appl., April 19, 1904.]\* April 18.  
 „ 8804. Thom. Manufacture of artificial marble and stone.\* April 26.  
 „ 9049. Hadlington. Continuous brick kilns or ovens. April 29.  
 [C.S.] 13,804 (1901). Craig and Kemp. Compound for preventing dust on roads. April 27.  
 „ 14,177 (1904). Howlett. Kilns and ovens, and refractory blocks, bricks, slabs, and tiles for the same. May 3.

## X.—METALLURGY.

- [A.] 8221. Gin. *See under XI.*  
 „ 8307. National Brazing Compound Co. Brazing metals. [U.S. Appl., April 18, 1904.]\* April 18.  
 „ 8387. Allen. Method of converting copper mattes.\* April 19.  
 „ 8509. Flewin. Gold extractor or concentrator. April 20.  
 „ 8555. Timm. Reducing, smelting, burning, sintering, and like furnaces.\* April 20.  
 „ 8642. Römer. The decomposition of chrome-iron ore by alkaline carbonates. April 22.  
 „ 8808. Klepetke. Roasting furnaces. [U.S. Appl., Sept. 6, 1904.]\* April 26.  
 „ 9007. Lake (Baker and Hearne). Treatment of ores.\* April 28.  
 [C.S.] 8817 (1904). Malzac. Process for desulphurising and oxidising cadmium, cobalt, copper, nickel, silver, zinc and like ores by a wet method. April 27.  
 „ 9202 (1904). Daclen. Manufacture of iron and steel. May 3.  
 „ 12,785 (1904). Fleischer. Manufacture of iron. April 27.  
 „ 16,412 (1904). Lake (Cyanid Ges.). Treatment of iron and steel for the hardening or case hardening of the same. April 27.  
 „ 17,031 (1904). Jackman, Woodcock and Ledgerl. Manufacture of solder for aluminium. April 27.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- [A.] 8190. Lake (Soc. Anon. la Carbone). Electric batteries. April 17.  
 „ 8221. Gin. Process for the electro-metallurgical manufacture of metals or alloys free from carbon.\* April 18.

- [A.] 8631. Weatherill. Dry battery. April 22.  
 .. 8721. Westdeutsche Thomasphosphatwerke. Processes of preparing nitrogen-oxygen compounds by means of electricity. [Ger. Appl., April 7, 1905.]\* April 25.  
 .. 8836. De Frise. Ozonising apparatus. [Fr. Appl., April 26, 1904.]\* April 26.  
 [C.S.] 14,128 (1904). Leitner. Preliminary treatment of electric accumulator plates. April 27.  
 .. 15,294 (1904). Betts. Process of electrodepositing antimony. April 27.  
 .. 15,298 (1904). Betts. Process of treating the metal mixtures produced as a by-product in electrolytic metal refining operations. April 27.  
 .. 27,900 (1904). Gardiner. Secondary batteries. April 27.  
 .. 27,902 (1904). Gardiner. Storage batteries. May 3.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

#### (A.)—PIGMENTS, PAINTS.

- [A.] 8617. Gottschalk. Process of removing old varnish and paint.\* April 22.  
 .. 9017. Chatillon. Process for preparing antimonial substances used for painting and other purposes, and the products thereof.\* April 28.

#### (B.)—RESINS, VARNISHES.

- [A.] 8293. Menge. Driers for oils, oil paints, lacquers, varnishes, and the like.\* April 18.  
 .. 8617. Gottschalk. *See under XIII. A.*  
 [C.S.] 14,314 (1904). Suter. Binding medium for securing linoleum and the like. April 27.  
 .. 17,222 (1904). Walton. Manufacture of floor cloth, wall coverings, or the like, and apparatus therefor. April 27.  
 .. 21,661 (1904). Uchmann. Means for protecting copper from destruction by sea water. May 3.

#### (C.)—INDIA-RUBBER.

- [A.] 8378. Gregory and Thom. Process for reclaiming waste vulcanised india-rubber.\* April 19.  
 .. 8504. Spencer and Romschki. The devulcanisation of india-rubber. April 29.

### XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

- [A.] 8875. Story. *See under XIX.*  
 [C.S.] 14,130 (1904). Southworth. Process for treating raw or partly dressed hides. May 3.  
 .. 14,203 (1904). Castets. Process and apparatus for the extraction of tannin at a low temperature and at a low pressure. May 3.

### XV.—SUGAR, STARCH, GUM, Etc.

- [A.] 16,546a (1904). Stein and Loewenthal. Manufacture of inulin. April 27.  
 .. 8661. Thomas and Howe. Method of clarifying juices in the manufacture of sugar. April 22.  
 .. 8898. Stein and Loewenthal. Manufacture of levulose.\* April 27.

### XVII.—BREWING, WINES, SPIRITS, Etc.

- [A.] 8342. Lennox. Evaporators for evaporating the liquid in brewers' wash, spent wash or pot ale from distilleries, waste or spent dyes or the like, and concentrating the solids in the same. April 19.  
 .. 8371. Crossman and Selg. Apparatus for fermenting and storing worts, beers, stout, and the like. April 19.  
 .. 8372. Crossman. Spargers for obtaining extract from malt, grain, &c. April 19.  
 .. 8576. Baeger and Güttner. Method and apparatus for separating wort from mash by centrifugal action.\* April 20.  
 .. 8643. Parry. Self-governing apparatus for the distillation of spirits. April 22.  
 [C.S.] 12,962 (1904). Vignier. Materials for the production of whiskey and beer. April 27.

### XVIII.—FOODS, SANITATION, WATER PURIFICATION, & DISINFECTANTS.

#### (A.)—FOODS.

- [C.S.] 7631 (1904). Ohlsson. Sterilisation of food products and the like and other perishable substances. May 3.  
 .. 13,715 (1904). Hatmaker. Milk foods. May 3.  
 .. 2166 (1905). Stern. Process for preparing alcoholic fruit juices. April 27.

#### (B.)—SANITATION; WATER PURIFICATION.

- [A.] 8172. Hutchinson. *See under IX.*  
 .. 8347. Spence, Spence, and Peter Spence and Ltd., and Ockel. Treatment of sewage and sludges. April 19.  
 .. 8944. Adams. Sewage purification apparatus. April 28.  
 [C.S.] 9219 (1904). Filby. Process for the purification of sewage. May 3.  
 .. 12,061 (1904). Cie. Française de l'Appareil pour la stérilisation de l'eau par l'ozone. May 3.

#### (C.)—DISINFECTANTS.

- [C.S.] 17,320 (1904). Stephan. Disinfectant. May 3.

### XIX.—PAPER, PASTEBOARD, Etc.

- [A.] 8325. Morris. Manufacture of paper. April 27.  
 .. 8725. Arledier. Manufacture or treatment of pulp for use in the manufacture of paper, other fabrics and apparatus therefor. April 27.  
 .. 8875. Story. Process for producing substances for celluloid, horn, ebonite, &c. April 27.  
 .. 8884. Leacham. Method of finishing paper like the substances. April 27.  
 .. 8960. Mather. *See under V.*  
 [C.S.] 13,510 (1904). Gronwald. Process for producing corks. April 27.  
 .. 4552 (1905). Wootton and Wootton. Manufacture of pulp for use in the formation of jewellers' cases, boxes, and the like. April 27.

### XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 8297. Chem. Fabr. auf Actien, vorm. E. Seligmann. Manufacture of camphor. [Ger. Appl., April 18, 1904.]\* April 18.  
 .. 8451. Jameson. Manufacture of saccharin. April 20.  
 .. 8544. Bibus and Scheuble. Production of saccharin menthol ether. April 20.  
 .. 9008. Zimmermann (Chem. Fabr. auf Actien, E. Schering). Manufacture of camphor. April 28.  
 .. 9009. Zimmermann (Chem. Fabr. auf Actien, E. Schering). Manufacture of camphor. April 28.  
 [C.S.] 13,285 (1904). Abel (Act.-Ges. f. Anilin). Manufacture of new derivatives of benzene. April 27.  
 .. 17,003 (1904). Newton (Bayer und Co.). Manufacture of pyrimidine derivatives. May 3.

### XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 8458. Kempton and Gordon-Bertram. Production of photographic negatives by mechanical means. April 20.  
 .. 8911. Kelly and Bentham. The development of photographic plates, films, and the like.\* April 27.  
 [C.S.] 23,766 (1904). Höchheimer. Photographic development paper. May 3.

### XXII.—EXPLOSIVES, MATCHES, Etc.

- [A.] 8746. Thomas. Manufacture of chlorinated explosives. [Ital. Appl., Dec. 12, 1904.]\* April 27.



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ors of communications read before the Society, or its Local Sections, are requested to take notice that Rule 43 of the Bye-laws the Society has the right of publication for three months of all such papers. Payment of this Bye-law renders papers liable to be taken by the Publication Committee, or ordered to be sent to the Journal, in which case no reprints can be sent to the author.

### ANNUAL GENERAL MEETING, 1905.

Annual General Meeting will be held in London next, and the proceedings will commence on July 10th.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council are from their respective offices at the forthcoming Meeting.

Edward Divers, F.R.S., has been nominated to the office of President under Rule 8; Dr. L. Baekeland, Carter Bell, Dr. J. Lewkowitsch, and Mr. N. H. Williams have been nominated Vice-Presidents under Rule 9, and Mr. Wm. H. Nichols has been nominated a President under Rule 11.

Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices. Members are hereby invited to nominate fit and proper persons to fill four vacancies among the ordinary members of Council. Forms for this purpose can be obtained, on application, from the General Secretary, or from the Local Secretaries of the Canadian, New York, and London Sections.

*from Rule 18* :—"No such nomination shall be valid if it is signed by at least ten members of the Society who are not in arrear with their subscriptions, and if it is received by the General Secretary, at the office, at least one month before the date of the Annual General Meeting, at which the election to which it takes place. Nor shall any such nomination be valid if the person nominated be ineligible for election under Rules 12 or 15. No member shall sign more than one nomination form."

### CONGRESS OF CHEMISTRY AT LIÈGE.

In connection with the Liège Exhibition, a Congress of Chemistry and Pharmacy will be held from the 27th to the 31st of July next. By a subscription of 10 francs, members may take part in the Congress, and will receive the benefit of the transactions. Application for Adhesion and programmes should be made at once to M. J. D. Pharmacie, Liège, or M. J. Wauters, Chimiste à la Ville de Bruxelles.

### BIRMINGHAM SECTION.

A list of Committees will be found the names of the Committees of the Birmingham Section which, at intervals of some years, has resumed active work. Meetings will be held at the University, and Prof. J. Frankland, F.R.S., has accepted the chairmanship. Mr. F. R. O'Shaughnessy as Hon. Local Secretary and Treasurer.

### NEW ENGLAND SECTION.

The New England Section, a list of the Committee of which will be found on p. 524, held its inaugural meeting in Boston, Mass., on May 12th. Between 80 and 90 members were present, including the President of the Society, Dr. H. Schweitzer, Mr. T. J. Parker, and representatives of the New York Section.

### SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

At a meeting of the Organising Committee of the Sixth International Congress of Applied Chemistry, held in Rome on March 2 last, Prof. E. Paternò in the chair, it was decided to divide the Congress into the same number of sections as was the case at Berlin in 1903. At the suggestion of the Presidents of foreign Committees, the date of meeting was fixed for April, 1906, during Easter week.

All communications with respect to the Congress should be addressed to the President, Prof. E. Paternò, Via Panisperna 89, Rome.

## List of Members Elected.

May 23rd, 1905.

- Armstrong, Theodore, 115, Chestnut Street, Philadelphia, Pa., U.S.A., President, Penn. Salt Manufacturing Co.  
 Barry, Eugene, Ayer, Mass., U.S.A., Leather Manufacturer.  
 Bliss, H. J. W., 417, West 118th Street, New York City, U.S.A. (after June 10, Cornwall Gardens, London, S.W.), Student.  
 Browning, Prof. R. C., Medical College, Colombo, Ceylon, Professor of Chemistry.  
 Clexton, Thomas J., 86, Elm Hill Avenue, Roxbury, Mass., U.S.A., Manager, A. Klipstein and Co.  
 Davison, Alex. Young, 396, Atlantic Avenue, Boston, Mass., U.S.A., Dyestuff and Chemical Merchant.  
 Dearing, Mark Gordon, Grosvenor Villa, Ashby Road, Canonbury, N., Chemist.  
 Dupin, Dr. Eugene, 131, West 53rd Street, New York City, U.S.A., Chemist.  
 Durfee, Winthrop C., 190, High Street, Boston, Mass., U.S.A., Manufacturing Chemist.  
 Forrester, Harris A., Usina de Gas, Retiro, Buena Vista, South America, Chemical Works Manager.  
 Geussler, Dr. Otto, 4, Princess Road, Crumpsall, Manchester, Chemist.  
 Hanna, W. W., 36, Purchase Street, Boston, Mass., U.S.A., Aniline Colour Manufacturer.  
 Hardy, Chas. H., c/o Reckitt and Sons, Ltd., Hull, Chemist.  
 Hesse, Bernhard C., 137, West 110th Street, New York City, U.S.A., Chemist.  
 Hulton, Henry F. Everard, 11, Colinet Road, Putney, S.W., Chemist.  
 Jenkins, Chas. D., 8, Grove Street, Winchester, Mass., U.S.A., Chemist.  
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 McCleary, William, 102, Cook Street, Pendleton, near Manchester, Finisher.  
 Maisel, Carl, 122, Covert Street, Brooklyn, N.Y., U.S.A., Pharmaceutical Chemist.  
 Menzies, David, 11, Camphill Avenue, Langside, Glasgow, Analyst.  
 Moore, Leslie R., 173, Oakleigh Road, Newton, Mass., U.S.A., Chemist.  
 Moulton, Jno. Fletcher, K.C., M.P., F.R.S., 57, Onslow Square, London, S.W., Barrister-at-Law.

- Nash, W. A., Corn Exchange Bank, New York City, U.S.A., President, Corn Exchange Bank.
- Neech, Herbert R., c/o The Rio Tinto Co., Ltd., Casa Colon, Huelva, Spain, Chemical Engineer.
- Norton, Arthur Leavitt, 36, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.
- Oakes, F. J., jun., 147, Milk Street, Boston, Mass., U.S.A., Secretary, Oakes' Manufacturing Co.
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- Schweitzer, Jacob, 60th Street, near 14th Avenue, Brooklyn, N.Y., U.S.A., Chemist.
- Shaw, John, 40, India Wharf, Boston, Mass., U.S.A., Manufacturing Chemist.
- Sheldon, John C., Dartmouth Villa, Chester Road, Erdington, near Birmingham, Analytical Chemist.
- Speyer, James, c/o Speyer and Co., 24, Pine Street, New York City, U.S.A., Banker.
- Talbot, Prof. Henry P., Mass. Institute of Technology, Boston, Mass., U.S.A., Professor of Inorganic Chemistry.
- Taylor, Wm. H., 4A, Durlston Road, Northwold Road, Upper Clapton, N.E., Chemist.
- Todhunter, B. E., West Hydraulic Engineering Co., 23, College Hill, London, E.C.
- Whiteside, Harold, 74, Holby Avenue, Jesmond, Newcastle-on-Tyne, Colour Maker.
- Williams, Gerard W., South Rose Deep, Ltd., Box 21, Germiston, Transvaal, Metallurgical Chemist.
- Wills, William H., 162, Main Street, Waltham, Mass., U.S.A., Dyer.
- Hunter, Prof. A. G. Kidston; all communications to P.O. Box 164, Dunedin, New Zealand.
- Hyde, B. T. B., 1/o Washington Street; 80, West Street, New York City, U.S.A.
- Johnson, Jesse F., 1/o Montreal; Vaudreuil Street, P.Q., Canada.
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- Noake, Frank; Journals to S. S. Mond Gas Works, Dudley Port, Tipton.
- Norton, Dr. T. H., 1/o Mamouret-ul-Aziz; American Consul, Smyrna, Turkey-in-Asia.
- Park, James, 1/o Garngad Hill; Millburn Chemical Works, 51, Millburn Street, Glasgow.
- Parker, Chas. E., 1/o Vine House; Penketh, Warriington, Lancashire.
- Pringsheim, Dr. H. H., 1/o Cambridge, Mass.; Garfield, 68, Breslau, Germany.
- Rawson, Christopher, 1/o Ludwigshafen; retain Journals.
- Ross, Herbert W., Journals (temporary) to 1302 Broadway, New York City, U.S.A.
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- Stewart, Samuel, 1/o Wallington; 138, Marine Parade, Brighton.
- Tighe, Arthur, 1/o London; Ravensworth, Glebe Point, Sydney, N.S.W.
- Watson, Herbert J., 1/o Mansfield; 35, Park Road, Widnes, Lancashire.
- West, Leonard, 1/o Uttoxeter New Road; 10, The Lane, Derby.
- Wray, O. J. P., 1/o British Alizarine Co.; all communications to Hazlemere, Coleraine Road, Blackpool, S.E.

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- Butler, W. Wata: Journals to c/o Mitchells and Butlers, Ltd., The Brewery Library, Cape Hill, Birmingham.
- Carhart, Dr. C., 1/o Nicaragua; retain Journals.
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## Deaths.

- Ackroyd, Wm., Crossley Street, Halifax, Yorks.
- Glatz, Jos., 485, Kent Avenue, Brooklyn, N.Y., Jan. 26.
- Williamson, G. N., of 14, Dey Street, New York City, U.S.A.; at Rome, April 27.

## London Section.

### THE MECHANICS OF FIRE.

BY HENRY E. ARMSTRONG, PH.D., LL.D., F.R.S.

(This J., May 15, 1905, 473—482.)

### ERRATUM.

Mr. R. J. FRISWELL'S remarks in discussion on col. 1, par. 4, line 4 *seq.*, should read as follows:—

"By reducing the products so formed with zinc he was able to show that the effect of the oxidant been to introduce a large number of hydroxyl groups into the coal."



## New York Section.

Meeting held at Chemists' Club, on Wednesday, April 19th, 1905.

MR. RUSSELL W. MOORE IN THE CHAIR.

### PAINT CONDITIONS EXISTING IN THE NEW YORK SUBWAY.

BY MAXIMILIAN TOCH.

The steel structure of the New York Subway was painted for the purpose of protection against rust, and the engineers in charge of this were guided by their past experience, and endeavoured to specify what they thought best and would last longest. It must be taken into consideration from the outset that this investigation is only a means any reflection on the specifications as they are written, nor in the remotest sense a criticism of the materials that were used.

It was stated, the steel arrived on the work treated with a coat of pure red lead and pure linseed oil, and had been placed in position, competent men were put in charge; the structure was cleaned and given one heavy, continuous coat of pure red lead, and pure linseed oil, specifications calling for 33 lb. of red lead to the gallon of linseed oil. All the exposed steel work was covered with pure white lead and linseed oil as a final coat. Analyses were frequently made of the paint.

A paper on the Chemistry of Paints and Pigments, published in the Journal, Jan. 31, 1902, pp. 104-5, will be seen from the photomicrographs of a film of red lead. These were taken from the pots of two painters, one of whom was engaged in painting the elevated railroad structure, and the other the exposed steel work on the Subway at the Avenue C Circle Station. I was previously given a sample of red lead and linseed oil, of which I made a chemical analysis in order to be sure that the materials were absolutely pure, which turned out to be the case; I then discourse on this subject before this Society I state my objections to this mixture (*loc. cit.*).

The work on the 50th Street section was completed first, and after one year and three months after the application of a coat of paint it was noticed that at this section, the paint appeared to be in good condition, it showed no air line cracks, and if a knife blade were inserted between these cracks large sheets of paint were pulled off, the remaining paint carrying rust varying in thickness. The engineers in charge very kindly granted me permission to make an investigation as to the cause of this oxidation of the paint, and it gives me very much pleasure to report publicly on this subject with the consent of the engineers.

Underneath the paint appeared under the microscope to be distributed in a laminated condition, and graphically described, my analyses showed that the oxidation was progressive in leaf-like layers. The paint alternate light red-brown and dark brown layers, the brown layers having the composition equivalent to  $\text{Fe}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ , and the blackish brown,  $\text{Fe}_3\text{O}_4 \cdot \text{H}_2\text{O}$ . The percentage of iron varied between 55.6 and 64.9 per cent, and the water between 5.87 and 6.8 per cent.

Then, would preclude the possibility of mill scale causing the oxidation, but from the photomicrographs already referred to, it can readily be seen that the film of red lead were so large and the air bubbles which were so thoroughly encysted that the material could scarcely have acted as a rust producer instead of preventive.

In a paper before the American Chemical Society, March 20, 1903, I gave it as my opinion that a film of linseed oil is not impervious, excepting for the blue which may be bedded in it, but that any dried linseed oil subjected to moisture forms with it a colloidal solution, and the moisture is carried through on to the surface of the metal. We then have two films, which, beyond a doubt, have sufficient inherent tendency to produce oxidation under the proper conditions,

and, granted that the percentage of carbon dioxide in the air of the tunnel is not beyond the normal, the fact that carbon dioxide together with moisture would cause this progressive oxidation is sufficient warrant for the discontinuance of paints that are not moisture and gas proof. Dr. Lewkowitsch demonstrated in his (Lantor) lectures that the fats and fatty oils hydrolysed with water alone, and linseed oil is hydrolysed to a remarkable degree in eight hours when subjected to steam. It can, therefore, be inferred that water would act on linseed oil without the presence of an alkali, and calcium added to water simply hastens the hydrolysis, leaving the inference that lime is the catalyser. This, then, bears out my previous assertion that a film of linseed oil (linoxyn) and water combine to form a semi-solid solution similar in every respect to soap, and, inasmuch as we have lime, iron, lead and similar bases present in many paints, it is almost beyond question that these materials aid in the saponification of oil and water.

For nearly three months, beginning with January and ending with March, I kept a strict record of the temperature, humidity, vapour density and dew point of the air in the Subway, and I particularly selected these months as being the driest in this climate. Our winters here, excepting on such days when we have a thaw and a rain, are considerably below normal in point of humidity, and from the list which I here append, it will be easily seen that condensation on the posts of the Subway is normal and a high dew point is abnormal. For this purpose I carefully registered the conditions according to Lambrecht polyimeter, and though the temperature of the Subway may have been on a very dry day, say, 50°, if it were sufficiently cold outside, the post itself may have been 40°, or lower, owing to its direct conductivity with the outer air, and in such a case condensation would take place on the posts even though the relative humidity and dew point were not excessive.

	Temp.	Vapour Pressure.	Degrees to deduct to find Dew Point.	Humidity.
Jan. 13th ..	51.0	10.0	15.0	56.0
" 14th ..	50.0	9.0	21.0	45.0
" 15th ..	50.0	9.0	21.0	45.0
" 16th ..	49.0	8.0	22.0	43.0
" 17th ..	50.0	8.5	20.5	45.0
" 18th ..	50.0	8.5	18.0	50.0
" 19th ..	51.0	8.5	16.0	54.0
" 20th ..	52.0	10.0	15.0	56.0
" 21st ..	52.0	10.0	18.0	50.0
" 22nd ..	55.0	11.0	13.0	60.0
" 23rd ..	50.0	9.0	21.0	45.0
" 24th ..	50.0	9.0	22.0	42.5
" 25th ..	48.0	8.5	15.5	56.0
" 26th ..	43.0	7.0	22.0	52.5
" 27th ..	45.0	7.5	21.0	45.0
" 28th ..	50.0	9.0	22.5	52.5
" 30th ..	47.0	8.0	20.0	46.0
" 31st ..	47.0	8.5	21.0	44.5
Feb. 1st ..	47.0	8.0	20.0	45.0
" 2nd ..	49.0	8.5	18.5	49.0
" 3rd ..	47.0	8.0	23.0	41.0
" 4th ..	46.5	8.0	22.5	41.5
" 6th ..	47.0	8.4	3.0	*39.0
" 7th ..	48.0	8.5	17.5	51.0
" 8th ..	47.5	8.0	22.0	42.5
" 9th ..	48.0	8.5	6.0	†79.0
" 10th ..	50.0	9.0	10.0	69.0
" 11th ..	47.0	8.5	21.0	44.0
" 12th ..	48.0	8.5	20.5	45.0
" 13th ..	50.0	9.0	8.5	*72.5
" 14th ..	52.0	8.0	23.0	41.0
" 15th ..	48.0	9.5	22.0	42.5
" 16th ..	45.0	7.5	25.0	38.0
" 17th ..	47.0	8.0	21.0	44.0
" 18th ..	47.0	8.5	22.0	42.5
" 20th ..	50.0	9.0	18.0	49.0
" 21st ..	50.0	9.0	12.0	64.0
" 22nd ..	50.0	9.0	15.5	58.0
" 23rd ..	49.0	8.5	17.0	52.0
" 25th ..	50.0	9.0	18.5	49.0
" 27th ..	49.0	8.5	20.0	45.0
" 28th ..	50.0	9.0	18.5	49.0

\* Bad weather, rain.

† Bad weather, snow.

It will, therefore, be seen that a pigment compound with linseed oil is not fit for subterranean work.

We have evidently learned a very valuable lesson on the action of linseed oil paint in the New York Subway, and if it has done nothing more, it has, at least, taught chemists and engineers that, in places where there is vapour pressure, condensation and abnormal humidity, a linseed oil paint and a pigment are useless. A paint, therefore, which will not saponify or hydrolyse should be used for all subterranean work.

From the examination made of the rust taken from the Subway, I cannot draw any average of composition. The wide differences are due to the fact that some of these particles of rust were carefully selected as to colour, the light ones having the probable formula of  $\text{Fe}_2\text{O}_3 + 2\text{H}_2\text{O}$ . The darker ones  $\text{Fe}_3\text{O}_4 + \text{H}_2\text{O}$ . The percentages of moisture vary between 5.87 and 6.80, and from the laminated structure of the rust and the figures obtained, it is possible to deduce that the rust in the Subway is a mixture of  $\text{Fe}_2\text{O}_3 \cdot 2\text{H}_2\text{O} + \text{Fe}_3\text{O}_4 \cdot \text{H}_2\text{O}$ .

There must be no misunderstanding on the subject of any existing danger of continued oxidation to the posts in the Subway for the following reasons, that the present paint is being scraped, and that the factor of safety is so great that even if the posts were left uncoated, it would be very many years before any appreciable difference could be detected. At the same time, it is an object lesson to us all on progressive oxidation, and in connection with this I have lately examined the steel pier at Atlantic City, N.J., which was erected on the 3rd of April, 1898, and from which I picked with a pen knife in the places covered by the mean tide, scales from  $\frac{1}{4}$  in. to  $\frac{3}{4}$  in. in thickness. A pier of this kind is absolutely no test for paint, because the cyclic oxidation produced by salt water is similar to that of carbon dioxide, and a great number of the salts, ammonium chloride in particular, will produce progressive oxidation which in time may probably destroy the object itself.

I wish to express my thanks to the engineers who have permitted me to make this investigation, and have rendered me every assistance possible.

#### Analyses of Subway Rust.

##### Iron Per Cent.

63.1  
64.2  
64.9  
64.6  
60.8  
62.8  
63.4  
61.5  
62.4  
60.0  
60.7  
62.7  
62.6  
61.96  
59.9  
59.8  
58.10  
57.1  
55.6  
61.9  
62.7  
62.87

#### Analyses of Steel Pier Rust

Atlantic City, N.J.  
Per Cent.

Weight of  $\text{H}_2\text{O}$  in  $\text{CaCl}_2$ —  
8.05  
7.38

Difference  $\text{H}_2\text{O}$  by heat—  
9.84  
9.93

Iron—  
61.04  
60.93

Average Per Cent. of  $\text{H}_2\text{O}$  in  
Subway Rust.

6.36  
6.8  
5.87

## Yorkshire Section.

Meeting held at Leeds, on Monday, April 17th, 1905.

PROF. A. SMITHells IN THE CHAIR.

### NATURAL AND INDUCED DRAUGHT.

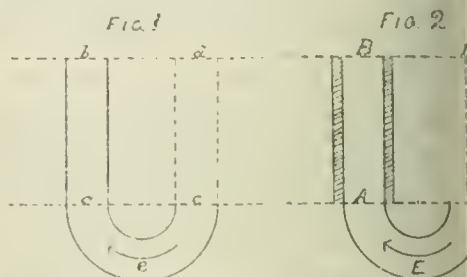
BY JOHN W. COBB.

Many papers have been submitted in recent years to many societies on this subject, and a plea is necessary for

adding one to the number; I find justification in the what one-sided treatment which, to my mind, has often given to the subject. One would suppose that was a consensus of opinion that natural draught, or by a chimney, was of necessity as wasteful as it is antiquated, when compared with artificial draught or by a fan. Let us dispassionately look at the fact ascertain so far as we can the limits within which a combination of that venerable antique, the chimney-steeple justified.

And first let us consider how the chimney does its

If we suppose a U-tube  $a b c d e$  (Fig. 1), of which is filled with cold gas, and  $b a e c$  with hot gas, then have a moving force on the gas in the tube in the direction  $c e a$ , that of the arrow, which moving force will exceed in weight of the column  $c d$  over that of the column  $a b$ . So in a chimney, the moving force is the excess weight of a column  $C'D$  (Fig. 2) of cold air, reaching



the level of the combustion grate  $C$  to that chimney-top  $B$  or  $D$ , over the weight of the column  $A'B$  of hot gas, reaching from the grate level  $A$  to the chimney top  $B$ .

For the quantity of air which this force can draw through the chimney, in the ideal frictionless system the following formula is calculated:—

$$(i.) Q = Sd_0 \sqrt{\frac{2gaL(t_1 - t)}{1 + at_1}}$$

(see Appendix I., page 532), where

$Q$  = weight of air in unit time.

$S$  = cross-section of chimney,  $L$  = height.

$d_0$  = density of air at temperature  $0^\circ \text{C}$ .

$t_1$  = temperature inside chimney, supposed uniform.

$t$  = outside temperature.

$a$  = coefficient of expansion of air.

$g$  = acceleration due to gravity.

or making  $Sd_0 \sqrt{2ga} = K$  (constant)

$$(ii.) Q = K \sqrt{L} \frac{\sqrt{t_1 - t}}{1 + at_1}$$

We see that the weight drawn increases as the root of the length, i.e., each added unit of length increases the draught, but to a less extent than its proportion, if we double the length we multiply the weight drawn by  $\sqrt{2} = 1.4$ .

The weight of air drawn increases also with the temperature up to a certain point, but not indefinitely; it evidently reaches a maximum when  $\frac{\sqrt{t_1 - t}}{1 + at_1}$  is a maximum, which by differentiating and equating to zero is found to be when  $t_1 = 2t + \frac{1}{a}$ . If the outside

at freezing point  $t_1 = \frac{1}{a} \therefore t_1 = 273^\circ \text{C}$ .

and generally, the weight of air drawn is a maximum when the absolute temperature of the inner is twice that of the outer air, an easily remembered result.

The same temperature for maximum weight drawn is obtained if the actual velocity be taken as a constant fraction of the nominal velocity as calculated directly from the formula  $v = \sqrt{2gaL(t_1 - t)}$ .



ndix I. This is important, because the actual ties are always considerably below the calculated ties, owing mainly to frictional resistance and stalling effect of turns in the flues.

a special case, let us take that in which the flues and key offer a negligible resistance compared with that of fuel on the grate. We need only consider here the resistance of air through a highly resistant bed of material; difference of pressure on the two sides would be the driving force, and would be the same as in the frictionless case, but  $S$  in formula (i.) (the cross-section of the key) would have to be replaced by a new constant  $A$ , equivalent area of the interstices of the fuel on the grate. With this alteration, formula (i.) is applicable, and the weight of air drawn is a maximum when  $t = \frac{1}{\alpha}$ .

This case is more nearly that of good practice; it is why even with ample flues and chimney the actual velocity and that calculated from (i) are not the same.

If the normal air temperature of  $15^\circ \text{C.}$ ,  $t = 15^\circ = 288^\circ \text{ Abs.}$ —i.e., the weight of air which a chimney can draw is greatest when the mean temperature of the gases in the chimney is  $(288 \times 2 - 273)^\circ \text{C.}$  Here lies the strength and weakness of the theory as an air mover. The idea is still very prevalent that drawing power of a chimney rises continuously with the internal temperature. The velocity of gas flowing through the chimney can be increased indefinitely by raising the temperature (and the draught-gauge will show this increase, and so may mislead), but the weight of the gas diminishes at the same time, and it is at  $303^\circ \text{C.}$  that the weight of air drawn is greatest. At this point I would, however, point out that the temperature of  $273$  or  $303^\circ \text{C.}$  is not that of the gas at the chimney mouth which is the temperature easily determined, but is the mean temperature in the chimney; this temperature may be taken as the mean of the temperatures of gas entering and leaving the chimney, but it is not usually convenient to determine the latter.

The calculation as usually made for the loss of heat by a chimney body allows separately for conduction and for convection losses; the formulae are complicated and not easy to apply to this case, even if at all applicable. If, however, we make the simple assumption of free circulation of air round a chimney is sufficiently to maintain some temperature, say  $40^\circ \text{C.}$  on the surface, then the only calculation necessary is for the amount of heat conducted through the walls of the chimney; radiation and convection are simply means of getting the heat so conducted, and do not enter into the calculation.

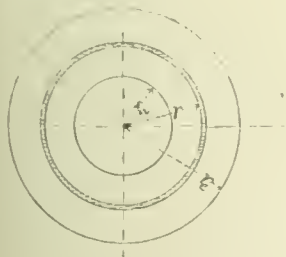


FIG. 3.

is the quantity of heat conducted per metre height through a chimney, of external radius  $r$  and internal radius  $r_i$ , and if  $t_i$  is the temperature of the internal,  $t_e$  of the external surface, then for an elemental ring of radius  $r$  and thickness  $dr$  :—

$$Q = -2\pi r C \frac{dt}{dr}, \quad C \text{ being the coefficient of conductivity}$$

$$\therefore C dt = -\frac{Q}{2\pi} \frac{dr}{r}$$

Whence, integrating between the limits  $r_i$  and  $r_e$  for  $r$ , and  $t_i$  and  $t_e$  for  $t$

$$(iii.) \quad Q = \frac{2\pi C (t_e - t_i)}{\log_e \frac{r_e}{r_i}};$$

the logarithm is to the natural base  $e$ .

If we take the specific case of a brick chimney of 1 metre internal diameter, and 0.25 metre thickness of wall, the mean internal temperature being  $273^\circ \text{C.}$ , then

$$(iv.) \quad Q = \frac{880}{\log_e \frac{r_e}{r_i}}$$

$$\text{or } Q = \frac{44}{7} \times 0.6 \times \frac{273 - 40}{0.40} = 2200 \text{ kg}^\circ \text{C. units per metre of height per hour.}$$

0.6 is Péclet's mean value for  $C$ , the  $\text{kg}^\circ \text{C.}$  units transmitted by 1 sq. metre surface of burnt clay 1 metre thick, for  $1^\circ \text{C.}$  difference, per hour.\*

If we allow a velocity of 5 metres per second for the gases in the chimney (a good working velocity), then the

$$\begin{aligned} \text{Volume of gas per hour} &= 5 \times 3600 \times \frac{22}{7} \times (0.5)^2 \\ &= 14,140 \text{ m}^3 \text{ at } 273^\circ \text{C.} \\ &= 7,070 \text{ m}^3 \text{ at } 0^\circ \text{C.} \end{aligned}$$

$$\begin{aligned} \text{containing } 7070 \times 0.31 \times 273 \text{ kg}^\circ \text{C. units of heat} \\ = 600,000 \text{ kg}^\circ \text{C. units.} \end{aligned}$$

$\therefore$  in this case the gas would lose—

$$\frac{22,000}{600,000} \times 273 = 1.00^\circ \text{C. per metre of height.}$$

If the chimney were 30 metres high, the loss would be  $30^\circ \text{C.}$ , and the mean temperature inside being  $273$ , the temperature of the gas entering would be  $290^\circ \text{C.}$  nearly. The calculation may be a little simplified by substituting for (iii) the formula

$$(v.) \quad Q = C 2\pi \times \frac{\text{mean radius}}{\text{thickness of wall}} \times (t_e - t_i)$$

which is permissible if the mean radius is large compared with the thickness of wall.

The above calculation is made to illustrate the method; a simple application will show that the fall of temperature in a chimney may be very considerable if it is much too large for its work; to get a good draught in such a case would, of course, require a high entering temperature of gas to be maintained at the chimney base.

S. H. Davies (this J., 1904, p. 478) has made conductivity determinations for many insulating materials by a method very similar to the above, but in which he observes the actual temperature on the outer skin; unfortunately burned clay was not tested and I have, therefore, used Péclet's figure for the conductivity.

The general conclusion is that an average chimney-gas temperature of  $300^\circ \text{C.}$ , or say  $320^\circ \text{C.}$  entering the chimney is an upper limit of temperature which it is vain to exceed with the hope of drawing more air. It is not, however, to be regarded as a working standard, for a simple substitution in equation (i.) shows that the weights of air drawn diminish very slowly with falling temperatures in the chimney. Thus, if  $t = 0^\circ \text{C.}$ , the weights drawn with  $t_i$   $273^\circ \text{C.}$ ,  $200^\circ \text{C.}$ , and  $100^\circ \text{C.}$  are as 8.25, 8.16, 7.4; i.e., with an average chimney temperature of  $100^\circ \text{C.}$ , the weight drawn is 90 per cent. of the maximum.

$273^\circ \text{C.}$  if outside air is at  $0^\circ \text{C.}$ ;  $303^\circ \text{C.}$  if outside air is  $30^\circ \text{C.}$

\* Péclet's "Traité de la Chaleur." Third Edition, p. 406.

I do not propose to discuss the theory of the chimney further; it is so exceedingly difficult to take into account all factors in such a way as to arrive at absolute demonstration, but I venture the opinion that the result at which we have arrived in our brief, theoretical consideration of the problem, that nothing is to be gained by increasing the average temperature beyond 300° C., is quite in consonance with practice.

Good draught, then, can be got out of a chimney without sending into it excessive heat, and high chimney temperatures are aberrations of practice.

A very low temperature at the chimney foot is sometimes taken as a sign of economical working, but that may not be assumed, since an analysis of the flue gas will often show that the in-leak of air between the furnace and the chimney is the real cause of the lowness of temperature. The temperature and composition of the flue-gas should always be taken together if conclusions are going to be drawn. Bunte's table (*vide* Appendix 2A) will then show the important number, the percentage of the original calorific power of the coal present in the flue-gases entering the chimney. Thus, assuming flue-gas from ordinary bituminous coal to contain 10 per cent. of carbon dioxide, and to enter the chimney at 200° C.,  $\frac{18.5}{15.5} \times 100 = 12$  per cent. of the heat of the coal is going up the chimney; 5 per cent. of carbon dioxide and 150° C. would show 17 per cent. waste. This test can, of course, be applied to a chimney serving a complete battery of boilers or furnaces, or both. I have calculated a similar table for use with Mond Gas (*vide* Appendix 2B).

We have seen to some extent the mode of action of a chimney, which is the only natural draught producer. Artificial draught is produced in a more obvious manner, by the direct suction of a fan, or in the case of what is called "forced draught," by the direct blowing of a fan or other air-compressor. Let us now consider the sort of draught most useful in several types of furnaces.

Most of the discussion on this question has centred on the steam boiler, and since it is so widely used an apparatus and is a very illustrative example, we can well take it first. In a steam boiler, the products of combustion are, immediately after their formation, at a temperature very much higher than that of the surrounding metal plates of the boiler; they give up heat quickly to the water through the plates; as they proceed they are cooled, and give up less and less heat to each unit of plate-surface; they still contain useful heat on leaving the boiler, and, consequently, are usually passed through an economiser, in which the feed-water is heated. (We are considering primarily the widely-used Lancashire boiler.) The economiser contains a great many pipes presenting in total a large surface in order to compensate for the fact that the cooled gases have not nearly the same excess of heat over that of the water to be heated as they had in the boiler. Supposing the installation is a good one, we may take the products of combustion as leaving the economiser at 150° C., containing 4–8 per cent. of carbon dioxide.

Is it better now to turn the products of combustion into a chimney, and so produce a natural draught, or to deal with them by a fan? What can we gain by interposing a fan? We might cool the gases further, and for that purpose add more economiser tubes. But we realise that each set of economiser tubes added abstracts less heat from the flue gases, and if the addition is carried too far the first cost and up-keep of the tubes will more than balance the value of heat units saved. Moreover, if the products of combustion are too cool, the sulphur acids condense on the cooler iron of the economiser tubes, and cause a fall in their efficiency more or less rapid and an ultimate destruction, with possible danger and certain expense. Such a deposit on analysis proved to be essentially a mixture of ferrous and ferric sulphates. Apart from the action of sulphur gases, there is also a deposit of moist sooty matter on over-cooled economiser tubes. The limit to the advantageous adding of tubes is acknowledged by the economiser makers; 400° F. (204° C.) is sometimes given as a temperature of gases leaving boiler,

below which it is of no use to add economiser tubes. makers also rightly insist on the economiser being with warm water; the effect of cold water inside economiser pipes is, of course, to cause condensation cooled products of combustion on the outside. It is to be noted that the cooling and condensing may be and usually is so, the large cross-section of economiser flues being favourable thereto; it is not sufficient to ensure that the average temperature of the products of combustion is a safe one; no part of the economiser top, bottom, or sides, should show the presence of ice at a dangerously low temperature: this is a point of some importance in practice which may be easily missed. It appears, then, that cooling of the gases below a certain point, say, 150° to 200° C., is not to be regarded as an advantage, and so we may say that if a chimney already exists, and has the drawing power required of it, there should not be put in. A calculation can be made which shows that the efficiency of a chimney as an air-mover is appallingly low; such a calculation has been published as showing the great advantage of using the much more efficient fan; it is quite plain, however, that in the case of a chimney using gas at 200° C., and a fan drawing with gas at the same temperature, the chimney is utilizing a very small proportion of the heat, but the fan is not at all (for it has to be driven independently); that is the difference between them. Suppose, however, that a chimney does not already exist, then the short smoke-stack which is sufficient for the fan-discussion offers a considerable saving in cost, even when the cost of the fan is considered. Or, suppose that the drawing power is insufficient, that the flues or the chimney are not sufficiently capacious, we can use the full draught of a chimney with economy certainly, but cannot increase in any reasonable way; the addition of a length to a chimney may be of some use, but such a piece of work is usually done at great disadvantage, and, as has been noted, each additional foot does less than its predecessor. Or, suppose that the fuel is of low quality, and will burn in a fierce draught, or, again, that it is desired to increase the output beyond the normal, the full natural draught being already applied. Then we recognise that air can be drawn or forced through the fuel and flues at a greater speed than the chimney can give, and that the aid of a fan. A damper can be used to secure accurate control just as with a chimney, and the power used is small (say, 1 per cent. of the steam raised) and the attendance almost nil. The fan here finds its legitimate function.

Let us compare the natural and forced draughts more closely. A boiler is much more likely to work efficiently if the combustion is effected without a large excess of air. Thus, if the gases leave the economiser at 200° C. containing 8 per cent. of carbon dioxide, 15 per cent. of heat of the coal is wasted in them; if they contain 4 per cent. of carbon dioxide at the same temperature the waste is 28 per cent. The best way to diminish the excess of air, while maintaining active convection, is to work with a thicker fire, but the thicker fire offers more resistance to the passage of air, and to overcome the resistance effectively often means more pressure or draught than a chimney can give. The use of very low class fuels this high pressure is an absolute necessity if they are to burn at all, and probably it allows a smaller excess of air to be used. On six Lancashire boilers side by side, working into the same chimney one with a fan-made air-pressure of 5 cm. water-gauge, the grate and the others with 15 mm. draught on the flues, observations were made as to coal burned per unit of grate area and composition of flue gas. The advance in output lay greatly with the forced draught; the fan-burned averaged 21 lb. per sq. ft. of grate per hour as against 15 lb. for the natural draught. In composition of flue gas the differences shown were small so long as the samples at the hand-fired natural draught boilers were taken while the firing doors were closed. The following table illustrates this; the figures are strictly representative of normal working:—



Description of Boiler.	No. of Boiler.	Minutes sampling after firing.	Sample drawn.	Analysis—Flue Gas.		
				CO <sub>2</sub> .	O.	CO.
Hand-fired Lancashire draught...	1	2	Leaving furnace flue.	12.8	5.6	0.0
	2	4		15.1	3.2	0.0
	3	7		14.8	3.5	0.0
	4	10		14.6	3.4	0.0
	5	12		13.7	4.8	0.0
Mechanical stoker with draught ....	6	—	Leaving furnace flue	15.1	2.8	0.0
	6	—		14.8	3.2	0.0

NOTE.—The grate area in the case of forced draught included side dead-plates; the consumption of coal per sq. ft. of effective grate area was considerably higher.

The average amount of free oxygen in many tests was 1 per cent. for the forced draught, 4.0 per cent. for the hand draught, indicating about 30 and 40 per cent. of air used in the two cases. All these samples were taken leaving the furnace flue at the back of the boiler. I think that the erratic numbers which find their way into conversation and print regarding the amount of carbon dioxide and oxygen in the flue-gases from boilers are very largely due to sampling at the wrong place. With a good new boiler-setting the errors from this cause are considerable, and with an old or bad one most inconceivably large. I give examples (Lancashire boiler):—

can be burned so as to raise steam, but weird stories are in circulation as to the proportion of the steam required to work the injector. I have made no tests.

It may be worth noting that since the special usefulness of a fan is to create a high velocity against resistance on the grate, it follows that in a gas-fired boiler, the fan is not called for; in this case there is no bed of fuel and, therefore, the resistance is low, and much larger quantities of gas than of coal can be burned with the same draught. There is here the further reason that whereas the stopping of a fan for a few minutes in itself checks combustion in the coal fire, it only checks the air supply to a gas-fire, and large volumes of unburnt gas stream through the

Sample drawn.	Per Cent. in Flue Gas.					Remarks.
	CO <sub>2</sub> .					
	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	
Leaving furnace flue .....	15.2	14.8	14.4	—	4.8	<i>d</i> was the mean of 5 determinations for a gas-fired boiler, newly set.
From front .....	8.6	8.4	8.2	14.9	11.2	
Side flue .....	5.9	6.2	—	—	—	<i>a</i> and <i>b</i> are averages—setting 10 years old.
Economiser .....	—	—	—	11.5	—	

Chemical analysis is to be used as a positive means of control in boiler firing, the necessity for caution in this is obvious; samples should be drawn as soon as possible after the completion of combustion, before air has a chance to leak in and make the sample tell a tale about the combustion process; if the sample is drawn too near the fire, the presence together of carbon dioxide and oxygen discloses the fact. In a Lancashire boiler a good sample can be drawn at the back, where the gases leave the furnace flues. Of course, if the idea is to determine the percentage of total heat escaping in the gases (before or after economiser) the sample must be taken at the leaving-point and be coupled with a simultaneous temperature determination at the same point. In the comparison made above, the results of gas analysis would be less favourable to the hand-fired boiler if we were to take into account the very low percentage of carbon dioxide at the time of firing, when the doors are open, but this is not caused by using natural draught but by using hand-firing. I think we may say that the comparison leads to the conclusion that there is a decided advantage in the forced draught, inasmuch as the output was easily maintained, combined with a satisfactory combustion ratio of carbon dioxide to oxygen in the flue gas.

There is a caution to be given here respecting the use of a fan for the sole purpose of enlarging output; the hand and economiser have a heat-abstracting power which can be increased by apt use up to a certain point, but which is none the less limited, and a fan so used as to draw more coal on the grate than this limit allows, is a wasteful fashion; such waste is pointed out by the excessive temperature in the escaping flue gas. The high temperatures developed by rapid combustion under forced draught, make the construction of the grate and the method in which the fuel is to be burned, and from which the clinker is to be removed, also a very important factor. The temperature of the fire can be kept down by using a steam injector to suck in air, and discharge it under the grate, mixed with steam. There can be no doubt that in this way low-class fuels

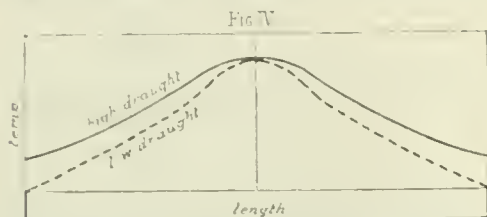
flues until the attendant turns off the gas supply; this may be a serious danger, especially at night. (The gas is supposed to be supplied under pressure, as from a modern producer-gas or blast-furnace plant.)

We will now consider briefly other types of furnaces. Perhaps the simplest of all is the ordinary reverberatory furnace, of which the iron-puddling furnace and coal-fired reheating furnace are samples. The coal burns on a grate, and the products of combustion pass at once into the working part of the furnace, and there heat the iron or other material; they then pass to the chimney. This is the ordinary construction, and since the gases reach the chimney at nearly the working temperature of the furnace, their temperature is obviously too high for a fan. And not entirely because no quick-running machine can withstand the heat and oxidation satisfactorily for any length of time. Even if that difficulty were overcome the increased volume of the gas resulting from its high temperature would be a hindrance. If the temperature of gas is 819° C., the fan to draw them must have twice the capacity; if 1365° C., three times the capacity, which would be necessary for the same gases at 273° C. A pressure-fan delivering air under the grate would be more applicable, and a steam jet blower is sometimes used. The furnace may be arranged so that the products of combustion are utilised in a boiler on their way to the chimney. This is a very efficient arrangement if well-designed, because the steam-boiler is such a capital heat abstractor and the steam is nearly always wanted at hand. The conditions in general governing choice of draught become in this case those of boiler-firing previously discussed.

The furnace or kiln ordinarily used for the firing of bricks and pottery is really a reverberatory furnace, in which the volume of the goods to be heated is very large in relation to the grate area. Consequently, until the temperature inside the kiln becomes high, the products of combustion are cooled by giving up heat to the goods, and the flue-gases are cool; when the higher temperatures are reached inside the kiln the hot goods have very little heat-abstracting power, and so the flue-

gases escape hot. Here we have a peculiar case in which the products of combustion increase continually in temperature and volume as the firing progresses; it is much better suited for a chimney than a fan. The conditions are different in a kiln of the continuous type which we will now consider, taking as our example the continuous brick-burning kiln as introduced by Hofmann.

In this type of kiln the coal is consumed in direct contact with the bricks: it is usually fed down through small round holes in the kiln top and, dropping among the bricks, burns there. The air which burns the coal is heated by coming through cooling bricks behind, already baked; the products of combustion pass forward and heat up the unbaked bricks in front until these products of combustion are so far reduced in temperature that they would deposit moisture if cooled any further; they are then taken out through a damper into the main flue and so to the chimney; the kiln is divided into chambers, usually about sixteen, and each chamber has a damper of its own, opening or shutting the way into the main flue. As will be readily understood the temperature of flue-gas can be reduced in this case to a point such that the products of combustion will just not deposit moisture on the bricks; the draught is small, therefore, and very high chimneys are usually provided for these kilns. The use of a fan would be good practice, and indeed the fan is coming into use, more particularly in new plants, where the saving of the first cost of a high chimney is desired. The effect of increasing the draught by means of a fan is interesting to follow.



In the accompanying figure (IV.) the dotted line marks the assumed distribution of temperature along the length of the kiln when the chimney is producing the draught. On putting a fan into use and raising the draught the quantity of air drawn is increased, and in order to neutralise the cooling effect of the excess of air the rate of feeding-in coal must be also increased. Two effects follow; in the first place the temperature curve is flattened; this necessitates more chambers in use, and shows us that the usable draught is limited by the number of chambers in the kiln. In the second place the peak of the temperature curve travels more quickly along the kiln, the chambers are burned more quickly, and the output increased. The increase in output can be effected with economy by increasing the draught until the limit is reached which the size of the kiln determines; beyond this, higher draught means waste of fuel; it would then be usually wrong to apply a fan to increasing

the output of a kiln which has already as few chambers as will work well with natural draught, but, increasing the draught up to the maximum determined, economy is effected, and this because, a from increased output from the same plant which increases the commercial efficiency, the radiation and conduction losses from the kiln remain constant, and so can be made to bear a smaller ratio to the total thermal units of combustion.

So far as regards regenerative gas-furnaces, with ordinary construction, the gases leave with quite enough heat in them, 200—400° C., to work a chimney well; the remarks applied to the gas-fired boiler are also applicable here, but to a less extent.

Enough has now been said, I think, to indicate the of question which must be answered before a rational choice between natural and artificial draught for specific purpose can be made. The exact form question and answer take is dependent on very many factors. Finally, let me say that I cannot feel that I have treated this large subject in any adequate fashion, but can only have approached it without prejudice, and not without some experience.

#### APPENDIX I.

The formula (i) is derived thus:—

$v = \sqrt{2gh}$  where  $v$  is the velocity of gas in  $cca$ , Fig. 1 hot column.

$h$  = the head producing motion.

$g$  = the force of gravity.

Now  $(L+h)(1+at) = L(1+at_1)$

where  $L$  = height  $ab$  (chimney height)

$a$  = co-efficient of expansion of air,  $\frac{1}{273}$   
 $t$  = temperature of column  $cd$  (outside temperature).

$t_1$  = temp. of column  $ab$  (inside-temperature)

$\therefore h = L\alpha(t_1 - t)$

$1 + at$

or, since  $a$  is so small,

$h = L\alpha(t_1 - t)$

$\therefore v = \sqrt{2g L \alpha (t_1 - t)}$

But  $Q = svdt_1$

where  $Q$  = weight of air in unit time.

$s$  = cross-section of  $ab$ .

$dt_1$  = density of air at temperature  $t_1$ .

$= Sv \frac{d_0}{1 + at_1}$

where

$d_0$  = density of air at temperature 0° C.

$\therefore Q = Sd_0 \sqrt{2g L \alpha (t_1 - t)} (i)$   
 $1 + at_1$

#### APPENDIX II.

A.—BUNTE'S TABLE.

For Calculating the Per Cent. Loss of Heat from Flue Gases. Coal = C. 84.45; H. 5.43; O. 8.18; S. N. 1.16.

Percentage of CO <sub>2</sub> in the Flue Gases.	Capacity for Heat in Cals. of the Flue Gases = C.		Initial Temperature °C. ( $\frac{W}{C}$ )		Difference for 0.1 Per Cent. of CO <sub>2</sub> .	Cb. ft. of Gases per lb at 62° F
	Per Cb. m.	Per Cb. ft.	For Carbon = T.	For Coal = T.		
1	0.303	0.00873	141	167	16	2660
2	0.310	0.00877	280	331	16	1330
3	0.311	0.00880	410	493	16	889
4	0.312	0.00883	557	652	15	665
5	0.313	0.00886	694	805	15	522
6	0.314	0.00889	830	961	15	413
7	0.315	0.00892	962	1112	15	330
8	0.316	0.00895	1096	1261	15	262
9	0.318	0.00899	1229	1407	14	205
10	0.319	0.00903	1360	1550	14	160
11	0.320	0.00907	1490	1692	14	122
12	0.322	0.00911	1620	1830	14	92
13	0.323	0.00914	1750	1963	13	68
14	0.324	0.00916	1880	2102	13	50
15	0.324	0.00918	2005	2237	13	37
16	0.325	0.00920	2130	2366	—	26

\* The 7th column is added by Fletcher.



1 lb. ft. of carbon dioxide is formed by combustion 23 cal. are evolved. The quantity of heat (=W) lost from the per cent. CO<sub>2</sub> is divided by the capacity cat (=t') of 1 cb. ft. of the chimney gases. The fraction  $\frac{W}{C}$  gives the so-called initial temperature (T).

Use this Table:—If T = the initial temperature and t = the difference between the exit temperature of the flue and the temperature of the air supply then  $\frac{t}{T}$  expresses the ratio of the heat lost through the escaping to the heat developed.

The following table is calculated for works use Mond gas is the fuel employed, and has only the degree of accuracy necessary for that purpose. A mean calorific capacity of 0.34 per m<sup>3</sup> of combustion products is used; the Bunte numbers are, of course, too low. The rapid change in specific heat of carbon dioxide and water with temperature makes it necessary to calculate separately for each case if a high order of accuracy is demanded. The table is only scientifically correct for products of combustion containing 9 per cent. CO<sub>2</sub> at 600° C., and the error increases as the actual conditions differ more widely from these. The numbers of MM. Mallard and Le Chatelier are taken for the specific heats. The gas is supposed to be an average sample of Mond gas saturated at

15° C. with a calorific power of 1,200 kg.° C. units per m<sup>3</sup>, the products of combustion being supposed cooled to 0° C. without condensation.

It is interesting to note that the table is applicable to determine the percentage of the total heat of gas escaping in the exhaust of a gas-engine.

To Use the Table:—

If T is the initial temperature (nominal) of combustion and t is the difference between the exit temperature of the waste gases and the temperature of the air-supply, then  $\frac{t}{T}$

expresses the ratio of the heat lost through the escaping gases to the heat developed.

T was calculated in constructing the table by dividing the kg.° C. units in 1 m<sup>3</sup> of the products of combustion by 0.34.

The per cent. of carbon dioxide is the percentage as determined by ordinary gas analysis.

The excess air per cent. is the excess over that required for theoretical combustion.

#### GAS-FIRING TABLE.

For Calculating the Per Cent. Loss of Heat in the Products of Combustion of Mond Gas.

(CO<sub>2</sub>, 16; CO, 12; H<sub>2</sub>, 26; (H<sub>2</sub>, 2; N, 44 per cent.).

Per Cent. CO <sub>2</sub> .	Per Cent. O.	Excess Air Per Cent.	Initial Temperature °C.	Difference in °C for 0.1 Per Cent. CO <sub>2</sub> .	Vol. Air to 1 Vol. Gas.	Vol. Products Calc. to 0° C.
1.0	—	—	121	12.1	—	—
2.0	—	—	242	12.1	—	—
2.7	16.6	800	327	—	9.9	10.8
3.0	—	740	360	11.2	—	—
4.0	—	540	472	11.2	—	—
4.7	14.4	400	551	—	5.5	6.4
5.0	—	378	583	10.7	—	—
6.0	—	304	690	10.7	—	—
7.0	—	230	797	10.7	—	—
7.4	11.4	200	840	—	2.3	4.2
8.0	—	180	898	9.6	—	—
9.0	—	148	994	9.6	—	—
10.0	—	116	1090	9.6	—	—
10.5	8.0	100	1138	—	2.2	3.1
11.0	—	91	1183	9.1	—	—
12.0	—	73	1274	9.1	—	—
13.0	—	54	1365	9.1	—	—
13.2	5.1	50	1384	—	1.6	2.5
14.0	—	40	1452	8.6	—	—
15.0	—	28	1538	8.5	—	—
15.2	2.9	25	1555	—	1.4	2.3
16.0	—	18	1615	7.5	—	—
17.0	—	9	1690	7.5	—	—
17.8	0.0	0	1765	—	1.1	2.0

#### DISCUSSION.

A. SMITHILLS said Mr. Cobb's paper was a very valuable contribution to an important subject, which had been very much neglected. Merely from the theoretical point of view, it would form a good problem in elementary physics. Text books and engineering treatises gave the subject little consideration, and a student working at a laboratory or engineering might become highly educated without gaining much knowledge of it. Even engineering students showed remarkable ignorance on these matters. It was a reason he hoped the paper would have a good circulation and attract attention, which was fortunately the case when it came to be printed in the Journal.

LEACH asked if Mr. Cobb could explain the big difference in the percentage of carbon dioxide present in the flue gas (14 per cent.) and gases leaving the boiler (4—5 per cent.), as it was almost impossible to find a large difference could be due to air leakage in the

T. FAIRLEY said he had had some experience in the use of destructors, where the only object was to burn a fuel as completely as possible. The temperature at the bottom of the chimney stack was higher than the temperature at the top. Mr. Cobb recommended. He had analysed the flue gases and found a certain amount of leakage between the bottom and the top of the chimney. In complicated

apparatus this was unavoidable. By the use of a steam injector a hotter fire might be obtained. Possibly in such a case the chimney might be dispensed with and a form of blast furnace substituted, in which the steam used and the higher temperature would both tend to greater efficiency in a destructor.

Mr. COBB, in reply, said he did not consider that the paper brought forward the theoretical side of the subject too prominently, as he had always found that a proper understanding of theory was the best way to arrive at practical results. He thought that leakage between the boiler and far end of the economiser caused the difference in percentage of carbon dioxide in the gases leaving them. Considerable leakage took place at the damper, and samples of gas should therefore be taken on the boiler side of it. Where an economiser was working for several boilers, one of them might be firing up when a sample was taken. The economiser was usually so constructed that an enormous brickwork surface was obtained, and this always caused leakage of air. The tubes of the economiser required to be cleaned by the use of scrapers, with chains attached, working inside holes in the outer casing, and this also involved leakage. This leakage of air lowered the temperature as well as the percentage of carbon dioxide, and might lead to a misapprehension, if the fall of temperature alone in the economiser was assumed to indicate its efficiency. It was a mistake to have the tem-





Seville oil with low percentage of free oleic acid given unsatisfactory results on wool, and from the aints made, it was evident that this oil had oxidised erably and had produced a stickiness and semi-like result on the fibres. The Gallipoli oil with the percentage of acid, six times that present in the oil, had given excellent results on wool; the uniform with Gallipoli oils; even with those containing high tages of free oleic acid. In a paper upon "Lubri-Oils" by one of us and H. Norman Hanson (is J., 1905,) we indicated a method for testing oils (ising at 212° F. or 400° F. in shallow layers, and ve an illustration of the apparatus used. We also ed a simple 5 c.c. viscometer which has enabled us rk with small volumes of oil and to obtain very agreeing results. Shallow layers of the two oils e wish to compare were submitted to a current of 212° F. for six hours, with the following interesting gnificant results:—

	Viscosities at 210° F.		Butyro-refractometer at 19° C.	
	Before Oxidation.	After Oxidation.	Before Oxidation.	After Oxidation.
olive oil F. free acid) ...	43	47.5	63	64
olive oil F. free acid) ...	46	61.0	65	67

the percentage-increases of viscosity on oxidation Gallipoli 10.5 per cent. and Seville 32.6 per cent. e interesting figures were obtained with a series of eluding those under consideration, and it will be at they are quite in harmony with the reputed or non-drying characters of the oils taken.

ITY. INCREASE OF OILS AFTER OXIDATION IN ALLOW LAYERS FOR FOUR HOURS AT 210° F.

	In Percentage.
Linseed .....	solid
Cotton .....	302.0
Arachis .....	116.0
Rape .....	111.0
Maize .....	92.0
Lard .....	53.5
Olive (Seville) .....	32.6
Olive (Gallipoli) .....	10.5
Sperm .....	8.0
Castor .....	4.0

ompared the shallow layer test at 400° F. with 's process at 212° F., using three different classes oil and their fatty acids. ollowing are our results:—

	Gallipoli.		Seville.		Levant.	
	Oil.	Fatty Acids.	Oil.	Fatty Acids.	Oil.	Fatty Acids.
ge of free fatty acids cal-						
ted as oleic .....	4.23	98.0	4.23	99.0	12.69	100.0
test, 1 hour .....	207	222	206	230	204	236
test, 1½ hours .....	218	316	218	346	214	340
test, 1½ hours .....	237	350	238	368	236	378
gs of increase of viscosity						
oxidation for four hours at						
F. ....	73	—	644	407	315	215

Seville oil shows nearly nine times as great an of viscosity as the Gallipoli oil under exactly the nditions of exposure to hot air. The fatty acids eville oil and Levant olive oil show only two-thirds osity after oxidation of the oils themselves similarly Quite an unexpected result. It may be urged ° F. is a very high temperature to use—this we ut even 212° F. required for Mackey's test, is e normal temperature of the atmosphere, and

we have proved that, whether we use 212° F. or 400° F., the oxidation products obtained are in general the same as those produced at lower temperatures. Our 400° F. test certainly gives a good idea as to the readiness or otherwise with which an oil or its fatty acids will become viscous and finally varnish-like on exposure to air. If 400° F. does produce abnormal effects as far as fatty acids are concerned, it should be in the direction of increased, rather than decreased, viscosity as compared with the neutral oils, because the fatty acids certainly lose much more weight and suffer a loss of some of their more volatile and doubtless less viscid constituents. The heating effect developed on cotton or silk waste when the oil and fibre are heated together at 212° F. does not run parallel with the increase of viscosity as far as concerns olive oils when tested in comparison with their fatty acids; although in general the drying tendency of an oil, e.g., linseed oil, is indicated by this process.

It may be urged that the Seville oils contained a larger proportion of unsaturated fatty acids other than oleic acid, e.g., more linoleic and linolenic acids, &c.; if this were so we should expect to see it reflected in a proportionately higher iodine number; but this was not the case. We are forced to the conclusion that olive oils are very much more complex than has commonly been supposed. At all events it is much easier to try the oxidation test we have suggested than to proceed to separate and estimate the fluid fatty acids present, and obtain their bromine or iodine numbers. The changes which take place when a vegetable oil is oxidised are:—(1) Increase in viscosity with the final production of solid varnish-like bodies. (2) Increase in refractive index. (3) Increase of the melting point of the fatty acids. (4) Decrease of the iodine number.

These changes are always found in oils recovered from tops by means of solvents, and furnish data of a perplexing character to the analyst who is requested to make an examination for cotton or some other seed oil. In a typical case we found the following results:—

	Iodine No. Per Cent.	M. Pt. °C. of Fatty Acids.	Refractometer at 49½° C.
Oil recovered from wool tops	52.0	35.5	48°
A pure edible olive oil .....	83.0	27.0	39°
A ditto after oxidation for 2 hours in shallow layers at 400° F. ....	50.39	36.5	44.5

These figures show that one has accomplished in two hours much the same changes that have resulted from the exposure of olive oils on tops for several weeks; thus the process is absolutely in line with the changes which occur on atmospheric exposure.

The conclusions which we deduce from our observations and experiments are:—

(1st.) The mere percentage of free oleic acid in an olive oil is no very reliable guide as to the suitability or otherwise for oiling wool.

(2nd.) The neutral portion, constituting by far the largest bulk of the oil, is worthy of more consideration than the free oleic acid factor.

(3rd.) Oil importers of large experience are right in their assumption that it is the whole character of the oil, and

the nature of the source and the crop which are of far more importance than the free oleic acid factor.

(4th.) To decide whether an olive oil will produce sticky and varnish-like results when applied to wool one has only to oxidise in shallow layers at 400° F. and obtain the increase in viscosity. This datum, in comparison with figures obtained under the same conditions with standard oils of well-known excellence, should furnish a reliable guide as to the value of the oil in question. We do not wish to set aside such factors as the colour, odour, and taste, but these require long experience for their satisfactory determination and are more reliably determined by the commercial oil expert than by the average chemist.

#### DISCUSSION.

Mr. WILLIAMSON said that years ago Gallipoli olive oil was of a superlative quality, and contained only a small amount of free oleic acid. During the last ten years the proportion of oleic acid had increased considerably, owing to deterioration of the olives by the ravages of a certain fly. There was, however, no deterioration in quality, and no complaints had been made by buyers, even in oils containing as much as 10 to 14 per cent. This showed that it was not advisable to attach too much importance to the free oleic acid present. The best oil was probably Gallipoli, then Cretan, and then possibly Málaga oil from Spain. Excellent oils were obtained from Greece and the Ionian Islands, but the growers did not take sufficient care in the cultivation.

Mr. VINT, speaking from a consumer's point of view, said he had changed his opinion within the last few months, and now thought that oils which gave low acid tests were not necessarily the best for woollcombers. The chief requirement was an oil which would not oxidise or increase in viscosity. Free oleic acid was only injurious because it might set up corrosive action on the metal parts of the woollcombing machinery. He preferred good Gallipoli oil, such as last year's supply. Could something be done to remedy the ravages of the fly which Mr. Williamson said had caused the increase in acid in Gallipoli oil? Sound Gallipoli oil with low percentage of free oleic acid was always preferable to same oil with higher acid test.

Mr. W. McD. MACKEY said that his apparatus was originally intended for testing oil for insurance purposes, but he was pleased to find that Mr. Richardson had been able to make use of it in his work. The paper and discussion seemed to show that users of olive oil in Bradford had got back to where they were before the acid value had come into prominence as a test, which said something for the value of what were often called rule-of-thumb methods as opposed to analytical.

Mr. W. RUSHBY said he understood that the chief disadvantage of the presence of oleic acid in olive oils was the discoloration of tops which it caused, due to small quantities of metal which dissolved in the acid, and which set up secondary changes in the oil. Was it not a fact that Belgian oleine, consisting chiefly of oleic acid, was being used for woollcombing?

Mr. T. FAIRLEY had tested oils for oxidation on the surface of wool, and found that oleic acid sold as "oleine" compared favourably with other oils. An important point to notice was that the amount of free acid increased in oils on prolonged keeping.

Mr. W. M. GARDNER stated that the discoloration of tops was more likely to occur by the use of olive oil containing free oleic acid, and this was probably caused not by the oleic acid itself but by decomposition products.

Mr. C. W. SLATTER said that woollcombing experts objected to the presence of free fatty acids in oils. He agreed with Messrs. Richardson and Williamson in preferring Malaga to Seville oil. How would Mr. Richardson recognise mixtures of olive oil, with olive oil extracted by carbon bisulphide? He agreed that oleic acid would be injurious to brass and metals. Did Mr.

Richardson refer to adulterated oil when he spoke of defective olive oils? He advised caution in accepting new methods of testing, and would not throw over the ideas without due consideration.

Mr. RICHARDSON, in reply, said he considered Malaga oil second only to Gallipoli oil, since it was excellent rule. Very little Cretan oil came to this country. In the past 20 years, in Bradford, he had never known browned by Gallipoli oil containing even over 20 per cent of free acid. With regard to oils extracted by carbon bisulphide, samples which he had at first thought adulterated, owing to the peculiar results obtained testing, afterwards proved to be genuine. The distinguishing feature of "sulphur" oils was the blackening with silver nitrate and the orange colour produced by mercury nitrates.

## Obituary.

### JULES KOLB.

OFFICIER DE LA LÉGIION D'HONNEUR. DIRECTOR OF THE FIRM OF KUHLMANN AND CO. MEMBER OF THE SOCIETY OF CHEMICAL INDUSTRY.

Jules Kolb was born in Strasburg, July 2, 1831. After a course of study in the Lycée of Strasbourg and Algeria, he entered the École Centrale in Lille, leaving it in 1859, with high honours, to become chemist of the firm of M. Kuhlmann, in whose service he continued in various capacities for the rest of his life. After a year as chemist, M. Kuhlmann advanced him to the position of manager of the Amiens branch of his business. With indomitable energy, the young director applied himself to his new duties, as also the solution of numerous technical problems. In 1861 he was one of the founders of the *Société Industrielle d'Amiens*, and in its Proceedings most of his subsequent investigations appear. Of this Society also he was Vice-president from 1870 to 1873. In 1863, the *Faculté des Sciences de Lille* conferred upon Kolb the degree of doctor, on the presentation of his remarkable thesis on "*The Reactions in the Manufacture of Phuric Acid*." In 1870, he was nominated to membership of the *Académie des Sciences, Arts, et Lettres*, of Amiens, and in 1872, he became the president of the *Société Industrielle de Mulhouse*, in consequence of his Memoir on the specific gravities of Commercial Sulphuric Acid. In 1881, M. Kuhlmann died, and Kolb was chosen to fill the vacant place of that practical director of the firm. In 1883, he wrote the articles on the chlorides, phosphates, superphosphates, for *Fremy's Encyclopædia*, and in 1884, he was called to be the Director of the Lycéeum. In 1885, Kolb entered the Society of Chemical Industry as a member, and so continued until shortly before his death. In 1886, he was decorated by the *Académie des Sciences*, and the Montyon prize awarded him for his Researches in connection with "*Improvements introduced into Chemical Industry bearing upon Sanitation*." M. Kolb was also elected President of the Society of Political Economy and Statistics, and President of the "*Commission de l'École des Beaux-Arts et Conservateur des Musées Industriel et Commercial de Lille*;" in 1884, he was nominated "*Inspecteur Départemental de l'Enseignement Technique*," and in 1895, was further elevated to "*Officier de la Légion d'Honneur*," and the Society of Chemical Industry awarded him the Founder's (Kuhlmann) gold medal.

Jules Kolb died April 18, 1905, at Lille.



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## PLANT, APPARATUS & MACHINERY.

### ENGLISH PATENTS.

*Apparatus; Impts. in* —, B. Hoffbaur, Cologne. Eng. Pat. 7739, March 31, 1904.

paratus, several forms of which are described and is arranged so that the drying chamber is divided o parts, through which the material to be dried d successively. A current of air passes through or preliminary drying chamber, and after effecting oval of a portion of the moisture passes direct to . Another current of air is sent through the chamber and completes the desiccation. This air carries away with it much dust or fine material, first through the partially dried substance in the ary drying chamber, in order that the dust may ed by the partially dried material, and then to .—W. H. C.

*Churning, Concentrating or Drying of Semi-uid or Viscous Materials. and Apparatus efor.* J. S. Beeman, London. Eng. Pat. 8600, cil 14, 1904.

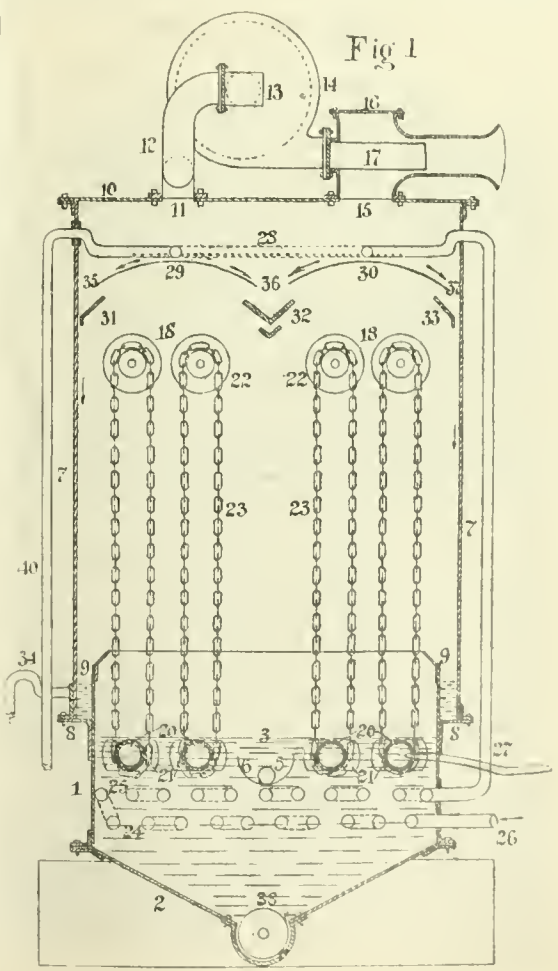
es are mounted so as to rotate in opposite directions. es overlap and are so adjusted that the distance their flat sides is just sufficient to cause a thin the material to be dried to form between them. erial, which may be fed on to the discs by any means, also forms a "curtain" or connecting een the discs. To facilitate drying, the surface ilm may be broken up by a scraper. The dried l is removed by another adjustable scraper which brought into operation as required. The drying promoted by enclosing the apparatus in a casing, which a current of air is caused to flow.—W. H. C.

*Solid Materials or Crucibles, Pans, Retorts, the like, containing Solid or Liquid Materials, Gas; Impts. in* —, L. C. Reece, London. g. Pat. 10,094, May 3, 1904.

ssel to be heated is supported on perforated bricks as in the furnace and surrounded by broken refrac- terial, leaving sufficient space between the pieces utter, to allow room for the gas and air to enter and und for the products of combustion to escape. gs are left in the furnace casing for the gas-supply e, the waste-gas flue and for the introduction and t of the crucible or other vessel to be heated. nace casing is surrounded by an annular jacket, which the air necessary for combustion may ed in order to preheat it.—W. H. C.

*Vaporising Apparatus; Impts. in* —, L. E. Vial, Brussels. Eng. Pat. 28,424, Dec. 27, 1904.

The liquid to be evaporated is fed into the tank 1 by the pipe 5, in the trough 6, and the upper layers only are



heated by the steam-pipes 20, provided with the wings 21, and round which the chains 23, are moved by the rollers 18, provided with flanges 22, and actuated from without the vessel. These chains serve to expose a large surface of the hot liquid, so that evaporation takes place easily. The lower portion of the liquid in the tank 1 is cooled by water which circulates through the pipes 26, 24, 25, and then passes by 27 to the perforated pipe 28. The water issuing from 28 falls on to the curved plates 29 and to the troughs 31, 32, and 33), and thence to the inner surfaces of the sides of the tank 7, which may be covered with metallic gauze, down which the water flows. This water serves to condense the vapour, and so maintain a partial vacuum within the apparatus. The water and condensed vapour collect in the trough 9 and flow away through the siphon 34. Any uncondensed vapour is removed through the pipes 11, 12, and 15 by the exhaustor 13, 14 and by the ejector 16, 17, actuated by the vapour delivered by the exhaustor 14. Any solids deposited during the evaporation are carried by the conveyor 28 to an outer trough from which they can be removed. Claim is made for the acceleration of the vaporisation by the partial condensation, caused by the water flowing down the sides, and for operating the ejector by the vapour from the exhaustor.—W. H. C.

#### FRENCH PATENT.

*Evaporating Apparatus; Impts. in* —. S. M. Lillie. Fr. Pat. 348,686, Nov. 26, 1904.

SEE U.S. Pat. 777,114 of 1904; this J., 1905, 78.—T. F. B.

## II.—FUEL, GAS & LIGHT.

*Gas Plant for Methane-Hydrogen at Truro* —. J. Gas Lighting, 1905, 90, 225—228.

THE plant which is capable of producing 200,000 cb. ft. of methane-hydrogen gas per 24 hours comprises an upright generator 6 ft. diam. by 20 ft. high, condenser-scrubbers, with exhausters, blowers, pumps, and engines in duplicate, station meter, relief holder, mixing meter and benzol carburettor. The generator is filled with coke and then blown up to incandescence, the waste-gas escaping part of the way up the generator to the stack pipe, so that the fuel above is dried and heated before it comes down into the hot zone, and also serves to filter out the finely divided carbon produced during the "run." When the requisite temperature has been attained, the valves are altered and steam and tar are injected into the body of incandescent fuel. The tar is decomposed into carbon and gaseous products, the steam combining with the coke and separated carbon to produce water-gas. A further quantity of steam, injected at the bottom of the generator serves to produce "straight" water-gas which passes away with the gas produced by the mixture of tar and steam. One gallon of tar and 28 lb. of coke will yield 1000 cb. ft. of gas of the following composition:—Hydrogen 58.7 per cent.; methane 10.0; unsaturated hydrocarbons 1.3; carbon monoxide 20.0; nitrogen, carbon dioxide; sulphuretted hydrogen, &c., 10.0 per cent. The gas has a calorific value of from 350 to 400 B.T.U. and is mixed with ordinary coal gas in the foul main, where it takes up a considerable quantity of illuminants from the hot tar. With coal-gas of 15 candle illuminating power, a mixture containing 20 per cent. of methane-hydrogen requires no further enrichment, whilst with 30 per cent. and 50 per cent., one-fifth and one-third gals. of 90 per cent. benzol will bring up the illuminating power of the mixture to 15 candles. The methane-hydrogen is said to take up the enriching benzol better, and to retain it in a gaseous form more perfectly, than ordinary water-gas. The cost per 1000 cubic ft. is given as:—Fuel (at 15s. per ton) 3.38 pence, labour 0.79 pence, tar (at 1d. per gal.) 0.27 pence, benzol (at 1s. per gal.) 3.48 pence, and boiler 1.0 pence, making a total of 8.92 pence.—W. H. C.

*Oils for Safety Lamps; Notes on* —. G. P. Lish. Trans. North Eng. Inst. Mining and Mech. Engin. 1905, 55, 136—138.

PATENT safety-lamp oils are mixtures of fatty oils varying proportions of the distillate from petro which passes over just before the lubricating oil. distillate is termed "mineral colza." It has a flash point of 240 to 260° F. (Pensky-Martens' close test a sp. gr. of 0.830. The flashing-points of patent safety-lamp oils range from 250° to 290° F., and are frequently about 270° F. In testing the burning qualities of different oils, 50 grms. of the respective samples were placed in the bottom of safety-lamps and burnt in a photometer, wicks being regulated so as to give a constant light of 0.4 candle power. After six hours, the residual oil was weighed, the difference between the weight and the original weight giving the quantity of oil consumed. Determinations with a patent safety-lamp oil, of 21.7 grms. of oil were consumed, the average being Colza oil burned very badly, and the quantity consumed was 22.8 grms. Cottonseed oil has a tendency to lead to charring of the wick at the top; amount consumed was 22.3 grms. Seal and white were no better, though niger-seed oil gave slightly satisfactory results. Speaking generally, no one oil showed any pronounced superiority in illuminating power, and price must therefore be the chief factor in selection. As regards the mineral oils, the American petroleum distillate already referred to, was found to be the best, showing a consumption of 18.7 grms., the light burnt steadily with a low wick, and for the time was above 0.4 candle-power. This experiment contradicts the assertions of certain dealers that it is a larger consumption of oil when the petroleum distillate is used alone. In the author's opinion, there are many pits where a safety lamp oil with a flash point of 270° F. might be safely replaced by a "mineral colza" flashing at 250° to 252° F.; and when a flashing-point is essential it should be obtained by the addition of fatty oils. Experiments were also made with mixtures of cotton-seed oil and the petroleum distillate. A mixture of cotton-seed oil and petroleum distillate containing 75 per cent. of the latter was satisfactory. It flashed at 256° F., and showed a consumption of 19.1 grms. in the burning test. The backs of cotton-seed oil, viz., slight charring of the wick and separation of stearin in cold weather, can be avoided by the use of some rape-seed oil if the price per gallon is not too high.—C. A.

#### ENGLISH PATENTS.

*Gas Generators; Impts. in Producer* —. H. G. and C. H. Schill, Hyde, Cheshire. Eng. Pat. 1,104, May 21, 1904.

THE apparatus consists of the usual metal vertical vessel lined with refractory material, and is provided at the top with a feeding-hole, and at the bottom with a vertical cavity for the reception of combustible material. The top of the case is provided with a device for evaporating water by direct contact with heated surfaces, consisting of a number of iron bars placed chequer-work and below them a similar chequer-work of brick. An air-inlet fitted with a non-return valve communicates through the annular space formed between the metal case and the refractory lining, with the interior of the apparatus. To use the apparatus, a fire is lighted and the steam-raising device allowed to become hot, the products of combustion being drawn off through a chimney. The chimney draught is then cut off by means of a valve, and water admitted at a slight pressure to the hot chequer-work. The steam thus generated is forced through the incandescent fuel, and the gaseous products pass out at the bottom of the apparatus through a non-return valve to a gas-holder. When the gas-holder is full, the water supply is cut off and the chimney valve automatically opened; the draught thus created sucks in air, which becomes heated in passing down the annular space, and renews the combustion of the fuel, the products of combustion heating the steam-raising device. The chi-



is then again closed, and water admitted to generate steam.—L. F. G.

*Apparatus for Subjecting Gases or Vapours to the action of Liquids or Liquid Agents or Vapours therefrom, especially applicable for Washing or Scrubbing, Enriching, Illuminating or other —, and for Recovery Purposes.* A. F. Browne and R. McKinlay, London. Eng. Pat. 16,427, July 25, 1904.

The apparatus consists of a casing of triangular section with a tank in its base to contain the "washing" liquid. A travelling reticular open-work or chain-diaphragm is stretched over rollers inside in such a way as to follow the contours of the chamber, and to dip into the liquid in the tank. The diaphragm is made to revolve by suitable means, and the gases to be purified are passed several times through it. A special form of elevator belt chain fitted with cups may also be mounted inside the chamber, to continuously wet the revolving diaphragm by discharging over it liquid raised from the tank.—L. F. G.

*Heating; Method of Treating [Drying] —.* A. Mathys, London. From J. Gayley, New York. U.S. Pat. 25,213, Nov. 19, 1904.

The apparatus used for heating purposes are freed from moisture by passing them over pipes or surfaces cooled by a refrigerant.—L. F. G.

*Purifiers; Impts. in —.* J. Hodge, Lostwithiel, Cornwall. Eng. Pat. 8492, April 13, 1904.

The object of the invention is the purification of gas by passing it through a layer of oxide, without increasing the back pressure in the retorts. An upright purifier is fitted with a series of grids, each composed of a stationary and a movable part. It is charged through a suitable hopper and, when working, the grids cover the cross-section of the purifier. For the discharge of the purifying material, the sliding part of the grids is horizontally moved under the stationary part, by means of screws passing through screw-threaded stuffing boxes in the outer wall of the purifier; the purifying material falls through, and is discharged at the bottom through a trap-door. When working, the gas-ways are formed by upright pieces attached to the grids. Revolvers fixed to a central shaft and provided with vertical vanes, keep the purifying material in a loose state. With a cylindrical purifier, the grids are arranged in separate sections, while with a square one, two circular sections are used.—R. L.

*Methods for Incandescent Lamps; Impts. in —.* E. A. Arrolan, London. From the General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 13,161, June 10, 1905.

Carbon, hydrocarbons, silica and other impurities are removed from filaments for incandescent lamps by the use of fluorine compounds, for example iodine pentafluoride. By treating the ordinary carbon filaments with this substance, the impurities are practically eliminated, while any remaining foreign matter is driven off during the exhaustion and heating of the filament.—R. L.

*Lamps; Electric Arc Lamp —.* The British Electric Lamp Co., London. From the General Electric Company, Schenectady, N.Y., U.S.A. Eng. Pat. 257, Jan. 5, 1905.

The electrodes are made by filling a thin metal tube with a powdered material in which are interspersed granules of refractory material. The powdered material may be zirconium or titanium, and the granules chromite or graphite oxide.—L. F. G.

#### UNITED STATES PATENTS.

*Artificial —; and Process of Making same.* Meeker, Rye, N.Y. U.S. Pat. 787,458, April 18, 1905.

The fuel is divided and graded fuel such as bituminous coal or lignite is moulded into briquettes, with the addition

of a suitable binding material, such as rosin or the like. The block is then strongly compressed and heated, at first to a temperature high enough to dry the briquette, and subsequently to a higher temperature, sufficient to liquefy and diffuse the rosin or similar body through the briquette. A pigment may be added to the binding material, and claim is made for: "A compressed, strongly-adherent briquet, approximately anhydrous, and of approximate maximum density."—W. H. C.

*Peat; Process for Treating [Drying] —.* W. T. Griffin, Limoges, France. U.S. Pat. 788,100, April 25, 1905.

The claim is for a process according to which peat is excavated in thin layers and conveyed to a screening station, where the extraneous matter is separated, and the peat passed to a draining station. After draining off the water, the peat is conveyed to a compressing station, and is then alternately heated to 190°–275° F., to cause the cells to burst, and suddenly chilled to prevent volatilisation of the oils or hydrocarbons.—L. F. G.

*Coking-Oven.* J. M. Sullivan, Assignor to the American Coal Converting Company, Chicago. U.S. Pat. 786,694, April 4, 1905.

The apparatus consists of a number of beehive ovens arranged in parallel series, the party-walls separating adjoining ovens being provided with passages controlled by dampers. A flue extends between the series of ovens, and has passages, also controlled by dampers, communicating with the individual ovens of the series. Means are provided for forcing air through this flue, to promote the draught through the ovens. By suitably arranging the dampers, alternate ovens in each series can be made to communicate with the flue through the adjoining ovens.—W. C. H.

*Gas-Producer.* W. O. Amsler, Assignor to the Amsler Engineering Co., Pittsburg, Pa. U.S. Pat. 785,929, March 28, 1905.

The producer consists of a vertical combustion chamber, provided with a series of poke-holes in the clinkering zone, and arranged above a circular water-sealed trough. A cylindrical apron of the same internal diameter as the combustion chamber is attached to the bottom of it, and extends below the level of the water in the trough, and has a series of openings, of sufficient size to allow of the removal of clinkers, arranged between the bottom of the combustion chamber and the level of the water. A stand-pipe of large area, with closed sides, rests on the bottom of the trough, and extends upwards, concentrically with the producer, to a height intermediate between the bottom of the combustion chamber and the level of the seal. This stand-pipe is connected through the apron with a fluid-supply pipe immediately above the water-seal. A conical hood, composed of non-perforated plates, is arranged over the stand-pipe, with a passage for fluid between them, and a smaller hood is similarly arranged just above the apex of the larger hood with a passage for fluid between the hoods.—W. C. H.

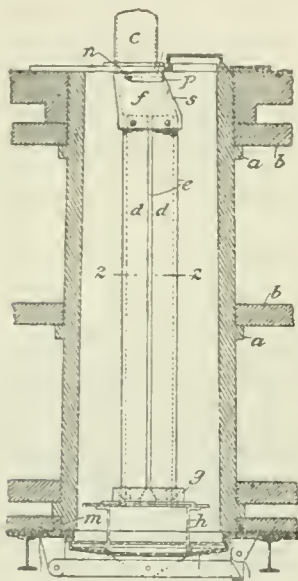
*Gas-Producer.* F. W. Johnstone, Mexico. U.S. Pat. 785,955, March 28, 1905.

The producer consists of a vertical fire-chamber, from the top of which an open-bottomed retort hangs, and extends more than half-way down into the chamber. The gas-discharge pipe leads from the top of the chamber. Fuel is supplied to the retort through a covered feed-hopper, provided with a grate and a poker-bar which passes through the cover and the gate. Fuel which passes out of the bottom of the retort into the surrounding fire-chamber space between the walls of the producer and the retort, is raised into the fire-chamber space by means of lifting-rods (pokers) inserted into the chamber through openings in the wall, provided with seat-blocks and joint-blocks fitted and movable in them. The lifting bars can be inserted on two levels. Tuyères pass through the lower portion of the wall of the fire-chamber, and are "recessed on their lower sides to form water-cups."—W. C. H.

*Gas-Producer; Suction* — H. F. Smith, Lexington, Ohio. U.S. Pat. 786,063, March 28, 1905.

AN arrangement for supplying steam and heated air to suction gas-producers, each proportioned to the load on the engine, and changing in time with the changes of the load. A weighted cylindrical vessel, mounted on knife-edges, is supplied with water to a constant level, and provided with an overflow, and with an outlet port controlled by a valve. The air-supply pipe is concentric with the water vessel, and contains an air-vane, connected with the vessel by a rod, also concentric with the vessel. As the air enters the pipe it moves the vane and tilts the water vessel so that a certain amount of water escapes through the valved outlet into the air-supply pipe. The air and water pass into a chamber, containing a number of discs, which are heated by arranging this vessel in the path of the exhaust from the engine, whereby the water is converted into steam and the air is heated.—W. C. H.

*Gas; Apparatus for Generating* — G. W. Parker, New York, N.Y. U.S. Pat. 787,539, April 18, 1905.



A COLLAPSIBLE tube *dd*, made up of a number of segments and having perforations through which the gas may pass, is suspended from the support *s*, in the centre of an approximately vertical retort, which tapers slightly towards the top. The tube is centred by means of the appliance *h*, which is attached to the bottom cover of the retort.

—W. H. C.

*Gas-Producer.* J. Reuleaux, Wilkesburg, Pa. Assignor to A. Laughlin, Sewickley, Pa. U.S. Pat. 788,378, April 25, 1905.

A GAS-PRODUCER with a water-sealed bottom is provided at the top with a dome-shaped air distributor, and surrounded by an air-heating chamber. A series of lateral branches connect the air-heating chamber to the air-distributor, and an air-flue extends from the latter centrally into the fuel. Water-sealed valves are provided for admitting air, and for drawing off the gases.

—L. F. G.

*Gas from Oils; Apparatus for Making* — N. G. Hock, Greeley, Col. U.S. Pat. 788,405, April 25, 1905.

THE apparatus consists of a number of horizontal retorts mounted at different elevations, their ends connected together by detachable elbows in such a manner as to

secure a flow of liquid through the whole length of retorts. Inside the upper retort is placed a horizontal pipe extending through it and with the corresponding detachable elbow, to convey material into the apparatus.

—L. F. G.

*Gas-Purifier* — A. Steinbart, Carlstadt, N.J. Pat. 787,593, April 18, 1905.

THE apparatus consists of two vessels connected at their upper ends. The gas is treated with a water-spray in the first vessel and then passes to the second vessel, in which are two horizontal partitions, united by a central vertical tube, this second vessel being open at the top and provided with a water supply at the bottom. In this vessel gas passes through a series of tubes, each provided with a core, around which is arranged a helical web; the tubes are disposed in a circle around the central tube and also connect the horizontal partitions.—W. H.

#### FRENCH PATENTS.

*Gas, Blast-furnace; Process for Heating Coke-ovens, and other Industrial Furnaces by means of* — J. Hulin. Fr. Pat. 348,402, Feb. 8, 1904.

THE process consists in dividing the blast-furnace gas into two portions, and using the first portion to heat the second, which is the combustible to be used for heating coke-ovens, &c. This preliminary heating may be effected either directly or indirectly through the medium of the gas, by the help of which the second portion is to be burned, or by combination of the two methods. The heated gas of the second portion is carried out in chambers constructed of refractory material.—W. C. H.

*Gas and Air; Process and Apparatus for Preparing Mixtures of* — Selas Ges. m.b. H. First Addition dated June 29, 1904, to Fr. Pat. 338,967, Aug. 19, 1904. SEE Eng. Pat. 16,288 of 1904; this J., 1904, 977.—T.

*Gas, Illuminating; Process and Apparatus for the Manufacture of* — with continuous admission of Coal Gas. Busse. Fr. Pat. 348,411, Dec. 1, 1904.

THE coal is introduced into the gasifying chamber in such a way as to be spread out in as thin a layer as possible on the inclined sides and on the bottom of the chamber. The gasifying chamber is wider at the top than the bottom, and is provided with inclined walls, and on the top are arranged a series of hoppers and grooved cylinders, by which the coal is fed in a thin layer on to the inner face of the inclined walls, which are strongly heated externally. The coal is removed by a mechanical pusher, the end doors of the chamber being opened for the purpose.—W. C. H.

*Gas for the Production of Motive Power; Process and Apparatus for the Manufacture of* — E. Fleischer. Fr. Pat. 348,748, Dec. 10, 1904.

SEE Eng. Pat. 26,770 of 1904; this J., 1905, 324.—T.

### III.—DESTRUCTIVE DISTILLATION OF TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

#### UNITED STATES PATENTS.

*Lubricants; Method of Manufacturing* — C. V. Vanderslice and J. E. Riley. U.S. Pat. 787,545, April 18, 1905. XII., page 552.

#### FRENCH PATENTS.

*Distillation of Exhausted Marc of Olives, and of Residues; Apparatus for* — P. Bernard. Fr. Pat. 348,983, March 1, 1904.

THE residues, or marc, after being extracted with oil



oride, are distilled over fire in an ordinary still, the products being collected in a receiver from which ions layers of immiscible distillates can be drawn different levels. The tar, which forms the lowest run into a second still heated by steam, and the from it are passed through a vessel containing re of chalk and sodium sulphate, which fixes the aid in the form of sodium acetate. The unabsorptions, which contain methyl alcohol, are passed in ordinary condenser.—M. J. S.

*m*: Solidification of —. V. E. F. Brun. First ion, dated Dec. 7, 1904, to Fr. Pat. 346,619, 29, 1904.

product, much harder than that obtainable g to the principal patent (see this J., 1905, 192), to be produced by incorporating with petroleum per cent. of soap and 2 to 6 per cent. of fat T. F. B.

## V.—COLOURING MATTERS AND DYE STUFFS.

and *Acacatechin*. A. G. Perkin. Chem. Soc. Proc., 1905, 21, 89–90.

ors catechin (from Gambier catechu)  $C_{15}H_{14}O_6$ , 175°–177° C., and not, as stated by Clauser (this 227) at 210° C. Acacatechin (from Acacia  $C_{15}H_{14}O_6 \cdot 3H_2O$ , loses one mol. of water when over sulphuric acid, whereas catechin,  $C_{15}H_{14}O_6$ , loses 3 mols. under these conditions. amethyl ethers of the two compounds both ratic acid and another substance, probably cinol dimethylether, when oxidised with potassium inate. Both catechins, also, when oxidised with ferrieyanide in the presence of an alkali acetate, new dyestuff, which dyes mordanted fabrics in own shades.—A. S.

### ENGLISH PATENTS.

*Acine Salts; Manufacture of* —. J. Y. Johnson, 1. From the Badische Anilin und Soda Fabrik., shafen on Rhine, Germany. Eng. Pat. 5,564, 16, 1905.

uct obtained by the action of an excess of aniline -acetic acid is heated further in a vacuum until ses to distil off. The phenylglycin produced, is lly converted into its anilide. Sufficient alkali e or carbonate is then added to liberate all the aniline, which is distilled off in a current of steam, phenylglycinanilide which remains, is saponified molecule of alkali hydroxide in an autoclave. t, the solution in aniline of the phenylglycin- ay be separated from the aqueous liquor con- ne alkali chloride, and saponified with 1 mol. hydroxide in an autoclave at 140° C.—E. F.

*Azo Colouring Matters; Manufacture of* —. Johnson. London. From the Badische Anilin da Fabrik. Ludwigshafen on Rhine, Germany. t. 5,861, March 20, 1905.

NO-1-CHLOROBENZENE-4-SULPHONIC acid is com- 1 mol. of a diazo-compound of the benzene or ne series. The most valuable results are by using the diazo-compounds from sulphanilic, and naphthionic acids, and from *m*-nitraniline. icts yield pure yellow to reddish-yellow shades rom an acid bath, which have a bright overhand e, and are very fast to acids. The dyestuffs t equalising power.—E. F.

*hylaniline and Derivatives thereof; Manufacture* . J. Y. Johnson, London. From Badische und Soda Fabrik. Ludwigshafen on Rhine, y. Eng. Pat. 13,956, June 20, 1904. Pat. 778,772 of 1904; this J., 1905, 84.—T.F.B.

### UNITED STATES PATENT.

[*Dyestuff*] *Anthracene Compound and Process of Making same*. R. H. Scholl and O. Bally, Mannheim. Assignors to Badische Anilin und Soda Fabrik. Ludwigshafen on Rhine, Germany. U.S. Pat. 787,859, April 18, 1905.

NEW anthracene compounds, called benzanthrone, are produced by condensing oxanthrol with glycerin in presence of sulphuric acid. On melting with alkali hydroxide these yield violet-blue dyestuffs which dye vegetable fibres substantively from a vat containing an alkali hydro-sulphite.—E. F.

### FRENCH PATENTS.

*Indoxyl [Indigo Dyestuffs] and Derivatives; Production of* —. Badische Anilin und Soda Fabrik. Fr. Pat. 348,980, Feb. 29, 1904.

INDOXYL, or its derivatives, are obtained by melting hydroxyethylaniline  $C_6H_5NHC_2H_4OH$ , or certain of its derivatives, with alkali hydroxides, alkaline earth hydroxides, alkali metals or their amides, or any other compound capable of decomposing water. The melts are heated to a temperature of 250°–290° C. The derivatives of hydroxyethylaniline which may also be used, are its alkali salts, homologues, carboxylic acids and derivatives alkylated in the amino-group, also dihydroxyethylaniline,  $C_6H_5N(C_2H_4OH)_2$ . For example, 137 kilos. of hydroxyethylaniline and 500 kilos. of potassium hydroxide are heated in an autoclave for one hour to 280°–290° C. On dissolving in water and blowing air through the solution, indigo is deposited (see also U.S. Pat. 772,775 of 1904; this J., 1904, 1084). —E. F.

*Dyestuff, Sulphide; Production of Yellow* —. Actien-Ges. f. Anilin-Fabr. Fr. Pat. 348,900, Dec. 6, 1904.

1-THIOCYANO-2,4-DIAMINO BENZENE, obtained by the action of potassium thiocyanate on 1-chloro-2,4-dinitrobenzene is heated with sulphur from 200° to 240° C. The product dyes unmordanted cotton in greenish-yellow shades, very fast to fulling.—E. F.

[*Anthracene Dyestuff*] *Product of the Anthracene Series; Production of a New* —. Farbenfabr. vorm. F. Bayer and Co. Fr. Pat. 348,926, Dec. 14, 1904.

ANTHRAQUINONE is transformed into 1-hydroxy-4-diazo-anthraquinone by treatment with nitrous acid in sulphuric acid solution in presence of mercury or mercury compounds, and with or without the presence of boric, arsenic or phosphoric acid, or of other compounds acting in a similar manner. This new product is converted into erythrohydroxyanthraquinone by treatment with alcohol or with other bodies acting on diazo compounds in the same manner, and into quinizarin by treating with concentrated sulphuric acid. For example, 10 kilos. of anthraquinone, 20 kilos. of sodium nitrite, 5 kilos. of crystallised boric acid, 2 kilos. of mercurous sulphate and 300 kilos. of sulphuric acid of 66° B. are heated from 120° to 150° C. until a sample is almost completely soluble in water. The melt is cooled, poured into 1000–1500 litres of ice-water, filtered from small quantities of insoluble matter, and the diazo solution so obtained, is heated with 500 litres of alcohol to from 60°–70° C. Nitrogen is evolved, and erythrohydroxyanthraquinone separates in yellow needles.—E. F.

[*Anthracene Dyestuffs*] *Anthraquinone and its Derivatives; Process for the introduction of Hydroxyl Groups into* —. Farbenfabriken vorm. F. Bayer and Co. Fr. Pat. 348,927, Dec. 14, 1904.

THE introduction of the hydroxyl groups into anthraquinone derivatives by heating with concentrated or weakly fuming sulphuric acid, in presence or absence of boric, phosphoric or arsenic acid, etc., is found to take place much more easily in presence of even very small quantities of mercury or selenium, or of their compounds. For example, 10 kilos. of Alizarin Bordeaux (1,2,5-tetrahydroxyanthraquinone) are dissolved in 200 kilos. of sulphuric acid of 66° B and heated to from 170°–180° C.

with the addition of 0.5 kilo. of selenious oxide ( $\text{SeO}_2$ ). In a short time 1,2,4,5,6,8-hexahydroxyanthraquinone is formed with intermediate formation of 1,2,4,5,8-pentahydroxyanthraquinone.—E. F.

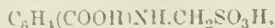
#### GERMAN PATENTS.

*Dyestuffs, Monoazo; Process for Preparing Blue* —. Badische Anilin und Soda Fabrik. Ger. Pat. 158,499, Dec. 19, 1902.

Azo dyestuffs which give fast indigo blue to greenish blue shades on wool, are obtained by combining the diazo derivative of 1,8-dinitro-4-naphthylamine with aliphyl derivatives of 1,8-naphthylaminesulphonic acid.—T. F. B.

*$\omega$ -Sulphomethylantranilic Acid; Process for Preparing* —. Badische Anilin und Soda Fabrik. Ger. Pat. 155,628, March 12, 1903.

$\omega$ -SULPHOMETHYLANTRANILIC ACID,



is produced by the action of sulphites or bisulphites on the product resulting from the condensation of equimolecular proportions of anthranilic acid and formaldehyde. For instance, a mixture of 137 parts of pure anthranilic acid and 80 parts of 40 per cent. formaldehyde solution is heated for a short time at  $50-60^\circ\text{C}$ . and the product is heated and stirred with a solution of 255 parts of sodium sulphite in 500 parts of water. The salts of the resulting acid are converted by metallic cyanides into  $\omega$ -cyanomethylantranilic acid.—T. F. B.

*Dyestuffs, Anthracene; Process for Preparing* —. Badische Anilin und Soda Fabrik. Ger. Pat. 155,572, Aug. 11, 1903. Addition to Ger. Pat. 154,337, Feb. 22, 1903.

POLYHYDROXYANTHRAQUINONESULPHONIC acids are heated with sulphonic acids of aromatic amines in presence of dehydrating agents. Twenty kilos. of polyhydroxyanthraquinonesulphonic acid, 40 kilos. of sodium sulphamate and 10 kilos. of phosphoric anhydride are heated in an autoclave for one hour at  $200^\circ-205^\circ\text{C}$ .; the product is poured into water, dissolved by heating, salted out, filtered and washed. The dyestuff dyes unmordanted wool bluish-red, chromed wool reddish-blue, and alumina-mordanted wool. violet shades.—T. F. B.

*Dyestuffs, Monoazo; Process for Preparing Yellowish-red* —, especially suitable for Producing Lakes, from Anthranilic Acid Alkyl Esters. Badische Anilin und Soda Fabrik. Ger. Pat. 154,871, Oct. 4, 1903.

The yellowish-red dyestuffs obtained by combining diazotised anthranilic esters with  $\beta$ -naphthol are suitable for the preparation of colour lakes, which are very fast to washing and light.—T. F. B.

*Dyestuffs, Monoazo; Process for Preparing* —. Chem. Fabr. vorm. Weiler ter Meer. Ger. Pat. 155,083, Feb. 20, 1903.

THE sulphonic acids of 1,2-aminonaphthol cannot be successfully diazotised in presence of mineral acids; by diazotising with neutral nitrite solutions, impure dyestuffs result. The acids may, however, be diazotised in presence of excess of organic acids such as acetic acid or oxalic acid. The dyestuffs obtained by combining the diazo compounds with  $\alpha$ - or  $\beta$ -naphthol, 1,5-aminophenol, &c., are of no technical value, but those obtained by combining with resorcinol in presence of excess of alkali hydroxide are of practical value; they dye wool red shades, converted to violet or violet-black on subsequent treatment with chromium salts, and to brown with iron salts. The 4- and 6-monosulphonic acids and the 4,6-disulphonic acid of 1,2-aminonaphthol may also be utilised for the production of such dyestuffs.—T. F. B.

*Glycollic Acids of Pyrogallol and its Alkyl Ethers; Process for Preparing the* —. Act.-Ges. f. Anilinfabr. Ger. Pat. 155,568, Feb. 27, 1903. XX., page 559.

*Dyestuffs of the Cyanine Series; Process for the Preparation of Sensitising* — [for Photographic Purposes]. Act.-Ges. f. Anilinfabr. Ger. Pat. 155,541, Jan. 1903. XX., page 561.

*Dyestuffs containing Nitrogen; Process for Preparing New* —. W. König. Ger. Pat. 155,782, June 3, 1903.

DYESTUFFS containing the pyridine nucleus are obtained by the action of a cyanogen halide on pyridine or primary or secondary aromatic amine, or derivative thereof in presence or absence of a solvent. One mol. of the cyanogen halide is used to 1 mol. of pyridine or 2 mols. of the amine. The dyestuffs obtained, are at to be practically pure, and to produce shades on wool silk which vary according to the amine used (e.g., orange, red, violet).—T. F. B.

*Dyestuffs, Disazo; Process for Preparing Primary* — from 2,5,7-Aminonaphtholsulphonic Acid. K. O. Ger. Pat. 155,740, Aug. 18, 1903. Addition to Ger. Pat. 151,332, March 14, 1903.

DYESTUFFS which give "Bordeaux" to violet shades on wool, transformed to brownish-black and to violet on subsequent chroming, are obtained by combining diazotised amino-compound with 2,5,7-aminonaphtholsulphonic acid, and then combining this dyestuff with diazotised chloro-derivative of  $o$ -aminophenol. following are mentioned as first components:—Sulphonic acid, chloro-metanilic acid,  $p$ -nitraniline- $o$ -sulphonic acid,  $p$ -toluidine- $m$ -sulphonic acid; and naphthionic acid. the following  $o$ -aminophenol derivatives may be used:  $p$ -chloro- $o$ -aminophenol,  $o$ - $p$ -dichloro- $o$ -aminophenol,  $p$ -chloro- $o$ -aminophenol- $o$ -sulphonic acid.—T. F. B.

*Anthrachrysonedialkyl Ethers [Anthracene Dyestuffs] Process for Preparing* —. Farbwerke vorm. Meister, Lucius and Brüning. Ger. Pat. 155,633, Dec. 23, 1902. Addition to Ger. Pat. 139,424, March 22, 1902.

NEGATIVELY substituted Anthrachrysones (dinitro-tetrabromonanthrachrysones) are heated with dialkyl sulphates. The dialkyl esters thus produced, are said of technical value, e.g., that from tetrabromonanthrachrysones gives blue dyestuffs when heated with aromatic amines.—T. F. B.

*Dyestuffs, Monoazo; Process of Preparing Yellowish-red* —. Farbwerke vorm. Meister, Lucius and Brüning. Ger. Pat. 158,148, Feb. 14, 1904.

THE diazo derivatives of  $\alpha$ -aminosalicylic acid and derivatives (e.g., nitro- or sulphonic acid derivatives) combined with derivatives of  $\beta$ -ketonealdehydes in which the aldehyde hydrogen atom has been replaced by alkyl, aliphyl, alkyloxy or aliphylamino radical. The dyestuffs produce pure yellow shades, fast on wool on cotton mordanted with chromium or copper salts.—T. F. B.

## V.—PREPARING, BLEACHING, DYING, PRINTING, AND FINISHING TEXTILE YARNS, AND FIBRES.

*Silk Mordanting*. G. H. Hurst. J. Soc. Dyers and Colourists, 1905, 21, 130—132.

THE decrease in lustre produced on treating silk with various mordants at elevated temperatures is found due to the surface of the fibre becoming covered with number of excrescences, due to the precipitation of mordant oxide on the fibre. The appearance of excrescences generally begins between  $140$  and  $150^\circ\text{C}$ . and then they appear on the surface of the fibre at higher temperatures, the deposit of oxide appears to penetrate further into the fibre, the appearance which then becomes quite "dead." Treatment with dilute mineral acid removes a portion of this deposit, but does not restore the lustre to the silk. Little or no diminution of lustre was produced by ordinary mordants between temperatures of  $70^\circ$  and  $120^\circ\text{C}$ . but the mordanting under such conditions is a less



ation, and the process is considered no better than the ordinary one of working at the ordinary temperature. Only mordant found to be applicable at temperatures  $\leq 150^{\circ}$  F. was chromium bisulphite; a treatment for 100 hours, at a temperature of  $180^{\circ}$ — $190^{\circ}$  F., was found to tann silk fully, and to produce only very slight decrease in strength. This treatment is stated to be especially applicable to mordanting in the case of Alizarin dyestuffs.

—T. F. B.

*Le Fibres; Relations between the Chemical Constitution and Dyeing Properties of —.* W. Suida. *Monatsh. f. Chem.*, 1905, 26, 413—427.

Assuming that cellulose is an alcoholic anhydride, any chemical activity which it may possess, is to be ascribed to the reactivity of the alcoholic hydroxyl groups. As these are numerous and are, moreover, situated in the molecule with oxygen atoms combined with hydrogen, they may conceivably have an acid character. The formation, apparently with acid hydrolysis of the molecule, of labile alkali compounds analogous to saccharates, supports this view. With a view of ascertaining their dyeing properties, acetyl and alkyl derivatives of cellulose were prepared. To this end, several lots of cotton yarn (containing 18 per cent. of ash), which had been freed from fatty matters, were heated with acetyl and benzoyl chloride, dimethyl sulphate and caustic soda, and alcohol (c.c.) and sulphuric acid (1 c.c.). The products, freed from acetyl chloride and benzoyl chloride contained approximately one acetyl radical per molecule of cellulose ( $\text{C}_{12}\text{H}_{20}\text{O}_5$ ), after being washed, were immersed, for 24 hours at the ordinary temperature, along with samples of the original cotton yarn and of gun-cotton (containing 12.1 per cent. of nitrogen), in dilute solutions of genta and Crystal Violet (basic dyestuffs), Bordeaux (a direct cotton dyestuff) and Azo Fuchsin B (an acid dyestuff), respectively. The results showed that the direct dyestuffs were absorbed freely and to the extent by cellulose and by its acyl and alkyl derivatives, the acid dyestuff did not dye in any instance. It thus appears that the activity of the hydroxyl groups in cellulose is so slight that the dyeing properties of the nucleus are uninfluenced by the conversion of the hydroxyl groups into acyl and alkoxyl groups, i.e., by their substitution.

Cotton acts energetically as a catalysing agent. When treated at the ordinary temperature with benzoyl chloride and caustic soda, the benzoyl chloride almost entirely disappears on agitating the mixture. An alkaline mixture, without the cotton, remains for some time almost entirely unchanged. An action, probably of similar nature, takes place when small quantities of cotton are immersed in succession in a dilute solution of genta, the cotton becoming dyed and the solution turning decolorised and giving, when tested with silver nitrate, a precipitate of silver chloride. In this case, the decolorisation or decomposition of the dyestuff-salt is probably due to the cotton, and may possibly take place within the vat. The decolorised solution was found to be precipitated, but this, it is considered, may be due to the siliceous matters present in the cotton employed in the experiment.

Small quantities of purified wool were treated with acetyl chloride, acetic anhydride, ethyl bromide, and the water-bath for an hour with a mixture of 1 (200 c.c.) and sulphuric acid (1 c.c.), respectively, being washed successively with alcohol and the various lots were treated for a quarter of an hour at  $90^{\circ}$  C., with solutions of the basic and acid dyestuffs mentioned above, samples of the wool in its unchanged state being submitted to the same tests, for comparison. Acetylated and acylated samples were thus found to be slightly tinted, while the wool in its original state was strongly dyed, by the basic dyestuffs. On the other hand, the treated wool was coloured a deep crimson and untreated wool merely faintly stained by the acid dyestuffs. Both acid and basic dyestuffs dyed in deep shades of red wool which had been boiled in dilute sulphuric acid (200) and then well washed. On heating the acetylated wool on the water-bath with a solution

of ammonium carbonate, the original properties of the wool were restored. In view of this fact, it is considered unlikely that there is any formation of an anhydride by the acylating and acylating reagents employed. It is probable that these act primarily upon the carboxyl-group, and secondarily upon the amino-group, with the production in the latter case of a salt or analogous compound. A salt is doubtless formed by the action of aqueous sulphuric acid.

No change could be detected in the microscopic appearance of the fibre after treating it with the reagents mentioned.

*Silk.*—Considering the close resemblance in properties between wool and silk, it is remarkable that the dyeing properties of the latter fibre are unaffected by treating it with the acylating reagents which were applied to the wool. On heating silk, however, with alcoholic sulphuric acid, it becomes changed in the same manner as wool. It is then dyed strongly from a neutral bath by acid, and but faintly coloured by basic dyestuffs, while, in its natural condition, silk is dyed feebly by the first and strongly by the second of these, under comparable conditions.

*Theory of Dyeing.*—The results obtained would appear to show that, in the case of wool and silk, dyeing with non-mordant dyestuffs is a simple chemical action.—E. B.

*Potassium Ferricyanide; Action of Ammonium Chloride on —.* J. Matschek, VII., page 544.

#### ENGLISH PATENTS.

*Silk, Horschair, Ribbon or Straw; Process of and Apparatus for the Manufacture of Artificial —.* L. Crespin, Paris. Eng. Pat. 27,565, Dec. 17, 1904. Under Int. Conv., April 11, 1904.

SEE Fr. Pat. 342,077 of 1904; this J., 1904, 899.—T. F. B.

*Yarns and Fabrics; Machine for the Bleaching of —.* M. Muntadas y Rovira, Barcelona. Eng. Pat. 13,867, June 18, 1904. Under Int. Conv., June 18, 1903. (See this J., 1903, 1042).—A. B. S.

*Yarn and Slubbing; Machine for Dyeing —.* S. S. Partridge, Kidderminster. Eng. Pat. 8570, April 14, 1904.

The yarn or slubbing is carried on a horizontal framework suspended from a beam placed above the dye-vat and extending the whole length of the latter. To the ends of this beam are fixed slides projecting downwards, and which can move vertically in guides placed outside the vat. Each of these slides has a small roller at its lower end, which rests on a cross lever, and these levers are moved up and down by a suitable mechanism, thus causing the framework to move up and down in the dye-vat. The whole moving frame is partly counterpoised by weights. To each end of the horizontal yarn-frame is fixed a large ratchet wheel which gears with a ratchet on the side of the vat. As the frame rises and falls, these come into gear and so cause the frame to revolve on its axle a certain distance, which can be regulated by adjusting the ratchets. The poles which support the yarn are revolved individually by gear wheels or other suitable mechanism, and the whole framework can be lifted bodily out of the vat by means of an overhead pulley.—A. B. S.

*Alizarin-Red; Dyeing Cotton in the Form of Cops, Spools &c. in —.* J. Dolder, Esslingen, Switzerland. Eng. Pat. 13,484, June 14, 1904.

COTTON yarns (100 kilos.) in the form of cops and cross spools, after being mordanted with oil and alumina, are dyed in red from a bath containing alizarin (12.75 kilos. of the 20 per cent. paste), dissolved by means of strontium saccharate,  $\text{C}_{12}\text{H}_{20}(\text{SrOH})_2\text{O}_{11}$  (1.075 kilos.). The yarns, it is stated, are very uniformly dyed, and the colour obtained is, in fastness and brilliancy of shade, equal to the dye produced in other ways.—E. B.

*Indigo; Printing with — on Vegetable Fibre.* J. Y. Johnson, London. From The Badische Anilin- und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 6495, March 27, 1905.

INSTEAD of a solution of glucose, a solution of maltose is

employed in padding tissues before printing them with an alkaline indigo mixture. The maltose may be economically prepared from inferior starch products, e.g., rice refuse.—E. B.

*Yarns; Dressing or Sizing — [with Soluble Starch].* W. Möller-Holtkamp, München-Gladbach, Germany. Eng. Pat. 16,105, July 20, 1904.

A MIXTURE of "potato flour" (50 lb.) and water (100 galls.) is heated until it thickens. A solution of bleaching powder (28 oz. of a 10 per cent. solution) is then added, and the whole is boiled until the smell of chlorine disappears and the mass becomes thin and clear, when it is ready for use in sizing yarns.—E. B.

#### UNITED STATES PATENTS.

*Wool; Treating Sheep's —.* A. Kann, Heidelberg, Germany. U.S. Pat. 787,923, April 25, 1905.

SEE Eng. Pat. 3492 of 1903; this J., 1903, 904.—T. F. B.

*Skein-Dyeing Machine.* W. H. Fletcher, Paterson, N.J., U.S.A. U.S. Pat. 787,285, April 11, 1905.

TWO endless chains, operated by sprocket-wheels attached to suitable driving mechanism, convey holders upon which hanks of yarn are placed, above and along a dye-vessel. The holders have forked and recessed ends, into which projections from the links of the chains fit, and are in places roughened or provided with teeth, to cause them to revolve as they are brought into contact with racks or ledges fixed at the top of the dye-vessel, the hanks being thus moved round the holders as they pass through the dye-liquor contained in the vessel.—E. B.

#### FRENCH PATENTS.

*Tissue Printing; Process of —.* C. Walker. Fr. Pat. 348,436, Feb. 9, 1904.

DESIGNS are printed upon one side of a tissue in such a manner as to penetrate more or less through the tissue. They are then attenuated on, or altogether effaced from, the side of the tissue to which they have been applied, being left on the other side, which is, or now becomes, the face of the tissue, with a softness and delicacy of appearance greater, it is stated, than it is possible to produce by direct printing.—E. B.

*Tissue Printing; Process of —.* C. Walker. Fr. Pat. 348,437, Feb. 9, 1904.

IN printing designs upon tissues by means of two or more rollers, the colour printed by each roller, except the last of the set, is pressed into the tissue by the rollers which subsequently operate, with the result that the colour applied by the last roller of a set appears, as a rule, less distinctly at the back of the tissue than the colours printed by the other rollers, the difference being especially noticeable in the case of raised tissues. To obviate this and, at the same time, to produce novel effects, a colour is printed on the back of the tissue by a roller upon which the whole of the design is engraved, the parts corresponding with those printed by the last roller of the set being engraved upon it in the ordinary manner, and the other parts being engraved in parallel lines, nearer to or further away from one another according to the degree to which the colour applied to the back of the tissue requires to be pressed, to meet the colours printed upon the face in the corresponding parts of the design.—E. B.

*Tissues [Pile Fabrics]; Process for Decorating —.* F. Prud'homme and J. Chardonnal. Fr. Pat. 348,616, Feb. 9, 1904.

BRUSHES, mounted so as to rotate upon vertical axes and to move vertically and horizontally, are supplied with colour-mixtures or with sizing or other materials, which they apply to tissues passed, at full width underneath and in contact with them, either in a continuous manner or intermittently. The tissues are, in the latter case, drawn forward while the brushes are raised, and are held

stationary when the brushes are lowered and put in operation. Stencils may be interposed between the tissues and the brushes to vary the effects produced.—E. B.

#### GERMAN PATENT.

*Dyestuffs, Azo; Process for the Production of Insoluble Red-brown — on the Fibre.* Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 155,903, Dec. 5, 1903.

VERY fast reddish-brown shades are produced by impregnating fabrics with  $\beta$ -naphthol, and then immersing in a bath of diazotised *p*-nitrobenzene-*o*-toluidine. The diazotisation may be carried out at a temperature of 15°–20° C. By substituting  $\alpha$ -naphthol or a mixture of the two naphthols for  $\beta$ -naphthol, deep purple shades are produced.—T. F. B.

#### VII.—ACIDS, ALKALIS, AND SALTS

*Potassium Chlorate and Hydrochloric Acid, Acceleration of the Reaction between — by Platinum.* H. Z. Elektrochem., 1905, 11, 261–263.

THE reaction between chlorates and hydrochloric acid takes place in two stages; the first is the slow reaction  $\text{ClO}_3' + 2\text{H}^+ + 2\text{Cl}' = \text{ClO}' + 2\text{HClO}$ , and in the second the hypochlorous acid thus formed immediately reacts with hydrochloric acid to form chlorine and water. The author enclosed normal solutions of thrice recrystallised potassium chlorate with twice the volume of N-hydrochloric acid in sealed tubes, which were heated in benzene for three hours to from 60°–70° C. The chlorate 2 c.c. of the liquid was then titrated with sodium sulphate, and the gaseous chlorine formed was calculated by measuring the volume of the liquid and the air above it. Experiments were made side by side with and without added platinum. The addition of piece of platinum foil was found to increase the yield of chlorine by one-sixth, that of platinum black by two-fifths. Using a platinised platinum wire and keeping the solution agitated, the yield was doubled, whilst with platinum black, under agitation, a nearly six-fold increase was obtained. The author points out that the inverse reaction  $\text{ClO}' + 2\text{HClO} = 2\text{H}^+ + 2\text{Cl}' + \text{ClO}_3'$  should be significantly favoured in presence of platinum, which is of significance in regard to the electrolytic production of chlorates.—W. A.

*Potassium Ferrieyanide; Action of Ammonium Chloride on —.* J. Matschek. Chem.-Zeit., 1905, 29, 439–440.

POTASSIUM-AMMONIUM ferrieyanide which is used in aniline black printing was made by Schaller (Bull. Chim., 1864, 1, 275) by boiling a solution of potassium ferrieyanide with ammonium sulphate. The author substituted ammonium chloride for the sulphate with similar results, and obtained the best yield by dissolving 10 gms. of potassium ferrieyanide in 20 gms. of water on the water-bath, adding 4.86 gms. of ammonium chloride, and crystallising the solution. By boiling the solution for 12 hours, a Prussian blue containing ammonia is formed. The author explains this by the dissociation of ammonium chloride in aqueous solution; the acid thus set free reacts on the ferrieyanide with formation of Prussian blue, and the latter is partially decomposed by the free ammonia with production of ferric hydroxide, and Prussian blue containing ammonia.—R. L.

*Polysulphides; Study of the —.* F. W. Küster and F. Heberlein. Z. anorg. Chem., 1905, 43, 53–54, 1905, 43, 431–451.

FOR the experiments described, a solution of sodium polysulphide was prepared by passing hydrogen sulphide into a solution of pure sodium hydroxide. On adding a small amount of sulphur to the sodium sulphide solution, the sulphur is dissolved rapidly at first, but complete saturation is attained only after a long time, especially with the dilute solutions. In this respect, the preparation of a solution of sodium polysulphide resembles that of a solution of sodium polysulphide.



line in potassium iodide. Between 0° and 50° C. the solubility of sulphur in sodium sulphide solution is almost independent of the temperature, showing a very slight increase as the temperature rises. The amount of sulphur dissolved varies with the concentration of the sodium sulphide solution; it is greatest with a N/16 solution, in case of which the amount of sulphur in the saturated solution corresponds to the formula  $\text{Na}_2\text{S}_5 \cdot 24$ . It is probable the solutions do not contain definite individual compounds, but consist of a mixture of different poly-sulphides in a condition of equilibrium, of which the tetra-sulphide  $\text{Na}_2\text{S}_4$  is characterised by relatively great stability. Iodides and polysulphides are hydrolysed considerably in aqueous solution, the degree of hydrolysis diminishing only as the sulphur content increases. The authors regard the polysulphides as salts of complex acids of the type  $\text{H}_2\text{S}_x\text{S}_y$ , which have a structure similar to those of the complex iodo-hydriodic acids,  $\text{HI}_3$  and  $\text{HI}_4$ . Experiments in which the potentials of platinum and silver electrodes in sodium sulphide solutions containing small amounts of dissolved sulphur were measured, showed that such measurements afford an index of the degree of saturation of the solution. The results obtained confirm the conclusion drawn from the chemical experiments, that up to the formation of the tetrasulphide,  $\text{Na}_2\text{S}_4$ , the sulphur is firmly bound than that portion taken up subsequently.—A. S.

**Calcium Carbide; Existence of a —.** J. T. Nance. Chem. Soc. Proc., 1905, 21, 124.

The residue left after burning magnesium in carbon dioxide, or after heating magnesium with carbon or in air, giving carbon dioxide, be treated with water or dilute hydrochloric acid, a smell resembling that of geraniums is observed, owing to the presence of a hydrocarbon produced by the action of water on the residue. The author states that the gas produced by treating the residue left gently igniting a mixture of magnesium powder and powdered wood charcoal with dilute hydrochloric acid consisted mainly of hydrogen, but it also answered to various reactions of acetylene. He concludes that a calcium carbide is formed which does not interact with water so vigorously as calcium carbide.—A. S.

**Manganous Chromates.** M. Gröger. Z. anorg. Chem., 1905, 44, 453–468.

The author determined the composition of the precipitates obtained by treating a solution of manganous chloride with potassium chromate, potassium, and ammonium chromates under various conditions. The results obtained indicate that in cases soluble manganous chromate  $\text{MnCrO}_4$  is first formed, from which ultimately insoluble chromic manganite  $\text{Cr}_2\text{O}_3 \cdot 3\text{MnO}_2$  is formed, with separation of chromic acid. The extent of the transformation into the insoluble product increases with the time, the concentration of the solutions, and the temperature. Potassium chromate, when used in large excess and in highly concentrated solution, completely prevents the separation of manganite, owing to the formation of the soluble double salt  $\text{K}_2\text{Mn}(\text{CrO}_4)_2 \cdot 2\text{H}_2\text{O}$ . Under other conditions, the separation of the chromic manganite is prevented partially by ammonium chromate, but not by sodium chromate.—A. S.

**Ammonia; Formation of — from its Elements.** Haber and G. van Oordt. Z. anorg. Chem., 1903, 341–378.

The results of the experiments described in a former paper (this J., 1905, 131), the authors calculated the free energy of formation of ammonia, and deduced the following values for the amounts of ammonia contained in mixtures of hydrogen, nitrogen, and ammonia in equilibrium at various pressures, and at the temperatures given:— at 98.51° C., 327° C., 8.72; 627° C., 0.21; 927° C., 0.01; and 1020° C., 0.012 per cent. The figures show that in the synthesis of ammonia, in order to obtain a value of technical value, a catalyst is needed which will act satisfactorily at a temperature much above 300° C. Experiments with metallic

calcium showed that the reversible reaction  $\text{Ca}_3\text{N}_2 + 3\text{H}_2 \rightleftharpoons 3\text{CaH}_2 + \text{N}_2$  occurs readily at a red heat, and is associated with the reaction  $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ . Ammonia was formed in sufficient quantity to be detected by the action of hydrogen on calcium nitride, but not by the action of nitrogen on calcium hydride. The limits of temperature within which calcium nitride and hydride can be used as intermediate products in the synthesis of ammonia are, however, so high, that the production of considerable quantities of ammonia in this way is impossible. By alternately acting on manganese with nitrogen and hydrogen, manganese nitride can be formed and again reduced to metal. The dissociation of the manganese nitride is associated with the formation of ammonia from its elements. The limits of temperature within which manganese can be used as a catalyst, whilst lower than with calcium nitride, are, however, too high to allow of results of technical value being obtained.—A. S.

**Carbon Monoxide; Action of — on Ammonia.** H. Jackson and D. Northall-Laurie. Chem. Soc. Trans. 1905, 87, 433–434.

If a mixture of dry carbon monoxide and ammonia be heated in presence of platinum, subjected to the silent electric discharge or to electric sparking, or treated with a high frequency current, a reaction occurs, ammonium cyanate being formed according to the equation:—  $\text{CO} + 2\text{NH}_3 = \text{OCN} \cdot \text{NH}_4 + \text{H}_2$ . As the temperature rises, the ammonium cyanate is rapidly converted into carbamide. The best results were obtained by using a spiral of platinum wire sealed inside a glass bulb, and heated by the electric current. Contrary to the view generally held, which is based on Kuhlmann's results (Annalen, 1841, 38, 62), the amount of ammonium cyanide formed is small. Among the other products of the reaction detected were ammonium carbonate (formed by the action of water on the carbamide), methane and nitrogen. It was observed that the best yields of ammonium cyanate and carbamide are obtained with a heated spiral of platinum wire, heated platinised asbestos, and the ordinary spark from an induction coil, whilst the silent electric discharge and high frequency current favoured the production of complicated cyanogen compounds.—A. S.

**Hydrocyanic Acid; Phenolphthalein as a Reagent for —.** F. Weekuizin. XXIII., page 562.

**Ammonia; Electrolytic Oxidation of —.** E. Müller and F. Spitzer. XI. A., page 550.

**Sulphites; Oxidation of — by Iodine in Alkaline Solution.** R. H. Ashley. XXIII., page 561.

**Chlorine, Bromine and Iodine; Separation of — from one another in Mixtures of Chlorides, Bromides and Iodides.** O. Wentzki. XXIII., page 561.

**Potassium Permanganate in the Presence of Potassium Persulphate; Determination of —.** J. A. N. Friend. XXIII., page 561.

**Lead-Potassium Sulphate; Existence of a Definite —.** F. G. Belton. XXIII., page 561.

#### ENGLISH PATENTS.

**Ferrocyanides; Treatment of —, to obtain Hydrocyanic Acid.** A. G. Bloxam. London. From J. Teberniac, Freiburg, Germany. Eng. Pat. 12,634, June 3, 1904.

An alkali ferrocyanide is heated with sulphuric acid of "such concentration that it will neither produce carbon monoxide from the ferrocyanide nor give up much water when gently heated," and the heating is continued for as long as may be necessary to obtain the whole of the cyanogen as hydrocyanic acid. For example, a saturated solution of sodium ferrocyanide is heated with an excess of 20 per cent. sulphuric acid in a vessel provided with an inverted condenser, and a current of a non-oxidising gas, such as carbon dioxide, is passed continuously

through the system. (Compare Eng. Pats. 17,976 of 1902, and 17,449 of 1903; this J., 1903, 1045; and 1904, 714.)  
—E. S.

*Alumina and Alkali; Method of Production of — from Alkaline Silicates of Alumina, such as Leucite.* G. Levi, Rome. Eng. Pat. 13,875, June 18, 1904.

SEE Fr. Pat. 344,296 of 1904; this J., 1904, 1090.—T. F. B.

*Carbonic Acid; Recovery of — from Waste Gases.* H. H. Lake, London. From Chem.-Techn. Fabr. Dr. Alb. R. W. Brand und Co., Charlottenburg, Germany. Eng. Pat. 14,464, June 27, 1904.

SEE Fr. Pat. 344,744 of 1904; this J., 1904, 1215.—T. F. B.

#### UNITED STATES PATENTS.

*Alkali Cyanides; Process of Making —.* C. B. Jacobs, Port Chester, and R. A. Witherspoon and N. Thurlow, both of Niagara Falls, N.Y., Assignors to Cyanide Co., Jersey City, N.J. U.S. Pat. 787,380, April 18, 1905.

A MIXTURE of an alkaline earth cyanide (which may contain cyanamide) with an alkali carbonate, with or without carbon, is heated to redness. The product, after cooling, is lixiviated, and sodium bicarbonate is added to the solution, which is then filtered from the precipitate, concentrated, and cooled to 5° C. or under, to obtain a crystallisation of the alkali cyanide. The mother liquor is concentrated, to obtain another crop of the cyanide, which latter is added to a fresh quantity of lixiviated solution similarly obtained, and to be similarly treated.—E. S.

*Lead Hydroxide; Process of Converting Lead Sulphate into —.* A. S. Ramage, Detroit, Mich. U.S. Pat. 787,541, April 18, 1905.

LEAD sulphate is treated with a solution of an alkali hydroxide in excess; the lead hydroxide formed is separated, and the solution, still containing lead, is treated with another portion of lead sulphate, which precipitates a basic lead sulphate, and the precipitate and solution are treated with a solution of an alkali hydroxide, and the lead hydroxide precipitated is separated. The cycle of operations is repeated on successive portions of lead sulphate. (Compare U.S. Pat. 715,214 of 1902; this J., 1903, 36.)—E. S.

*Oxygen; Process of Obtaining — from Alkali Peroxide.* H. Foersterling and H. Philipp, Perth Amboy, N.J., Assignors to the Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 788,256, April 25, 1905.

A SOLIDIFIED, fused mass of an alkali peroxide is brought into contact with water, or "with any suitable liquid," to obtain oxygen gas.—E. S.

#### FRENCH PATENTS.

*Sulphuric Acid; Process and Arrangement for Leading to the Lead Chambers for the Manufacture of —, the Water required for the Reaction.* Soc. Anon. Ing. L. Vogel per la Fabbricazione dei Concimi Chimici. Fr. Pat. 348,769, Dec. 10, 1904.

THE usual arrangement of lead chambers with a Glover and a Gay Lussac tower is supplemented by another tower, into which a portion of the gases from the pyrites kiln is diverted, and in which the gases are exposed to a shower of water or of dilute sulphuric acid, the water vapour so produced being conveyed, with the accompanying gases, to the top of the lead chambers by a pipe from which vertical branches lead them downwards into the body of the chambers, thus making the direct injection of water or of steam from an independent boiler unnecessary.—E. S.

*Nitrates, Nitrites, Sulphonitrates or Sulphonitrites of Calcium, Sodium, or Potassium; Process of Making —.* J. Price. Fr. Pat. 348,670, Nov. 14, 1904.

SEE Eng. Pat. 24,297 of 1903; this J., 1905, 276.—T. F. B.

*Pyrites; Apparatus for Treating —.* W. B. Simo. Fr. Pat. 348,866, Nov. 22, 1904.

SEE U.S. Pat. 778,149 of 1904; this J., 1905, 90.—T. F. B.

*Soap; New Process of Preparing Soda [Sodium Bicarbonate] intended for the Manufacture of —.* C. Ferr. Fr. Pat. 348,708, 1904. XII., page 552.

#### VIII.—GLASS, POTTERY, AND ENAMELS

*Glass; Hardness of —.* A. Lecrenier. Bull. S. Chim. de Belg., 1905, 19, 16—28.

THE Herz-Auerbach method of expressing the absolute hardness of bodies as a function of the elastic limit within a sphere of the substance is pressed against a plane surface of the same material has given, in the case of glass, abnormal results which do not correspond with relative hardness as understood industrially. The author has devised a process for the determination of the hardness of glass based upon the relative resistance which the glass presents to the cutter's wheel. He employs a machine provided with a wheel of red sandstone which cuts facets in the glass under a constant pressure, and he notes the time required to cut away an equal volume of substance from different glasses of the same shape and size. The results obtained were totally at variance with the theoretical hardness calculated from the composition of glass by means of Auerbach's coefficients, but they were in more or less direct concordance with the coefficient of resistance of the various glasses to tensile and compressive strains. The cutting action of the wheel can, in fact, be regarded as a combination of compressive and tensile forces.

As regards the influence of the composition of the glass upon the hardness as thus determined, the author concludes:—In a general manner, the soda glasses are harder than the potash glasses containing equal proportions of silica (by volume). With the purely lime-soda glasses the hardness for the same proportion of silica increases with increase of the lime and decrease of the soda. Boric acid imparts great hardness to the glass. With glasses the introduction of soda or lime considerably increases the hardness.—J. F. B.

*Colours; Brown Pigments for Underglaze —.* Sprechsaal, 1905, 38, 557—559.

OWING to the high temperature and reducing atmosphere of the hard-porcelain kiln, it is difficult to obtain deep gradations of brown on the ware; but greater success is possible with stoneware or soft porcelain fired at about cone 10 in an oxidising atmosphere. As brown pigments the oxides of iron, chromium, aluminium, zinc are suitable, those of cobalt, manganese, nickel, antimony being also useful for certain purposes. However, to reduce their fusibility, it is necessary to use them in a form in which a trivalent oxide is combined with a divalent one, after the manner of spinel. Thus, a blackish-brown is obtained with 76.5 parts of chromic oxide and 23.5 of ferric oxide, the mixture being fired at a high temperature and in a reducing atmosphere. A perfect black is obtained on replacing one-half the ferric oxide by cobalt oxide, and firing under the same conditions. The addition to the first mixture, of 51 parts of alumina gives a reddish-brown, whilst doubling the ferric oxide and alumina in the latter recipe furnishes a more reddish tone. In both cases an oxidising fire, at the temperature of cone 10, is necessary. For lighter shades, alumina is unsuitable to replace chromic oxide, owing to its inferior capacity for combining with iron, the result being that the glaze attacks and fuses the pigment. On the other hand, chromic oxide can be almost completely deprived of its colouring power by zinc oxide, whilst leaving the faculty of resisting the glaze unimpaired. In this way, a light red-brown can be obtained from 38.3 parts of chromic oxide, 40 of ferric oxide and 40.5 of zinc oxide. A brighter shade is furnished by chromic oxide 23 parts, ferric oxide 32, alumina 3 and zinc oxide 40.5 parts. The pigment for yellowish-brown consists of chromic oxide 15.3 parts, ferric oxide 32, alumina 20.4 and zinc oxide 40.5 parts; whilst



v-brown is obtained with chromic oxide 15.3 parts, oxide 20, alumina 28 and zinc oxide 40.5 parts. Warm dark brown shades, manganese oxide is useful in combination with chromic oxide, e.g., 76.5 parts of the oxide to 114.5 of the former, the mixture being heated to high temperature. The same oxide may also be used in place of part of the ferric oxide in the black pigment mentioned, the mixture being fired in the porcelain kiln. Still darker brown shades are furnished by the addition of nickel oxide to the pigment mass: thus, 23 of chromic oxide, 32 of ferric oxide, 15.3 of alumina, 1.5 of zinc oxide and 10 of nickel oxide give a deep brown, fired at cone 10 in an oxidising atmosphere.

The foregoing mixtures are ground along with 50 per cent. of sherds, when intended for use on porcelain, with 15 per cent. of sherds and 10 per cent. of glaze for stoneware. A light yellow-brown may be produced by the aid of antimony oxide; but, owing to the tendency to liberate gas in the kiln, and thereby produce cracks in the glaze, the mixture, when prepared, must be fired with 33 per cent. of sherds and heated at the rate of cone 10 in an oxidising atmosphere. The result for a paler yellow-brown than that already given is compounded of: Chromic oxide 15.3 parts, ferric oxide 20, alumina 25.5, antimony oxide 7.2 and zinc oxide 40.5 parts.—C. S.

*Slip Body; Measuring Viscosity of* —. Simonis. *Sprecheaal*, 1905, 38, 597—601.

When the viscosity of slip body does not form a measure of the plasticity of the constituent clay, as is the case in the one property is accompanied by an augmentation of the other; and the measurement of the viscosity is of importance in connection with the influence of added bases, such as alkalis. The apparatus used for determinations consists of a graduated cylinder, 100 mm. high and 30 mm. internal diameter, with a nozzle 2 mm. in diameter. A narrow glass tube open at both ends, passes down through the upper hollow stopper of the cylinder, and is attached to an alcohol pointer, indicating on the scale the level of the end of the tube in the cylinder. The principle is that of the Mariotte bottle. The coefficient of fluidity is determined by dividing the volume escaping from the nozzle in a given time by the pressure recorded on the scale.

Testing the influence of caustic soda on slip body, a mixture composed of 40 grms. of fine Zettlitz kaolin and 100 of water was used. The action of the alkali increases at first, and then rapidly attains a maximum with 10 grms. of sodium hydrate. Caustic potash is less effective, and though the same maximum is reached, a concentrated solution of the alkali is necessary to obtain this result. By means of similar determinations it is possible to avoid adding to slip body for casting, excessive amount of saline matter that is likely to prove objectionable in later stages.—C. S.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

### ENGLISH PATENT.

*Treating* —, for Preserving and like purposes. B. Weed, Fayetteville, N.C., U.S.A. Eng. Pat. 29, Dec. 29, 1904.

Wood is subjected to the action "of a relatively non-e substance having a higher boiling point than some of the natural constituents of the wood," and is then, while admitted to the action of a solvent of the constituents removed, and is lastly again treated with a hot liquid of a higher boiling point than the solvent used. The wood thus prepared is ready for treatment with a preservative. The first bath may be of melted rosin, heated out 320° F., the solvent used may be gasoline; and the rosin may again be used, heated sufficiently to the gasoline from the pores of the wood. (Compare Eng. Pat. 4355, 1903; this J., 1903, 692.)—E. S.

### UNITED STATES PATENTS.

*Fire-Bricks, Crucibles, Retorts or other Refractory Articles; Process of Manufacturing* —. P. Klein, Riga, Russia. U.S. Pat. 787,770, April 18, 1905.

A MIXTURE of powdered chrome-ore from which easily fusible impurities have been removed, fire-clay, and pure aluminium hydroxide, with or without carbonaceous material, is moulded, pressed and burned.—A. S.

*Refractory Material; Method of Manufacturing* —. G. C. Glynn, Iola, Kans., Assignor to F. B. Smith. U.S. Pat. 788,131, April 25, 1905.

KAOLINITE is freed from moisture or uncombined water, pulverised, and then burnt in the presence of "free air" to eliminate organic and volatile impurities, and "to reduce the ferric compound to metallic iron." The heated mass, with or without the addition of a flux, is plunged into cold water; the disintegrated mass obtained is allowed to cool, moulded under high pressure, dried and burnt at a high temperature.—A. G. L.

*Refractory Material and Method of Making same.* G. C. Glynn, Iola, Kans., Assignor to F. B. Smith. U.S. Pat. 788,132, April 25, 1905.

THE refractory material consists of a mixture of one part of finely-divided aluminium, three parts of ferric oxide, and four parts of titanite iron ore containing about 60 per cent. of titanite oxide, together with a binding agent, such as a solution of ammonium chloride of acid reaction.—A. G. L.

*Cement-Kiln.* C. Ellis, Assignor to Eldred Process Co., both of New York, N.Y. U.S. Pat. 788,503, April 25, 1905.

A PAIR of long rotatory kilns are inclined so that the material in one kiln travels in a direction opposite to that of the flow of material in the other kiln. At the stack end of each kiln there is a heat regenerator, continuous or otherwise, and means are provided for passing air through this regenerator, as well as means for conveying the air pre-heated by its passage through the regenerator of one kiln into the juxtaposed fuel-feeding end of the other kiln.

—A. G. L.

### FRENCH PATENT.

*Cement; Artificial* —. E. L. Candlot. First Addition, dated Dec. 3, 1904, to Fr. Pat. 334,705 of Aug. 19, 1903 (this J., 1904, 116).

IN the cement described in the main patent, a certain proportion of the clay introduced may be replaced by ferric oxide. In one of the examples given, 5 parts each of ferric oxide and gypsum are added to a mixture of 20 parts of clay with 100 parts of chalk, and the burning of such a composition is stated to be effected with less consumption of fuel than when no iron oxide is added.—E. S.

### GERMAN PATENT.

*Wood; Process for Removing Juices and Air from, and for the Simultaneous Colouring of* —. P. Hampel. Ger. Pat. 158,103, Oct. 11, 1902.

THE wood is immersed in a bath of a fused metal or alloy having a relatively low melting point, such as tin, lead, antimony, bismuth, or alloys of these metals, in order to prepare it for subsequent treatment with a suitable impregnating liquid. It is stated that the juices and air contained in the wood are rapidly expelled, without burning or carbonisation taking place. During the treatment, the wood becomes dark-coloured. For the subsequent impregnation process, the use of linseed oil, cottonseed oil, or other fats or oils is recommended; the treated wood can then be employed as a substitute for vulcanite and other insulating materials.—A. S.

## X.—METALLURGY.

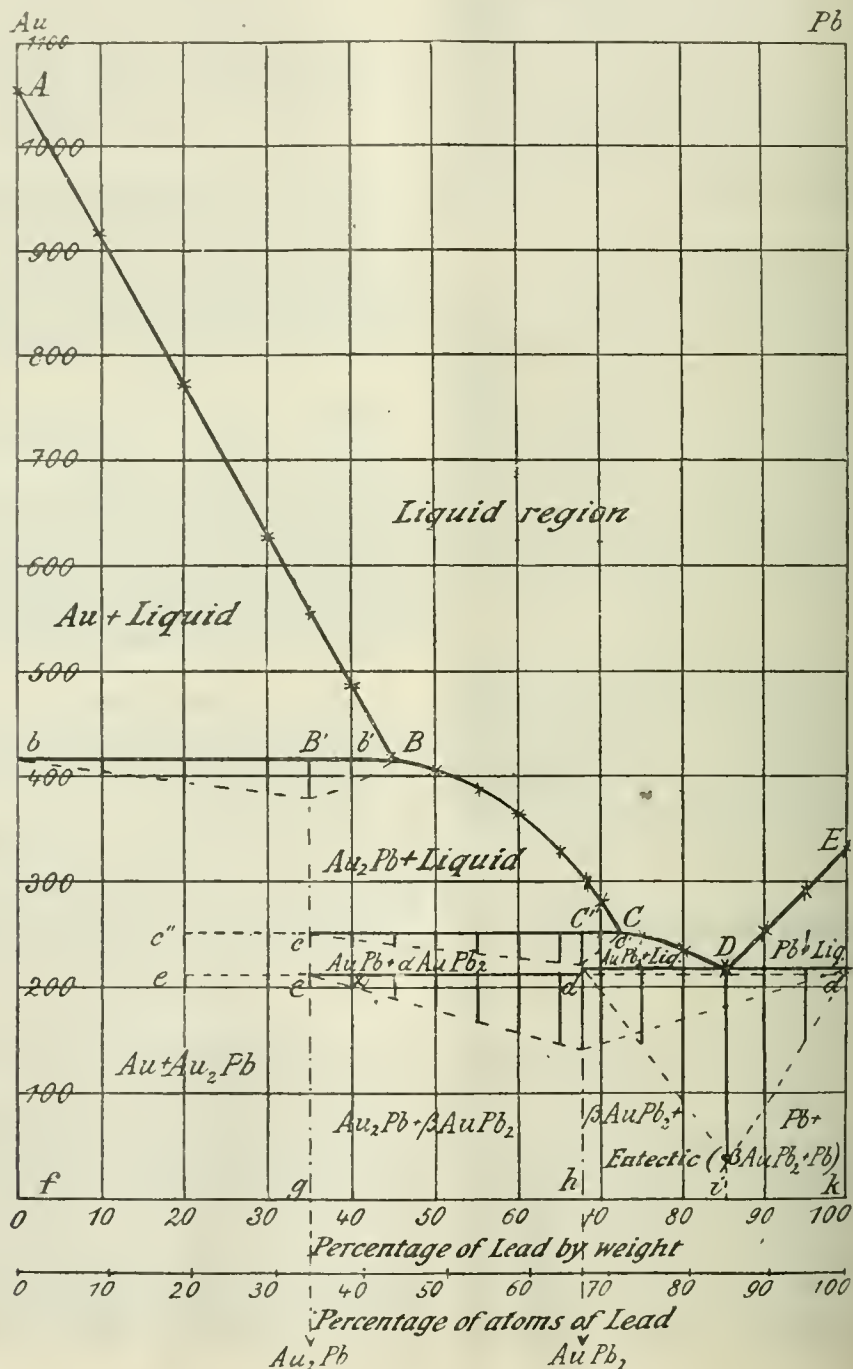
*Steel, Mild; Use of Cold-blown Pig-Iron in the Manufacture of —.* Geilenkirchen. Stahl u. Eisen, 1905, 25, 328—334; 407—410; 463—469.

THE subject is treated under the following headings:—  
(1) Cold-blown pig-iron in the process of refining by a blast of air; (a) hot blast in the converter process, (b) superheating of the pig-iron in the converter process, (c) economy of heat by reducing the proportion of nitrogen in the air-blast; (2) cold-blown pig-iron in the hearth-

smelting process: (a) preliminary heating of the flux (b) the Bertrand-Thiel process, (c) the continuous hearth smelting process, (d) the preliminary refining process (e) combinations of converter and Martin furnaces.—A

*Alloys of Gold and Lead.* R. Vogel. Z. anorg. Chem. 19 45, 11—23.

AN extended study by thermal and microscopic methods of alloys ranging by 5 per cent. differences from pure lead to pure gold. The results of the freezing-point determinations are all shown in the diagram. The compounds are indicated,  $Au_2Pb$ , which separates





presented in the region B'Ce of the diagram, and which separates as represented in C'Dd. The alloy undergoes at 211° C., a molecular change during the evolution of heat; the two forms are referred to in the diagram by the letters  $\alpha$  and  $\beta$ . Eutectic solidification occurs at 426°, 255°, and 215° C.; the reaction at 215° C. of the last eutectic is easily connected with the molecular change just mentioned, but the two are entirely distinct phenomena. The compound  $\text{Au}_2\text{Pb}$  forms large white rhombic crystals; it is exceedingly hard and brittle, and can be easily pulverised in mortar. The compound  $\text{AuPb}_3$  forms fine silver-needles, harder than lead and somewhat brittle, less so than  $\text{Au}_2\text{Pb}$ . Micrographic examination of various alloys confirms the results of the thermal analysis.—J. T. D.

*Metallurgy of —*. C. Goldschmidt. Chem.-Zeit., 1905, 29, 424.

The separation of metallic silver from silver sulphate is effected by roasting silver sulphide, the author recommends the use of sheet cobalt in place of copper and iron. Silver is separated partly in the amorphous and partly in the crystalline condition; and better yields are stated to be obtained.—A. S.

*Method of Determining — and its application to Metallurgical Products*. E. Campagne. (II., page 561.

#### ENGLISH PATENTS.

*Process for the Manufacture of —*. E. Fleischer, den-Strehlen, Germany. Eng. Pat. 12,785, June 1904.

Pat. 343,701 of 1904; this J., 1904, 1032.—T.F.B.

*and Steel; Treatment of — for the Hardening and Case-Hardening of the same*. H. H. Lake, London. Cyanid-Ges. m.b. H., Berlin. Eng. Pat. 16,412, 25, 1904.

Pat. 345,642 of 1904; this J., 1905, 32.—T.F.B.

*um, Cobalt, Copper, Nickel, Silver, Zinc, and like —; Process for Desulphurising and Oxidising — by Wet Method*. M. Malzac, Paris. Eng. Pat. 16,412, April 16, 1904. Under Int. Conv., May 6, 1903.

Pat. 332,596 of 1903; this J., 1903, 1247.—T.F.B.

#### UNITED STATES PATENTS.

*Cast Iron, and Steel; Process of Treating [Case-Hardening]*. J. Lecarme, Paris. U.S. Pat. 792,616, April 25, 1905.

Addition of Oct. 10, 1902, to Fr. Pat. 327,984 of this J., 1903, 1052.—T. F. B.

*Process of Roasting*. S. B. Patterson, -Phillipsburg, N.J. U.S. Pat. 787,540, April 18, 1905.

Of ore is continuously roasted within a receptacle, and the ore is intermittently fed in at the top. The subjected throughout its length to the action of steam, whilst at intervals steam at a lower temperature is injected into the lower layers of the ore. The roasted ore is intermittently withdrawn from the base of the body of ore.—E. S.

*concentration*. A. E. Cattermole, H. L. Sulman, H. F. Kirkpatrick-Picard, London. U.S. Pat. 792,616, April 25, 1905.

Pat. 17,109 of 1903; this J., 1904, 902.—T.F.B.

*Apparatus for the Treatment of —*. R. O. Reilly, Albuquerque, New Mexico, Assignor to T. J. Curran, Albuquerque. U.S. Pat. 788,330, April 25, 1905.

A water-jacketed smelting chamber is provided with air-chambers, sliding agitators, and a rotary distributor.—J. H. C.

*Filtering Cell for Separating Slimes in Ore Treatment*. G. A. Duncan, Deadwood, S.D. U.S. Pat. 787,736, April 18, 1905.

The filtering cell consists of a bag in which is disposed a frame, shorter than the bag, for keeping it extended. The frame consists of vertical spacing-bars at relatively short intervals, and top and bottom side-bars. Around the exterior of the bag are arranged vertical check-bars in pairs, the two bars of each pair being locked opposite each other on opposite sides of the bag. The corresponding ends of the two bars of each pair are received in slotted plates by means of which they are pressed against the upper and lower side-bars of the inner frame. The portion of the bag which extends above the frame is rolled around a rod. In the bottom bar of the frame, are nipples which extend through water-tight joints into the filtering bag, and are connected, below the cell, to an exhaust pipe and a supply pipe. Means are provided for exhausting the air from the interior of the cell.—A. S.

*Slimes; Process of Treating — in Ore Production*. G. A. Duncan, Deadwood, S.D. U.S. Pat. 787,878, April 18, 1905.

A FILTERING-CELL (see preceding abstract) is immersed in the slime-bearing liquor contained in a tank, and the air is exhausted from the interior of the cell, whereby the liquid is sucked through, and the slime accumulated on the outer surface of the filtering-bag. The accumulated slime is then successively treated with a solution capable of dissolving the metal or metals which it is desired to recover, and with a washing liquid, these liquids being introduced into the tank, and sucked through the slime into the filtering-cell. The residual slime is finally removed by forcing water into the interior of and out through the filtering-cell, and directing jets of water against the outer surface of the bag.—A. S.

*Furnace; Roasting —*. F. J. Falding, New York. U.S. Pat. 788,098, April 25, 1905.

The ore is carried through a series of superimposed hearths, having concentric openings, by means of a rotating central shaft and detachable stirring arms, which are hollow and cooled by a circulating fluid.

—J. H. C.

*Copper; Precipitating Process for —*. G. H. Waterbury, Denver, Colo., Assignor to the Waterbury Metals-Extraction Co., Spokane, Wash. U.S. Pat. 788,443, April 25, 1905.

The solution is placed in a tank containing pieces of aluminium of suitable shape, and agitated therein by means of air and steam.—J. H. C.

#### FRENCH PATENTS.

*Minerals; Process and Apparatus for Treating — with Fatty and Resinous Hydrocarbons and Sulphur*. Schwartz Ore Treating Co., Fr. Pat. 348,958, Nov. 12, 1904.

The powdered minerals—wet or dry—are mixed with the hydrocarbons, sulphur or sulphides, and strongly heated. Steam or gas and finally fine jets of water are forced through the mass whereby the sterile gangue is separated from the metallic particles which remain partly with the hydrocarbon and partly with the sulphur. A jacketed cylinder capable of being heated, and provided with tuyères and a movable bottom is employed for this process.

—J. H. C.

*Zinc Ores; Treatment of —*. E. Demenge. Fr. Pat. 348,733, Dec. 9, 1904.

The ores are smelted in a water-jacketed cupola furnace, using a strong blast. The volatilised lead and the precious metals are recovered in the metallic state. Zinc is volatilised and drawn off by a fan through a series of cooling and condensing chambers where it is deposited as oxide.

—J. H. C.

*Furnaces; Construction of —, for Roasting, Smelting, and similar purposes.* U. Wedge. Fr. Pat. 348,793, Dec. 12, 1904.

SEE U.S. Pat. 777,577 of 1904; this J., 1905, 93.—T. F. B.

*Metals; Extraction of — from their Ores.* J. Nicholas. Fr. Pat. 348,804, Dec. 13, 1904.

Zinc and cadmium are separated from the other metals by chlorination in a furnace, with subsequent lixiviation, and separated from each other by known methods. If the residues contain lead and the precious metals, they are suitably fluxed and reduced in a furnace; after re-smelting, aluminium is added, which on cooling forms a crust containing the precious metals. From the residues after pulverisation, other metals may be extracted by the action of nascent chlorine prepared in the ordinary way. Sulphur and sodium sulphate are recovered by known methods when present in sufficient quantities.—J. H. C.

*Sold, ring Metals, particularly Aluminium, Copper and its Alloys, Iron and Steel, Nickel and German Silver; Alloy for —.* A. G. Le Chatelier. Fr. Pat. 348,925, Dec. 14, 1904.

THE best results are obtained with an alloy of zinc and cadmium containing about 20 per cent. of zinc, but as little as 15 per cent. or as much as 30 per cent. of zinc will be found suitable in some cases. Occasionally a little lead is added. The alloys are prepared by adding the zinc to the cadmium while fused in a crucible.

—J. H. C.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A.)—ELECTRO-CHEMISTRY.

*Ammonia; Electrolytic Oxidation of —.* E. Müller and F. Spitzer. Ber., 1905, 38, 1188—1190. (See this J., 1905, 279 and 280.)

THE authors have shown that the conversion of  $\text{NO}_2$  ions to  $\text{NO}_3$  ions at the anode, when iron anodes are used, depends only on the concentration of hydroxyl ions, occurring with the greater facility as the amount of alkali around the anode is less; it is quite independent of the presence or absence of ammoniocupric ions, and Traube and Biltz are mistaken in attributing any influence to the catalytic effect of the ammoniocupric compound. This discovery of the authors led at once to the observation that the conditions least favourable to the action  $\text{NO}_2 \rightarrow \text{NO}_3$ , were also those most favourable to the action  $\text{NH}_3 \rightarrow \text{NO}_2$ ; but the influence of the ammoniocupric ion on this latter action has been thoroughly established by Traube and Biltz, to whom only the credit of the discovery is due.—J. T. D.

*Tantalum; Temperature Coefficient of Resistance of —.* F. Streintz. Z. Elektrochem. 1905, 11, 273—274.

IT is pointed out that the temperature coefficient, determined by W. von Bolton between  $0^\circ$  and  $100^\circ \text{C.}$  to be 0.3, per cent. (this J., 1905, 1400) in comparison with other metals in the same periodic series, agrees with the author's conclusion that the temperature coefficient increases with rising atomic weight.—R. S. H.

*Ceric Ammonium Nitrate; Electrolytic Preparation of —.* G. Planeher and G. Barbieri. XX., page 558.

*Molasses; Electrolytic Treatment of —.* H. Claassen. XVI., page 554.

### ENGLISH PATENTS.

*Meter; Electrolytic —.* S. H. Holden and Chamberlain and Hookham, Ltd., Birmingham. Eng. Pat. 13,223, June 11, 1904.

THIS invention relates to the type of meter in which the current is passed through an electrolyte, such as dilute sulphuric acid, and in which the loss of water by electrolysis is made a measure of the current passing through the meter. The vessel containing the electrolyte is

suspended from springs so as to form a spring balance, and by means of a rack and pinion, combined multiplying gear, the amount of electricity consumed is recorded on dials.—B. N.

*Fan or Exhauster; An Improved —, for the Electrolysis of Air or other Gases.* F. de Mare, Brussels. Eng. Pat. 20,630, Sept. 24, 1904. Under Int. Conv., Sept. 24, 1903.

THE fan is adapted to exhaust or compress a gas or vapour, and at the same time subject it to a high electric discharge. The casing, of insulating material, is made in two parts which are separated by a dielectric diaphragm, and within the casing a double series of lugs or wings are fixed on an insulated shaft, and are adapted to be rotated for exhausting and propelling air or gas. An electric current passes from one series of lugs to the other through the dielectric diaphragm during the passage of the gas through the fan.—B. N.

*Gases and Vapours; Apparatus Operating with Automatic Regulation for Submitting — to the Action of the Electric Arc.* O. Imray. From Soc. d'Etudes Electro-Chimiques, Geneva. Eng. Pat. 13,952, June 20, 1904.

THIS invention relates to an apparatus for effecting self-regulation of electric arcs operating in the presence of gases or vapours, and enables the arcs to be maintained at the requisite low tension without danger of extinction. A number of pairs of electrodes are arranged in series, the electrodes being made horn-shaped or any other shape which enables the arc to vary its length by rising or falling along the same with increased or diminished pressure, and each pair of electrodes is arranged within a vertical tube acting automatically as a draught chamber for the gas to be treated.—B. N.

### FRENCH PATENTS.

*Accumulator; Electric —.* T. A. Edison. Fr. Pat. 348,746, Dec. 10, 1904.

SEE Eng. Pat. 26,948 of 1904; this J., 1905, 280.—T. F. B.

*Furnaces, Electric —, for Provoking Reactions in Gaseous Bodies.* Badische Anilin und Soda Fabrik. Fr. Pat. 348,791, Dec. 12, 1904. Under Int. Conv., Jan. 12, 1904.

SEE Eng. Pat. 5688 of 1904; this J., 1905, 201.—T. F. B.

*Gum-Resins; [Electrical] Treatment of —, and Related Products ["Sylvine"].* A. Nodon. Fr. Pat. 348,746, Feb. 16, 1904. XIII. B., page 552.

*Alcohols, Aromatic, and their Derivatives; [Electro] Process for Manufacturing —.* C. Mettler. Fr. Pat. 348,951, Oct. 28, 1904. Under Int. Conv., July 15, 1904. XX., page 559.

### (B.)—ELECTRO-METALLURGY.

#### ENGLISH PATENTS.

*Metals; Apparatus for Electro-deposition of —.* King, Newark, N.J. Eng. Pat. 28,601, Dec. 28, 1904.

THIS invention relates to the forms of apparatus, in which the electro-deposition of metals, in which a revolving container is provided with openings for the circulation of electrolyte. The openings are made large so as to offer little resistance to the current, and in order to prevent the articles to be plated from dropping through these openings, an inner thin flexible diaphragm of cellulose, vulcanite, or similar material, provided with numerous fine holes, is made to conform to the inner contour of the container. The diaphragm may, if necessary, be made in sections to fit containers of any shape.—B. N.

*Galvanising, Tinning or otherwise Plating Wire and Metallic Bodies; Process of —.* G. A. Goettling, Minneapolis, U.S.A. Eng. Pat. 3798, Feb. 23, 1904. Under Int. Conv., June 9, 1904.

THE wire is brought into contact with molten plating



the surfaces of contact are "electrically excited," an electric current being passed through the metal to be plated and through an attenuated mass of plating metal which it is submerged.—R. S. H.

UNITED STATES PATENTS.

*Liquor; Utilising Spent* — A. S. Ramagc, Detroit, Mich. U.S. Pat. 788,064, April 25, 1905.

Iron dioxide is added to spent pickle liquor containing iron, and the liquor is electrolysed, an insoluble iron being used. Iron is deposited at the cathode, and sulphur dioxide is oxidised at the anode. The treated liquor is then again used in pickling iron.—U.S. Pat. 758,687, of May 3, 1904; this J., 1904, E. S.

*Galvanic Separation [Metal Deposition]; Method of* — J. A. Hoopes, Pittsburg, Pa. U.S. Pat. 788,315, April 25, 1905.

Preparation of an anhydrous salt of the metal in ammonium is electrolysed, the anode and cathode compartments of the cell being separated by a porous diaphragm. The solution is kept cold to prevent precipitation. Applications of the process to the separation of magnesium and to the refining of metals are described.—R. S. H.

FRENCH PATENT.

*Method of Treating Surfaces; [Electrolytic] Method and Apparatus* — T. A. Edison. Fr. Pat. 348,747, of April 10, 1904.

U.S. Pat. 26,947 of 1904; this J., 1905, 201.—T. F. B.

II.—FATTY OILS, FATS, WAXES, AND SOAP.

*Carbon Tetrachloride as a Solvent for Fats* — O. Brücke. Chem. Rev. Fett-u. Ind., 1905, 12, 100—102.

Carbon tetrachloride is now produced at a price that renders its being used extensively for the extraction of fats. The ordinary iron extraction apparatus used for extraction with petroleum spirit has proved quite unsuitable for the new solvent, and it has yet to be determined what is the most suitable material and mode of construction. The advantages offered by the extraction of fats with carbon tetrachloride are as follows: The solvent is superior in colour and odour, and will fetch about 100 per cent. more than the fat extracted with petroleum spirit, which always retains the smell of the solvent, whereas the odour of the carbon tetrachloride is completely expelled by means of steam. Moreover, petroleum spirit dissolves malodorous products of fat decomposition, which is stated not to be the case with carbon tetrachloride. It is further stated that no other compounds dissolve in carbon tetrachloride, owing to the lower temperature of extraction, the bones are better suited for the manufacture of soap, giving both a higher yield and a better product. The ordinary high premiums for fire insurance and the precautions against fire are obviated. There is a great saving in steam and cooling water. Experiments made on the large scale show that there is a saving of 5 to 6 kilos. of solvent on each 1000 kilos. of bones treated, which at the present price of carbon tetrachloride represents a loss of three to four marks.—C. A. M.

*Vegetable; Purification of* — C. Niegemann. Chem.-Zeit., 1905, 29, 465—466.

Allegem. Chem.-Zeit., 1905, 100) found that when vegetable oil was exposed to temperatures of 5° to 35° C., the separation of the whole of the proteid impurities that cause turbidity did not occur until after four weeks, but that exposure of from 24 hours to a few days at 4°—6° C. was sufficient for their complete separation, only a small proportion of the precipitated substances being redissolved

on heating the oil. He attributed the more general occurrence of turbidity in oils of late years to the more thorough grinding of the seeds, and to the expressed oil being sent out without having been stored. The author now finds that only a few minutes' exposure of oils to a low temperature is required for the complete separation of the impurities, and the purification can thus be carried out in one continuous operation, the long storage advocated being unnecessary. The temperature required to effect this result and that most suitable for the filtration of the oil must be separately determined for each individual oil. The occurrence of turbidity has hitherto not been of very frequent occurrence in edible oils owing to the latter being cold-drawn. The deposited impurities are only soluble again to a small extent in the case of such oils, including cold-drawn linseed oil, and this is the explanation of Benz's conclusion of the insolubility of the separated substances. Linseed oil that has been expressed at a moderately high temperature soon becomes turbid, and even after storage and filtration will still yield fresh deposits, whilst oil expressed at the usual temperature of 70° to 80° C. yields still more pronounced deposits. This is notably the case with oil as expressed in some works where the slimy residue from the filtration of the oil through the bags is mixed with a fresh portion of crushed seed, usually after preliminary heating, and again pressed. This is said to cause a large portion of the proteid impurities to be dissolved by the oil, for the substances that are deposited in oil obtained by hot expression, will dissolve again to a large extent. In large works using filter-presses, the conditions are more favourable, and the oil does not become turbid so readily. Benz confirmed the author's conclusion that the separated substances were of a pectinous and proteid nature. The composition of Thomson's deposit (this J., 1903, 1005) which contained 47.79 per cent. of ash and only 1 per cent. of nitrogen is attributed by the author to the washing with ether and petroleum spirit, in which about 80 per cent. of the proteid deposit from linseed oil is soluble. Moreover, the oil obtained by extracting linseed with these solvents contains a large proportion of proteid impurities.—C. A. M.

*Oleic Acid; Technical Separation of* — [from Solid Fatty Acids, by means of Petroleum Spirit and Alcohol. K. W. Charitschkoff. Chem. Rev. Fett-u. Harz-Ind., 1905, 12, 106—109.

FROM experiments on a small scale the author concludes that treatment of a mixture of oleic and solid fatty acids with petroleum spirit (sp. gr. 0.672) at 0° C., effects a fractionation of which the first fraction is a snowy white product of high melting point, whilst the final one is stated to be practically oleic acid with only a very small amount of solid fatty acids. Thus 155 grms. of the mixed fatty acids from a fat when treated in this way with 200 c.c. of the solvent gave a residue which was collected on a filter and washed with a smaller amount of petroleum spirit, thus being separated into two fractions (1) and (2). The original filtrate was evaporated and the residue treated with 100 c.c. of the solvent at 0° C., thus giving two fractions 3 and 4.

Fraction.	Weight.	Melting Point.	Solidification Point.	Iodine Value.
	Grms.	°C.	°C.	
1	18	58.0	57.0	—
2	9	39.5	38.5	90.0
3	35	46.8	45.6	80.1
4	51	30.8	30.2	90.1

In the author's opinion the first fraction was superior to that obtained by the ordinary method of separation by filter-presses. The solubility of pure stearic acid in petroleum spirit (of sp. gr. 0.672) at 0° C., was found to be 0.4 per cent. Its solubility in dilute alcohol (0.886 sp. gr.) at the same temperature was 0.11 per cent. Alcohol thus effects a more complete separation of the solid fatty acids, but unlike petroleum spirit, does not dissolve the

colouring matters. In practice therefore it is advisable to treat the fatty acids with alcohol first and then to remove the colour by a subsequent treatment with petroleum spirit.—C. A. M.

*Oil's for Safety Lamps; Notes on —.* G. P. Lishman. II., page 538.

*Butter; Detection of Coconut Fat in —.* Wauters. XXIII., page 562.

*Soaps; Determination of the Water and Free [Caustic] Alkali in —.* K. Braun. XXIII., page 563.

#### UNITED STATES PATENTS.

*Lubricants; Method of Manufacturing —.* G. W. Vanderslice, Clayton, N.J. and J. E. Riley, Trenton. Mo. U.S. Pat. 787,545, April 18, 1905.

A SUITABLE lubricating-oil is boiled, and whilst still hot, is treated with wood. The resin of the wood is extracted and is stated to combine with the oil.—W. H. C.

*Fatty Substances; Method of Cooling Melted —.* A. R. Wilson, Brighton, Assignor to A. E. Iveson, Gainsborough. U.S. Pat. 788,446, April 25, 1905.

SEE Eng. Pat. 25,868 of 1903; this J., 1904, 1153.—T.F.B.

*Soap, Antiseptic; and Process of Making same.* O. Liebknecht, Frankfort-on-the-Maine, Germany Assignor to Roessler and Hasslacher Chemical Co., New York, U.S. Pat. 787,776, April 18, 1905.

An antiseptic and cosmetic soap is prepared by melting ordinary household-soap, stirring the mass with zinc peroxide, and moulding the mixture into pieces of suitable shape and size.—A. S.

#### FRENCH PATENTS.

*Oil-seed Cakes and similar Residues; Apparatus for Distilling Exhausted —.* P. Bernard. Fr. Pat. 348,983, March 1, 1904. III., page 540.

*Oils and Greases or Machine Lubricants; Apparatus for Purifying Thick —.* C. A. Koellner. Fr. Pat. 348,880, Nov. 28, 1904.

SEE Eng. Pat. 22,238 of 1904; this J., 1904, 1226.—T. F. B.

*Gum-Resins; [Electrical] Treatment of —, and Residual Product ["Sylvine"].* A. Nodon. Fr. Pat. 348,653, Feb. 16, 1904. XIII. B., see next column.

*Soap; New Process of Preparing Soda [Sodium Bicarbonate] intended for the Manufacture of —.* C. Ferrier. Fr. Pat. 348,708, Dec. 9, 1904.

SODIUM bicarbonate as obtained in the first stage of the ordinary ammonia-soda process is applied directly in the manufacture of soap. The fat is heated in a closed boiler, to which the bicarbonate, mingled with sodium chloride solution, is added, the mixture being boiled. The carbon dioxide evolved is collected for use in the manufacture of fresh sodium bicarbonate. Finally, a small proportion of caustic soda is added to complete the saturation of the fatty acids, and to decompose any ammonium salts in the residual lye.—E. S.

#### GERMAN PATENT.

*Castor Oil in the Form of a Dry Powder [with Magnesia]; Process for Obtaining —.* D. Wasserzug. Ger. Pat. 156,999, April 3, 1903. XX., page 559.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

#### (A.)—PIGMENTS, PAINTS.

##### ENGLISH PATENT.

*Pigment; White —.* J. Giband and O. Baag, Houbout, France. Eng. Pat. 27,757, Dec. 19, 1904. U.S. Int. Conv., March 25, 1904.

SEE Fr. Pat. 341,539 of 1904; this J., 1904, 873.—T. B.

##### GERMAN PATENTS.

*Lake fast to Light [from Azo Dyestuff]; Process for preparing a —.* Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 154,668, May 16, 1903.

THE azo dyestuff prepared by combining tetrazobenzidine with 2 mols. of 2.6-naphthylaminesulphonic acid is precipitated on a suitable substratum in the manner. Unlike the corresponding lakes prepared with tolidine or with 2.7-naphthylaminesulphonic acid, the lakes resulting from the above dyestuff are quite fast to light.—T. F. B.

*Dyestuffs, Monazo; Process for Preparing Yellowish —, especially suitable for Producing Lakes, Anthranilic Acid Alkyl Esters.* Badische Anilin- und Soda Fabrik. Ger. Pat. 154,871, Oct. 4, 1904. IV., page 542.

#### (B.)—RESINS, VARNISHES.

*Copal Resin; Preparation of Artificial —.* C. H. Schmidt. Chem.-Zeit., 1905, 29, 444.

A GOOD substitute for Indian or Zanzibar copal is a resin prepared by mixing an excess of formaldehyde with monomethylaniline and hydrochloric acid. After standing in the cold, the resin is precipitated by sodium hydroxide and filtered off.—R. L.

*Turpentine Oil; Examination of —.* Utz. X. I. page 562.

##### ENGLISH PATENT.

*Linoleum and the like; Binding Medium [Cementing] —.* F. Suter, Berlin. Eng. Pat. 15,100, June 25, 1904.

SEE U.S. Pat. 774,286 of 1904; this J., 1904, 1154.—T. F. B.

##### FRENCH PATENT.

*Gum Resins; [Electrical] Treatment of —, and Residual Product ["Sylvine"].* A. Nodon. Fr. Pat. 348,653, Feb. 16, 1904.

THE gum-resins are mixed with potash or soda lye and the mixture is distilled, the heating being effected electrically. The charge is placed in an earthenware retort the bottom of which is covered with a sheet of iron plate, and a second layer of iron gauze is placed on the surface of the charge. A potential difference of 110 volts is maintained between the two metallic sheets. The turpentine obtained by this method is said to be superior in quantity and quality to that obtained by ordinary heating, and the residue in the retort, for which the name "Sylvine" is proposed, is said to be completely soluble in water and forms a serviceable soap.—M. J. S.

*Resinous Products; Apparatus for the Distillation of —.* G. Col. First Addition, dated Nov. 15, 1904, to Fr. Pat. 342,425, April 18, 1904 (this J., 1904, 943).

IN the present additional patent, claim is made for distilling the distillation apparatus described in the main patent.



vertical instead of in a horizontal position; and also use of a double-walled monteius provided inside screen, the surface of which is cleaned by a rotating The crude resinous matter is melted in the jus and then transferred by compressed air or the o the distillation apparatus, whilst the ligneous ities, &c., are held back by the screen.—A. S.

(C).—INDIA-RUBBER, Etc.

rubber; *Microscopic Examination of* ——. P. Breuil. Comptes rend., 1905, 140, 1142—1143.

tions of the rubber in carbon bisulphide or other were allowed to evaporate on microscopic slides. case of non-vulcanised rubbers containing sulphur, ld shows branching lines due to the sulphur, and al for the same rubber whatever may have been lvent. The same appearance is obtained when a n of sulphur in carbon bisulphide is slowly evapo- With vulcanised rubbers the sulphur appears to in centres from which lines radiate, to a greater as the temperature to which the rubber has been d is higher and has been longer maintained; these ng lines interlace with one another forming a kind work. Similar appearances are shown by the thin of rubber obtained by distinding bicycle air-tubes. r and ebonite surfaces, polished and etched by s, and examined by reflected light, also show a net- pearance; no doubt the lines are the same as those ad above, which have been attacked differently he rest of the surface. Gutta-percha under the ope shows a grauarul structure, the fineness and nity of which appears to be connected with the of the gutta-percha.—J. T. D.

ulber; *Swelling of* — in Carbon Bisulphide. itmar. Gummi-Zeit., 1905, 19, 578—580; 608— this J., 1904, 794 and 943; 1905, 448).

aw Para rubber "swells," or enters into a partial solution, less readily than pure dimethyloctadiene , but much more so than when dry and freed sins. Moist raw Para forms an emulsion, which earlier stages contains a larger percentage of ouc than when dry Para is used, but this per- diminishes later on, the rubber not dissolving g) further. The same applies also to moist ed caoutchouc. When freed from resins the ate ling varies with the degree of polymerisation; elling proceeds with greater rapidity in proportion resin content increases. The more resin is present ariety, the more easily such a specimen will be to "swell" in carbon bisulphide. The structure utchouc retards swelling, so that masticated ouc turgesces more quickly than dried raw Para; astication changes both the structure and poly- ion of the substance. Pure dimethyloctadiene swells more readily than masticated dry Para. It

is prepared according to the known method by solution (swelling) of Para rubber in chloroform and precipitation with absolute alcohol, the Para having first been freed from resins by treatment with acetone in the Soxhlet apparatus (Berichte, 1902, 35, 3261). The solution (swelling) and precipitation are repeated six times. A small proportion of oxygen does not appreciably affect the tendency to swell in carbon bisulphide. Turgescence is increased by agitation. Warnith accelerates swelling, but retarda solution; and as its action is probably one of depolymer- isation, it would appear that multiplication of the  $C_{10}H_{14}$  molecule retards awelling but facilitates solution. The degree of elasticity of any one kind of caoutchouc does not influence the curve of turgescence, when moderate thick- nesses are in question. Elasticity probably depends mainly on the degree of polymerisation; and the experi- ments with Madagascar and Para rubber seem to indicate that higher polymerisation is accompanied by increased elasticity.—C. S.

ENGLISH PATENT.

Rubber; *Process for Reclaiming and Regenerating* ——. L. T. Petersen, Akron, U.S.A. Eng. Pat. 28,294, Dec. 23, 1904. Under Int. Conv., June 24, 1904.

SEE U.S. Pat. 774,727 of 1904; this J., 1904, 1155.—T. F. B.

UNITED STATES PATENT.

Rubber; *Cleaning* ——. W. A. Lawrence, Assignor to Continental Rubber Co., New York. U.S. Pat. 787,518, April 18, 1905.

The impure rubber is ground with water, subjected to a hot-water bath, and the floating impurities removed by means of a blast of air directed against the surface of the water. The residual rubber and woody impurities are then immersed in a liquid, such as salt water, having a density greater than that of the rubber, until the woody impurities sink to the bottom; the rubber, which floats to the surface is removed.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Barks, Woods, &c.; *Analyses of Cuban and Argentine* ——. L. E. Levi and J. F. Sigel. Hide and Leather, 1905, 12, 38.

The increasing scarcity of hemlock bark in America has caused tanners to look further afield for a suitable substitute. The authors have made analyses of a number of Cuban and Argentine barks, woods, and fruits that were exhibited at the St. Louis Exhibition, with the following results:—

CUBAN EXHIBIT.

	Tanning Matter.	Soluble Non-Tanning Matter.	Soluble Solids.
	Per Cent.	Per Cent.	Per Cent.
de Jagua .....	4.44	20.96	25.40
de Carba .....	8.21	5.37	13.53
de Peralijo .....	6.34	3.02	9.36
de Mangle Colorado .....	24.08	6.13	30.21
de Juearo .....	7.16	4.59	11.75
del Arbol Jucan .....	9.13	3.16	12.29
de Gamagua .....	6.25	1.02	8.17
e Mangle Colorado .....	5.19	9.04	14.23
e Peralijo .....	10.72	19.38	30.10
e Potoban .....	19.67	19.43	37.10
.....	6.01	3.06	9.07
.....	1.67	3.61	5.28

## ARGENTINE EXHIBIT.

		Tanning Matter.	Soluble Non-Tanning Matter.	Soluble Solids.
		Per Cent.	Per Cent.	Per Cent.
<i>Anacardiaceæ</i> (Family)—				
Mollo ( <i>Lithraea Gilliesii</i> Gr.)	Bark *	16.79	8.14	24.93
Mollo ( <i>Lithraea Gilliesii</i> Gr.)	Wood†	3.66	5.97	9.63
<i>Leguminosæ</i> —				
Churqui ( <i>Mimosa Farinosa</i> Gr.)	Wood	3.86	2.67	6.53
Guayacau Itin ( <i>Casalpinia Melanocarpa</i> Gr.)	Wood	18.09	6.99	9.08
Guayacau Itin ( <i>Casalpinia Melanocarpa</i> Gr.)	Fruit	14.78	19.90	34.68
Palo de Rivera de Formosa	Bark	7.38	2.94	10.32
Palo de Rivera de Formosa	Wood	2.53	2.05	4.58
Curupay—Cebil Colorado ( <i>Piptadenia Cebil</i> Gr.)	Bark	15.0	10.92	25.92
Guayaiba Blanco	Bark	7.06	11.69	18.75
Guayaiba Blanco	Wood	1.01	2.74	4.65
Sacha Naranja	Bark	3.21	12.23	15.44
Sacha Naranja	Wood	0.96	2.9	3.86
Tusca ( <i>Acacia Cavenia</i> H.A.)	Bark	10.08	3.46	13.54
Tusca ( <i>Acacia Cavenia</i> H.A.)	Wood	2.69	2.65	5.34
<i>Poligouæ</i> —				
Iviraró—Virau ( <i>Ruprechtia Exeelsa</i> Gr.)	Bark	1.6	3.81	5.41
Iviraró—Virau ( <i>Ruprechtia Exeelsa</i> Gr.)	Wood	1.38	2.5	3.88
<i>Rhamnæ</i> —				
Piquillin ( <i>Condalia lineata</i> A. G.)	Bark	9.01	2.99	12.6
Piquillin ( <i>Condalia lineata</i> A. G.)	Wood	6.23	3.10	9.35
<i>Bignoniaceæ</i> —				
Lapacho Negro ( <i>Tabebuia Avellanedia</i> Ltz)	Bark	3.22	6.25	9.47
Lapacho Negro ( <i>Tabebuia Avellanedia</i> Ltz)	Wood	1.46	3.25	4.71

\* 1.5 per cent. sugar.

† 0.5 per cent. sugar.

—M. C.

*Fat from Bones; Carbon Tetrachloride as a Solvent for Extracting* — O Brücke. XII., page 551.

## ENGLISH PATENTS.

*Depilatories; Non-desiccating* — E. Hannemann, Zurich. Eng. Pat. 16,888, Aug. 2, 1904.

Known depilatory mixtures of calcium sulphide, zinc oxide, strontium sulphide and sugar, &c., are mixed with about five parts of pulverised gum arabic, five of neutral soap powder and about five parts of zinc sulphide or sodium sulphide, the whole forming a non-desiccating product which can be easily removed from the skin.—C. S.

*Gelatine and Glue; Process for the Manufacture of* — L. C. E. Fauchaux, Alencon, and J. A. Boissière, Tauville, France. Eng. Pat. 8788, April 16, 1904

SEE Fr. Pat. 337,598 of 1903; this J., 1904, 553.—T. F. B.

## XV.—MANURES, Etc.

*Calcium Cyanamide; Application of Peat to the Conversion of* —, into Ammonium Compounds. R. Perotti. Atti R. Accad. dei Lincei Roma, 1905, 14, 174—177. Chem. Centr., 1905, 1, 1181.

THE author has previously pointed out (this J., 1905, 143) that calcium cyanamide must undergo decomposition in the soil, before it is capable of acting as a fertiliser. Experiments were made with a calcium cyanamide fertiliser containing 9.35 per cent. of calcium cyanamide, and 15.4 per cent. of nitrogen; and peat containing 83.83 per cent. of humus-substances and 1.31 per cent. of nitrogen. On treating mixtures of: (1) 250 grms. of the fertiliser and 250 grms. of peat; (2) 125 grms. of the fertiliser and 375 grms. of peat; each with 300 c.c. of foul water, the calcium cyanamide was rapidly hydrolysed without appreciable loss of nitrogen. The course of the hydrolysis was followed by means of determinations of the calcium cyanamide and water. It was found that with the mixture containing only 25 per cent. of calcium cyanamide, this was decomposed in four days, whilst in the other mixture the decomposition was complete after two to three months. The author recommends for technical purposes the admixture of peat with fertilisers containing calcium cyanamide, in order to convert the latter into directly assimilable ammonium compounds.—A. S.

*Calcium Cyanamide*. W. Zielstorff. Bied. Centr., 34, 217—218; from Illustr. Landw. Zeit., 1904, 1103.

By applying calcium cyanamide some days before sowing the seed, the nitrogen value of the manure was increased to 92.8 (sodium nitrate=100), the value being 88.4 when the seed was sown immediately after the manure.

Calcium cyanamide should not be applied as a dressing. Like sodium nitrate, the manure has little after-effect.—N. H. J. M.

*Perchlorates and Chlorates; Determination of* — Sodium Nitrate. D. Tschernobajeff. XXIII., page 1

## XVI.—SUGAR, STARCH, GUM, Etc.

*Molasses; Electrolytic Treatment of* —. H. Claus. Z. Ver. Deutsch. Zucker Ind., 1905, 446—448.

THE author comes to the conclusion that the electrolytic treatment of molasses has as little chance of becoming a profitable operation as the similar treatment of juice. On the other hand, the electrolytic treatment of molasses-residues gives better promise of success, provided that a market can be found for the organic acids obtained.—W. P. S.

*Apricot Gum*. P. Lemeland. J. Pharm. Chim., 21, 443—448.

THE gum exuded by the apricot tree is usually of a brilliant conchoidal fracture. Two specimens examined by the author, one collected in 1896, the other in 1904, gave a loss of about 16 per cent. on drying at 100° C. and contained about 76 per cent. of matter soluble in water. By heating the gum with nitric acid of sp. gr. 1.15, it yielded mucic acid, corresponding with 15.53 per cent. of galactose respectively (calculated on the original substance). Pentosans were determined by Tollens' method, and amounted to 40.75 and 38.4 per cent. respectively. Fifteen grms. of the gum were heated in an autoclave at 110° C., with 100 c.c. of 5 per cent. sulphuric acid. The excess of acid was neutralised with the non-hydrolysable portion of the gum precipitated with alcohol. From the solution left, L-arabinose was isolated by means of its benzylphenylhydrazon.—B.



nd Woody Fibre in the Sugar Cane and in Bagasse ;  
mination of —. H. and L. Pellet. Bull. Assoc.  
Sucr. Dist., 1905, 22, 921—936.

ight of experience gained with Egyptian canes the  
g conclusions are stated with regard to the analy-  
termination of sucrose and fibre in the sugar cane  
bagasse. The cane fibre offers a very different  
to pressing according to the conditions under  
the cane has been grown. While some canes may  
to 73 per cent. by weight of juice at the first  
under the same conditions other canes will  
y 55 to 56 per cent. The direct determination of  
the cane, if whole canes be taken, does not give  
average richness of a crop of canes, owing to the  
a in the composition of the cane from one stalk  
er, and of canes from different fields. The richness  
cane can be approximately deduced only by the  
method. The direct determination of the sugar  
ne may be effected with a certain approximation  
ies working by diffusion, the division of the cane  
settes allowing of the taking of a true average

The determination of sugar in the fresh cosettes  
rided cane can be accomplished only by taking a  
rge weight, at least 50 grms., and treating it by  
e exhaustions with boiling water (say six times).  
nal treatment for control. The same observations  
the bagasse. The alcoholic method can also be  
d for the determination of sugar provided that  
rial be finely divided by being first cut into thin  
l then bruised in an iron mortar, and thoroughly  
control exhaustion being made by a final treatment  
and alcoholic extraction in a Soxhlet apparatus.  
hors have shown, however, that for certain  
as it was possible for a second control extraction  
to sugar notwithstanding the presence of sucrose  
aterial treated, in consequence of the resistance  
ells to the diffusion of sugar in the presence of

The method of direct hot aqueous digestion does  
exact results except under conditions in which the  
on of the samples is generally very difficult.  
etermination of woody fibre in the cane, great care  
taken in preparing an average sample, and alcohol  
t be used. Alcohol precipitates from the juice a  
of organic and mineral matters which remain  
fibre and increase its weight by about 0.30 to  
cent. Sugar also, is less soluble in alcohol than  
and unless all the precautions necessary in an  
extraction are taken, sugar and the ordinary  
as which are associated with it in the juice may be  
ssolved and increase the amount of fibre from  
40 per cent. The use of alcohol should therefore  
d from cane sugar factories as it practically  
beetroot sugar works. Specimens of cane fibre  
ig equal percentages by weight of woody fibre  
ways show the same resistance, or contain the  
portion of cellulose.—L. J. DE W.

## V.—BREWING, WINES, SPIRITS, Etc.

Products of the Autodigestion of Certain Varieties  
— M. Schenck. Woch. f. Brau., 1905, 22,  
127.

hor allowed quantities of pure cultivated top-  
tion beer yeast, distillery yeast and mycoderma  
undergo auto-proteolysis in presence of chloro-  
a temperature of 28° C., until the biuret reaction  
longer be obtained. The digested liquids were  
jected to a series of precipitations by group-  
and the substances present in the various  
were characterised as far as possible. The  
of the investigation are summarised in a table, and  
ped with those of a similar research on the products  
tion of bottom-fermentation yeast by Kutscher  
L. mann. The substances identified as present in  
stion products of all three varieties of yeast  
succeinic acid (considerable quantities), lactic  
rosine, leucine, adenine, hypoxanthine (traces),  
acid, glutamic acid (doubtful traces in products

of distillery and mycoderma yeasts), lysine, choline, t-(tra-  
methylenediamine. Histidine could not be detected, but  
it has been recorded amongst the products from bottom-  
fermentation yeast. Uraeil was detected in the products  
from distillery and mycoderma yeasts, but not in those  
from beer yeasts. On the other hand, arginine and  
guanidine were present in the products from beer yeasts,  
but absent from those from distillery and mycoderma  
yeasts.

The digestion products of pure cultures of top-fermenta-  
tion beer yeast and of distillery yeast showed the "trypto-  
phane" reaction strongly, whereas those from cultures  
of mycoderma yeast, free from culture yeasts, did not give  
this reaction. The exhausted cell residues of the beer  
yeast and the mycoderma yeast turned brown on exposure  
to the air, but those of distillery yeast remained white. The  
above observations might be utilised for the recognition  
of the purity of cultures of mycoderma yeasts and distillery  
yeasts respectively.—J. F. B.

Yeast ; Production of Sulphuretted Hydrogen by —.  
H. Will. Z. ges. Brauw., 1905, 28, 285—287.

A CASE is described in which a beer of the Pilsener type  
had a peculiar musty smell, due to sulphuretted hydrogen.  
The cask-sediments blackened lead-paper distinctly.  
After racking and long storage, the bad flavour of the  
beer disappeared to a large extent. This beer was pre-  
pared with a special variety of yeast propagated in the  
form of a pure culture in a separate vessel. This yeast was  
employed because of its property of developing a special  
flavour characteristic of Pilsener beer, and when it was  
first taken into use the results obtained were excellent.  
The wort was strongly hopped and brewed with the addi-  
tion of gypsum, but the development of the sulphuretted  
hydrogen could not be attributed to any abnormalities  
of the raw materials, because the same wort, when fer-  
mented with other yeasts, showed scarcely a trace of  
sulphuretted hydrogen. Neither was the trouble due  
to infection. After an exhaustive investigation, the  
conclusion is drawn that the production of sulphuretted  
hydrogen is a normal characteristic of certain varieties  
of culture yeast, although the quantity developed under  
normal conditions can only be detected by a very expert  
taster. But in this case the tendency was magnified by  
a weakening or degeneration of the yeast by prolonged  
cultivation in the propagating apparatus, resulting in a  
starved or pathogenic condition peculiarly favourable to  
the formation of sulphuretted hydrogen, the addition  
of gypsum to the brewing water also possibly contributing  
to this result.—J. F. B.

Yeast, Agglutination of — by Borates ; Coagulation  
Phenomena. H. van. Laer. Bull. Soc. Chim. de  
Belg., 1905, 19, 31—47.

BORAX possesses the property of coagulating yeast, but  
the coagulum disintegrates after a time which is pro-  
portional to the excess of borax employed. This dis-  
integration coincides with a disappearance of the alkaline  
reaction, and the addition of sodium carbonate prevents  
it; the tendency to disintegrate occurs only in the case  
of living yeast. The phenomena of agglutination of yeast  
present many analogies to the coagulation phenomena  
of other colloids. There is a critical minimum proportion  
of borax below which no coagulation takes place.  
For a given suspension of yeast the quantity of borax  
necessary to produce agglutination is proportional to  
the volume of the yeast suspension. Brewery  
yeasts require a larger proportion of borax than  
bakers' yeasts. The tests are best made by suspending  
250 grms. of pressed yeast in 500 c.c. of water, and adding  
increasing quantities of a solution of 6.376 grms. of  
anhydrous borax in a litre of water, to 10 c.c. of the yeast  
mixture. The critical proportion of borax required for a  
given yeast suspension is lower the lower the temperature  
of the mixture. Yeast killed by boiling, requires, under  
similar conditions more borax than living yeast for its  
agglutination. Certain very flocculent yeasts resist  
agglutination; this resistance can be overcome by the  
addition of a little calcium chloride. Resistance to coagu-  
lation is due to some extent to the acidity of the mixture  
and can be overcome by the addition of sodium carbonate.

A clear solution of calcium borate agglutinates yeast in the same way as borax. The presence of salts of the heavy metals and of magnesium, increases the quantity of borax necessary for agglutination. In the case of yeasts which agglutinate readily with borax, the addition of calcium chloride has little effect. Beyond a certain variable limit of dilution the agglutinating power of borax is lost. The quantities of borax required for the agglutination of equal volumes of suspensions of the same yeast at different dilutions are proportional to the squares of the inter-cellular distances, the latter being proportional to the cube roots of the relative dilutions. A clot of yeast, even if prepared by an excess of borax, can consequently be disintegrated by diluting the system with water. Sodium aluminate has the same agglutinating properties as borax.

—J. F. B.

*Beer and Metals* J. Brand. Z. ges. Brauw., 1905, 28, 237—240.

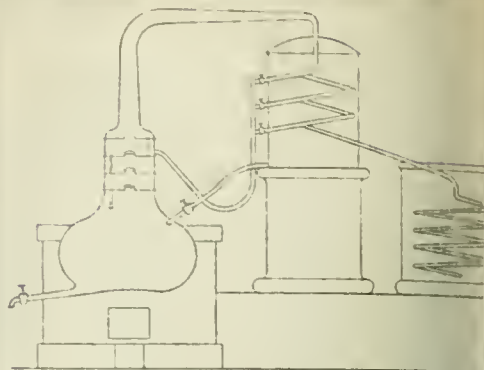
WHEN sheet zinc is left in contact with pale lager beer in stoppered bottles, the beer remains clear for a long time, but its colour becomes appreciably paler, and hydrogen sulphide is formed in the beer owing to the reduction of either the sulphite present, or the organic compounds containing sulphur. The zinc goes into solution, and, after 16 hours, the beer exhibits a distinct metallic, astringent taste, which does not, however, increase in intensity even if the action is allowed to proceed for six days. When galvanised iron is covered with beer and allowed to remain at the ordinary temperature, the beer becomes slightly turbid after 16 hours, and the metallic taste and odour of hydrogen sulphide are of about the same intensity as with the sheet zinc; the mouldy smell, however, is much more marked than in the latter case. The metallic taste and the zinc-content of the beer continue to increase, and after three days, analysis showed that 100 c.c. of the beer contained 0.017 gm. of zinc; after this time the disagreeable odour was much less noticeable. No iron was found in solution. The rapid action of beer on galvanised iron is due to the loose consistency of the layer of zinc; this may be improved by adding small quantities of aluminium to the zinc.

Beer has a much greater action on iron than wort. In order to decide whether this is due to the presence of carbon dioxide in the beer, the author measured the action on iron of beer containing the normal proportion of carbon dioxide and of beer from which the gas has been expelled by boiling. After three days' action, the beer free from carbon dioxide contained 0.0108 gm. of iron per 100 c.c., and the other 0.0129 gm. The former becomes turbid much more rapidly than the latter; this is probably to be explained by the fact that the soluble iron compound in the beer precipitates certain albuminoid matters, which in the ordinary beer are carried to the surface by the gas and form a yellow scum, whilst they remain suspended in the beer free from gas. As the carbon dioxide in the beer appears to exert but little influence on its power of attacking iron, the action must be due mainly to the organic acids and the acid salts.

The author examined, with reference to their behaviour with beer, two samples of so-called "Neutral Iron," which is manufactured by the Ferrum Company in Zawodzie, near Kattowitz, and is very resistant to the action of acids. One of these samples (I.) was more resistant to acids, but also more brittle and difficult to work than the other (II.). Pieces of these samples, and one of ordinary iron (III.) of 20 sq. cm. area, were covered each with 100 c.c. of pale beer and left for three days. With I., the beer remained bright; with II., the beer exhibited a moderate turbidity, whilst with III., the beer was very turbid and had acquired a greyish-green colour. One litre of the beer contained the following amounts of iron:—I., 0.002; II., 0.028; III., 0.0996 gm.—T. H. P.

*Brandy.* P. Schidrowitz. J. Inst. Brewing, 1905, 11, 125—139.

THE best brandies are those produced in the Cognac districts, viz., Charente and Charente Inférieure; then follow in order of value those from Armagnac, Marmande,



POT STILL WITH SIMPLE RECTIFYING HEAD, ALAMBIC DE

Nantes and Anjou; the cheapest class is that known as "Montpellier." The marc brandies form a class themselves, those from the Burgundy districts coming high prices. Cognac brandy is generally made by a system of double distillation, known as "brouillage," in simple pot-stills. The spirit is distilled slowly, a charge of 110 galls. occupying 8 hours. The first runnings come over at a strength of 60—65 per cent. of alcohol, rapidly rising to 70—75 per cent., after which distillation is continued until the distillate consists of 80—85 per cent. The first distillate is sometimes divided into three fractions. The first fraction has an alcoholic strength of 25—35 per cent., known as "brouillis." This is rectified during the "repasse"; the first runnings, to the extent of 5 per cent. of the whole, are mixed with the next fraction of "brouillis." The middle fraction, or fine spirit, comes over at a strength of 80—85 per cent. at first, and is rectified until the strength has fallen to about 56 per cent. The average strength of this spirit is 66—70 per cent. The residue is distilled until water passes over; this fraction is called "seconde," it has a strength of 40 per cent., and is either mixed with a fresh charge of spirit or is rectified separately. In recent years simple pot stills have to a certain extent displaced the double distillation stills. Such a still, known as "Alambic de Nantes," is illustrated in the figure. The new stills enable the distiller to obtain the brandy in a single operation, and have had the effect of extending the range of wines which may be employed for brandy manufacture, a result not so desirable on account of the ravages of Phylloxera. In regard to the extent to which rectification of a grape spirit may legitimately be carried, the author would not impose any restriction beyond that imposed by the necessities depending only on the natural odour and taste of the wine for the flavour of the brandy. Passing to the question of the definition and chemical analysis of brandy, the author proposes to limit the term "brandy" to "wine distilled in France, the volatile constituents of which are derived entirely from the grape, and which contain no added matter of any kind excepting water, sugar, and colouring matter, and of which the taste and odour are those ordinarily associated with that designation." The question of analytical criteria must be approached with great caution, since the number of well-authenticated analyses of genuine brandies is really very small; the tendency to base a judgment as to the genuineness of a sample of brandy upon the proportion of esters is emphatically condemned. A spirit 50 years old is in every way comparable with one only five to six years old, and the physiological properties of very old brandies are only in a minor degree to the initial constituents of the spirit.—J. F. B.

*Malt Analysis.* J. S. Ford and J. M. Guthrie. J. Inst. Brewing, 1905, 11, 206—221.

FOR the determination of the diastatic power of malt, the authors describe the following method:—20 g. of finely-powdered malt, weighed out in the form of a corn, are extracted with 500 c.c. of water in a



is. After settling for 10–15 minutes, 1 c.c. of filtered extract is added to 70 c.c. of a solution of starch (=2 grms. of dry starch) at 40° C. and ure is maintained at this temperature for 1 hour. on is then stopped by the addition of 1 c.c. of oda solution (10 grms. per litre), the mixture is iluted to 100 c.c. and the cupric-reducing power ained in 25 c.c. of the solution, using 30 c.c. of solution.

astatic power on Lintner's scale is calculated by ing the weight of cupric oxide per 100 c.c., after g for the reducing power of the starch by the 0. authors have also worked out a method for g the quantity of maltose produced during conversion polarimetrically. In this case trin (Brown and Morris) must be used instead of arch; the procedure in other respects resembles ribed above, the change of rotation being det- place of the reducing power. The diastatic ult, when 2.5 c.c. of the above malt extract oyed per 100 c.c., is calculated on Lintner's multiplying the decrease in rotation in angular or sodium light in the 2 dem. tube by the factor

thers lay great stress on the necessity for the of all impurities of a metallic or alkaline nature solutions used in the analysis (see this J., 1904, e tests are conducted in vessels of Jena glass, ater employed is distilled in a special still with e.—J. F. B.

n Beer; Determination of — by the Zeiss ion Refractometer. E. Ackermann and A. ann. XXIII., page 563.

#### FRENCH PATENT.

Beer and Treating Wine and other Beverages g from Alcoholic Fermentation: Impts. in —. be and A. Vandekerkhove. Fr. Pat. 348,557, 2, 1904.

Pat. 24,994 of 1904; this J., 1905, 146.—T. F. B.

#### GERMAN PATENTS.

rocess for the Preparation of — in a Vacuum. Vettig. Ger. Pat. 154,997, Dec. 10, 1903.

is introduced into a chamber from which the en exhausted, and is there exposed to a constant re, either that at which the formation of iso- takes place (67° C.), if dark malt is desired, hat below this temperature if pale malt is to ed. The temperature is maintained constant in period and is then raised to the point necessary te the kilning process. It is stated that the d colour of the malt depend on the formation ose, which occurs at a temperature of 67° C. s the malt contains more than 10 per cent. of —A. S.

idues; Process for the Extraction of the Coarser the Mash-Tun or Clearing Tun and of the Finer s from the Worts in a Filter-Press. C. Prandtl. t. 154,481, August 26, 1902.

e turbid main wort has been passed to the filter- residue remaining in the tun is repeatedly mashed r, and the weaker worts thus produced are used he residue from the main wort in the filter-press. —A. S.

### XL.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

#### (A.)—FOODS.

apid Method for the Analysis of —. F. Bordas and Touplain. XXIII., page 563.

Cocoa Analysis; Use of the Centrifugal Machine in —. F. Bordas and Touplain. XXIII., page 563.

Butter; Detection of Cocoa-nut Fat in —. Wanters. XXIII., page 562.

#### ENGLISH PATENT.

Fatty Acid Esters; Utilisation of — as Alimentary Fats, Illuminating Oils, Ointment Bases, and the like. C. Dreyman, Turin, Italy. Eng. Pat. 10,466A, May 6, 1904.

SEE FR. Pat. 343,158 of 1904; this J., 1904, 988.—T. F. B.

#### UNITED STATES PATENTS.

Meat Extracts; Process of Making —. U. Giantar and F. W. F. Ross, London. U.S. Pat. 788,451, April 25, 1905.

SEE Eng. Pat. 199 of 1901; this J., 1902, 269.—T. F. B.

Radio-Active Organic Matter and Food. H. Lieber. New York. U.S. Pat. 788,480, April 25, 1905.

PRESERVED food of solid or liquid nature is impregnated with thorium emanations free from the thorium from which they were obtained, and is thereby rendered radio-active. (See also U.S. Pat. 787,928, page 559) —J. F. B.

#### GERMAN PATENT.

Milk and the like; Process and Apparatus for the Mechanical Treatment of Liquids such as —. Homogenisiermaschinen Schroeder, Berberich und Co. G. m. b. H. Ger. Pat. 156,997, Aug. 19, 1902.

THE milk which may be heated to a temperature of about 85° C., is forced by strong pressure, between two elastic surfaces pressed one against the other, whereby it is thoroughly mixed. It is stated that milk which has been treated in this manner does not separate any particles of casein or fat after being pasteurised.—A. S.

#### (B.)—SANITATION; WATER PURIFICATION.

##### FRENCH PATENTS.

Water; Purification of —. W. M. Jewell. Fr. Pat. 348,840, Aug. 2, 1904.

SEE U.S. Pat. 776,146 of 1904; this J., 1904, 833.—T. F. B.

#### (C.)—DISINFECTANTS.

##### UNITED STATES PATENT.

Soap, Antiseptic, and Process of Making same —. O. Liebknecht, Assignor to Roessler and Hasslacher Chem. Co. U.S. Pat. 787,776, April 18, 1905. XII., page 552.

### XIX.—PAPER, PASTEBOARD, Etc.

Straw Cellulose; Manufacture of — by the Sulphite Process. R. Dietz. Z. angew. Chem. 1905. 28. 648—653.

THE siliceous nature of straw has hitherto stood in the way of a satisfactory isolation of the cellulose by the bisulphite process. The proportion of silica in different varieties of straw varies between 1.5 and 3.7 per cent. Experiments have shown that the treatment of the straw with the theoretical quantity of hydrofluoric acid, calculated on the basis of the silica-contents of the straw, in the form of a 0.5–1.25 per cent. solution, is capable of reducing the proportion of silica to less than 0.05 per cent. In this form the straw is quite suitable for treatment by the bisulphite process. The waste liquors from the hydrofluoric acid extraction can be passed into streams without injury to fish, if they are diluted in the proportion of one part to 70; precipitation with lime will also make these liquors harmless. The author has worked out on

a small scale the best conditions for boiling the purified straw. An ordinary calcium bisulphite liquor, as employed for wood, has given good results. Such a liquor contains 3.6 per cent. of total sulphur dioxide: 2.4 per cent. being "free" and 1.2 per cent. combined. The proportion of liquor to straw should be reduced as much as possible, in order to avoid excessive action. If the straw be well packed it can be covered with 4.5 times its weight of liquor. The boiling should be regulated so that a pressure of 3.5 atmospheres is reached in one hour, and this should be maintained for three hours. The waste liquor should contain 0.15 per cent. of sulphur dioxide. The yield of cellulose obtained is about 42 per cent. It is of excellent quality and bleaches well in two treatments, with a consumption of 13 per cent. of bleaching powder. The bisulphite process modified in the above manner offers many advantages over the older soda process in the case of straw.—J. F. B.

#### UNITED STATES PATENT.

*Paper Coating.* F. X. Govers, Owego, N.Y. U.S. Pat. 788,043, April 25, 1905.

THE coating composition contains 20 parts of saponified vegetable wax, 30 parts of casein, one part of alkali, 100 parts of water, and 600 parts of a mineral base. The saponified wax should contain a certain proportion of wax in the unsaponified condition.—J. F. B.

*Pulp; Apparatus for Treating Filter* —. R. Birkholz, Milwaukee, Wis. Assignor to E. Goldman & Co., Chicago. U.S. Pat. 787,971, April 25, 1905.

THE apparatus consists of a mixer situated in the filter-cellar, a pump connected with the mixer, a pulp-washing machine situated on a floor above the mixer, and supplied with pulp from the mixer by means of the pump, and lastly a draining-chest in the filter-cellar into which the washed pulp is discharged. Different forms of washing machines are described; they are provided with stirrers, water- and steam-supplies and washing screens either fixed or rotary.—J. F. B.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Ceric Ammonium Nitrate; Electrolytic Preparation of* —. G. Plancher and G. Barbieri. Atti R. Accad. dei Lincei Roma, 1905, 14, 119—120. Chem. Centr., 1905, 1, 1075—1076.

CERIC-AMMONIUM nitrate, which is made use of in the separation of cerium from lanthanum, neodymium, praseodymium and samarium, cannot be easily prepared by mixing together solutions of ceric and ammonium nitrates. The authors prepared it by electrolytic oxidation of a concentrated solution of cerous-ammonium nitrate rendered strongly acid with nitric acid, using a piece of sheet platinum as anode surrounding a porous cell containing a platinum wire cathode immersed in nitric acid. By using a current strength of 0.1—0.2 ampère per sq. dem. of anode surface, the cerous salt was oxidised quantitatively to ceric-ammonium nitrate.—A. S.

*Mercuric Acetate in Glacial Acetic Acid; Reactions of Certain Substances with Ethylene Bonds with a Solution of* —. Formation of Resorcinol Mercuric-mercuri-acetate and Triacetyl-mercuric-phloroglucinol. A. Leys. J. Pharm. Chim., 1905, 21, 388—396.

THE reagent is prepared by heating 3 or 4 grms. of mercuric oxide or 10 grms. of mercuric acetate to boiling in 100 c.c. of glacial acetic acid; on cooling, the excess of mercuric acetate crystallises out; the mother liquor is decanted and furnishes the reagent. It keeps well at ordinary temperatures, but, after boiling for half an hour under a reflux condenser, it deposits, on cooling, crystals of mercurous acetate. Prolonged boiling should therefore be avoided. Phenols should first be boiled with a little glacial acetic acid and then cooled before being added to the reagent. Monohydric phenols,

their derivatives and monovalent acids, give no reaction, but with more complex phenols definite compounds are formed.

With *resorcinol* a deep yellow glistening precipitate formed between 60°—70° C., which increases in quantity as the temperature rises to the boiling point. This is mercuric-mercuri-acetoresorcinol  $C_6H_3O_2Hg.Hg.CO$ .

*Phloroglucinol* under similar conditions forms a yellow precipitate of triacetomeric-mercuric-phloroglucinol  $C_6H_3(O.Hg.O.CO.CH_3)_3$ . Both these bodies are insoluble in most solvents.—J. O. B.

*Ether; Oxidising Action of Impure* —. H. Ber. 1905, 38, 1409—1410.

THE blue solution of cobaltous oxide in highly concentrated potassium hydroxide solution is decolorised by formation of a brown precipitate, on addition of drops of impure ether. It is not decolorised by pure ether, and only after some time by addition of a hydrogen peroxide solution. It is therefore probable that the action of the impure ether, in this case, is a more active oxidising agent than hydrogen peroxide, probably ethyl peroxide, thus bearing out the conclusion of A. J. Rossolimo (this J., 1905, 288).—E. F.

*Glycerolphosphates; Analysis of* —. Reidel's Ber. 1905, 73—75. Z. angew. Chem., 1905, 18, 62.

IN the examination of glycerolphosphates, tests have been made for uncombined phosphoric acid, free glycerol sulphates, chlorides, barium, heavy metals, and anions (which has been recently detected in quantities ranging from traces up to 3.5 per cent.). Comparative determinations of the phosphoric acid in glycerolphosphates by the usual gravimetric process and by Astruc's volumetric method (this J., 1898, 179) showed that the latter gives good results in the case of alkali glycerolphosphates, but figures several per cent. too high with the calcium magnesium salts.—A. S.

*Gynocardin, a New Cyanogenetic Glucoside.* F. B. and F. H. Lees. Chem. Soc. Trans., 1905, 87, 346.

POWER and Gornall (Chem. Soc. Proc., 1904, 21) have previously shown that when the seeds of *Gynocardia* (R. Br.) are crushed and brought into contact with water, hydrogen cyanide is formed, owing to the presence in the seeds of a cyanogenetic glucoside, which was isolated and designated *gynocardin*. The authors have prepared a larger quantity of the glucoside, and attempted to determine its constitution. Four kilograms of powdered *gynocardia* seeds were first extracted with petroleum for the complete removal of the fatty matter, then with 95 per cent. alcohol. On expelling the alcohol from the extract, a dark syrupy residue was obtained, which soon formed a paste consisting chiefly of a crystalline substance; this was separated from the mother-liquor, digested for several minutes with warm acetate, and again separated. A further quantity of crude glucoside was obtained from the syrupy mother-liquor, by first mixing it with "prepared" dust, drying the mass and extracting it with ethyl alcohol, which slowly removes the glucoside. The crude glucoside was purified by dissolving it in water, treating the solution with animal charcoal, and evaporating under diminished pressure to a syrup, which set to a hard cake of crystals which were dried on porous earthenware. The yield was 200 grms. *Gynocardin* forms colorless, glistening, prismatic needles of the composition  $C_{13}H_{19}O_9N + \frac{1}{2}H_2O$ ; the water is expelled at 162°—163° C. The anhydrous compound melts at 162°—163° C., and the optical rotation  $[\alpha]_D^{21} = +72.5^\circ$  in aqueous solution.

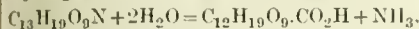
It is readily hydrolysed at the ordinary temperature by *gynocardase*, an enzyme contained in the seeds, but with difficulty by boiling with 5 per cent. hydrochloric sulphuric acid. Dextrose and hydrogen cyanide are isolated from the products of the reaction, but the substance,  $C_6H_8O_4$ , which should be produced, according to the equation:

$$C_{13}H_{19}O_9N + H_2O = C_6H_{12}O_8 + C_6H_8O_4 + HCN$$

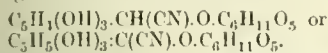
is decomposed by secondary reactions. *Gynocardin*



other known cyanogenetic glucosides (this J., 1901, 1902, 996; 1903, 1255) in its relatively great activity towards acid hydrolysing agents. It is hydrolysed by treatment with barium hydroxide solution, and the barium salt of *gynocardinic acid*,  $\text{O}_9\text{CO}_2\text{H}$ , being formed, according to the equation:



*gynocardinic acid* forms dextrose and an acid,  $\text{C}_5\text{H}_{10}\text{O}_6$ , on hydrolysis with acids. The results obtained indicate that *gynocardin* is the dextrose ether of the cyanohydrin of a  $\alpha$ -oxy-aldehyde or ketone in accordance with one of the following formulae:



The enzyme *gynocardase* was isolated by treating the ground seeds with light petroleum to remove the oil, and then digesting them with water at the ordinary temperature for 24 hours. The filtered liquid was treated with twice its volume of alcohol, and, after standing for some hours, the precipitate was filtered off, washed with alcohol and dried *in vacuo* over sulphuric acid. The residue was two per cent. of the weight of the seeds.

—A. S.

*Oil*. Ziegelmann. Pharm. Rev., 1905, 280. Chem. and Druggist, 1905, 66, 612.

The author distilled 43 kilos. of savin with steam, and obtained 7.3 grms. of essential oil floating on the surface water, whilst by extracting the water with petroleum ether further 17.34 grms. of oil was recovered. The first had the sp. gr. 0.91329 and the second, 0.91331. The oil was optically inactive; it had an acid value of about 1 and an ester value corresponding to about 40 per cent. ethyl acetate.

The author pointed out that the U.S.P. requires savin oil to be obtained from the ends of the branches of *Juniperus communis*; in Belgium the fresh leaves are distilled, in Greece the twigs, in Spain the leaves and fruits, and in some other countries, the entire plant is subjected to distillation.

—A. S.

*and Cinchonine*; Reaction for Distinguishing between —. C. Reichard. XXIII., page 562.

*and Cinchonine*; New Reaction for —. E. P. Alvarez. XXIII., page 562.

*Oil*; Indirect Method of Determining the Aldehyde in —. E. Berté. XXIII., page 563.

#### ENGLISH PATENT.

*Manufacture of New [Bromo] Derivatives of —*.

J. Abel, London. From Act.-Ges. f. Anilinfabr., Ger. Pat. 13,285, June 11, 1904.

Eng. Pat. 156,110 of 1903; this J., 1905, 512.—T. F. B.

#### UNITED STATES PATENTS.

*Barbituric Acid*; Process of Making —. M. J. Mann, Elberfeld. Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 787,360, April 8, 1905.

*Barbituric Acid* is condensed with the dinitrile of a malonic acid, in presence of an alkaline condensing agent, e.g., an alkali alcoholate, forming 2-cyanimino-5-dialkylpyrimidine. The cyanimino and dialkyl groups are removed from this latter compound by treatment with acids (e.g., hot dilute sulphuric acids), barbituric acids being thus produced.—T. F. B.

*Active Matter, and Process of Making same*. H. J. Mann, New York. U.S. Pat. 787,928, April 25, 1905.

*Active Matter*, solid or liquid, is prepared by heating thorium below red heat, separating the thorium from the thorium from which they were derived, and passing these emanations through a filter of matter so as to impregnate the whole. (See S. Pat. 788,480, page 557.)—J. F. B.

#### FRENCH PATENTS.

*Alcohols, Aromatic, and their Derivatives*; [Electrolytic] Process for Manufacturing —. C. Mettler. Fr. Pat. 348,951, Oct. 28, 1904. Under Int. Conv., July 15, 1904.

ESTERS of aromatic carboxylic acids may be reduced electrolytically in presence of mineral acids, the products of reduction being the corresponding alcohol and ether; thus, the reduction of ethyl benzoate gives rise to a mixture of benzyl alcohol and benzyl ethyl ether, the proportions of the final product being dependent on the conditions of the reaction. The following is an example of the process:—A solution of ethyl benzoate, 300 grms., alcohol (96°), 600 grms., sulphuric acid, 350 grms., and water, 100 grms. is submitted to electrolysis in the cathode compartment of a suitable apparatus, the anode compartment containing dilute sulphuric acid; the electrodes are of pure lead, and a current density of about 7 amperes per 100 sq. cm. of cathode surface is employed. The temperature of the solution is kept between 20° and 30° C. When reduction is complete, the solution is made alkaline, and the oily layer is separated, dried, and fractionated.—T. F. B.

*Alcohols*; Method of Synthesising Monatomic and Polyatomic —. V. Grignard. Fr. Pat. 348,957, Nov. 10, 1904. Under Int. Conv., March 4, 1904.

By the reaction of organomagnesium halides with halogen derivatives of alcohols (using 1 mol. of the magnesium derivative for each hydroxyl group present in the alcohol) and decomposing the resulting products with water, alcohols are obtained which contain the organic radical of the magnesium compound in place of the halogen in the halogenated alcohol employed; for instance, the interaction of phenylmagnesium bromide and monochlorhydrin gives rise to the formation of the compound  $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{OMgBr}$ , which, on decomposition with water, yields phenylethyl alcohol.—T. F. B.

#### GERMAN PATENTS.

*Saponin*; Preparation of a Non-poisonous — from the Bark, Leaves, Stems and Roots of *Bulnesia Sarmienti* and *Guaicum*. E. Merck. Ger. Pat. 156,954, Feb. 13, 1903.

The acid saponin is precipitated from an aqueous extract of *Bulnesia Sarmienti* or *guaicum*, the filtrate is treated with basic lead acetate, and the product is decomposed by means of sulphuretted hydrogen. The resulting saponin is neutral and non-poisonous, having only a small solvent action on red blood cells. Its composition is represented by the formula  $\text{C}_{22}\text{H}_{36}\text{O}_{10}$ .—T. F. B.

*Glycollic Acids of Pyrogallol and its Alkyl Ethers*; Process for Preparing the —. Act.-Ges. f. Anilinfabr. Ger. Pat. 155,568, Feb. 27, 1903.

THE glycollic acids of pyrogallol or of its mono- or dialkyl ethers are prepared by the action of monochloroacetic acid on pyrogallol, &c., in presence of alkali. Pyrogallol mono-, di-, or tri-glycollic acids, pyrogallol monoalkyl ether mono- or diglycollic acids, and pyrogallol dialkyl ether monoglycollic acids can be obtained by this process. They all possess the property of developing the latent photographic image, and may also be utilised for the production of dyestuffs or for medicinal purposes.—T. F. B.

*Castor Oil in the form of a dry Powder [with Magnesium Carbonate]*; Process for Obtaining —. D. Wasserzug. Ger. Pat. 156,999, April 3, 1903.

ONE part of castor oil is thoroughly mixed with one part of magnesium carbonate and one part of water, the water is evaporated, and the resulting mass pulverised. It is stated that a dry powder is obtained by this method, suitable for medicinal purposes.—T. F. B.

*Fatty Acids*; Preparation of Monochloro-Derivatives of —. H. Blanck. Ger. Pat. 157,816, June 7, 1903.

FOR the preparation of their monochloro-derivatives, fatty acids are heated, in presence of their chlorides or anhydrides, with sulphuryl chloride to a temperature below the boiling point of the latter. The chlorination is stated to proceed quantitatively.—A. S.

*Alcohol [o-Toluy] Alcohol*; *Process of Preparing the Alkyl Ethers of an Aromatic* — Farbentfabr. vorm. F. Bayer und Co. Ger. Pat. 154,558, Aug. 2, 1903.

THE ethers of o-toluyalcohol are obtained by the interaction of equimolecular weights of the double compound of benzylmagnesium halides with ether and of halogen-methylalkyl ethers of the composition  $\text{XC}_6\text{H}_4\text{OR}$ , when X represents a halogen and R an alkyl radical. The resulting ethers are stated to be applicable to perfumery and also as intermediate products for the preparation of pharmaceutical compounds. — T. F. B.

*o-Chlorophenol*; *Process for Preparing* — W. Lossen. Ger. Pat. 155,631, Aug. 14, 1903.

ORTHOCHLOROPHENOL is prepared by the interaction of equimolecular weights of phenol and chlorine in presence of carbon tetrachloride or similar indifferent solvent, the mixture being strongly cooled during the reaction. — T. F. B.

*S-Aminothreophylline and its Alkyl or Aryl Derivatives*; *Preparation of* — C. F. Boehringer und Soehne. Ger. Pat. 156,900, Sept. 2, 1903.

S-AMINOTHPHYLLINE and its alkyl or aryl derivatives are produced by the action of ammonia or primary or secondary amines on S-chlorothreophylline. — T. F. B.

*Paraxanthine*; *Process for Preparing the S-Amino Derivatives of* — C. F. Boehringer und Soehne. Ger. Pat. 156,901, Sept. 2, 1903. Addition to Ger. Pat. 156,900 (see preceding abstract).

THE S-amino-derivatives of paraxanthine are prepared from S-chloroparaxanthine by the action of ammonia or amines. — T. F. B.

*Cyanodialkylacetylureas*; *Process for Preparing* — E. Merck. Ger. Pat. 156,383, Nov. 1, 1903.

CYANODIALKYLACETYLUREAS of the general formula  $\text{NC}(\text{R}'\text{R}')\text{CO.NH.CX.NHR}$ ,

where X may be oxygen, sulphur, or NH, which find application in the manufacture of barbituric acid derivatives, are obtained by condensing dialkylcyanoacetic esters with the corresponding urea derivative in presence of a metal alcoholate at the ordinary temperature. — T. F. B.

*p-Allylphenol Alkyl Ethers*; *Process for Preparing* — A. Verley. Ger. Pat. 154,654, Nov. 23, 1902.

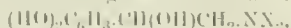
THE alkylethers of p-allylphenol are obtained by the reaction of an allyl halide on the compound obtained by the action of magnesium on a p-bromophenol alkyl ether. The mixture is heated under a reflux condenser, the ether is distilled off, and the product fractionated. The resulting p-allylphenol ethers are converted by means of alcoholic potash into the corresponding propenyl compounds. — T. F. B.

*Peptone Salt*; *Preparation of a Halogen Acid* — Kalle und Co. Ger. Pat. 156,399, Nov. 29, 1903.

ORDINARY peptone is treated with a halogen acid, and the product is washed with a dilute alkali carbonate solution until it ceases to exhibit an acid reaction. — T. F. B.

*Aminocyclohexols of the Constitution  $(\text{HO})_2\text{C}_6\text{H}_3\text{CH}_2\text{OH}$*  ( $\text{C}_6\text{H}_5\text{N}_2$ ); *Process for Preparing* — Farbwerke vorm. Meister, Lucius und Bründing. Ger. Pat. 157,300, Dec. 25, 1903.

AMINOCYCLOHOLS of the general constitution



where X represents a hydrogen or alkyl radical, are obtained by the reduction of the aminoketone compounds described in Eng. Pat. 26,480 of 1903 (see this J., 1904, 1943). The reduction may be carried out electrolytically, or by means of sodium amalgam, or by any other suitable method. — T. F. B.

## XXI. PHOTOGRAPHIC MATERIALS AND PROCESSES.

### GERMAN PATENTS.

*Dye-stuffs of the Cyanine Series*; *Process for the Preparation of Sensitizing* — [for Photographic Purposes]. Act.-Ges. f. Anilinfabr. Ger. Pat. 155,541, June 5, 1903.

CYANINE dyestuffs which extend the colour sensitiveness

of photographic plates further towards the red end of spectrum than those known at present, are obtained by oxidising methyl derivatives of quinoline alkyl halides the methyl group being in the pyridine nucleus (quinoline, lepidine); one only of these compounds may be used, or a mixture of two of them, or a mixture of one of them with a quinoline alkyl halide. For example, 20 grms. of quinoline iodomethylate are dissolved in 500 cc. of water, and oxidised with 25 grms. of potassium ferricyanide and 50 cc. of "concentrated" caustic solution; the dyestuff is extracted from the product by means of ether. Quinoline alkyl halides alone give no dyestuffs on oxidation. — T. F. B.

*Glycollic Acids of Pyrogallol and its Alkyl Ethers*; *Process for Preparing the* — [Photographic Development]. Act.-Ges. f. Anilinfabr. Ger. Pat. 155,568, Feb. 1903. XX., page 559.

## XXII.—EXPLOSIVES, MATCHES, Etc.

### ENGLISH PATENT.

*Heating Substances in a Vacuum at a Constant Temperature*; *Apparatus for* — [Stability Test for Gunpowder]. W. R. Hodgkinson and A. H. Coote. XXIII., see below.

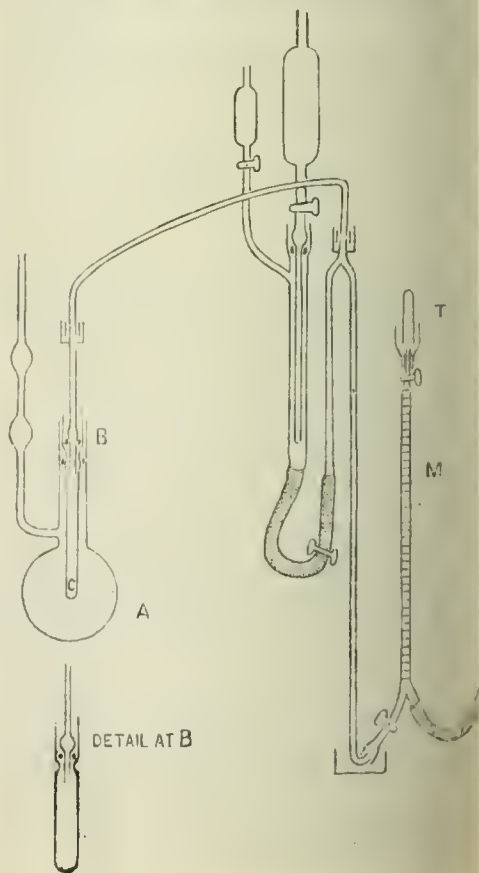
### FRENCH PATENT.

*Explosives*; *Process of Manufacturing* — A. M. Jacobs. Fr. Pat. 348,807, Dec. 13, 1904. SEE U.S. Pat. 777,125 of 1904; this J., 1905, 44.—T. F. B.

## XXIII.—ANALYTICAL CHEMISTRY.

### APPARATUS, Etc.

*Heating Substances in a Vacuum at a Constant Temperature*; *Apparatus for* — W. R. Hodgkinson and A. H. Coote. Chem. News, 1905, 91, 194.





apparatus which is shown in the adjoining figure has been used for the stability test for gun cotton.

The heating vessel, and contains a liquid of constant weight. (For gun cotton testing it is surrounded by fine gauze screen.) C is a tube containing the aneurism to be heated. B shows how C is connected to the rest of the apparatus by an india-rubber ring. C is wedged in between the two tubes and moistened with glycerin. The gas is measured over water or mercury and may be collected for analysis by means of the T.—C. E. F.

#### INORGANIC QUANTITATIVE.

*Acids; Oxidation of — by Iodine in Alkaline Solution.* R. H. Ashley. Amer. J. Science, Silliman, 55, 19, 237—239. Chem. Centr., 1905, 1, 1047.

(this J., 1902, 1473) has proposed the oxidation of arsenious acid or sulphites by treatment with a standard solution of iodine in presence of sodium borate, and the determination of the excess of iodine with thiosulphate solution. The author finds, however, that the oxidation of thiosulphate by iodine in the above solution proceeds further than the formation of tetraborate, so that more than the theoretical amount of iodine is consumed. On the other hand, under the conditions given by Rupp, the oxidation of the sulphite by iodine is not complete, so that his approximately correct results were evidently due to a fortunate compensation of error by another tending in the opposite direction. It is probable that a similar compensation of errors occurs in the determination of phosphoric acid by Ruppink's method (this J., 1902, 1473).—A. S.

*Mercurous Bromide, and Iodine; Separation of — from one another in Mixtures of Chlorides, Bromides, and Iodides.* O. Wentzki. Z. angew. Chem., 1905, 696—698.

The principle of the method is that mercurous bromide, when shaken with a soluble iodide, completely decomposes the latter, forming mercurous iodide and a soluble bromide, whilst mercurous chloride behaves similarly with bromides (and *a fortiori* with soluble iodides). The author's experiments have shown the method to be applicable to the haloid salts of potassium, sodium, ammonium, magnesium, barium, strontium, and calcium. The results are as follows:—In 100 c.c. of a solution of mixed mercurous chloride and iodide (containing, say, 1—2 grms. per litre of each salt), the weight of mixed silver halide is determined by precipitating with excess of silver nitrate. In 300 c.c. of the same solution are placed in a glass-stoppered flask, successive small amounts of precipitated silver chloride added, and the mixture shaken well after each addition. When the reaction is thought to be complete, 10 grms. of calomel will be needed for 0.127 gm. of silver chloride, a small quantity is filtered, some calomel added, and the mixture shaken and allowed to subside; the tint of the settled solid is compared with that of a similar quantity of calomel in distilled water—the merest trace of silver is indicated by a yellow colour. If the reaction is thought to be incomplete, the portion filtered off is returned to the main quantity, and more calomel added. When the reaction is complete, the solution is filtered through a filter, and the silver chloride formed determined by precipitation of 100 c.c. of the filtrate with excess of silver nitrate. From this weight, and that of the silver halides above, the amount of chlorine and bromine present are readily calculated. The separation of chlorine from bromine is carried out in exactly similar manner, while bromine is separated from iodine by treatment of the mixed solutions with mercurous bromide instead of calomel, testing the filtrate for iodine by means of nitrous acid and chloroform. If the whole three are present together, determinations are made of the silver precipitate from 100 c.c. (1) direct, (2) after precipitation of 300 c.c. of mercurous bromide ( $x\text{AgCl} + (y+z)\text{AgI}$ ); (3) after precipitation of 300 c.c. with mercurous chloride ( $y+z\text{AgCl}$ ). The results show a satisfactory accuracy in the last case.—J. T. D.

*Potassium Permanganate in the Presence of Potassium Persulphate; Determination of —.* J. A. N. Friend. Chem. Soc. Proc., 1905, 21, 133.

In order to obtain accurate results in the iodometric determination of small quantities of potassium permanganate in the presence of potassium persulphate (up to 0.08 gm.), the solution should be diluted to at least 150 c.c., and only a very slight excess of potassium iodide and acid added.—A. S.

*Perchlorates and Chlorates; Determination of — in Sodium Nitrate.* D. Tschernobajeff. Chem.-Zeit., 1905, 29, 442—443.

A METHOD for the determination of perchlorates in sodium nitrate was suggested by H. Lemaître (Monit. Scient., 1904, 18, 253). He reduced the perchlorate to chloride by melting the sample with sodium sulphite, dissolved the melt in water, precipitated with barium nitrate, filtered, and precipitated the filtrate with sodium persulphate. After neutralising with acetic acid, the sodium chloride was titrated with silver nitrate, using potassium chromate as indicator. The author found that the reduction in this process is complete, but that the sodium nitrite formed interferes somewhat in the titration. He recommends dissolving the melt in about 100 c.c. of water, adding an excess of N/20-silver nitrate solution and 6 c.c. of concentrated nitric acid, heating the solution almost to boiling for half an hour, filtering off the silver chloride and titrating the filtrate with N/20-potassium thiocyanate solution with a ferric salt as indicator. For the determination of sodium chlorate and iodate, which are equally reduced by sodium sulphite, the author employs Hendrixson's method (this J., 1904, 951), *viz.* reduction by metallic iron in sulphuric acid solution at ordinary temperature. Using 0.3—0.4 gm. of iron powder and 10 c.c. of sulphuric acid (1:3) he obtained complete reduction of about 0.1—0.2 gm. of sodium chlorate mixed with nitrate after 15—20 minutes. The iodate being present in the natural nitrate in very small quantity may be neglected.—R. L.

*Lead-Potassium Sulphate; Existence of a Definite Compound [Determination of Lead].* F. G. Belton. Chem. News, 1905, 91, 191.

THE determination of lead as sulphate in presence of potassium salts often leads to too high results. The author finds that this is due to the formation of a lead-potassium sulphate. In order to obtain accurate determinations of the lead in such cases, he recommends that the precipitation of the lead as sulphate should take place at a boiling heat, and that excess of sulphuric acid be used.

To prepare lead-potassium sulphate,  $\text{K}_2\text{Pb}(\text{SO}_4)_2$ , 10 c.c. of a 10 per cent. solution of lead nitrate are slowly added to 20 c.c. of a saturated solution of potassium sulphate at 75°C. After digesting for five minutes at 75°C., the solution is filtered through a Gooch crucible, washed with a saturated solution of potassium sulphate, and then once with cold distilled water.—C. E. F.

*Vanadium; Method of Determining —, and its Application to Metallurgical Products.* E. Campagne. Monit. Scient., 1905, 19, 373—378.

AN amount of the vanadium compound which contains not more than 0.1 gm. of vanadium is evaporated with 50 c.c. of hydrochloric acid, and the treatment repeated twice, when it is stated, all the vanadium will be present as divanadyl chloride,  $\text{V}_2\text{O}_5\cdot\text{Cl}_4$ . This is converted into the sulphate by heating with concentrated sulphuric acid, and the solution is diluted to 250 c.c. to 300 c.c. and titrated with potassium permanganate solution, a convenient strength for which is about 1 gm. per litre. In the application of this method to vanadiferous minerals or alloys, the substance is decomposed by heating with nitric acid, and the residue heated to convert the nitrates into oxides, which are then dissolved in hydrochloric acid. Iron is separated from the solution of the chlorides by Rothe's ether extraction method (see this J., 1892, 940). Alloys which contain copper or nickel as well as vanadium are attacked in the same manner, and the copper or nickel

is removed from the chloride solution by electrolysis. Silica is removed by filtering the sulphate solution just previous to titrating.—T. F. B.

### ORGANIC QUALITATIVE.

*Hydrocyanic Acid; Phenolphthalin as a Reagent for —.* F. Weehuizen. Pharm. Weekblad., 1905, 42, 271–272. Chem. Centr., 1905, 1, 1191.

If an alkaline solution of phenolphthalin, together with a 1:2000 solution of copper sulphate be added to a solution of hydrocyanic acid, a red coloration is produced in the cold, the phenolphthalin being oxidised to phenolphthalein. A perceptible coloration is produced in a solution containing 1 of hydrocyanic acid per 500,000.

—A. S.

*Turpentine Oil; Examination of —.* Utz. Chem. Rev. Fett-u Harz Ind., 1905, 12, 99–100.

A DETERMINATION of the refractive index of that portion of commercial turpentine oil which remains insoluble in fuming sulphuric acid may afford valuable indications of the nature of a sample, especially when considered in conjunction with the amount of this insoluble portion (Herzfeld's test). Thus a turpentine oil with refractive index of 1.4723 at 15° C. yielded 1.8 c.c. of a portion insoluble in sulphuric acid, and one of 1.6 c.c. insoluble in fuming sulphuric acid, and the second residue had a refractive index of 1.4944. The same oil mixed with 10 per cent. of a turpentine oil substitute yielded an insoluble portion of 2.2 c.c. with sulphuric acid and one of 1.5 c.c. with fuming sulphuric acid, the refractive index of the latter being 1.4672. A Russian turpentine oil yielded similar insoluble portions of 1 c.c. and 0.6 c.c. respectively, and the second had a refractive index of 1.4956. The same oil mixed with 10 per cent. of petroleum distillate yielded products having the following corresponding values:—2.4 c.c., 1.8 c.c. and 1.4544. Certain turpentine oils, notably those of German origin, give no further separation with fuming sulphuric acid, and in such cases the first portion separated by ordinary sulphuric acid, should be taken. Thus, a rectified turpentine oil treated with sulphuric acid yielded 0.9 c.c. of insoluble matter with a refractive index of 1.5108 at 15° C. For the detection of pine oil products it has been recommended that the substance should be shaken with an equal volume of sulphurous acid solution (yellowish green colour of the upper pine oil layer). The author confirms the fact that in this test American turpentine oil gives a snow-white emulsion which separates very slowly; rectified turpentine oil of the German Pharmacopoeia behaves in a similar manner, though the separation into layers is more rapid. Turpentine oil substitutes (benzol preparations and petroleum distillates) give no colours. The substance that gives the coloration can be separated by repeated distillation of pine oil, being left behind in the residue. Stannous chloride solution (Bettendorff's reagent) affords another means of distinguishing between turpentine oil and pine oil. The sample is shaken with an equal volume of the reagent and the colour observed. With Austrian turpentine oil the reagent becomes yellow and the oil remains colourless; whilst with Greek turpentine oil and American turpentine oil the reagent becomes orange and the oil yellow. On the other hand pine oil colours the stannous chloride solution raspberry red, whilst the oil itself usually remains yellow, though in some cases it, too, becomes raspberry-red. Certain samples of pine oil then give Lyon's reaction (a dark brown or black coloration with concentrated hydrochloric acid).—C. A. M.

*Butter; Detection of Coconut Fat in —.* Wauters. Bull. Soc. Chim. de Belg., 1905, 19, 6–7.

THE presence of cocoanut fat in butter can be detected by an examination of the crystalline form of the product with a polarising microscope. Cocoanut fat crystallises in long needles, frequently united in the form of a leaf or fan, whilst butter-fat crystallises in round masses which show a very characteristic cross in polarised light. Cocoanut fat having a very low critical temperature of solution and a low Reichert-Meißl value, the sum of these two

constants is also very low. The presence of cocoanut in butter therefore lowers this sum considerably, e.g. pure butter-fats the value is about 84, but the addition of 10 per cent. of cocoanut fat lowers it to 80. Refractometer number and the quantity of fixed acids are no longer in accordance with the Reichert-Meißl value. The presence of cocoanut fat also lowers critical temperature of solution and the refractor number of the fixed fatty acids.—J. F. B.

*Quinine and Cinchonine; Reaction for Distinguishing between —.* C. Reichard. Pharm.-Zeit., 1905, 314. Chem.-Zeit., 1905, 29, Rep., 122.

THE alkaloid is treated in the cold with a mixture of concentrated sulphuric acid and ammonium molybdate gently with a few crystals of ammonium sulphate, and then treated with a 40 per cent. solution of formaldehyde and a drop of a strong solution of ammonium thiocyanate. The dark blue colour produced by treatment with sulphuric acid and ammonium molybdate changes to yellow on heating with ammonium persulphate. On adding the potassium thiocyanate solution, the mixture is coloured an intense reddish-brown if cinchonine is present, whilst if only quinine be present, either no reaction takes place or the mixture becomes faintly red after a time.—A. S.

*Aconitine; New Reaction for —.* E. P. Alvarez. Chem. News, 1905, 91, 179–180.

IN the examination of a specimen of pure aconitine, the coloration with sucrose and sulphuric acid was obtained. The alkaloid was readily saponified by caustic potash, but no formation of veratrine could be detected. The new reaction for pure aconitine is as follows:—The alkaloid (0.0005–0.0002 gm.) is warmed with 5–10 drops of pure bromine, 1–2 c.c. of fuming nitric acid are added, and the mixture evaporated to dryness, with the addition of a little more bromine necessary. From 0.5 to 1 c.c. of a saturated alcoholic solution of caustic potash is then added, and the mixture evaporated to dryness; the residue has a more or less intense brown or red colour according to the quantity of aconitine present. After cooling, 5–6 drops of an aqueous 10 per cent. solution of copper sulphate are added, and the solution soon acquires a deep green colour, if aconitine be present.—A. S.

### ORGANIC QUANTITATIVE.

*Carbon, and Hydrogen in Organic Compounds; Determination of —.* F. Pregl. Ber., 1905, 38, 1444.

THE object of the method is to enable a combustion to be performed automatically without personal attention, beyond the necessary initial and final weighings, and the initial adjustment of the apparatus. The part of the combustion-tube, furthest from the absorption apparatus, is left empty. The next 30 c.m. are filled with copper-oxide-asbestos, followed by 6 c.m. of lead peroxide, to a nitrogen oxides, halogens, &c. In the case of compounds containing iodine, the last portion of the copper-oxide-asbestos must be replaced by silver-asbestos. The end of the tube nearest the absorption apparatus, which is of the ordinary type, is heated to 150°–180° C. in an air-bath. The copper-oxide-asbestos portion is heated by five fixed Fletcher burners. The substance to be analysed is placed in a boat, behind which a diffusion plug is inserted and is heated by a single burner which is made to travel from the end, towards the absorption apparatus, slowly and steadily, by means of clock-work. A horizontal asbestos screen travels just above the combustion boat with the movable burner, and so concentrates the heating effect. The combustion is carried out in a slow stream of oxygen. After starting the combustion no further attention is necessary, except to finally drive out the oxygen by air, and perform the final weighings. The speed of the movable burner can be initially adjusted according to the nature of the substance to be analysed. For further particulars, especially with regard to the method of filling the tube, the original paper must be consulted.—E. F.



*Al Groups; Simple Method for the Determination of* —. J. J. Sudborough and W. Thomas. Chem. c. Proc., 1905, 21, 88.

0.5 to 1 gm. of the acetyl derivative is treated with per cent. solution of pure benzenesulphonic acid (aphthalene-  $\alpha$ - or  $\beta$ -sulphonic acid), and the mixture with steam until the distillate is no longer acid. distillate is then titrated with a standardised solution of sodium hydroxide, using phenolphthalein as indicator. O-acetyl compounds the distillation takes from one to two hours, but somewhat longer with N-acetyl derivatives. The pure benzenesulphonic acid used can be purified by blowing steam through a solution of the barium salt until the distillate is neutral, then allowing the solution to crystallise, and decomposing the purified barium salt the theoretical quantity of sulphuric acid.—A. S.

*Alkali; Determination of the Water and Free [Caustic] Alkali in* —. K. Braun. Z. angew. Chem., 1905, 58, 573–574.

A weighed quantity of the finely-divided soap is dried to constant weight in a wide-necked flask fitted with a U-tube containing soda-lime. The soda-lime prevents access of carbon dioxide of the air, and thus the conversion of free caustic alkali into carbonate during the drying is avoided. The dried soap is dissolved in the smallest possible quantity of alcohol, and the free alkali determined by titration, using phenolphthalein as indicator.

—A. S.

*Alcohol and Woody Fibre in the Sugar Cane and in Bagasse; Determination of* —. H. and L. Pellet. XVI., page 555.

*Alcohol Analysis.* J. S. Ford and J. M. Guthrie. XVII., page 556.

*Alcohol in Beer; Determination of* —, by the Zeiss Immersion Refractometer. E. Ackermann und A. Steinmann. Z. ges. Brauw., 1905, 28, 259–260.

Good agreement is obtained between the strengths of aqueous alcohol as given by Windisch's tables from the specific gravity and by Wagner's tables from the refractometer number obtained by the Zeiss immersion instrument; the differences amount to about 0.2 per cent. for solutions containing from 0 to 6 per cent. of alcohol and to about 0.3 per cent. for those with from 6 to 10 per cent. It is found that the alcohol content of a solution is proportional to its refractive index except between 6 and 7 per cent., where the ratio suddenly changes to another value, at which it then remains constant. It was not found possible to draw up an exact table for the refractometric determination of alcohol in wines, probably owing to the influence exerted on the refraction by the volatile acids and aromatic substances.

With beer distillates, however, much better results are obtainable, as is shown by a large number of estimations carried out by the authors. Since Wagner's tables were not calculated for beer distillates, the authors have prepared a new table, giving the percentage of alcohol present in the distillate for all refractometer numbers from 15.0 to 23.5.

*Table for the Determination of the Alcohol-content of Beer Distillates from the Refraction by Means of the Zeiss Immersion Refractometer at 17.5° C.*

Refractometer Number.	Alcohol, Per Cent., by Weight.	Alcohol, Per Cent., by Volume.	Refractometer Number.	Alcohol, Per Cent., by Weight.	Alcohol, Per Cent., by Volume.	Refractometer Number.	Alcohol, Per Cent., by Weight.	Alcohol, Per Cent., by Volume.	Refractometer Number.	Alcohol, Per Cent., by Weight.	Alcohol, Per Cent., by Volume.
0	0.00	0.00	17.2	1.38	1.74	19.4	2.74	3.46	21.6	4.02	5.06
1	0.06	0.08	17.3	1.44	1.82	19.5	2.80	3.53	21.7	4.07	5.13
2	0.13	0.16	17.4	1.51	1.90	19.6	2.86	3.61	21.8	4.13	5.20
3	0.19	0.24	17.5	1.57	1.98	19.7	2.91	3.68	21.9	4.18	5.26
4	0.25	0.32	17.6	1.63	2.05	19.8	2.97	3.75	22.0	4.22	5.32
5	0.32	0.40	17.7	1.68	2.12	19.9	3.04	3.83	22.1	4.28	5.39
6	0.38	0.48	17.8	1.74	2.20	20.0	3.10	3.90	22.2	4.33	5.46
7	0.44	0.56	17.9	1.81	2.28	20.1	3.15	3.97	22.3	4.39	5.53
8	0.50	0.64	18.0	1.87	2.36	20.2	3.20	4.04	22.4	4.44	5.59
9	0.57	0.72	18.1	1.93	2.44	20.3	3.26	4.11	22.5	4.49	5.65
0	0.64	0.80	18.2	2.00	2.52	20.4	3.33	4.19	22.6	4.54	5.72
1	0.70	0.88	18.3	2.06	2.60	20.5	3.38	4.26	22.7	4.59	5.78
2	0.77	0.96	18.4	2.13	2.68	20.6	3.43	4.33	22.8	4.64	5.85
3	0.83	1.04	18.5	2.19	2.76	20.7	3.50	4.41	22.9	4.70	5.92
4	0.88	1.12	18.6	2.25	2.84	20.8	3.56	4.48	23.0	4.76	6.00
5	0.95	1.19	18.7	2.31	2.92	20.9	3.61	4.55	23.1	4.81	6.07
6	1.01	1.27	18.8	2.37	2.99	21.0	3.67	4.63	23.2	4.86	6.13
7	1.05	1.33	18.9	2.43	3.07	21.1	3.73	4.71	23.3	4.92	6.20
8	1.13	1.43	19.0	2.49	3.14	21.2	3.78	4.77	23.4	4.97	6.27
9	1.19	1.51	19.1	2.55	3.22	21.3	3.84	4.84	23.5	5.02	6.33
0	1.25	1.58	19.2	2.61	3.29	21.4	3.90	4.92	—	—	—
1	1.32	1.66	19.3	2.68	3.37	21.5	3.96	4.99	—	—	—

—T. H. P.

*Alkali Analysis; Use of the Centrifugal Machine in* —. B. Bordas and Touplain. Comptes rend., 1905, 140, 108–1099.

The authors show that the fat is completely extracted from cocoa by digesting the latter with ether and subjecting the mixture to centrifugal action, the extraction separation being repeated three times, and taking half an hour altogether. In the case of chocolate, the residue left after removing the fat, as above, is treated with water and centrifuged to obtain the sugar. With chocolate, a little trisodium phosphate must be added, after extracting the fat, to keep the casein in solution.—W. P. S.

*Alkali; Rapid Method for the Analysis of* —. F. Bordas and Touplain. Comptes rend., 1905, 140, 1099–1100.

c.c. of the milk are added, drop by drop, to a mixture of alcohol (65 per cent.) and a little acetic acid contained in a test tube. After standing a short time the tube and contents are subjected to centrifugal action. The supernatant liquid is then decanted off, the precipitate is treated with 30 c.c. of 50 per cent. alcohol, again subjected to centrifugal action and the solution decanted. These

solutions are united and the lactose determined by Fehling's method. The residue left in the tube is extracted twice with a mixture consisting of 2 c.c. of 96 per cent. alcohol and 30 c.c. of ether, and the ethereal layer separated each time in the centrifugal machine and decanted. The mixed ethereal solutions are then evaporated in a weighed flask, and the residue of fat weighed. The finely-powdered casein left in the tube is weighed after being dried. A determination of the ash in a separate test tube. 10 c.c. of the milk completes the analysis. In the case of curdled milk, the whole sample is measured, separated into two layers by centrifugal action, and each layer separately analysed.—W. P. S.

*Lemon Oil; Indirect Method of Determining the Aldehydes in* —. E. Berté. Chem. and Druggist, 1905, 66, 682–684.

It is proposed to calculate the total amount of aldehydes present in lemon oil from the optical rotation of the oil before and after the removal of the aldehydes, the percentage being given by the expression  $100(A-a)/A$ , where  $a$  is the rotation of the original oil, and  $A$  that of the oil free from aldehydes. The aldehydes may be removed,

for example, by boiling 10 c.c. of the oil with 50 c.c. of a saturated solution of potassium bisulphite, under 5 mm. pressure. In preliminary experiments it was found that prolonged heating with reagents that removed aldehydes did not modify the rotation of the terpenes. This method was found to furnish accurate results when applied to mixtures of pure citral and limonenes of known composition.

—T. F. B.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Gold; Precipitation of — in the Crystalline Form.*  
R. Dykes. Chem. News, 1905, 91, 180.

On evaporating an ether solution of uranium nitrate and auric chloride, the solution, towards the end, changed from pale yellow to orange-red, and became viscous; on adding a few drops of distilled water and again evaporating, a bright yellow scintillating precipitate formed. On repeating the experiment, amorphous gold was obtained in one case and sealy gold in another, but on adding a few drops of auric chloride solution to the filtered liquid and again evaporating, a crystalline precipitate was obtained. In one experiment the gold was obtained in crystals only after repeated evaporation and the frequent addition of auric chloride. Crystals of gold were also obtained by keeping an ether solution of auric chloride in a sealed tube for some days in the dark.—A. S.

*Silver; Colloidal —.* A. Gutbier and G. Hofmeier.  
Z. anorg. Chem., 1905, 45, 77—80.

SOLUTIONS containing 50 c.c. of 1 per cent. gum arabic solution were made up to 200 c.c. by addition of 0.1 per cent. silver nitrate solution and water, the amounts of silver nitrate solution being 100, 25, 10, 5, and  $1\frac{1}{2}$  c.c. respectively; after reduction by a 0.05 per cent. solution of hydrazine hydrate, the solutions were dialysed, and then proved to be all very stable, showing no sign of precipitation even after 3 months. They could even be concentrated by careful evaporation, and *in vacuo* over sulphuric acid at the ordinary temperature could be dried to dark glass-like solids, completely soluble again in warm water. They were readily destroyed by shaking with animal charcoal or barium sulphate. About 95 per cent. of the quantity of silver used, was recovered in these hydrosols. The colours of the solutions were as follows:—

Volume of Silver Solution in 200 c.c.	Colour by Reflected Light.	Colour by Transmitted Light.
100 c.c.	dark olive green	brown red
25	olive green	red
10	brownish	dark violet
5	grey	violet
1.5	weak grey; appears turbid	in thick layers weak violet

Neither hydrogen peroxide nor formic acid could be used for the reduction. Ammoniacal silver nitrate reduced by phenylhydrazine sulphate, gave a hydrosol having a black colour by reflected, but appearing dark green by transmitted light; possibly there is here simultaneous formation of Blake's "blue" and "yellow" silver. Hypophosphorous acid, used to reduce silver nitrate in presence of gum arabic, gave a light-brown colour, turning dark-brown and then deep red; on gradually heating to boiling, the colour became olive-green (deep red by transmitted light), and this colour remained permanent after dialysis.—J. T. D.

*Arsenious Anhydride Crystals; Light emitted by —*  
D. Gernez. Comptes rend., 1905, 140, 1134—1136.

THE author has investigated this phenomenon, and finds that the light is emitted, not, as is usually supposed, at the moment of separation of the crystal from the liquid, but when through contact with a hard body, rupture of the crystal occurs. It is, in fact, a case of tribolumin-

escence. It is not necessary that the acid solution of anhydride should have been boiled; moreover the crystals retain for weeks or months the property of emitting light when broken by rubbing with a glass rod. Nor need anhydride which is dissolved be originally in the vitreous form; the pulverulent crystallised anhydride, dissolved in hot hydrochloric acid, gives, on cooling, crystals which show the phenomenon just as strongly as those formed from the solution of the vitreous variety.—J. T. D.

*Carbon; Separation of — from Carbon Dioxide*  
K. Brunner. Ber., 1905, 38, 1432.

THE separation of carbon from carbon dioxide is shown by burning magnesium powder in a dish formed in solid carbon dioxide. A grey cake is formed, which on treatment with dilute hydrochloric acid, is shown to be deep black, flocculent carbon. If the magnesium be replaced in this experiment by aluminium powder, aluminium oxide, soluble with difficulty, a little aluminium carbide and heavy graphitic carbon, are formed.—E. F.

*Hydroxyl and Alkoxyl Groups; Influence of — on Velocity of Saponification.* I. A. Findlay and W. E. Turner. Chem. Soc. Proc., 1905, 21, 127—128.

THE accelerating influence exerted by the hydroxyl group is shown by the following values for the saponification constant (*k*) in aqueous solution at 25° C.:—Ethyl phenylacetate,  $C_6H_5.CH_2.CO_2C_2H_5$ , 12.4; methyl mandelate,  $C_6H_5.CH(OH).CO_2CH_3$ , 157; ethyl mandelate,  $C_6H_5.CH(OH).CO_2C_2H_5$ , 66; propyl mandelate,  $C_6H_5.CH(OH).CO_2C_3H_7$ , 55; ethyl phenylmethoxyacetate,  $C_6H_5.CH(OCH_3).CO_2C_2H_5$ , 23.3; ethyl phenylethoxyacetate,  $C_6H_5.CH(OC_2H_5).CO_2C_2H_5$ , 157; and ethyl phenylpropoxyacetate,  $C_6H_5.CH(OC_3H_7).CO_2C_2H_5$  (calculated from the values obtained in alcoholic solution) 13.3. The results also show that on substituting an alkyl group for the hydrogen of the hydroxyl, the velocity of saponification is diminished, the diminution increasing regularly with the mass of the alkyl group.

The saponification constants of the esters mentioned above, in 30 per cent. and 60 per cent. alcohol, shown in the following table:—

Ester.	In 30 per cent. Alcohol. <i>k</i> .	In 60 per cent. Alcohol. <i>k</i> .
Ethyl phenylacetate .....	8.6	[6.0]
Methyl mandelate .....	[109.0]	[84.0]
Ethyl mandelate .....	49.4	29.1
Propyl mandelate .....	39.5	22.7
Ethyl phenylmethoxyacetate	15.2	[8.0]
Ethyl phenylethoxyacetate	10.2	[6.0]
Ethyl phenylpropoxyacetate	—	[5.0]

The numbers enclosed in brackets are only approximate in the case of the esters to which they apply, there was a gradual decrease in the value of the "constant" with time.

—A. S.

## Trade Report.

### I.—GENERAL.

#### BRITISH INDIA; TRADE OF —.

Chem. and Drug., March 13, 1905.

THE India Office has issued its annual Blue-book tables relating to the trade of British India with British Possessions and Foreign Countries, 1899-1900 to 1900-1901. The present return contains statistics of the foreign trade during the last five financial years, and gives details of imports and exports. The book is published at 1s. by Messrs. Wyman and Sons, and the Government booksellers in Dublin and Edinburgh.



		Imports.		Exports and Re-exports.	
		1902-3.	1903-4.	1902-3.	1903-4.
Alumina	lbs.	221,230	232,494	3,024	24,187
Alumina	cwt.	61,081	67,930	3,478	2,066
Alumina	"	2,957	2,380	—	—
Sulphuric acid	"	76,486	66,972	—	—
Chemicals	£	30,699	26,650	—	—
Chemicals	cwt.	17,727	25,079	—	—
Chemicals	"	3,810	4,677	985	1,427
Chemicals	"	44,632	46,581	—	—
Chemicals	"	50,204	74,666	—	—
Chemicals	£	198,340	215,331	4,080	4,782
Chemicals	lbs.	1,171,880	1,091,108	61,482	58,287
Chemicals	"	61,067	51,893	—	—
Chemicals	"	—	—	—	—
Chemicals	"	4,830,447	6,690,635	—	—
Chemicals	"	4,273,130	5,482,964	—	—
Chemicals	cwt.	1,607	1,156	—	—
Chemicals	"	26,270	27,436	—	—
Chemicals	"	1,064	219	65,377	60,410
Chemicals	"	2,432	1,368	—	—
Chemicals	"	295	341	3,142	2,960
Chemicals	"	15,140	11,021	2,397	21,712
Chemicals	galls.	8,602	10,406	25,955	6,091
Chemicals	"	—	—	—	—
Chemicals	cwt.	1,146	2,404	—	—
Chemicals	"	13,052	13,377	—	—
Chemicals	"	28,582	52,913	84,137	97,739
Chemicals	"	46,261	92,750	—	—
Chemicals	"	16,082	18,351	—	—
Chemicals	"	6,546	5,060	7,419	6,383
Chemicals	£	14,674	20,871	10,456	10,106
Chemicals	cwt.	134,598	161,224	6,867	6,060
Chemicals	galls.	—	—	2,073,573	1,916,200
Chemicals	cwt.	—	—	231,594	229,237
Chemicals	"	—	—	126,076	68,234
Chemicals	"	—	—	2,969	4,313
Chemicals	lbs.	—	—	1,579,498	1,108,527
Chemicals	£	—	—	70,127	80,234
Chemicals	cwt.	—	—	5,002	5,333
Chemicals	"	—	—	410,622	392,114

Blue-book also gives tables of imports of articles, showing principal countries, from which one is to see the source of the chemicals, drugs, and so on. Following are the figures for the United Kingdom for the five years:—

	1899-1900.	1900-1.	1901-2.	1902-3.	1903-4.
Alumina	£ 250,883	£ 312,316	£ 317,652	£ 295,977	£ 315,867
Alumina	188,040	219,096	207,711	215,881	221,369
Alumina	96,813	102,623	105,980	131,769	157,488
Alumina	94,455	95,558	97,185	128,132	155,201

Ally all the alum, sodium bicarbonate, borax, and chemicals, copperas, sal ammoniac and sulphuric acid were shipped direct from the United Kingdom. Sicily supplied the sulphur and Hong-Kong supplied the arsenic, of which 2,380 cwt. was imported. Bulk of the camphor was obtained from Japan and the Straits Settlements. Cocaine appears in the list for the first time, and of the quinine 46,692 lb. was obtained from Great Britain, 2,234 lb. from Belgium, 904 lb. from the U.S.A., and 2,033 lb. from other countries. India is a consumer of saffron, which practically all comes from Persia direct. Of spirit used in the manufacture of medicines, or chemicals, India imported 72,952 gallons during 1903-4, compared with 72,233 gallons during 1902-3. The U.K. supplied 57,787 galls. (57,240 galls. in 1902-3), and Germany 3,320 galls. (3,087 galls. in 1902-3). The spirit was imported to the extent of 24,815 galls., an increase of 6,600 galls. on the previous year. The U.K. supplied 11,259 galls. (9,103 galls. in 1902-3), and Germany 5,921 galls. (4,622 galls. in 1902-3). A considerable decrease is noticed in the imports of methyl spirit, only 40,566 galls. (4,652 l.) having been imported against 91,352 galls. (9,837 l.) in 1902-3. Germany has the largest share of the business, having sent 32,761 galls. (57,091 galls. in 1902-3). Austria-Hungary shipped 19,721 galls. in 1902-3, and other countries,

which included the U.K., exported only 1,308 galls., or 13,000 galls. less than in 1902-3. Germany has the bulk of the trade in gum arabic, her imports during 1903-4 being 19,000 cwt. out of 39,000 cwt., this comparing with 10,029 cwt. for the United Kingdom.

GERMAN INDUSTRIAL STOCK COMPANIES: DIVIDENDS OF —.

For. Off. Ann. Series, No. 3342.

The following table shows the dividends declared by some Industrial Stock Companies in the German Empire during the year 1904:—

Industry.	Dividends. Per Cent.
Chemical	13-92
Porcelain, glass, pottery	11-82
Brewing and distilling	10-0
Sugar	9-35
Mining	8-68
Paper and rubber	8-23
Cement	6-53
Textiles	5-36

NOTE.—All higher than in 1903, except textiles.

POLAND; CHEMICAL INDUSTRY OF —.

For. Off. Ann. Series, No. 3351.

The chemical industry in this Consular district was not very successful in 1904. In consequence of the diminution of production in the cotton and woollen industries, the consumption of different chemical products for dyeing and printing was reduced to a minimum.

The production of sulphuric acid was regulated by agreement between the producers, who raised the price and lessened the production to about one-half the quantity they are capable of producing. This measure is very prejudicial to the other branches of the chemical industry, for which the price of sulphuric acid is of essential significance.

Both sulphur, in the form of pyrites, and common salt, are burdened with a relatively high import duty. Pyrites is not exploited in the Russian Empire, and has to be imported from Spain and Germany; whilst salt, being only found in Poland in small quantity at Ciechocinek, has either to be brought from the north of the Crimea, whence the transport is excessively expensive, or imported from Germany, in which case there is a crushing duty of 2s. per cwt.

The difference between the duty on intermediate products and on a great many synthetic organic dyes has enabled some German firms to establish in Poland several small factories which carry out processes for which they use the intermediate products of their chief houses in Germany. By the new tariff, however, a change will be made in this respect, as a great many of these organic products which have hitherto paid the duty on "chemical products not separately designated" at the rate of 14s. 9d. per cwt., will, by the new tariff, have to pay a special duty, which will be in many cases double or more. The synthetic dye industry will therefore have either to extend their scope of work and produce the necessary products, or to give up some of their articles.

The new tariff is also favourable to the production of some mineral colours (white lead and zinc), and for the preparation of mercury, which has hitherto been exported as a metal and re-imported in the form of its products. There is also a whole series of pharmaceutical productions which ought to develop considerably, thanks to the imposition of a higher duty in the new tariff.

A great drawback to the chemical industry in Russia is the system of patents, by which foreigners, especially Germans, hold patents for inventions in Russia which prevents others from making use of this form of production, of which, however, they do not themselves make use in Russia.

Until last year ether, for which there is a considerable demand in this Consular district, was imported from Germany, but at the end of 1904 an ether factory was started in the government of Piotrkoff, with a production of 30,000 lb. a year; but as this is far from covering the demand, several distillers in the government of Kalisz have combined for the production of ether on a larger scale.

#### MEXICO; EXEMPTIONS FROM IMPORT DUTY.

*Bd. of Trade J., May 11, 1905.*

The following articles are exempt from import duty under Articles 13, 14 and 15 of a new Mexican Law dated March 25, 1905.

##### Tariff No.

- 295 Zinc, in ingots, filings, powder, or wire.
- 303 Zinc, in sheets, not exceeding 1 by 2½ metres in length and breadth, and 1 millimetre in thickness.
- 358 Sulphur.
- 654 Sulphuric acid.
- 677 Alkaline cyanides.
- 697 Hyposulphite of soda.
- 716 Saltpetre, or nitrate of potash or of soda.
- 719 Sulphate of copper.
- 800 Machinery imported by mining or metallurgical establishments in which the precious metals are refined.

The above-mentioned provisions of this law were to take effect from May 1.

#### VII.—ACIDS, ALKALIS, Etc.

BILBAO, SPAIN; CHEMICAL INDUSTRY IN —.

*For. Off. Ann. Series, No. 3352.*

The native production of sulphate of ammonia is advancing very notably, as a consequence of the greater consumption. The local output is so small in proportion to the demand that its price has risen to about 450 pesetas (13l. 10s.) per ton. It is chiefly used in beet cultivation. For the same reason the price of nitrate of soda has also advanced. The local production is about 2,400 tons,

whilst the import of both these articles is estimated about 48,000 tons of the first and 30,000 tons of the second, the former coming wholly from the United Kingdom. The best markets are in the south of Spain, especially Valencia. The native production of carbonate of soda and caustic soda has been so far of little importance, a Belgian company is erecting works at Torrelavega (Santander province) to work the Solvay process, and calculates its future annual output at 20,000 tons of carbonate of soda—an amount equal to the present consumption and 15,000 tons of caustic soda. Sulphuric and nitric acids are almost wholly produced in the country, with the exception of small quantities of superior quality. New works are being erected close to Bilbao capable of producing 5,000 tons per annum by the contact process. Citric juice and products of a like nature are no longer exported but are used in native works for the production of tartaric acid. Phosphates are imported from North Africa, Algiers, according to the quality or strength required. The importation of superphosphates has increased, and come from France, Belgium and the United Kingdom, but the production in the country in old establishments as well as in new works is also augmenting. The importation of nitrate of soda from Chile is increasing as well as the indirect via the United Kingdom and Germany.

#### VIII.—GLASS, POTTERY AND EARTHENWARE

CORUNDUM ORE CONCENTRATES; U.S. CUSTOMS DECISION. *April 28, 1905.*

Corundum ore concentrates, which, on chemical analysis, was found to be ground corundum, was held to be duty as "emery ground or pulverised," at 1 cent per lb., under paragraph 419 of the present tariff. The claim of the importer for free entry under paragraph 550, as "corundum ore," was overruled.—R. W. M.

#### IX.—BUILDING MATERIALS, Etc.

CEMENT IN THE UNITED STATES.

*For. Off. Ann. Series, No. 3353.*

The value of the imports of cement into New York again fallen from 75,000l. in 1903 to 24,000l. in 1904, the total imports into the United States have decreased in the same period from 605,000l. to 277,000l. A report on the production of cement in the United States in 1903 showed that the total production of hydraulic cement was about 29,900,000 barrels, showing an increase of over 4,000,000 barrels as compared with 1902. Of these, 22,350,000 barrels were Portland cement, 7,900,000 barrels natural rock cement and 526,000 barrels Pozzolanic or slag cement. The increase in the production of Portland cement resulted in a glutted market, a large quantity remained over at the close of the year 1903, and fell in consequence. Pennsylvania is the largest producing State, having seventeen works with an output in 1903 of 9,754,000 barrels. In New Jersey there are three works which produce 2,700,000 barrels and in New York two works with a production of 1,603,000 barrels. In the trade was greatly depressed; one of the works in New Jersey closed till the demand should improve and were working on short time. The price fell to 85 c. (3s. 6½d.) per barrel, but at a meeting of manufacturers in December it was resolved to raise it to 100 c. as to avoid working at a loss.

CEMENT INDUSTRY OF STETTIN.

*For. Off. Ann. Series, No. 3358.*

The year 1904 was not a very successful one for the cement industry. The very low prices ruling caused a considerable increase in the sales, but although demand remained good, prices did not revive owing to over-production in certain parts of Germany.

The total export of cement from Stettin by sea was 89,955 tons in 1903, and 88,869 tons in 1904, the greater part of which went to the Zollverein ports.

The small decrease is said to be due to the improvement in the quality of the cement.



cement produced in the receiving countries, which is in a better position to supply their own demand. Export to the United States of America is also handled by the high import duty levied on cement.

"Kraft" Ironworks at Kratzwiek, near Stettin, fully employed during the year and all products a ready sale.

Best Portland cement was in good demand, but prices very low. The following were among the products manufactured in 1903-04:—

	Quantity.	
	1903.	1904.
..... tons	40,881	43,765
..... number	3,690,000	3,468,000
of slag .....	1,190,000	3,648,000

men were employed during 1904. The last few years the output of bricks made from as much increased, having proved excellent for all purposes, so much so that over 15,000,000 bricks already been used. The selling price at the works

not less than 30,000 bricks, 16 marks 50 pf. per for not less than 50,000 bricks, 16 marks per 1000; less than 150,000 bricks, 15 marks 50 pf. per

blast furnace slag is also used in pieces, or in cast which are extremely hard, and have a high specific gravity. dykes, quay walls and bank protections. For bricks lime is mixed with the slag in presses at a high pressure; the bricks harden in 36 to 48 hours.

## X.—METALLURGY.

### MINING IN BILBAO.

For. Off. Ann. Series, No. 3352.

following is an approximate return of the different kinds of iron ore worked in the province of Bilbao,

	1902.	1903.	1904.
..... Tons.	4,182,500	4,267,078	4,433,885
..... Tons.	442,237	509,801	582,036
..... Tons.	57,081	81,634	54,537
Total .....	4,681,818	4,858,513	5,070,458

Iron ore exported from Bilbao during the last three years as follows:—1902, 4,196,851 tons; 1903, 4,028,730 tons; 1904, 3,846,352 tons. Of these totals, there was exported to the United Kingdom, 1902, 2,996,908 tons; 1903, 2,649,004 tons; 1904, 2,490,352 tons. Besides above quantity, 53,341 tons were shipped coastwise to Gijon, whilst of the total output of 567,791 tons remained in stock.

remaining ores worked in the province of Biscay were as follows:—Calamine, 2,963 tons; Pyrites, 1,914 tons; pyrites of copper, 270 tons; lead, blende, 35 tons.

### MINING INDUSTRY OF POLAND.

For. Off. Ann. Series, No. 3351.

Attempts were made last year to work the old lead mines in the neighbourhood of Kielce, which were exploited 100 years ago, with fair results; but the mine at Karczowka, which was reported to be very rich, only gave about 10 tons of galena for six months' work. Similar attempt to work the old copper mine at Chenciny were also made on a small scale. The carbonate of copper, impure malachite and azurite, which sulphate of copper is manufactured. This sul-

phate commands a better price than that prepared in the chemical factories, as it does not contain any iron salts.

In 1904 a company prospected for lead in the government of Kielce, and were eventually successful. The ore lies about 160 ft. underground, and the seam is from 2 to 6 ft. thick. The percentage of lead is estimated at 80 to 85 per cent., and the ore also contains a certain percentage of silver.

The production of zinc is steadily increasing, as in 1904 it was nearly 11,000 tons, which is 7 per cent. more than in 1903, when it had been 20 per cent. more than in the previous year. Three works are employed in this industry.

### PLATINUM PRODUCTION OF RUSSIA.

Eng. and Mining J., April 27, 1905.

The production of platinum in Russia during 1904 was 5005 kilograms, which was contributed by the districts as follows:—

	Kg.
Tcherdinsk .....	153'3
Perni .....	1,105'9
South Verkhotoorsk .....	3,533'6
North Verkhotoorsk .....	206'9
South Ekaterinburg .....	5'3
Total .....	5,005'0

This total is 1000 kg. less than the output in 1903 and 1130 kg. below that of 1902.

### MERCURY IN TUSCANY.

For. Off. Miscell. Series, No. 633.]

The output of mercury in Tuscany amounted to 355 tons in 1904, valued at about 80,000*l.*, and the indications are that it is likely to increase. The most important mine is that of Siete, near Castell' Azzara. Other mines have recently been opened up at Badia, San Salvatore, and at Montebruno. The mine at Cortevicchia continues to produce regularly. On a belt of land, starting at Monte Amiata and extending southwards to Capita, there are found at intervals indications of the presence of mercury; specimens of cinnabar have been found carrying 60 per cent. of mercury.

## XII.—FATS, FATTY OILS, Etc.

### PITCH; HARD ——. U.S. CUSTOMS DECISION.

April 28, 1905.

Hard pitch containing 50 to 60 per cent. of fatty acid compounds and no paraffins, is dutiable at 20 per cent. *ad valorem* under Section 6 of the present tariff as a "manufactured article unenumerated." The claims of the importer that it was free of duty under paragraph 617 as a "crude vegetable substance," or as "tar or pitch of wood" under paragraph 678, or as "wax vegetable or mineral," were all overruled.—R. W. M.

## XIII. A.—PIGMENTS, PAINTS, Etc.

### PIGMENTS; IRON OXIDE ——. U.S. CUSTOMS DECISION. April 28, 1905.

"Ferrubron natural purple," consisting of 85-15 per cent. of ferric oxide and 9-15 per cent. of insoluble matter, and "ferrubron steel grey," consisting of 84-87 per cent. ferric oxide and 11-16 per cent. of insoluble matter, were held to be dutiable at 30 per cent. *ad valorem*, under paragraph 58 of the present tariff, as "colours." The importers claimed that they were dutiable at 40 cents per ton, as "iron ore," under paragraph 121, but presented no evidence in support of their claim.—R. W. M.

### COLOURS; DRY ——. U.S. CUSTOMS DECISION.

April 26, 1905.

Colours invoiced as "fleischoecker" and "grune erde" were held to be dutiable at 30 per cent. *ad valorem* as "colours," under paragraph 58 of the present tariff. The importers claim that they were dutiable at  $\frac{3}{4}$  cent per lb. as "ochery earth, ground and washed," under paragraph 49 was overruled.—R. W. M.

## XIII. B.—RESINS, VARNISHES, Etc.

## TURPENTINE AND RESIN OUTPUT OF BILBAO.

*For. Off. Ann. Series, No. 3352.*

The most important resin company in Spain is registered in Bilbao under the name of "La Union Resinera Espanola." They are leasing and purchasing a great many pine-tree plantations all over Spain, and they acquired some 95,100 more trees in 1904 in the inland provinces. The total number of trees worked during that year was 6,278,485, which yielded 14,722 tons of resin.

The output of the factories amounted as follows:—

	Quantity.	
	1903.	1904.
	Tons.	Tons.
Turpentine .....	3,146	3,440
Colophony .....	10,825	12,080

The sales of both products in the country were less than in the preceding year, whilst exports abroad increased by 1,600 tons on each article.

## XIII. C.—INDIA-RUBBER, Etc.

## RUBBER EXPORTS FROM IQUITOS, PERU.

*For. Off. Ann. Series, No. 3355.*

In spite of the last rubber season being very short—not having commenced till July and being completely over in February—the output was larger than in 1903 and the value much higher on account of the enhanced prices in the consuming markets. The following table shows the quantities and value of rubber shipped to European ports, New York and Brazil:—

Country.	Quantity.				
	Peruvian Slab.	Peruvian Ball.	Peruvian Fine.	Weak Fine.	Scrappy Negroheads.
	Kilos.	Kilos.	Kilos.	Kilos.	Kilos.
United Kingdom .....	27,268	658,073	303,450	11,473	158,478
Germany .....	1,331	46,093	62,746	1,627	16,818
France .....	18,967	304,268	232,787	5,618	92,891
United States .....	86	8,969	38,569	—	4,590
Brazil .....	5,314	23,455	109,073	524	27,952
Total .....	52,966	1,040,858	746,625	19,242	300,729

The total of the exports of all kinds of rubber to the different countries being:—The United Kingdom, 1,158,742 kilos.; Germany, 128,615 kilos.; France, 654,531 kilos.; United States, 52,214 kilos.; and Brazil, 166,318 kilos. The total value is 669,304*l.* 8*s.*

## XVI.—SUGAR, STARCH, GUM, Etc.

## SUGAR PRODUCTION OF THE HAWAIIAN ISLANDS.

*For. Off. Ann. Series, No. 3365.*

There are 52 sugar plantations in the Hawaiian Islands, mostly belonging to joint stock companies, with outputs ranging between 350 and 35,000 short tons of sugar per annum. Although scattered over different islands, all these plantations have agencies in Honolulu. All the sugar produced is shipped to the United States.

The sugar-producing islands of the group are, in the order of their output, Hawaii, Oahu (on which Honolulu is situated), Maui and Kauai, with an acreage of 94,000 acres planted with cane for the crop of 1904, and an acreage under cultivation of some 220,000 acres altogether. For the year ended December 31, 1904, the total crop for the whole group reached 367,475 short tons, compared with 437,991 short tons in the previous year; with the excep-

tion of the crop of 1903, this is the highest that has yet been recorded.

## XVII.—BREWING, WINES, SPIRITS, Etc.

## ALCOHOL FOR INDUSTRIAL PURPOSES IN THE UNITED STATES.

*Times, May 15, 1905.*

Preparations are being made to secure such a change in the internal revenue law as will free alcohol used for commercial purposes from the heavy tax that is now levied upon it. Manufacturers who are compelled to use alcohol in their plants have for a long time been urging the necessity for legislation similar to that in force in many other countries, under which alcohol rendered unfit for use as a beverage is exempt from internal revenue taxation. In order to provide for the loss in revenue that removal of the tax from this class of alcohol might cause they have decided to accompany their proposition with free denaturalised alcohol with a provision for the imposition of a higher tax rate on all distilled spirits used solely for beverage purposes.

## XX.—FINE CHEMICALS, Etc.

## MUGUET POMADE; U.S. CUSTOMS DECISION.

*April 22, 1905.*

The Board of General Appraisers held that muguet lily of the valley pomade, not produced from the flower but by a mixture of other essential oils, is dutiable at 10 per cent. *ad valorem* under paragraph 3 of the tariff, as a "combination of essential oils." The claim of the importer that it was free of duty as "essence of muguet" under paragraph 626 or at 10 or 20 per cent. under Section 6 was overruled.—R. W. M.

## Patent List.

N.B.—In these lists, [A.] means "Application for Patent," [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journal in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

## I.—PLANT, APPARATUS, AND MACHINERY.

- [A.] 9108. Newell and Fennell. Rotary kilns. May 2  
 " 9115. B&K. Centrifugal separators. [Appl. Sweden, May 9, 1904.]\* May 1.  
 " 9177. Climax Kiln Co., Ltd., and Grimwa. Continuous muffle furnaces or kilns. May 2



- A.] 9417. Aktiebolaget Separator. Centrifugal separators for liquids. [Appl. in Sweden, May 5, 1904.]\* May 4.
9572. Leunox and Dawson. *See under XVII.*
9603. Mueller. Vaporisers.\* May 6.
9606. Brearley. Method of determining the temperature of heated spaces or areas. May 6.
9634. Day. Condensing plant.\* May 8.
9676. Newell and Fennell. Rotary kilns and the like. May 8.
9994. Hunt (Hunt). Separation of solids from liquids. May 12.
- S.] 10,797 (1904). Van der Heyden. Solidification of fluids. May 10.
- 12,600 (1904). Proctor and Morgan. Method of heating or cooling fluids. May 10.
- 13,765 (1904). Johnson. Apparatus for separating coal, slack, ores, minerals, or substances of different specific gravity. May 10.
- 15,010 (1904). Reavell. Cooling towers for reducing the temperature of condensing water and other liquids. May 10.
- 15,088 (1904). Dixon. *See under II.*
- 24,497 (1904). Saade. Refrigerating and cooling vessels. May 17.

## II.—FUEL, GAS, AND LIGHT.

- J.] 9152. Genz. Method for utilising the gases of combustion generated in kilns and furnaces. May 1.
9171. Hills. Gas producing plant. May 2.
9369. Hahn. Gas heated coking ovens. May 4.
9386. Ratcliffe. Utilisation of waste wood, shavings, sawdust, &c., as briquettes or fire lighters. May 4.
9548. Kestner. Process whereby furnace and other gases may be completely and rapidly freed from dust, &c., held in suspension therein, and apparatus therefor. May 5.
9588. Shedlock. Manufacture of coke and apparatus therefor. May 6.
9668. Schmidt. Apparatus for producing a mixture of combustion gases and steam.\* May 8.
9705. Consen. Apparatus for generating hydrocarbon vapour. May 8.
9864. Hirsch. Manufacture of incandescing bodies for incandescent lighting.\* May 10.
9885. Jahns. Process and apparatus for the production of producer gases. [Ger. Appl., Nov. 1, 1904.]\* May 10.
9919. Wilson. Gas producers. May 11.
9948. Hermansen. Regenerators for retort and other furnaces.\* May 11.
- 10,006. McIntyre. Manufacture of artificial fuel. May 12.
- 10,075. Radcliffe. *See under VII.*
- [S.] 10,066 (1904). Strong. *See under X.*
- 10,067 (1904). Strong. *See under X.*
- 11,917 (1904). Warburton. Process for obtaining producer gas and electrical energy from peat. May 17.
- 13,236 (1904). Sheldrake. Gas washer scrubbers. May 10.
- 13,517 (1904). Dunlop, and Kynoch, Ltd. Gas producing plant. May 10.
- 14,157 (1904). Armstrong. Manufacture of coke, and furnaces, ovens and apparatus therefor. May 10.
- 15,087 (1904). Dixon. Blast nozzles for gas producers. May 17.

- [C.S.] 15,088 (1904). Dixon. Gas washing, cleaning, and cooling towers. May 17.
- .. 15,821 (1904). Mason. Apparatus for manufacturing producer and water gas. May 17.
- .. 16,895 (1904). Bloxam (Bradley). Gas producers. May 10.
- .. 916 (1905). May. Process of making fuel from garbage. May 17.

## III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [A.] 9748. Garle and Neumann. Method of rendering certain inflammable solvents non-inflammable. May 9.
- [C.S.] 19,744 (1904). Blackmore. Process for making hydrocarbons and separating sulphur from sulpho-hydrocarbons or sulphurous petroleum. May 10.
- .. 24,554 (1904). Scholvien. Process for the manufacture of benzenes and hydroxyl derivatives of the same. May 10.

## IV.—COLOURING MATTERS AND DYESTUFFS.

- [A.] 9138. Newton (Bayer und Co.). Manufacture of new anthracene dyestuffs. May 1.
- .. 9139. Newton (Bayer und Co.). Manufacture of a new tetrazo dyestuff especially suitable for the preparation of colouring matter lakes. May 1.
- .. 9325. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of a new *p*-amidophenylether sulphonic acid and of colouring matters therefrom. May 3.
- .. 9547. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matter of the naphthalene series.\* May 5.
- .. 9604. Lepetit, Dollfus and Ganser. Production of logwood dyestuffs and extract for dyeing purposes. [Ital. Appl., June 4, 1904.]\* May 6.
- .. 9883. Imray (Meister, Lucius and Brünig). Manufacture of concentrated liquid dyestuffs or easily liquifiable pastes from sulphurised dyestuffs. May 10.
- .. 10,022. Imray (Soc. Chem. Industry in Basle). Manufacture of azo dyestuffs. May 12.
- .. 10,101. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new sulphurised dyestuffs. May 13.
- [C.S.] 10,925 (1904). Lilienfeld. Manufacture of indigo or homologues or derivatives thereof. May 17.
- .. 14,970 (1904). Imray (Meister, Lucius and Brünig). Manufacture of new dyestuffs of the anthracene series. May 10.
- .. 14,972 (1904). Imray (Meister, Lucius and Brünig). Manufacture of yellow mordant dyestuffs. May 10.
- .. 15,025 (1904). Shillito (Aniline Colour and Extract Works, formerly J. R. Geigy). Manufacture of *o*-oxyazo colouring matters. May 10.
- .. 15,418 (1904). Shillito (Aniline Colour and Extract Works, formerly J. R. Geigy). Manufacture of a nitro-1-diazo-2-oxy-naphthalenesulphonic acid or sulphonic acid of the nitronaphthalene-1,2-diazo-oxide. May 10.
- .. 15,624 (1904). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of 1,8-arylnaphthylaminesulphonic acids. May 17.
- .. 16,538 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of violet-blue colouring matters of the anthracene series and of intermediate products. May 17.

### V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 9088. Fleet and Roberts. Dyeing and stripping wool, silk, and other fibres by the use of electricity. May 1.
- „ 9311. Mills and Parker. *See under XIV.*
- „ 9572. Lennox and Dawson. *See under XVII.*
- „ 9683. Johnson (Badische Anilin und Soda Fabrik). Manufacture of discharging agents. May 8.
- „ 9698. Küess. *See under XIX.*
- „ 9809. Frankenstein, Spencer, Spencer and Lyst. Calico printing. May 10.
- [C.S.] 10,272 (1904). Kellner. Process and means for washing textile fabric. May 10.
- „ 12,632 (1904). Wohle. Detergent for scouring wool. May 10.
- „ 15,943 (1904). Johnson (Badische Anilin und Soda Fabrik). Production of coloured discharges on dyed materials. May 10.
- „ 15,944 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of discharging pastes for use in the discharging of dyed textile fabrics. May 10.
- „ 16,185 (1904). Bartelt. Apparatus for preparing bleaching liquor. May 17.
- „ 1501 (1905). Linkmeyer and Pollak. Manufacture of artificial silk from solutions of cellulose. May 10.
- „ 4761 (1905). Linkmeyer. Manufacture of lustrous threads of cellulose. May 17.
- „ 7005 (1905). Gerlach. Cylinders for steaming and shrinking cloth and the like. May 17.

### VI.—COLOURING WOOD, PAPER, LEATHER, ETC.

- [C.S.] 14,362 (1904). Marinier. Apparatus for applying designs or the like in atomised colours to paper or other material. May 17.

### VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 9239. Dolphin. Apparatus for use in the manufacture of sulphate of copper and the like. May 2.
- „ 9404. Haworth and Baker. *See under XX.*
- „ 9443. Clemm. Treatment of phosphates and the production of chlorine and of citrate soluble phosphates. May 4.
- „ 9666. Oehler. Muffle furnaces and apparatus for the manufacture of sodium sulphate and concentrated hydrogen chloride. [Ger. Appl., May 9, 1904.]\* May 8.
- „ 10,038. Vautin and Burt. Reducing agent for metallic oxides, chlorides and fluorides. May 12.
- „ 10,075. Radcliffe. Treatment of certain products of ammoniacal liquor obtained by washing illuminating and heating gases. May 13.
- [C.S.] 11,991 (1904). Boissière and Faucheux. *See under XX.*
- „ 28,613 (1904). Eyde. Production of nitrites. May 10.
- „ 28,614 (1904). Eyde. Production of pure nitrites from a mixture of nitrates and nitrites. May 10.
- „ 8816 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable dry hydro-sulphites. May 17.

### VIII.—GLASS, POTTERY, AND ENAMELS.

- [A.] 9211. Sievert. Manufacture of sheet glass. [Belg. Appl., April 12, 1905.]\* May 2.
- [C.S.] 10,676 (1904). Bottomley, Hutton, and Paget. Manufacture of silica glass. May 17.

### IX.—BUILDING MATERIALS, CLAYS, MORTAR AND CEMENTS.

- [A.] 9103. Westhoff. Process of converting waste material of paper mills into acidless, stone-like porous bodies of an easy specific weight. May 1.
- „ 9221. Thom. Manufacture of artificial marl dolomite, &c.\* May 2.
- „ 9422. Préaubert and Thubé. Product for tarmac or asphalted roads, and process of manufacture same [Fr. Appl., May 5, 1904.]\* May 4.
- „ 9587. Herdman. Apparatus for use in production of slag wool. May 6.
- „ 9610. Goldschmidt. Process for producing refractory crucible lining for aluminothermic processes. May 6.
- [C.S.] 11,151 (1904). Hamblet. Brick kilns and the like. May 17.
- „ 14,860 (1904). Dean and Redfern. Kilns for drying and burning bricks, tiles, or the like. May 10.
- „ 17,870 (1904). Elmes. Manufacture of artificial stone, plaster, or plastic material. May 17.

### X.—METALLURGY.

- [A.] 9199. Thiel. Manufacture of iron.\* May 2.
- „ 9249. Ridley. Treatment of slag and apparatus therefor. May 2.
- „ 9447. Cowper-Coles. *See under XI.*
- „ 9877. Queneau. Manufacture of metallurgical vessels. [U.S. Appl., May 21, 1904.]\* May 4.
- „ 10,036. Head. Acceleration of the manufacture of open-hearth steel or ingot iron. May 12.
- [C.S.] 9836 (1904). Lévy. Production of metallic deposits upon metal to prevent the same from oxidation. May 10.
- „ 10,066 (1904). Strong. Manufacture of blocks of briquettes for the production of steel and other metals, and for fuel. May 10.
- „ 10,067 (1904). Strong. Apparatus for manufacturing blocks and briquettes for the production of steel and other metals, and for fuel. May 10.
- „ 12,817 (1904). Brayshaw. Process of hardening high speed tool steel. May 10.
- „ 13,765 (1904). Johnson. *See under I.*
- „ 14,214 (1904). Simpkin and Ballantine. Means for dephosphorising iron ores and concentrates. May 10.
- „ 16,276 (1904). Kaufmann and Bouvier. Manufacture of steel. May 10.
- „ 23,909 (1904). Barber (Kingsley). Apparatus and process for treating sulphide and other ores. May 10.

### XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- [A.] 9008. Fleet and Roberts. *See under V.*
- „ 9447. The Metals Corporation, Ltd., and Cowper-Coles. Electrolytic refining of copper. May 4.
- „ 9448. Cowper-Coles. The electrolytic deposition of metals. May 4.
- „ 9522. Bottomley and Paget. Electric resistance furnaces. May 5.
- „ 9543. Crowley and Macleod. Primary batteries. May 5.
- „ 9657. Gouin. Electric accumulators. [Fr. Appl., May 9, 1904.]\* May 8.
- „ 9708. Cowper-Coles. Electrodeposition of metals. May 9.



- [ ] 9901. Richardson. Primary battery May 11.
- 10,119. Dickson. Electric insulating materials. May 13.
- 10,120. Schiele. Electro-plating of metals.\* May 13.
- [ ] 10,794 (1904). Blackmore and Byrnes. Electrolytic apparatus. May 17.
- 11,288 (1904). Ricks. Electric accumulator plates or electrodes. May 17.
- 11,917 (1904). Warburton. *See under II.*
- 16,648 (1904). Rudge-Whitworth, Ltd., Pugh, and Heathcote. Apparatus to be used in the electro-plating of metallic articles. May 10.

## X.—FATTY OILS, FATS, WAXES, AND SOAP.

- 10,001. Harrison, Wild and Robb. Method of and means for treating offensive odours given off by fish refuse during the process of extracting oil from it, or of its manufacture into manure. May 12.
- [ ] 17,965 (1904). Horn. Process for the preparation of soaps. May 10.
- 3438 (1905). Haase. Manufacture of candles and the like. May 10.

## X.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

### (A.)—PIGMENTS; PAINTS.

- [ ] 9480. Herisson. Method of manufacturing oil colours. May 5.
- 10,030. Jürgensen. Paint or coating composition. May 12.

### (B.)—RESINS, VARNISHES.

- [ ] 27,667 (1904). Jackson. Floorcloth, waxcloth, oilcloth, linoleum, and kindred goods. May 10.
- 6371 (1905). Smith. Manufacture of linoleum, floorcloths, and the like. May 17.

## X.—TANNING, LEATHER, GLUE, SIZE, Etc.

- [ ] 9311. Mills and Parker. Apparatus for degreasing leather, wool, and other materials of like nature. May 3.
- 9394. Fontana. Process for decolourising tanning extracts. May 4.
- 9779. Harger. Treatment of various substances—such as bones, skins—for obtaining useful products therefrom. May 9.
- 9902. Marsden. Apparatus or digesters for treating bones to obtain valuable products therefrom. May 11.
- [ ] 18,514 (1904). Amend. Process for bating and puring skins. May 17.

## XV.—MANURES, Etc.

- [ ] 10,001. Harrison, Wild and Robb. *See under XII.*
- 10,023. Von Haeften. Treatment of peat, particularly for making manure, and apparatus therefor. May 12.

## XVI.—SUGAR, STARCH, GUM, Etc.

- [ ] 9137. Roy. Apparatus for the treatment of massecuite. [Fr. Appl., May 2, 1904.]\* May 1.

## XVII.—BREWING, WINES, SPIRITS, Etc.

- [A.] 9572. Lennox and Dawson. Evaporator for evaporating the liquid in brewers' wash or pot ale from distilleries, sewage, waste or spent dyes and the like, and concentrating the solids in the same. May 6.
- " 9639. Lugo. Process of purifying and ripening grape wines. May 8.
- " 9704. Hunt. Treatment or utilisation of fuel oils and feints. May 8.
- [C.S.] 10,320 (1904). Vignier. Apparatus for distilling whisky and brandy. May 17.
- " 11,174 (1904). Dorn. Process for the maturing of wines and spirits, and for sterilising liquids. May 17.

## XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

### (A.)—FOODS.

- [A.] 9457. James (The Organose Co.). Manufacture of a food product.\* May 4.
- " 9703. Franzén. Method of treating liquids with hydrogen peroxide or other germ killers. [Appl. in Sweden, June 23, 1904.]\* May 8.
- [C.S.] 11,174 (1904). Dorn. *See under XVII.*
- " 15,440 (1904). Imray (Maragliano). Manufacture of meat powder or meal. May 17.
- " 46 (1905). Soc. Anon. "Union," and Jurgens. Process of improving margarine and the like. May 10.

### (B.)—SANITATION; WATER PURIFICATION.

- [A.] 9572. Lennox and Dawson. *See under XVII.*
- " 9578. Adams. Bacterial sewage purification plant, and apparatus connected therewith. May 6.
- " 9733. Hall and Hall. Apparatus for treating gases, smoke, and other products of combustion so as to render them innocuous. May 9.
- [C.S.] 10539 (1904). Stringfellow. Treatment and utilisation of sewage and other refuse. May 10.
- " 22,724 (1904). McLean and Paterson. Treatment of sewage. May 17.
- " 2219 (1905). Hamilton. Compound for removing scale from boilers. May 17.
- " 5932 (1905). Mitchell. Inhaling compound for firemen's use. May 10.

### (C.)—DISINFECTANTS.

- [A.] 9656. Griesse. *See under XX.*

## XIX.—PAPER, PASTEBOARD, Etc.

- [A.] 9103. Westhoff. *See under IX.*
- " 9698. Küess. Transformation of alfa and other similar plants into paper pulp or textile fibres. [Appl. in Tunis, May 9, 1904.]\* May 8.
- " 9832. Heys (General-Direction der Hugo, Lazy, Henckel von Donnersmarck-Beuthen). Process of manufacturing paper.\* May 10.
- " 9998. Fabr. Prod. Chim. Flora Soc. Anon. Process for directly converting cotton or cellulose into cellulose acetates. [Fr. Appl., Aug. 23, 1904.]\* May 12.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 9114. Valentiner. Manufacture of salicylic acid methylene acetate. [Ger. Appl., July 16, 1904.]\* May 1.

- [A.] 9404. Haworth and Baker. Manufacture of carbon tetrachloride and sulphur chloride. May 4.
- .. 9505. Thorpe. Process for making an organic compound for physiological or other use. May 5.
- .. 9550. Chem. Fabr. auf Actien. vorm. E. Sehering. Manufacture of camphor. [Ger. Appl., May 17, 1904.]\* May 5.
- .. 9656. Griese. Preparation of *m*-iodo-*o*-oxyquinoline-ana-sulphonic acid readily soluble in the stomach, and medicaments or internal disinfectants containing the same.\* May 8.
- .. 10,093. Wetter (Hoffmann La Roche & Co.). Benzoyl salicylic acid. May 13.
- [C.S.] 11,991 (1904). Boissière and Fancheux. Processes for the manufacture of potassium bitartrate and tartaric and citric acids in which torrefaction is employed. May 10.
- .. 14,955 (1904). Gärtner. Polychlorals and the manufacture of the same. May 17.
- .. 15,930 (1904). Liebreich. Preparations for the production of chloroform. May 17.
- .. 22,126 (1904). Merck, Merck, Merck and Merck. Method for the preparation of pyrimidines. May 17.
- .. 22,127 (1904). Merck, Merck, Merck and Merck. Method for the preparation of pyrimidines. May 17.
- .. 22,128 (1904). Merck, Merck, Merck and Merck. Method for the preparation of pyrimidines. May 17.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 9116. Abel (Act.-Ges. f. Anilinfabr.). Development and finishing photographic plates, films, or like, and photographic developers for use thereof. May 1.
- .. 9246. Sandell Films and Plates, Ltd., and Sandell. Photographic plates and films.\* May 2.
- .. 9324. Abel (Act.-Ges. f. Anilinfabr.). Sensitizing layers of gelatin, gum, or the like for the photographic processes. May 3.
- .. 9497. Mallabar. Rapid production of photographs on silver chloride paper without the use of light. May 5.
- .. 9537. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of a new compound of the aromatic series as a photographic developer containing this compound. May 5.
- .. 9667. Mallet. Manufacture of photographic paper. May 8.
- .. 9870. Kelly and Bentham. Treating photographic chemicals for photographic and other purposes. May 10.

## XXII.—EXPLOSIVES, MATCHES, Etc.

- [C.S.] 10,663 (1904). Bell. Method and apparatus for the formation of gun-cotton blocks. May 1.
- .. 15,219 (1904). Hadfield. Manufacture of pyrotechnic tiles. May 17.
- .. 28,808 (1904). Centralstelle f. Wissenschaftl. Techn. Untersuchungen. Manufacture and use of dinitroglycerine. May 17.
- .. 3789 (1905). Imperiali. Explosive. May 10.



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### COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

### ANNUAL GENERAL MEETING, 1905.

The Annual General Meeting will be held in London in July next, and the proceedings will commence on Monday, July 10th.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Dr. Edward Divers, F.R.S., has been nominated to the office of President under Rule 8; Dr. L. Baekeland, Mr. J. Carter Bell, Dr. J. Lewkowitsch, and Mr. N. H. Martin have been nominated Vice-Presidents under Rule 8; and Mr. Wm. H. Nichols has been nominated a Vice-President under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Mr. J. Bingham Alliot, Dr. J. T. Dunn, Mr. A. R. Ling, Mr. J. S. McArthur, Dr. K. E. Markel, and Mr. Charles Proctor have been nominated under Rule 18 to fill four vacancies among the Ordinary Members of Council.

A Ballot List, Member's Ticket, Supplementary Programme, and Request Form are contained in this number.

### BIRMINGHAM SECTION.

The Birmingham Section of the Society, after an interval of some years, has resumed active work. The meetings will be held at the University, and Prof. Percy F. Frankland, F.R.S., has accepted the chairmanship, with Mr. F. R. O'Shaughnessy as Hon. Local Secretary and Treasurer.

### NEW ENGLAND SECTION.

The New England Section held its inaugural meeting at Boston, Mass., on May 12th. Between 80 and 90 members were present, including the President of the Society, with Dr. H. Schweitzer, Mr. T. J. Parker, and other representatives of the New York Section.

### CONGRESS OF CHEMISTRY AT LIÈGE.

In connection with the Liège Exhibition, a Congress of Chemistry and Pharmacy will be held from the 27th to the 30th July next. By a subscription of 10 francs, members may take part in the Congress, and will receive a copy of the transactions. Application for Adhesion Forms and programmes should be made at once to M. J. Raymond, Pharmacien, Liège, or M. J. Wauters, Chimiste-adjoint de la Ville de Bruxelles.

### SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

The Sixth International Congress of Applied Chemistry will be held in Rome in April, 1906, during Easter week. All communications should be addressed to the President, Prof. E. Paternò, Via Panisperna 89, Rome.

## Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

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h, Dr. Ludwig K. should read Biach, Dr. Ludwig K.; address as before.

n, Charles A., M.Sc., Ph.D., Principal of the Sir John Cass Technical Institute to Keane, Charles A.; address as before.

## Death.

ck, J. Lloyd, 3, Hanover Street, Hanover Square, London, W. June 3.

## London Section.

Meeting held at Burlington House, on Monday, May 1st, 1905.

MR. A. GORDON SALAMON IN THE CHAIR.

### ACTION OF HYDROGEN PEROXIDE ON A PHOTOGRAPHIC PLATE IN THE DARK.

BY CHIRI OTSUKI, PH.D.

The action of hydrogen peroxide on a photographic plate in the dark, which was studied first by Russell,<sup>(1)</sup> recently been considered by Graetz<sup>(2)</sup> to be a radiation of this substance. Russell states in his paper that hydrogen peroxide acts not only directly on a photographic plate in the dark, but also through several solid mediums. The chief reasons why Graetz considers this action of hydrogen peroxide to be a kind of radiation are, because it penetrates through several solid substances, such as paper, gelatin, celluloid, ebonite, &c., and through thin sheets of metals; secondly, because the action cannot be prevented by passing a rapid stream of air through the space between the photographic plate and the peroxide solution during the exposure.

The first part of this paper treats chiefly of the question of the radiation of hydrogen peroxide; the second treats of the nature of the action of the peroxide on a photographic plate.

### PART I.

#### (1) On the Permeability of various Substances to the Action of Hydrogen Peroxide.

(a) Preliminary experiments with gelatin, celluloid, &c.

One c.c. of a 30 volume aqueous solution of hydrogen peroxide was poured into a small vessel. A thin sheet of the substance to be examined was placed over it at the distance of 1 cm. from the surface of the peroxide solution, and then a photographic plate was laid upon it. After some time the photographic plate was developed for 60 seconds by means of 5 per cent. commercial sodinal solution. The results were as follows:—

[No.	Substances Employed.	Thickness of Substances.	Time of Exposure.	Effect on Developed Plates.
		m.m.	Hours.	
1	gelatin	0.12	2	dark
2	gelatin	0.12	24	dark
3	celluloid	0.05	2	dark
4	celluloid	0.26	2	dark
5	celluloid	0.79	24	dark
6	black packing paper	0.15	2	very dark
7	soft gum	0.40	24	very dark
8*	Canada balsam	—	24	dark
9	ebonite	0.18	20	without effect
10	fish membrane	—	24	without effect
11†	paraffin	—	24	without effect
12	glass	0.75	24	without effect

\* No. 8.—A thin sheet of celluloid 0.05 mm. thick was coated on both sides with Canada balsam, and when dry was used for the experiment.

† No. 11.—A sheet of celluloid 0.05 mm. thick dipped in melted paraffin and cooled was used for the experiment.

The above substances were next placed between a 30 volume aqueous solution of the peroxide and a photographic plate which had been previously perfectly fixed. After some time the gelatin layer of the fixed plate and the upper surface of the substance which had been placed between the fixed plate and the peroxide solution were examined by means of titanium reagent (titanic oxide dissolved in concentrated sulphuric acid), and also of an aqueous solution of chromic acid. With gelatin, celluloid, paper, soft gum and Canada balsam, a yellow to orange coloration by the titanium reagent, and a green coloration by the chromic acid were always noticeable, after the exposure for the same length of time as in the last experiment; with ebonite, fish membrane, paraffin, and glass no coloration was noticeable. The experiments were made at the ordinary temperature.

#### (b) Experiments with thin sheets of glass.

A small vessel of glass containing 1 c.c. of a 30 volume aqueous solution of hydrogen peroxide was covered with a sheet of glass 0.75 mm. thick. A photographic plate was placed upon it at a distance of 7 mm. from the surface of the peroxide solution. After an exposure for four hours, the photographic plate was developed as above.

The part of the plate which had been in contact with

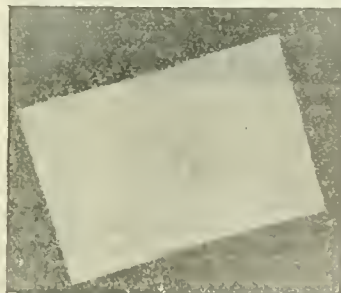


FIG. 1.

the sheet of glass showed no change after development; the other parts, however, appeared quite dark, and

this darkening extended a little within the contour line of the sheet of glass. (Fig. 1.)

By increasing the time of the exposure to 24 hours

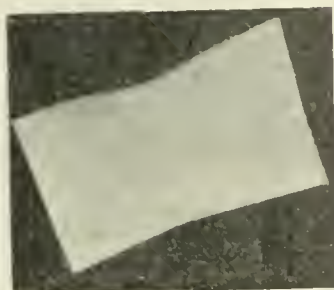


FIG. 2.

the darkening of the plate extended further inwards. (Fig. 2.)

By allowing a certain space between the sheet of glass



FIG. 3.

0.12 mm. space between the photographic and the glass plates,

and the photographic plate, instead of laying it directly upon the glass plate, the darkening extended much further toward the centre than in the latter case. (Fig. 3.)

By increasing the space between the photographic and

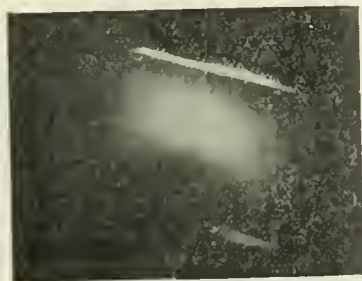


FIG. 4.

1.5 mm. space between the photographic and the glass plates.

the glass plates the extension of the darkening toward the centre increased more and more. (Fig. 4.)

After laying a photographic plate for 42 hours on a closed vessel of thin glass containing a 30 volume aqueous solution of hydrogen peroxide, no darkening of the plate was observed when the plate was developed. The vessel was made perfectly air-tight, so that it was quite impossible for any peroxide vapour to escape.

Further, a small vessel of glass containing 30 volume hydrogen peroxide solution was loosely covered with a



FIG. 5.

second cylinder of thin glass and a photographic plate was placed upon it for 42 hours. On developing, the plate showed no darkening at the part where it had touched the cylinder: the remaining parts of the plate, however, appeared dark. (Fig. 5.)

On examining a sheet of gelatin placed upon a peroxide solution over a thin sheet of glass by means of a titanium reagent and of the chromic acid, no coloration was noticeable.

#### (c) Experiments with thin Sheets of Metals.

A small vessel of glass containing 1 c.c. of 30 volume aqueous solution of hydrogen peroxide was covered with a thin sheet of metal, and then a photographic plate was placed upon it.

With the thin sheets of metals—zinc 0.09 mm. thick, copper 0.05 mm. thick, tin 0.01 mm. thick, alloy of composition of  $\text{Au} + \frac{1}{15} \text{Pt} + \frac{1}{32} \text{Ag}$  0.008 mm. thick, brass 0.005 mm. thick at an exposure for  $\frac{1}{2}$ —38 hours the distance of 0.5 cm. from the surface of the peroxide solution, no effect of the peroxide was perceived either photographically or chemically.

By making parallel experiments, any mistake such as that known as Russell's effect (3) was quite out of the question.

With regard to aluminium, three degrees of thickness 0.08 mm., 0.005 mm., and 0.003 mm., were employed for the experiments. The last is known usually at Lénard's aluminium.

It was not very easy to find a piece of Lénard's aluminium quite free from small holes; and since the peroxide vapour passes through the most minute of holes, the experiments were made with the greatest care.

A plate of glass having a small hole of 1 mm. diameter was cemented to a thin sheet of aluminium by means of paraffin. The aluminium foil was examined before and after cementing it on to the glass plate under a microscope to ascertain if it was free from holes. The plate was laid upon a small glass vessel containing 30 volume aqueous solution of hydrogen peroxide, and was fastened to the vessel by means of paraffin. The distance between the foil and the surface of the peroxide solution was 5 mm. Then a photographic plate was placed upon it. After an exposure for a half to three hours, the photographic plate was developed in the usual way. The aluminium foil was again examined after the exposure under a microscope. In experiments with Lénard's aluminium could not be made at an exposure over three hours, for the sheet was already corroded by the peroxide vapour, as Graetz (4) has already observed.

In 47 experiments an effect on the photographic plate was observed only three times, but in all the three cases, small holes were discovered in the foil owing to corrosion of the metal by the peroxide vapour. With foil 0.08 mm. thick, no effect on a photographic plate was obtained even after an exposure of 38 hours.

Graetz employed Canada balsam (5) as the cementing material in his experiments, but since this is permeable to the peroxide it cannot be said that the action penetrates through aluminium.



*The Action of Hydrogen Peroxide on a Photographic Plate by Exposing a Second Plate to the Peroxide and Pressing them together for some time.*

We have already seen that when sheets of such substances as gelatin, celluloid, &c., are exposed to the peroxide solution, then the chemical examinations show the presence of hydrogen peroxide on the surface of these substances.

Accordingly, if a plate with a sheet of such substance placed above be exposed to the peroxide solution, and then pressed against a photographic plate, the latter should become capable of being developed. The following experiments confirm this: A 4 per cent. solution of collodion was poured over a clean plate of glass, and after completely drying, it was exposed to a 3 volume aqueous solution of hydrogen peroxide at the distance of 1 cm. from the surface of the liquid. Then the plate was pressed closely to a photographic plate in a copying machine for 30 minutes in the dark. On developing this photographic plate in the usual manner, a distinct darkening was obtained. On using gelatin instead of collodion the same results were obtained. When the second plate was heated after it had been exposed to the peroxide solution no darkening of the photographic plate was obtained.

The chemical examination with the titanium reagent was carried on in the following manner: A collodion plate prepared as in the last experiment was exposed to an aqueous solution of hydrogen peroxide. Then it was pressed closely to a fixed photographic plate in a copying machine for some time. By examining these plates with the titanium reagent a yellow coloration was noticeable. On the collodion plate, however, was heated, after it had been exposed to the peroxide solution, and pressed against a fixed photographic plate neither plate gave coloration with the titanium reagent. On using gelatin instead of collodion the same results were obtained. It must therefore be concluded that the peroxide which condensed on the plate which was exposed to the peroxide solution is removed when the plate is heated during the exposure.

The photographic copying process, which is called by Katatype by evaporation," is based on this change. An ordinary photographic negative is exposed to an aqueous solution of the peroxide and then in the dark it is pressed closely against a photographic plate in a copying machine for some time. At the dark parts of the negative the condensed hydrogen peroxide is decomposed catalytically through metallic silver to water and oxygen, while absorbed by the gelatin layer at the clear parts of the negative without the decomposition. Thus a latent image of hydrogen peroxide is produced in the negative. When pressed closely against a photographic plate for some time, this latent image of the peroxide is transferred to the plate, and a positive image is obtained by developing. When the exposed negative is pressed against an ordinary gelatinised paper, instead of a photographic plate, the latent image of the peroxide is transferred on to the paper. Treating the paper with a solution of an easily oxidisable metallic salt the latter is oxidised by the peroxide, and a positive image consisting of the oxidised salt is produced on the paper. For example, by treating the paper with a solution of ferrous sulphate a faintly coloured image consisting of ferric salt is produced on the paper. By treating this with a solution of pyrogallie acid a blackened positive image is obtained.

This process is similar to that of Gros's Katatype except that it is operated by the evaporation of hydrogen peroxide solution, it is called by us "Katatype by evaporation."

From the experiments described above, it is concluded that the effect on a photographic plate in the dark by hydrogen peroxide cannot be considered as caused by radiation from the peroxide.

(3) *Experiments with a rapid Current of Air.*

One of the reasons why Graetz maintains the action of peroxide to be due to a kind of radiation, is that the effect cannot be dispelled by blowing a rapid current of air

into the space between the photographic plate and the peroxide solution during the exposure.

In order to study the fact the following experiments were made:—

A photographic plate was laid upon a glass plate having a small hole (3 mm. diameter) in its centre, and the plate was kept quite cold (7°) during the experiment by laying on it a large copper cylinder containing ice water. The muzzle of the blowing pipe was placed directly under the hole, the diameter of the muzzle being much larger than that of the hole and of the vessel containing the peroxide solution. During the blowing of a rapid current of air a small vessel containing 30 volume aqueous solution of the peroxide was brought under the hole, keeping the distance of 0.8 cm. between the sensitive layer of the photographic plate and the surface of the liquid. After the exposure the photographic plate was developed in the usual way. It was found that a distinct picture of the hole was obtained on development; but that part of the sensitive layer corresponding to the hole was moist in every experiment. This moistening was, however, unavoidable, because it was not possible to attempt to dry thoroughly such a large amount of air as was necessary for this experiment. By laying the photographic plate 11 minutes in water after the exposure, the degree of darkening of the picture of the hole decreased. By developing the plate after leaving it one hour in water after the exposure no picture of the hole was obtained.

Since the effect of the hydrogen peroxide can be eliminated by laying it for some time in water it cannot be considered as caused by a radiation; neither can it be assumed that the moisture which condenses on the photographic plate causes the effect. There must be some trace of the peroxide in the condensed moisture to cause the change, because by moistening the sensitive layer of an exposed plate with a drop of distilled water and blotting it, this part of the plate appeared lighter than the remaining parts after the development.

## PART II.

### (4) *Influence of Temperature.*

The influence of temperature on the photographic action of hydrogen peroxide is very interesting. A small difference in temperature in the photographic plate or between the plate and its surroundings, causes lighter or darker zones in the picture, either the border being lighter than the centre or *vice versa*. This phenomenon was called by Graetz a "border effect" (Randwirkung)<sup>(8)</sup>. He considers that that part of the plate where a current of heat enters is darkened more than that where it goes out, and he assumes that this is due to the falling of the temperature. According to Schaum and Braun,<sup>(9)</sup> however, the photographic effect of hydrogen peroxide is almost nullified at 0° C., and increases to a certain maximum and then decreases suddenly with an increase in temperature.

Our experiments show that when the temperature of the vessel containing the peroxide solution is equal to that of the sensitive layer of the plate, then the plate shows a uniform darkening over the whole surface of the picture. When the photographic plate is heated to a very high temperature—which is effected by placing a large vessel containing boiling water on the glass side of the plate during the exposure—no darkening of the plate takes place, though the sensibility of the plate does not decrease. By decreasing the temperature of the plate without changing any other conditions, the photographic action of the peroxide increases gradually, but this does not happen without a limit, so that the plate shows less darkening at 0° C. than at the ordinary temperature.

This phenomenon of the picture appearing lighter or darker depends on two factors, one of which is the degree of condensation of the peroxide on the plate, the other the influence of temperature upon the reaction between the hydrogen peroxide and the bromide of silver contained in the sensitive layer of the plate.

So far as the condensation is concerned, the effect must become greater when the temperature of the plate decreases, while the chemical reaction itself is weaker at the lower temperature.

It is important to allow some interval of time to elapse before developing, so that the temperature of the plate becomes uniform in all its parts, for the reducing power of the developer depends greatly upon the temperature.

When the sensitive plate is placed directly on the vessel containing the peroxide solution, the greatest condensation takes place at that part of the plate corresponding to the border of the vessel. On exposing the plate for a long time to the peroxide solution the border of the exposed part of the sensitive layer becomes corroded first.

A strong border effect on the exposed surface of the plate is due chiefly to temperature differences. For example, either by laying a photographic plate at the temperature of 0° C. directly upon a vessel containing a peroxide solution at an ordinary temperature, or by placing a photographic plate at the ordinary temperature directly upon a vessel containing a warm solution of the peroxide, the border of the exposed surface is darkened more than the centre. When a plate is exposed over a warm solution for a long time, it is observed that the gelatin layer of the plate is dissolved at the border of the exposed surface after the development, while its centre remains undissolved.

This fact can be explained as follows; owing to the conduction of heat to the border of the vessel, this part of the exposed surface has a higher temperature than the centre, so that the chemical action is more powerful at the border than at the centre.

When a metal cylinder, having a temperature a little higher or lower than that of the photographic plate is placed on the plate during the exposure, the so-called border-effect of Graetz is obtained. In the former case the border appears lighter than the centre, and in the latter, darker.

As already mentioned, Graetz considers this phenomenon to be due to a polar thermal effect of the falling of the temperature, but not to the difference of temperature itself.

We have found in our experiments that this phenomenon appears only with small differences in temperature, such as, for instance, when the temperature of the plate is 20° C., and that of the cylinder is 19° C. or 21° C. By placing a metallic cylinder containing boiling water on a photographic plate during the exposure, the part of the plate corresponding to the bottom of the cylinder shows no darkening, but on the surrounding parts a darkening is to be seen, so that there is no border effect. This fact may be explained as follows:—The temperature of the sensitive layer of the photographic plate is so high that no condensation of the peroxide can take place; on the surrounding parts, however, where the temperature is somewhat lower, the peroxide condenses and the chemical reaction between the peroxide and bromide of silver takes place.

Similar experiments prove that the border effect depends upon the distribution of the temperature within the glass plate.

Even though the temperature of the glass surface under the metal cylinder is uniform, yet on the lower side of the plate upon which the sensitive layer is the border zone is colder or warmer than the centre according as the metal cylinder is warmer or colder than the plate, because a heat current arises within the glass plate until it reaches a stationary condition.

By placing a metal cylinder having a flat bottom and containing a freezing mixture on the glass side of a photographic plate during the exposure the picture appears lighter at the centre than at the border. When cooling the plate only at a point—for instance by placing a semi-spherical nickel basin containing a freezing mixture upon the glass side of the plate instead of using a metal cylinder—the picture shows no lighter centre, but on the contrary, the greatest darkening is to be seen at the centre extending in all directions toward the outside, decreasing gradually in its darkness. By filling the nickel basin with boiling water instead of with freezing mixture, the darkening of the plate is reversed, so that its centre appears lighter than the surrounding parts, the darkening increasing gradually toward the outside.

In these experiments it is very necessary to isolate the apparatus from the surroundings by means of a bad

conductor of heat, for even a very small inequality of temperature causes secondary effects, from which mistake might easily arise, as pointed out by Graetz.

In order to obtain a definite effect on the photographic plate we, therefore, isolated the plate and also the nickel basin on sharply pointed corks and worked in a room of constant temperature.

If the assumption that the distribution of heat with the glass of the photographic plate causes this border effect to be true, then the effect should disappear when only thin sheet of sensitive layer be used instead of the glass plate; because if the photographic sheet be very thin the temperature on both the upper and lower sides should be the same. This was proved by the following experiment. By laying a copper crucible having a flat bottom and containing a freezing mixture on an ordinary photographic plate, and on a very thin sensitive film respectively, the border of the picture was darker than the centre in the first case, but in the second case, the part of the plate corresponding to the bottom of the crucible appeared uniform dark, and the surrounding part where the temperature was somewhat higher showed an intense darkening owing to the combined effect of the degree of the condensation and of the increased chemical effect.

Accordingly we believe that the border effect, which caused by a relatively small difference in temperature must certainly be due to the influence of the temperature on the chemical reaction between hydrogen peroxide and the silver bromide; for instance, under the cold cylinder the border is somewhat warmer than the centre, so that the chemical reaction is stronger at the border than the centre, and therefore the border appears dark. Under a warm cylinder the border is somewhat colder than the centre, and therefore the border appears lighter than the centre.

If one takes only the condensation into account, then the effect must be the reverse. Therefore the influence of temperature on the chemical reaction between hydrogen peroxide and bromide of silver must be the inverse of that upon the condensation.

#### (5) Influence of the Concentration of the Peroxide Solution on its Photographic Action.

The degree of concentration of the peroxide solution has also a very interesting influence on its photographic action. The following experiment shows this: Photographic plates were exposed for a certain length of time to aqueous solutions of hydrogen peroxide of several strengths at the distance of 1 cm. from the surface of liquid at an ordinary temperature under the ordinary pressure; then they were developed for one minute by means of 5 per cent. commercial rodonal solution. The degree of darkening of the produced pictures were determined by means of the Marten's polarisation photometer calculated according to the formula<sup>(10)</sup>:—

$$Dr = 2 (\log \tan \alpha - \log \tan S),$$

where Dr is the relative density of the picture;  $\alpha$ , angle of rotation of Nicols for the part of the plate the density of which is to be measured, when both sides of the photometer field appear equally light;  $S$ , angle of rotation of Nicols for the unexposed part of plate, which was, however, developed.

The following table shows the results:—

TABLE I.

C	Log C.	Exposure 1200 sec. Dr.	Exposure 420 sec. Dr.	Exposure 140 sec. Dr.
30.0	1.477	0.696	0.280	0.087
10.0	1.000	1.145	0.407	0.053
3.0	0.477	1.245	0.360	0.030
1.0	0.000	0.996	0.176	0
0.3	— 1.477	0.741	0.066	—
0.1	— 1.000	0.353	0	—
0.03	— 2.477	0.137	—	—
0.01	— 2.000	0.060	—	—

C=volume strength of  $H_2O_2$  in the solution.  
Dr=relative density of the picture.

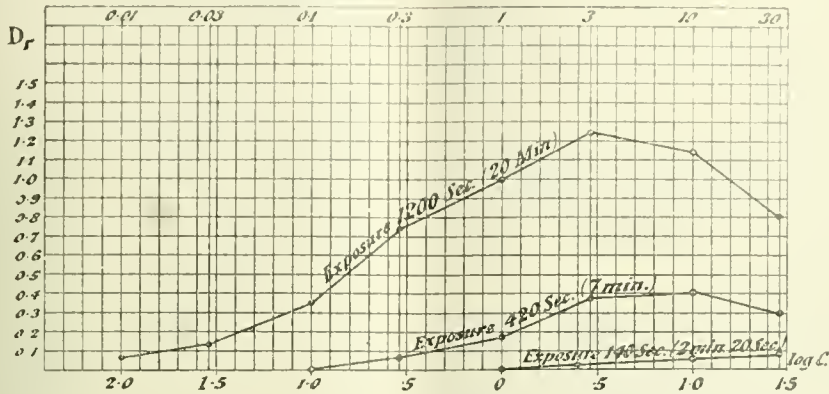


The following graphical Table (Table II.) is constructed on the Table I. in such a way that the ordinates present the relative density of the negative, and the abscissae, the logarithms of the concentration of the peroxide solution:—

(v.) On developing the plate for one minute by means of a 5 per cent. rodnal solution, the 3 volume solution causes a greater effect at the exposure for 20 minutes than the 30 volume solution.

These facts can be explained by the law of evaporation

TABLE II



It shows that:—

i.) The relative density of the negative for the same exposure increases to a certain point according with increase in the strength of the solution until it reaches the maximum and then decreases.

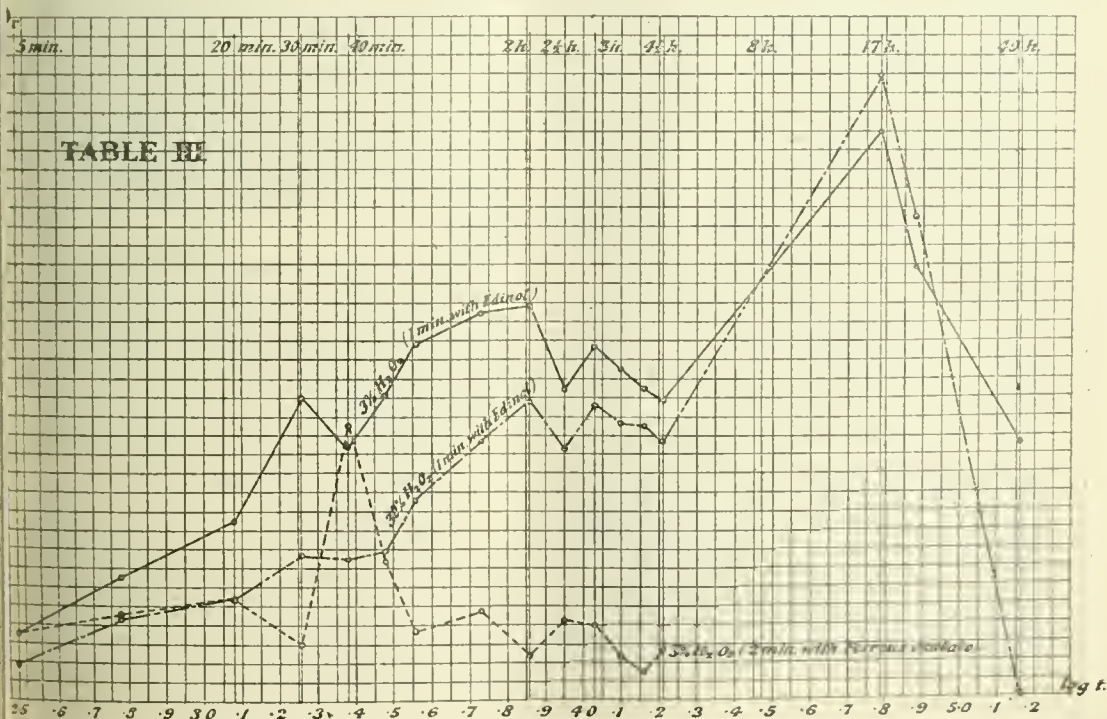
ii.) At the shorter exposure the relative density of the negative is smaller than that at the longer.

iii.) The differential quotient  $\frac{d D_r}{d \log C}$  (where  $D_r$  means relative density, and  $C$  the percentage of  $H_2O_2$  in the solution) becomes less at a shorter exposure than at a longer.

v.) The maximum moves at the shorter exposure to the higher concentration.

and of vapour pressure of a mixture of two liquids which have been investigated by Konowalow. The vapour pressure of the 30 volume solution is less than that of water and also than that of the weaker solution. From the weaker solution the mixture of hydrogen peroxide and water evaporated per unit of time is greater in quantity than from the stronger solution. The degree of the photographic effect, however, depends not on the total amount of the evaporation, but varies with the absolute quantity of hydrogen peroxide condensed on the sensitive layer of a photographic plate. The absolute quantity of hydrogen peroxide which evaporates from the solution increases to a certain point according to the increase of the strength of the solution, when the time of exposure remains constant. In our experiment given above this maximum is observed with the 3 volume solution for the exposure of 20 minutes.

TABLE III.



(6) *Influence of Length of Time of Exposure on the Degree of Darkening of a Photographic Plate.*

As already mentioned, the relative density of the picture produced by hydrogen peroxide varies with the time of exposure. The following experiment shows the details of this variation:—

Small glass vessels containing each 1 c.c. of hydrogen peroxide solution were covered with photographic plates (<sup>12</sup>), at a distance of 1 cm. from the surface of the solution. After the exposure for several intervals of time the plates were developed by means of ferrous oxalate developer (<sup>13</sup>) and 10 per cent. commercial edinol respectively.

The relative density was determined by the Marten's polarisation photometer as above. The experiments were made at 18° C. under the ordinary pressure.

The results are shown graphically in Table III. The ordinates represent the relative densities of the negative, and the abscissæ, the logarithms of the time of exposure in seconds.

It shows that:

(i.) In the case of edinol developer the relative density of the picture increases to a certain point according to the increase in the length of the time of exposure, and reaches its first maximum, then decreases to the first minimum; then it increases to its second maximum, and sinks again to the second minimum; it next increases gradually to the third maximum, from which point it begins again to fall to the third minimum; it rises again to the fourth—the absolute maximum which seems to be the beginning of reversal. From this point the relative density decreases gradually until the picture becomes quite transparent. This reversing of the darkening of the picture resembles the phenomenon of "solarisation."

This reversal of the image has been observed by Russell (<sup>14</sup>).

(ii.) With the 30 volume solution of the peroxide the relative density of the picture is less than that with the 3 volume solution at the beginning, but it gradually approaches that of the latter until the same density is reached. From this point it goes beyond that with the 3 volume solution, so that the absolute maximum in the former case lies higher than that with the latter. The decrease of the relative density from the absolute maximum in the case of 30 volume solution is much greater than that of the 3 volume solution, so that it reaches transparency more quickly than in the latter case.

(iii.) When the plates are developed with ferrous oxalate the relative density of the picture also increases to a certain point according to the increase in time of the exposure, and reaches the first maximum, then decreases to the first minimum, from which point it suddenly increases, and goes up to the second—the absolute maximum and then suddenly decreases.

It is very remarkable that the plates which were developed with edinol show a maximum density at the points where they show a minimum in the case of iron developer, and conversely; where the relative density is in ascending stage in the case of iron developer, it is in descending stage in the case of edinol, and conversely. This fact cannot be clearly explained, but may be due to the entirely opposite character of the two developers relatively to the hydrogen peroxide as will be described afterwards.

(7) *Acid, and Alkali-Developers.*

After exposing photographic plates for ten minutes to the 3 volume aqueous solution of hydrogen peroxide at the distance of 1 cm. from the surface of the liquid, some of them were developed for two minutes by means of ferrous oxalate developer of the composition already mentioned; some of them were developed for one minute by means of 5 per cent. commercial rodinal; others were developed only with caustic alkali solution. It was found that in the first two cases the plates became dark on developing, but in the last case, no darkening was observed until the gelatine layer was dissolved by the alkali solution. When developing unexposed photographic

plates by means of acid- or alkali-developers, or with caustic alkali respectively with the addition of hydrogen peroxide it was found that in the first case, practically no darkening of the plate was obtained; in the second case, the plate appeared dark, showing a rather yellowish tint, but the degree of darkening became much less than when it was developed only with alkali developer without the addition of the peroxide; in the third case, a darkening of the plate was also noticeable. From this experiment it follows that: (i.) The acid developer loses its developing power in a great degree when it is mixed with hydrogen peroxide.

(ii.) The developing power of an alkali developer decreases in some degree when it is mixed with hydrogen peroxide, but this decrease in the developing power is not so great as in that of an acid developer.

(iii.) Hydrogen peroxide together with caustic alkali acts as a weak developer on a photographic plate. This fact has already been mentioned by Andresen.

In the case of acid developer, as the acid which is contained in it together with the peroxide has no capacity of developing a photographic plate, the decrease in the developing power caused by the addition of a quantity of the peroxide is due only to the oxidation of the developer by the peroxide; but in the case of alkali developer, as the alkali which is contained in it gains some capacity of developing when it is mixed with the peroxide, the decrease in the developing power in this case is equal to the difference between the decrease due to the oxidation of the developer by the peroxide, and the developing power of the alkali produced by the addition of the peroxide.

(9) *Influence of the Length of the Time of Development on Darkening of the Plate exposed to the Peroxide Solution.*

It has already been stated that the degree of darkening of the picture produced by hydrogen peroxide is greater in the case of the 3 volume solution than in that of the 30 volume solution at an exposure not longer than eight hours (compare the Table III.), when the exposed plates are developed for one minute by 5 per cent. commercial rodinal.

This result, however, is quite reversed when the exposed plate is developed for a long time. The following experiments prove this:—

Ordinary photographic plates (Lomberg extra rapid) were exposed for the same length of time to the 3 volume and 30 volume peroxide solutions respectively, and then developed for various lengths of time.

The results show that a greater degree of darkening occurs with a 3 volume than with a 30 volume solution when the plate is exposed for 1–5 minutes and developed for a short time; by increasing the time of development the density of the negative in both cases becomes about the same; by further increasing the time of development, for example, to 4–5 minutes—the density of the negative is reversed, that due to the 30 volume solution being greater.

(10) *Auto-plates and the Action of Hydrogen Peroxide*

The action of hydrogen peroxide on auto-plates, i.e. photographic plates containing developers, is very interesting. Auto-plates were prepared for this experiment in the following manner:—

(i.) *Metol bath for Auto-plate.*

Metol (powder) .. ..	1 gm.
Sodium bisulphite .. ..	4 grms.
Water (make up to) .. ..	100 c.c.

(ii.) *Edinol bath for Auto-plate.*

Edinol (powder) .. ..	1 gm.
Acetone sulphite .. ..	6 grms.
Water (make up to) .. ..	400 c.c.

Ordinary dry plates (Lomberg extra rapid) were exposed for five minutes in the auto-plate bath, and then dried by means of a ventilator in the dark. The plates are referred to as "metol auto-plate" and "edinol auto-plate" respectively.

The auto-plates thus prepared were placed on glass vessels containing each 1 c.c. of 30 volume aqueous



tion of hydrogen peroxide at the distance of 1 cm. from the surface of the solution. After exposure for 5 minutes they were developed for one and five minutes by means of 10 per cent. sodium carbonate solution. The exposure varied from 3.5 minutes to 10 minutes.

With the metal auto-plates, the exposed part appeared much lighter than the unexposed parts; but with the edinol auto-plates the exposed part appeared darker than the unexposed part of the plate.

This fact can be explained in the following way:—The rate of chemical reaction between hydrogen peroxide and silver is greater than that of hydrogen peroxide and silver chloride, so that at the exposed part of the plate the metal chloride is contained in the sensitive layer is first oxidised to hydrogen peroxide. Accordingly, a very small quantity of metal remains unchanged on that part of the plate.

Further, the greater part of the hydrogen peroxide is condensed with the aqueous vapour from the solution is consumed for the oxidation of metal, so that the bromide of silver is very slightly affected by the peroxide; therefore this part of the plate appears lighter than the unexposed part on development. In the case of edinol, however, there is no great difference in the rate of chemical reaction between hydrogen peroxide and edinol, and hydrogen peroxide and bromide of silver, so that on the exposed part of the plate bromide of silver is affected in some degree by hydrogen peroxide, and edinol remains to produce any darkening of the plate.

#### *Action of Hydrogen Peroxide on the Latent Image Produced by Ordinary Light.*

It is very remarkable that when a photographic plate is exposed to light is placed on a vessel containing hydrogen peroxide solution, that part of the plate which is subjected to the peroxide vapour appears lighter than the remaining parts when developed. This can most likely be considered as a similar phenomenon to sensitisation.

#### *Action of Hydrogen Peroxide on Bromide of Silver.*

When treating pure bromide of silver with hydrogen peroxide solution, hydrogen peroxide and caustic alkalis, or hydrogen peroxide and citric acid solutions actively, and examining the effects, the following results were obtained:—

(i.) By shaking silver bromide with 10 volume aqueous solution of hydrogen peroxide for a half to two hours in a test tube and filtering it, no bromine was found in the filtrate. When the residue with nitric acid and filtering it, no bromine was found in the filtrate.

(ii.) When pouring a mixture of 10 per cent. aqueous solution of hydrogen peroxide and caustic alkali on a plate of silver, the yellow bromide turned dark immediately. After filtering, a large quantity of bromine and metallic silver was found in the filtrate and in the residue actively.

(iii.) When treating silver bromide with hydrogen peroxide and citric acid solutions and then filtering it, neither bromine nor metallic silver was found in the filtrate or the residue.

From this it is seen that by treating silver bromide free from binding material with hydrogen peroxide or with hydrogen peroxide and citric acid no decomposition of silver bromide takes place; but by treating it with a mixture of the peroxide and caustic alkali, it is decomposed to a certain extent into bromine and metallic silver.

#### *Bromination of the Photographic Plate exposed to the Hydrogen Peroxide.*

Lüppo-Cramer<sup>(15)</sup> considers the effect produced by the peroxide not to be due to any change in the silver bromide in the sensitive film of the plate. But his conclusion cannot be confirmed according to the following experiments:—

Ordinary gelatino-bromide plates were exposed for 5 minutes to 30 volume aqueous solution of hydrogen peroxide. One of them was developed for one minute by means of 5 per cent. commercial rodinal immediately

after the exposure; the others were kept for 30 seconds in concentrated bromine water before development, then after thoroughly washing they were developed as above. In the first case the plate became dark, but in the second case no darkening was noticeable.

2. Plates were similarly exposed and then placed over a vessel containing concentrated bromine water for two hours, at a distance of 1 cm. from the surface of the bromine water. After thoroughly washing they were developed for two minutes by means of 5 per cent. commercial rodinal. There was no darkening of the plate to be seen.

3. Instead of subjecting the plates to the bromine vapour as in the last experiment, they were put into 5 per cent. bromine water for two minutes after the exposure. After washing, they were developed as in the latter case. It was found that there was no darkening of the plate.

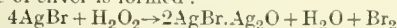
4. The same kind of plate as used in the above experiments was kept for one minute in 3 volume aqueous solution of the peroxide. After washing it, it was laid for one minute in 5 per cent. bromine water. After again washing, it was developed as in the latter case, and a darkening of the plate was observed. Instead of placing the plate in dilute bromine water, as in the last case, it was placed in concentrated bromine water for the same length of time. It was found that after completely washing it no darkening took place on development.

It must, therefore, be concluded that the latent image produced on a photographic plate by hydrogen peroxide can be destroyed by bromination of the exposed plate after the exposure. It may be supposed that in the experiment from which Lüppo-Cramer drew his conclusion, the bromine water was not strong enough to destroy the latent image in the time applied.

#### *(14) Hypothesis as to the Chemical Reaction between Hydrogen Peroxide and Bromide of Silver.*

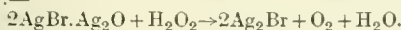
The chemical reaction which takes place between hydrogen peroxide and bromide of silver in the sensitive plate may be considered as follows:—

(i.) Silver bromide is oxidised by peroxide and oxybromide of silver is formed:



This oxybromide of silver, which is mentioned by Hodgkinson<sup>(16)</sup>, has probably the constitution of  $2\text{AgBr} \cdot \text{Ag}_2\text{O}$ .

(ii.) When  $\text{H}_2\text{O}_2$  comes into contact with the oxybromide of silver the former decomposes to  $\text{H}_2\text{O}$  and  $\text{O}$ ; and this active oxygen combines with that of the latter, forming  $\text{O}_2$ , as is generally the case<sup>(17)</sup> in reductions by hydrogen peroxide. So that the chemical process goes on as follows:—



Thus the end product of the change is the subbromide of silver  $\text{Ag}_2\text{Br}$ .

In the bromination of the exposed plate the chemical reaction is:—



so that the latent image is destroyed by the bromination.

#### *(15) CONCLUSION.*

(i.) So far as the propagation in a straight line and penetration through metals are considered as the reasons of a radiation, the action of hydrogen peroxide on a photographic plate cannot be considered as a radiation of this substance.

(ii.) Gelatin, celluloid, paper, soft gums, Canada balsam allow the action of hydrogen peroxide to pass through; ebonite, glass, metals, paraffin, fish membrane do not. This conclusion coincides with that of Russell.

(iii.) The reaction between hydrogen peroxide and silver bromide gelatin depends upon the temperature. This great sensibility to temperature causes the phenomenon called "border effect." When the temperatures of the peroxide solution and of the silver bromide gelatin layer are constant and equal the border effect does not take place.

(iv.) With the same degree of concentration of the

peroxide solution the photographic effect increases according to the increase of the time of exposure. Beyond the maximum, a phenomenon similar to solarisation takes place.

(v.) The effect of hydrogen peroxide on a photographic plate is due to the change in the bromide of silver contained in the sensitive layer of the plate. Silver bromide under the action of the peroxide changes most probably to a lower bromide of silver, which is easily reduced by the developer. The latent image produced by hydrogen peroxide consists of this lower bromide of silver, and can be destroyed by bromination.

I desire to express my thanks to Prof. Precht for his kindness in placing his laboratory at my disposal for carrying out this investigation.

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- (2) Graetz, Wied. Ann., 1902, 1100; Phys. Zeitschr., 1902-1903, 4, 160, 271, and 1904, 5, 688; Ber. deuts. Phys. Gesellsch., 1904, 6, 293.
- (3) Russell, Proc. Royal Soc., London, 1899, 64, 409.
- (4) Graetz, Ber. deuts. Phys. Ges., 1904, 296.
- (5) Graetz had the kindness to inform me that he cemented the aluminium foil to the glass by means of Canada balsam.
- (6) Gros, Phot. Corresp., 1903, 98 and 113; Eder's Jahrb. d. Phot., 1903, 522.
- (7) Graetz, Phys. Zeitschr., 1903, 4, 273.
- (8) Graetz, Ber. deut. Phys. Ges., 1904, 6, 293.
- (9) Schaum and Braun, Zeitsch. Wiss. Phot. Bd. II., 1904, 8, 288.
- (10) Martens and Michélli, Arch. de Genève, 1901 (4), 11, 472-487.
- (11) Konowalow, Wied. Ann., 1881, 14, 34, 219; Nernst Theoretische Chemie., 1903, 112.
- (12) In this case, "Lomberg extra rapid" were employed.
- (13) Composition of the ferrous oxalate developer employed:—60 parts saturated solution of ferrous sulphate, containing 2 per cent. citric acid.  
20 parts saturated solution of neutral potassium oxalate.
- (14) Russell, Proc. Roy. Soc., London, 1899, 64, 409.
- (15) Lüpke-Cramer, Phot. Corresp., 1902, 633.
- (16) W. R. Hodgkinson, Phot. News, 1891.
- (17) Erdmann, Anorg. Chemie., 1900, 141.

#### DISCUSSION.

Dr. DIVERS said they were likely to get a better knowledge of the nature of photo-chemical changes by comparing them with similar changes produced in the dark by such a substance as hydrogen peroxide, than they would be if they confined their attention to those caused by light.

Mr. A. PRINGLE said neither the nature of the sensitive salts nor the ultimate action of light on the haloid salts was yet properly understood. Dr. Divers had said, very truly, that when they began to investigate, not the action of light so much, as the action of other matters apart from light, then possibly they would get nearer to an elucidation of what was really the action of light. At any rate it seemed a hopeful line to pursue. Photographers, he was sorry to say, perhaps on account of the fact that they got tangible practical results, were too little apt to investigate fundamental principles.

Rev. C. F. LAMBERT said the author's investigation appeared to explain several of the troubles which were experienced with films, and supported the well-known fact that the keeping of photographic plates was a complex matter. In his experience he found that plates kept well when packed in paper saturated with paraffin.

Mr. DAVIS said he had followed the question of the action of hydrogen peroxide on a photographic plate with some interest since Graetz's first results were obtained. Prof. Otsuki's work was first published in conjunction with Prof. Precht, and Graetz had since replied in a recent paper to several objections urged against his view that the reaction of the hydrogen peroxide was really due to a special radiation. Prof. Otsuki in the present paper had not, he thought, replied to those objections in a sufficient manner. His principal basis for considering

it the effect of a radiation was the comparative lack of volatility of the hydrogen peroxide solution. It is difficult to conceive how such a comparatively non-volatile substance could give off vapour capable of penetrating such substances as celluloid and gelatine.

It must be recognised that it had a vapour tension considerably less than water itself, and that a hydrogen peroxide solution was so comparatively non-volatile that it could be concentrated by blowing through it—a 3 volume solution could be concentrated up to 30 volumes in that way. Hydrogen peroxide was found, it is true, on the part of a photographic plate which was attacked, but whether hydrogen peroxide directly permeated the gelatin or celluloid was another question. Graetz maintained that the hydrogen peroxide was formed on the plate as a secondary reaction brought about by the radiation, it seemed to him that there was considerable evidence in favour of that view. Take, for instance, the question of the permeation of hydrogen peroxide through metal plates. Even considering that there were minute holes present in the plates through which the vapour could pass, it must be acknowledged that hydrogen peroxide is so susceptible of a catalytic decomposition by metals that it was difficult to conceive that it could pass as such directly from a solution through a metal plate. There were several other objections to the view that there was such a direct passage through the various materials, but he need only refer to the latest paper of Graetz, which was published about five weeks ago. If Prof. Otsuki read that paper he should like to know what reply could be given to Graetz's objections.

Mr. S. E. SHEPPARD said that one answer to Mr. DIVERS' criticism was that the author had shown the presence of hydrogen peroxide by the "titanium" reaction, in cases where a photographic effect was obtained. Further, in a paper subsequent to Graetz's last one, Merz, in the last number of the "Ann. der Physik," showed that a photo film detached from its glass or celluloid support and exposed to hydrogen peroxide showed no action, while if exposed on a support the darkening development started on the side of the support—just as in plates exposed through the glass. This showed that probably the condensation of the hydrogen peroxide vapour played an important part. With regard to metal screens, control experiments appeared necessary, as metal plates themselves had a photographic action, the cause of which was still uncertain.

Mr. ARTHUR MARSHALL said he understood the author to say that he considered the small effect obtained with strong solutions of peroxide as compared with weak solutions was probably due to the fact that the vapour tension rose to a maximum. He thought that was due to a misunderstanding. The vapour tension of a mixture might rise to a maximum, but the partial tension of a constituent could never rise to a maximum, it increased continuously as its proportion increased. He thought the diminution was rather to be ascribed to the fact that hydrogen peroxide could act either as a reducing or as an oxidising agent.

Mr. J. THORNE BAKER said he should like to ask a question which might throw some light on the question whether the action of hydrogen peroxide was due to radiation, namely, whether the majority of the plates showed the effect of the rapid or slow variety. In rapid plates the gelatin was so treated that it became a very much more absorbent of bromine than the gelatine which was used in the slow plate. As bromine was liberated, according to Prof. Otsuki, possibly the gelatine in the rapid might assist the action; this would rather tend to support the view that it was not due to radiation.

Dr. RUDOLF LESSING asked if the author thought it possible to use, instead of a solution of hydrogen peroxide, one of the solid molecular compounds of hydrogen peroxide with inorganic salts such as sodium carbonate or sulphate. Under reduced pressure, these gave off almost the whole of the hydrogen peroxide, which could then be used, as hydrogen peroxide of crystallisation.



It would be possible to work in an atmosphere of hydrogen peroxide, thus ensuring the chemical action on the plate, perhaps excluding the influence of radiation.

Prof. OTSUKI, in reply, said the chief reason Graetz mentioned in support of his views, that the action was due to radiation, was the penetration through the gelatine of other substances, and especially through metals. He explained the penetration by suggesting that there was a medium through which the action could penetrate. In the case of celluloid, the camphor contained in it and in the case of gelatine, the moisture, are the medium through which the action could penetrate. This result had already been investigated by Russell, and was recorded in the proceedings of the Royal Society No. 64, 1899. With regard to the penetration through thin sheets of metal, as he understood, Graetz had experimented about a hundred times, and had obtained positive results in some cases, and negative results in 95; but then he would point out that Graetz had used Canada balsam, and Canada balsam was itself capable of allowing the action to pass through. As the whole of the glass plates which were used in the experiments were very small, and the photographic plate which covered the glass plate was also very small, it was probable that the hydrogen peroxide found its way between the glass and the thin sheet of metal, and also between the cementing materials, so that caused the action. With regard to the question of weak solutions being capable of concentration by blowing a stream of air, he thought that it could not be considered as a proof that hydrogen peroxide did not come off from the solution. He bored a small hole in a thin tinfoil about 3 mm. in diameter, and a photographic plate was covered with it. On the photographic plate a large cylinder with ice water was placed about 10 cm. distant from the hole in the foil in the same direction of the current, a small vessel containing hydrogen peroxide was placed, and a rapid stream of air was blown through. After five minutes the plate was developed and a strong darkening was obtained; then he brought the plate further distant (1 m.) from the hole of the blowing pipe in the opposite direction of the current of air. The blowing was continued for about ten minutes, the photographic plate was then developed and darkening was again obtained. After that a photographic plate was covered also with thin tinfoil having a hole and placed in a corner of the dark room. He exposed this plate about ten minutes without bringing fresh hydrogen peroxide near it. Of course, hydrogen peroxide remained in the vessel. He developed the plate and again obtained a strong darkening. Therefore he concluded that in this interval of time the hydrogen peroxide which was blown out from the solution with the moisture in the air, and the atmosphere of the dark room contained a certain quantity of hydrogen peroxide which condensed on the plate and produced darkening. Graetz had always used in his experiments a photographic plate. Now if the plate was not cold there would be no action; therefore, he thought it was due to the condensation of hydrogen peroxide which came off from the solution. With regard to the question whether any hydrogen peroxide could be used to produce this action he did not say for certain, but he thought it very probable that many metals and many organic matters containing resins and terpenes and such organic bodies, which are easily oxidised in the air, produced this action on the photographic plate. This was investigated by Professor Graetz, who stated that hydrogen peroxide was always produced in the case of auto-oxidation. Therefore, hydrogen peroxide is produced when solid peroxides come in contact with weak acid, for instance, tartaric acid and moisture in the air, this effect on the photographic plates must be produced.

Meeting held at Burlington House, on Monday, May 1st, 1905.

MR. A. GORDON SALAMON IN THE CHAIR.

# INFLUENCE OF THE LENGTH OF THE TIME OF DEVELOPMENT ON THE DEGREE OF DARKENING OF THE PHOTOGRAPHIC PLATE.

BY CHIRI OTSUKI, PH.D. (TOKIO, JAPAN).

Although the density of a photographic plate depends upon the time of exposure, the developer, nature of bromide of silver (1) and of binding materials, &c., yet it is also influenced in a great degree by the time of development.

When the same kind of plates and developers are used, the density for one and the same exposure varies according to the time of development on keeping the temperature constant.

An investigation of this subject was made in the following manner:

As the developers edinol and ferrous oxalate of the following compositions were used, the former is known as a rapid, and the latter as a slow, developer.

## 1. Edinol Developer.

A.	{ Edinol (powder) .. ..	1 grm.
	{ Sodium sulphite .. ..	8 grms.
	{ Water, make up to .. ..	100 c.c.
B.	{ Potassium carbonate .. ..	50 grms.
	{ Water, make up to .. ..	100 c.c.

For use 80 parts of A and 20 parts of B are mixed.

## 2. Ferrous Oxalate Developer.

A.—Saturated solution of ferrous sulphate containing 2 per cent. citric acid.

B.—Saturated solution of neutral oxalate of potassium. For use, 20 parts of A and 60 parts of B are mixed.

The exposure was carried on the following way:—

Four narrow pieces of an ordinary dry plate (the extra rapid dry plate of Lomberg was used) were loaded in a slide cassette. Each 1 cm. of the four pieces was exposed at the same time to a Hefner's standard amyl acetate lamp at a suitable distance, the exposure varying from one (Hefner metre seconds) to 153,600 (Hefner metre seconds). Two of the four pieces were developed with the ferrous oxalate developer and the other two with the edinol.

The time of development with both developers were selected as follows:

Series I.	.. ..	10 seconds.
Series II.	.. ..	20 "
Series III.	.. ..	40 "
Series IV.	.. ..	80 "
Series V.	.. ..	160 "
Series VI.	.. ..	320 "

The exposed plates were developed always with a constant amount of developer at 18° C. After the development, the plates were laid in 20 per cent. thiosulphate solution for ten minutes and then were washed under running water for one hour.

The density was determined by the Marten's polarisation photometer, and calculated according to the formula given by Martens and Micheli(2).

$$Dr = 2(\log \tan \alpha - \log \tan S)$$

Dr means the relative density of the developed plate;  $\alpha$ , the angle of rotation of Nicols for the part of the plate the relative density of which is to be measured, when both semi-circles of the field of the photometer appear equally light; S, the angle of rotation of Nicols for the unexposed but developed part of the same plate.

Tables I. and II. show these results graphically. The curves are constructed in such a way that the ordinates represent the relative density, and the abscissæ, the logarithms of ( $i \times t$ ), i.e., the logarithms of the product of the intensity of light in H.M. and the length of the time of exposure in seconds.

TABLE I.  
Edinol 18° C.

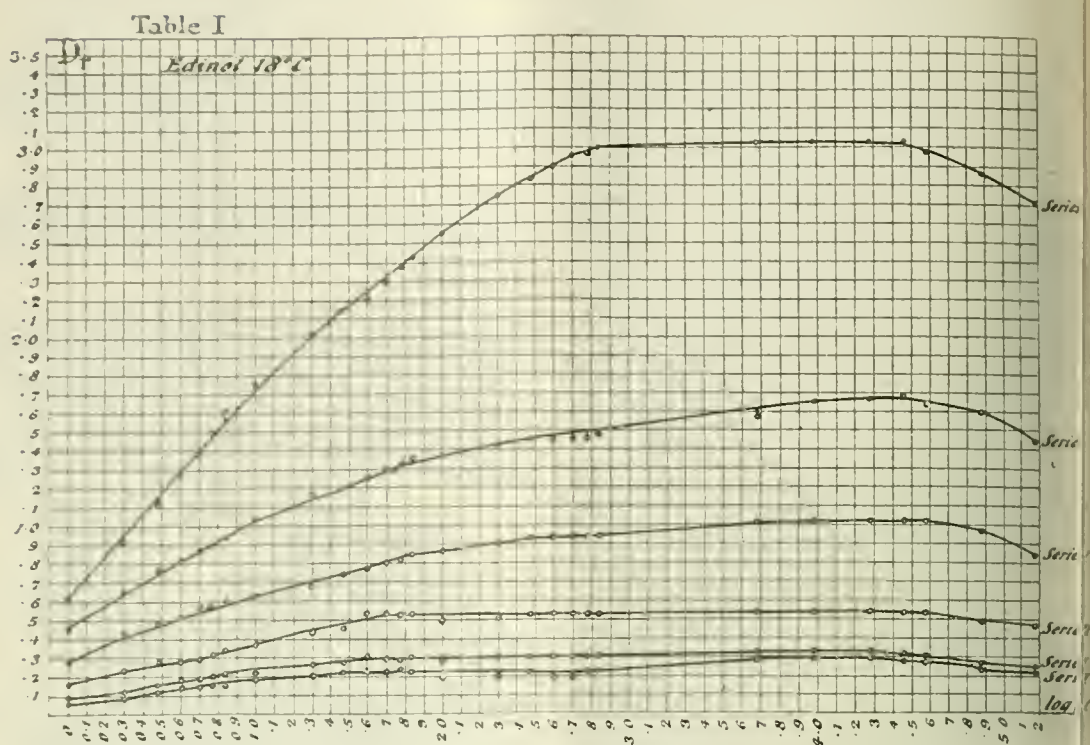


TABLE II.  
Ferrous Oxalate 18° C.





he results show that:—

) The density of a photographic plate for an exposure the same length of time and when developed with same kind of developer increases according to the base of the time of development.

) When the time of development is short, there is great difference in the density by changing the effectual exposure  $i \times t$ .

i.) By increasing the time of development the density quotient  $\frac{d}{D_0}$  becomes greater.

$$\frac{d}{d \log i \times t}$$

r.) At an exposure for the same length of time the use of oxalate developer gives less density than edinol if the plate is developed for a short time; but when the plate is developed for a long time the former causes a greater density than the latter.

Comparing the relative densities at the corresponding exposures for the successive lengths of time of development following results were obtained:—

TABLE III.

Time (S.)	Edinol 18° C.					Ferrous oxalate.
	$\frac{D_{T_2}}{D_{T_1}}$	$\frac{D_{T_3}}{D_{T_2}}$	$\frac{D_{T_4}}{D_{T_3}}$	$\frac{D_{T_5}}{D_{T_4}}$	$\frac{D_{T_6}}{D_{T_5}}$	$\frac{D_{T_6}}{D_{T_5}}$
	1.50	1.29	1.75	1.61	1.38	1.77
	2.00	1.50	1.90	1.60	1.50	1.77
	1.33	1.69	1.78	1.58	1.51	1.76
	1.80	1.56	1.82	1.59	1.58	1.79
	1.82	1.50	1.80	1.61	1.61	1.79
	1.67	1.60	1.75	1.61	1.67	1.76
	1.69	1.50	1.79	1.59	1.66	1.76
	1.50	1.58	1.66	1.59	1.70	1.75
	1.30	1.62	1.67	1.63	1.73	1.74
	1.40	1.61	1.65	1.62	1.77	1.73
	1.50	1.57	1.64	1.62	1.78	1.71
	1.43	1.60	1.67	1.61	1.78	1.70
	1.43	1.63	1.67	1.60	1.81	1.67
	1.37	1.67	1.68	1.57	1.82	1.65
	1.37	1.67	1.72	1.59	1.85	1.61
	1.37	1.67	1.73	1.60	1.90	1.60
	1.37	1.67	1.77	1.60	1.94	1.59
	1.37	1.67	1.76	1.60	1.96	1.59
13	1.512	1.566	1.734	1.601	1.739	1.708

Total mean = 1.630

Mean deviation =  $\pm 0.085$

,  $D_{T_2}$ ,  $D_{T_3}$ ,  $D_{T_4}$ ,  $D_{T_5}$ ,  $D_{T_6}$  mean the densities at the corresponding exposures for the lengths of time of development 10, 20, 40, 80, 160, 320 seconds respectively.

From these data the following *Exponential Law of Development* may be deduced.

#### Exponential Law of Development.

Within the range of the normal exposures, neutral density, the density ratio for any two lengths of time of development is constant and independent of exposure.

The density at a constant exposure is proportional to the logarithm of the length of time of development.

The density at any exposure for the length of time of development  $2 \cdot T$  seconds is equal to that of  $T$  seconds at corresponding exposure multiplied by  $C$ , where  $C$  is a constant.

In conclusion, I desire to express my thanks to Professor Martens of the Technical High School of Hanover, for his assistance in this investigation.

Meeting held at Burlington House, on Monday, 1st May, 1905.

MR. A. GORDON SALAMON IN THE CHAIR.

#### THE CHEMISTRY OF WHISKY.

##### PART II.

BY PHILIP SCHIDROWITZ, PH.D., F.C.S., AND FREDERICK KAYE, A.R.C.S.C.

The present communication is a continuation of the work presented to the Society by one of us (Schidrowitz) some three years ago (this J., June, 1902, 814).

The secondary products in a spirit of any kind—referring to new spirit—are obviously dependent upon the nature of the raw materials or on the method of manufacture. As regards pot-still whisky the chief points of interest appeared to us to be the effect of the use of peat in kilning the malt, and the result of the fire-action in the still, that is, the effects produced by the impinging of a naked flame

on the liquid, and particularly the solid contents of the still. We were inclined to believe that a considerable part of the flavour of pot whisky is due to this fire-action, and, starting from this hypothesis, we obtained results of interest, but, for reasons stated below, we have had to materially modify our views in this connection. We thought that fire-action would necessarily produce dry distillation in some more or less modified form of the solid particles in the still, which, notwithstanding the use of stirring apparatus, must, in part, be in close proximity to the still bottom. These solid particles consist mainly of woody or cellulosic material derived from the grain, and of yeast. It occurred to us, that by exaggerating this fire-action by suitable methods in the laboratory, we might obtain, in relatively large quantities, those substances which are formed in minute amount in the still. The simplest yet at the same time the most radical way of testing this view was to dry distil material identical with or similar to that present in the solid shape in the working still. The products resulting from the dry distillation of woody matter are well known, and we therefore confined our experiments in this regard to the dry distillation of distillery yeast, respecting which we could find no information in literature. A large number of experiments in this direction were made both in the laboratory and on a working scale. Briefly stated, the products obtained are somewhat similar to those formed on distilling bones. They consist mainly of tar bases (fatty amines, and of the pyridine and pyrrol series), tar acids (phenols), a large

Vogel. Handbuch d. Phot. Bd. I., (1890) 159; v. Die Entwicklung, 9 (1901).  
Martens and Michéli. Archiv. de Genève (4) (1901) 487.

proportion of nitriles, of neutral hydrocarbons, of organic sulphur compounds (mercaptans), of ammonia salts (chiefly carbamate and chloride), sulphides, thiocyanates, and a large volume of gases consisting chiefly of carbon dioxide, sulphur dioxide, and sulphuretted hydrogen. Having obtained these results we proceeded to examine new pot whisky, with a view to ascertaining whether any and which of these substances were present in the same. In this we were partially successful, for we obtained distinct evidence of the presence of pyrrol, of phenolic bodies, of an alkaline substance (probably an ammonia salt), of sulphuretted hydrogen, and of sulphurous acid in different whiskies. We are also inclined to think that new whiskies contain traces of nitriles, but the definite identification of these substances in spirits is attended with so much difficulty that we prefer not to mention this otherwise than as a mere suggestion. The work of identifying more closely the substances mentioned, and of estimating some of them, if possible, quantitatively, is being carried on, but progress must necessarily be slow in view of the minute quantities in which they occur.

It will be noticed that all the substances mentioned as having been detected are such as would tend to become changed in time on exposure to air and moisture. Pyrrol under the conditions of cask storage probably resinifies, and this action would no doubt also apply to any other substances of a similar nature that may be present. The phenols may, and probably would, interact with the aldehydes, acids or alcohol to form condensation products, the sulphurous acid and sulphuretted hydrogen would naturally oxidise, and nitriles, if present, would certainly and rapidly condense or be transformed into acids. We have not been able to detect any of the substances alluded to in mature spirit. These facts appear to us to form the basis of a more rational view of maturation than has hitherto prevailed, and although we do not suggest that the maturing process consists merely of the disappearance or transformation of the substances alluded to—in view particularly of the fact that we are aware that material changes take place with regard to the better-known constituents, such as furfural, the acids, aldehydes, &c.—yet the disappearance of these substances would certainly appear to account in part for the elimination of the raw and unpleasant character of new, and more particularly of new pot, spirit. Bodies such as these might well be, in conjunction with the aldehydes and furfural, accountable for the curious effects which are attributed to immature spirits.

The basis of the experiments which had the results mentioned above was the assumption that fire-action was one of the chief, if not the main, cause of the production of the characteristic products in pot spirit. In view of the results obtained, this hypothesis might, at the first glance, appear to have received substantial confirmation. We have, however, already stated that our opinion in this respect has undergone considerable modification, and the reason for this is that we have come across pot whiskies—the samples were taken personally by one of us at the distilleries—distilled by means of slightly superheated steam, the latter being applied by means of a steam jacket, which, as far as we have been able to determine, do not differ materially as regards the specific nature of the secondary products contained, from whiskies distilled by the more general direct fire process. This fact undoubtedly disposes of the assumption that furfural, to mention one of the better-known substances, the formation of which is usually attributed to fire-action, is due to the latter, and in this regard the presence, as found by us, of furfural in appreciable quantities in grain whiskies, proves that this substance is not only not attributable to fire-action, but that it is not a specific indication of pot distillation. Since we have discerned no material difference between the specific products of fire and steam distilled pot spirits respectively, it is obvious that the formation of the substances alluded to above—and found by us on the assumption that they are due to dry distillation—is not due to fire-action in the still. We presume, therefore, that, as far as they are obviously specific dry distillation products, they are derived from the peat and coke used in malting, or from the action of the hot gases on the kiln during the drying-off stage.

The results of the analyses are given in detail for the following reasons:—(1) That it is only by this method that the interesting and important differences, frequently of very wide nature, between spirits of the same class of different classes can be properly illustrated, and that it is only thus that the results can obtain technical importance; (2) that the number of full whisky analyses published so far is very small; and (3) that this is the first publication, to the best of our knowledge, of a large number of analyses of properly authenticated samples of any spirit whatever, be it of brandy, of whisky, or of any other potable spirit.

*Method of taking samples.* In order to make certain our material, all the samples were drawn at the distillery straight from bond, and duly signed or sealed by the authorities in charge. A great number of the samples were drawn by one of us, the remainder were obtained from bond and authenticated in each case as above by an agent of our own. In every case, the samples were drawn and submitted to us with the full knowledge and approval of the distillers. We take this opportunity of thanking the proprietors of the various Highland and Lowland malt, Campbeltown, Islay and Grain whisky distilleries, not only for their kindness in providing us with samples, but also for the facilities they afforded us in viewing without restrictions the materials employed, apparatus in use, and the methods of manufacture generally.

*The methods of analysis employed* were in the first place those set out by one of us in the first paper on this subject in this J. (*loc. cit.*). With regard to the high alcohols, it was stated in the paper alluded to that the colorimetric method, as devised by French investigators for the analysis of brandy, did not give satisfactory results inasmuch as the shade of colour obtained when operated on whisky differed sensibly from that given by the control—namely, isobutyl alcohol. It was suggested at the same time that the difficulty might possibly be got over by using a more suitable control, and we have now found that this is the case if, instead of isobutyl alcohol, amyl alcohol (isobutylcarbinol) be employed. This substance gives satisfactory results as far as shade of coloration concerned, but we are very strongly of opinion that the colorimetric process can give really accurate results, not only for the reason that—as Bell has shown—the high alcohols in whisky consist of a mixture of different alcohols, these, no doubt, varying in every individual case, and that it is well known that the coloration produced by the various higher alcohols with sulphuric acid varies enormously in intensity (*cf.* Allen J. Fed. Inst. Br. III., 1, 24). Thus, neither of the propyl alcohols gives a coloration with sulphuric acid and this, no doubt, accounts for the low results obtained in the case of the grain whisky. Moreover, there is some reason for believing that other substances besides the higher alcohols come into play in this reaction. This is (*cf.* Allen, *loc. cit.*) certainly the case with regard to the higher esters, and substances such as pyrrol and the terpenes; the great class of bodies grouped under the name of “essential oils,” would undoubtedly be affected. Nevertheless, we have given the results obtained by the colorimetric process as modified by us, for we think that it may, when compared with Allen-Marquardt results, afford some rough indication of the quantity of the higher esters, terpenes and other substances, to which we cannot yet give specific numerical expression, present. In order to make the results obtainable by the colorimetric process comparable as far as possible with those recorded in literature as obtained (chiefly in the case of brandy) with an isobutyl alcohol standard, we made some experiments to ascertain the relative intensity of colour obtained with this alcohol and with amyl alcohol respectively. The shades produced are not absolutely comparable, but if the figures given by us be divided by 2.5, the results will roughly approximate to those that would be obtained if an isobutyl control solution were used.

The analyses tabulated below comprise spirits from different distilleries. Each distillery is indicated by number, and where more than one sample from the same distillery was examined, an alphabetical letter is added. For obvious reasons we have refrained from referring



stilleries by name. A few words with regard to the classification, and the method of manufacture of the different classes, may be of interest. The classification is adopted by the industry concerned, and may be broadly characterised as indicating varieties of the same genus: *Highland Malts* are produced (if we except a few series on the islands in the west and north) in the north of the mainland lying north of an imaginary line through Dundee on the east and Greenock on the west. The malt is cured either with peat alone, or with peat and coke. *The Lowland Malts* are made of the imaginary line alluded to. Less peat is used in the preparation of the malt, and occasionally, where peat is dispensed with altogether, especially of years, owing to the growing taste for a spirit with a pronounced peaty flavour. *The Campbeltowns* are made at the southern end of the Kintyre peninsula. *Islays* are made in the island of that name. More peat is used in the preparation of these whiskies than in the other classes. We have laid some stress on the use of peat used, as it is one of the few specific points in the manufacture of which we have fairly definite knowledge. It must, however, not be assumed that the use of peat alone is responsible for all the characteristics of a whisky, for the Lowland malts in the preparation of which little and sometimes no peat is employed, and rain whiskies which are made without peat, yet takeably possess those broad characteristics of rain whiskies which are associated with the article in question. Differences between the various classes and individuals of the same class are largely dependent, no doubt, on the quality of the barley and other raw materials of a starchy nature employed, on the water, the methods of malting

and distilling, the shape and manner of working the stills, &c. We hope, on some future occasion, to give an account of an investigation in this direction. The *Grain* whiskies, in the manufacture of which other cereal grains—partly malted and partly unmalted—besides barley are employed, are made in the district bounded by the Firth of Forth on the east, and the Firth of Clyde on the west. The *Grain* whiskies are distilled in a still designed for partial rectification, but as will be seen from the figures below, they are far removed from being silent spirits, and, as we have already stated, they possess very considerable whisky flavour. Regarding the tables that follow we must mention that the first column shows the age of the spirit in years and months, and the letter following the age indicates the nature of the cask employed for storage. In this respect *P.* stands for *plain wood*; *R.* for *refill wood*, that is a cask which was originally used for the storage of sherry, was then employed once for storing whisky, was emptied and again filled with spirit; *S.* for *sherry wood*; and *B.* for *brandy wood*. The word *wood* is synonymous with cask. The brackets in cases of several spirits from the same distillery indicate that the spirit was originally the same, but placed in a different type of cask or submitted to varied conditions of storage, &c., after distillation. Where the age is given as identical, but the samples are not bracketed, the fact is indicated that the different spirits were not taken from one and the same period, which is the term applied to each separate distillation, but that they were distilled within a very short time (a week or two) of one another. The latter results are, of course, not strictly comparable.

Highland Malts.

Spirit Number.	Age and Wood.	Alcohol Per Cent. by Vol.	Extract Per Cent.	Ash Per Cent.	Total Acid.	Non-vol. Acid.	Volatile Acid.	Ethers	Higher Alcohols Color. Method.	Higher Alcohols A-M Method.	Aldehydes	Furfural.
1	new	63.4	0.008	0.004	12	0	12	59	667	201	24	3.2
1a	3/7 P	62.0	0.04	0.004	28	2	26	66	582	221	11	3.7
1b	3/7 S	61.0	0.28	0.003	49	14	35	49	647	218	10	3.4
1c	3/7 B	62.2	0.08	0.004	51	17	34	67	601	—	14	3.4
1d	4/9 S	58.6	0.05	0.006	54	17	37	79	485	180	8	3.9
2	new	69.0	0.006	0.001	15	0	15	52	543	166	10	3.9
(store) 2a	7 P	47.4	0.03	0.005	47	7	40	103	518	171	20	3.4
(re) 2b	7 P	60.5	0.06	0.008	49	9	40	90	487	161	12	4.7
2c	7 S	61.0	0.15	0.02	70	27	43	91	485	179	10	4.2
2d	15 B	49.4	0.06	0.007	61	9	52	80	431	160	16	4.9
3	new	62.8	0.01	0.001	14	0	14	64	703	195	10	3.6
3a	6/9 P	60.2	0.03	0.002	26	3	23	66	546	138	15	3.6
3b	6/9 S	59.5	0.17	0.012	66	35	31	63	480	134	18	2.7
4	new	63.5	0.007	0.001	16	1	15	78	358	126	11	2.4
5	new	60.3	0.01	0.007	12	1	111	59	361	—	4	1.6
6	new	63.6	0.009	0.002	15	1	14	55	491	156	7	1.7
7	new	63.4	0.006	0.002	15	1	14	72	525	181	7	1.9
8	new	62.0	0.009	0.005	19	0	19	33	578	175	18	5.8
9	0/6 P	63.0	0.02	0.003	23	1	22	68	391	142	15	3.1
10	new	63.0	0.02	0.002	22	1	21	48	515	197	30	3.3
11	new	63.4	0.005	0.000	20	—	—	57	543	154	11	3.1
12	0/4	62.6	0.01	0.003	15	1	14	185	328	177	29	4.4
12a	3/7 S	60.5	0.37	0.016	77	24	53	92	377	163	28	3.7
13	3/7 S	63.8	0.01	0.006	15	0	15	57	479	224	16	3.5
13a	7/7 P	57.1	0.16	0.008	32	7	25	50	390	196	16	3.7
13b	7/7 S	59.0	0.22	0.018	63	13	50	56	351	145	17	3.7
14	new	63.0	0.006	0.002	18	0	18	43	357	169	6	3.8
15	new	61.2	0.007	0.002	16	0	16	64	812	161	11	4.2
16	new	63.2	0.008	0.002	10	0	10	84	485	112	14	3.2
16a	Old. S.	56.0	0.16	0.012	62	21	41	—	481	218	18	2.7
17	5/4 P	61.3	0.04	0.003	83	12	71	101	533	154	19	3.1
18	new	63.7	0.007	0.003	19	0	19	67	480	144	11	5.2
19	new	68.4	0.008	0.002	18	0	18	67	560	133	17	2.7
20	new	62.6	0.01	0.002	22	2	20	63	584	175	37	3.7
21	new	63.1	0.008	0.002	27	2	25	82	864	142	44	6.3
21a	5 P	57.7	0.02	0.004	36	2	34	89	845	235	66	4.7
22	new	64.9	0.008	0.002	20	1	19	67	437	129	11	3.0
23	new	63.6	0.006	0.002	22	2	20	69	583	180	5	2.6
24	new	63.7	0.004	0.000	15	1	14	52	422	148	6	1.6

NOTE.—Results, excepting in case of alcohol, extract and ash, are expressed in grms. per 100 litres of Abs. Alcohol.

## Lowland Malts.

Distillery Number.	Age and Wood.	Alcohol Per Cent. by Vol.	Extract Per Cent.	Ash Per Cent.	Total Acid.	Non-vol. Acid.	Volatile Acid.	Ethers	Higher Alcohols Color. Method.	Higher Alcohols A-M Method.	Aldehydes.	Furfa
25	new	64.1	0.008	0.002	15	3	12	49	296	82	15	4.5
26	new	63.4	0.008	0.002	10	0	10	27	458	123	17	2.5
26a	15/9 P	60.7	0.03	0.006	20	3	17	44	501	154	15	3.1
26b	15/9 S	62.0	0.06	0.007	32	10	22	62	712	156	15	3.1
27	1/7 R	62.6	0.02	0.004	10	0	10	48	189	101	8	1.6
28	4/8 R	60.0	0.09	0.02	60	16	44	80	639	126	17	3.2
29	new	66.8	0.002	0.000	22	1	21	44	612	172	11	2.1
29a	15/8 P	57.5	0.02	0.004	36	2	34	71	980	179	27	5.2
29b	15/8 S	58.8	0.09	0.007	50	7	43	68	732	145	24	3.4
30	new	62.1	0.009	0.003	8	0	8	44	405	88	9	0.0
31	new	63.1	0.017	0.008	15	1	14	32	425	169	14	2.6
32	new	63.6	0.009	0.002	19	1	18	70	605	228	30	2.6
33	new	63.0	0.01	0.004	27	0	27	51	516	215	41	3.5
34	new	63.5	0.008	0.002	6	0	6	58	897	222	54	1.7
35	new	63.2	0.01	0.003	21	0	21	87	264	142	18	4.4
36	new	68.4	—	—	11	4	7	44	557	170	14	4.7

NOTE.—Results, excepting in case of alcohol, extract and ash, are expressed in grms. per 100 litres of Abs. Alcohol.

## Campbeltowns.

Distillery Number.	Age and Wood.	Alcohol Per Cent. by Vol.	Extract Per Cent.	Ash Per Cent.	Total Acid.	Non-vol. Acid.	Volatile Acid.	Ethers	Higher Alcohols Color. Method.	Higher Alcohols A-M Method.	Aldehydes.	Furfa
37	new	62.1	0.01	0.003	24	1	23	61	443	222	30	6.2
37a	5 P	50.1	0.025	0.004	49	3	46	90	723	235	73	6.7
37b	5 S	54.5	0.25	0.024	81	23	68	69	737	212	68	6.4
38	new	63.9	0.006	0.002	15	1	14	72	583	212	28	2.7
38a	5 P	62.1	0.015	0.004	20	1	19	62	645	166	85	2.4
38b	5 B	60.1	0.07	0.008	36	6	30	64	615	203	31	2.1
39	new	62.8	0.01	—	22	0	22	88	357	182	29	6.4
40	new	63.0	0.018	0.004	19	0	19	97	554	172	16	2.9
Cask A.—40a	5/7 S	58.7	0.18	0.01	75	16	59	140	930?	—	61	4.7
Cask B.—40b	5/7 S	58.8	0.18	0.01	75	22	63	132	846?	239	59	4.7
41	new	63.4	0.013	—	17	1	16	77	367	178	11	4.4
42	new	61.3	0.008	0.004	16	0	16	53	504	109	20	2.4
43	new	63.3	0.014	0.004	17	1	16	59	722	190	28	4.4
43a	6/5 P	59.8	0.04	0.004	35	3	32	63	877	250	40	8.4
43b	6/5 S	60.9	0.19	0.02	100	28	72	70	698	193	30	8.4
44	new	64.0	0.006	—	12	0	12	42	635	138	15	2.4

## Islays.

Distillery Number.	Age and Wood.	Alcohol Per Cent. by Vol.	Extract Per Cent.	Ash Per Cent.	Total Acid.	Non-vol. Acid.	Volatile Acid.	Ethers	Higher Alcohols Color. Method.	Higher Alcohols A-M Method.	Aldehydes.	Furfa
45	new	63.6	0.006	0.003	19	0	19	40	620	176	20	4.4
46	new	63.5	0.006	0.001	19	0	19	53	738	174	40	3.4
47	new	66.3	0.007	0.001	15	2	13	56	621	200	17	4.4
47a	5 P	60.5	0.04	0.006	36	6	30	71	740	162	18	4.4
47b	7 S	60.7	0.16	0.02	73	33	40	86	642	155	18	5.4

NOTE.—Results, excepting in case of alcohol, extract and ash, are expressed in grms. per 100 litres of Abstract Alcohol.

## Grain Whiskies.

Distillery Number.	Age and Wood.	Alcohol Per Cent. by Vol.	Extract Per Cent.	Ash Per Cent.	Total Acid.	Non-vol. Acid.	Volatile Acid.	Ethers	Higher Alcohols Color. Method.	Higher Alcohols A-M Method.	Aldehydes.	Furfa
48	new	62.8	0.007	0.001	4	0	4	25	58	49	2	0.4
48a	5 P	60.1	0.04	0.005	46	3	43	45	89	50	3	0.4
49	new	63.7	0.006	—	3	0	0	23	61	37	trace	0.4
49a	5/9 P	63.6	0.02	0.002	16	2	14	25	49	62	6	tra
50	new	61.6	0.01	0.004	4	0	4	55	52	62	17	tra
50a	6/4 R	58.7	0.03	0.007	22	4	4	54	93	35	2	0.4
51	new	63.1	0.002	—	69	18	51	45	70	54	6	0.4
51a	5 S	60.9	0.12	0.011	38	10	28	49	145	—	—	tra
51b	5 R	60.7	0.12	0.006	38	0	4	25	58	60	2	0.4
52	new	63.8	0.005	0.001	4	1	16	39	168	63	2	0.4
52a	6/7 P	58.9	0.02	0.001	17	15	22	27	89	65	4	tra
53	6 R	56.7	0.08	0.01	37	26	29	37	92	68	6	tra
53a	6 S	57.5	0.14	0.02	55	0	10	40	199	70	2	0.4
54	new	62.8	0.008	0.000	10	0	25	33	178	57	2	tra
54a	4/2 R	62.6	0.04	0.007	27	2	22	41	161	58	7	0.4
54b	4/2 S	62.7	0.10	0.01	48	26	22	41	161	58	7	0.4
55	6 R	60.7	0.04	0.006	21	3	18	41	34	35	4	0.4
55a	6 S	60.9	0.12	0.01	59	24	35	64	74	40	3	tra
56	new	63.9	0.004	—	3	0	3	20	231	51	15	0.4
56a	6 R	60.3	0.14	0.002	35	5	30	33	297	57	10	0.4
56b	6 S	60.8	0.17	0.01	42	15	27	33	400	61	14	0.4
56c	6/9 S	60.8	0.12	0.01	57	15	42	39	278	80	14	0.4
57	new	62.6	0.01	—	6	0	6	26	104	33	trace	tra
57a	6/7 P	61.5	0.03	0.003	27	5	22	26	190	47	5	tra

NOTE.—Results, excepting in case of alcohol, extract and ash, are expressed in grms. per 100 litres of Abs. Alcohol.



conclusions.—Looking at the above results, the first which strikes one is the very wide variation in regard to different constituents, not only between the different classes, but also as between members of the same class. The following table gives the maxima and minima in each taking all the spirits together regardless of age.

	Total Acid.	Non-vol. Acid.	Ether.	Higher Alcohols Colorimetric Method.	Higher Alcohols Allen-Marquardt Method.	Aldehydes.	Furfural.
all spirits	10—83	0—35	33—185	328—864	112—235	4—66	1·6—6·3
and malts	6—60	0—16	27—87	189—897	82—228	8—54	0—5·2
and malted	12—100	0—28	53—140	357—930	160—259	11—85	2·4—8·0
belts	15—36	0—33	40—88	620—740	155—200	17—40	3·3—5·2
...	3—69	0—26	20—55	39—400	33—80	trace—17	0—0·9

In regard to the effect of maturation we have not up averages for all the classes, as up to the present we have not been in a position, excepting in the case of the whiskies, of examining a sufficiently large number of corresponding old samples to make averages in this respect at all representative. In regard to the grain spirits, the averages for old and new samples respectively are as follows:—

	Total Acid.	Non-vol. Acid.	Ethers.	Higher Alcohols Colorimetric Method.	Higher Alcohols Allen-Marquardt Method.	Aldehydes.	Furfural.
New	4·7	0·0	33·5	113·2	49·3	5	trace
Old	38·5	10·6	38·2	151·1	56·2	6	0·24

It will be noticed that the old samples show marked differences from the new, in the case of the non-volatile acids, and the substances indicated by the colorimetric process, and slight, though appreciable differences in the case of the ethers, the higher alcohols, and the furfural. Aldehydes alone—contrary to our expectations—show no change. So far as we have been able to examine specimens of the other classes these conditions of maturation appear to be universal, but we prefer, at present, to express no definite opinion in this respect. On reference to the tables it will be seen that the type of cask used to exercise considerable influence on the course of maturation. We hope to say more about this on a future occasion, but meanwhile we may remark that the differences noted in this respect appear to affect all the products indicated by the colorimetric process and the aldehydes, and that the sherry cask used to hasten maturation as compared with other types of very great interest are the results concerning the effects of storage in a damp and in a dry house respectively are plainly evident. It is too, from No. 40, that the condition of the cask—its material and the nature of the wood—is of influence. It is scarcely, perhaps, within the province of analytical chemistry to take into consideration such factors as taste, colour, or of commercial quality except where a scientific expression can be given to such factors, but the technologist cannot pretend to ignore them. Viewed in this light we may say that, taking as a practicable standard of commercial quality the price, our results show, as might have been expected, that no single analytical figure denotes commercial quality. Our remarks in this respect are to be referred to individual members of the same class, it is out of the question to compare the various members of one class with another, as such a proceeding would be unreasonable as to compare Burgundy with Claret, or the Rhine with those of the Moselle, or the stout with a mild running beer. To take the case of malts as an example we may point out that Nos. 13, and 19, which are amongst the whiskies at the very highest prices, contain only a moderate amount of ethers as compared with Nos. 12, 17, and 21, the spirits being by no means regarded as of the

first quality. The same applies to any of the other figures taken singly, but at the same time, those spirits which have the greatest reputation commercially, all show a certain "balance" of the figures, taking them as a whole, and class for class, which, in our opinion, augurs well for the role which the chemical technologist in the future will

be able to play as an aid to the distiller and blender. Whiskies such as Nos. 5, 8, 12, 15, 17, 18, 21, and 24 (to confine ourselves to one class again) which all show either an excess or a deficiency of certain constituents chemically regarded, are all known to possess commercial characteristics which make them unsatisfactory in some respects particularly in regard to their use as "self" whiskies (i.e., in an unblended state), as far

as the taste of the average consumer goes, but valuable by virtue of this excess or deficiency, where other considerations are in view. We have good reason to think that, as is the case with regard to wine or beer, certain of the chemical figures either of themselves or in groups, connote specific attributes, such as "body," fullness of flavour, delicacy, softness and so on, but, as a discussion of these matters is scarcely likely to be of general interest we refrain from going into them further.

## Manchester Section.

Meeting held at Manchester, on Friday, May 5th, 1905.

MR. J. CARTER BELL IN THE CHAIR.

### RECENT ADVANCES IN THE ELECTRO-METALLURGY OF IRON AND STEEL.

BY R. S. HUTTON.

#### INTRODUCTION.

The belief is still far too prevalent amongst those responsible for the introduction of new industries in Great Britain that because of our very limited endowment of water-power, electro-chemical undertakings are altogether unpromising.

This matter deserves much closer attention than it has yet received. Above all it should be remembered that the cost of power is frequently but a small fraction of the total cost of production. The accompanying table, whilst only a rough approximation, will at least serve to point out the very wide differences which exist in the power expenditure and value of different electro-chemical products.

Product.	Yield per H.P. Year in Tons.	Approximate Value per Ton.
Copper (refining) . . .	15 to 24	£ 68
Caustic soda . . . . .	1.4 to 2.4 (75 p.c.) also 3 to 5 bleach	10 NaOH
Potassium chlorate . .	0.5 to 0.8	32
Calcium carbide . . . .	1.2 to 2.0	13
Ferro-chromium . . . .		
70 per cent. Cr. . . .	0.8	—
Aluminium . . . . .	0.25	130

We have next to consider what data can be brought forward as to the actual cost of power generation in this country.

Many of our leading electrical engineers have published minute data as to the cost of power generation, but only for electric lighting, traction and motor purposes. These cases, however, are so entirely different in character from those we are concerned with that no definite conclusions can be drawn from this evidence. The average power station is fortunate to get a 15 per cent. load-factor and overjoyed with 30 per cent., whereas in nearly all electro-chemical works the manufacture is continued night and day throughout the year, and the load factor may be taken as 100 per cent.

If one may judge from the evidence of those few who have had actual experience in electro-chemical industries using steam power, a figure of £6 to £8 for the h.p. year is quite attainable under such conditions. With producer gas this may probably already be brought down to £4 in this country.

For the sake of comparison, it may be pointed out that although in some few places in the Alps and Norway a figure as low as 17s. per h.p. year has been attained, water power is very seldom to be obtained so cheaply. At Niagara, the price of supply to large consumers varies from £3 11s. to £4 3s. and at Rheinfelden reaches £6 for the h.p. year.

So far as blast furnace gas is concerned, no very sure data are available for similar industries. The supply of cheap gas power is likely to prove so beneficial to our own country in the application of the industries we are about to consider that it is earnestly to be hoped that those who are concerned in the construction of large gas engines will be led to take an interest in these developments. With their co-operation, the number of remunerative electro-chemical industries may be very largely increased in this country.

#### *Electro-thermic Reduction of Iron Ores.*

The application of the electric furnace to the metallurgy of iron, with the exception of some few small scale experiments which are more of historical than technical interest, may be said to be largely founded on the experience gained in the manufacture of calcium carbide. Carbide furnaces have been and are being largely used for the production of rich ferro-alloys such as ferro-chromium and ferro-silicon, and in this way electro-

metallurgy has already been of considerable service to the steel industry.

As the production of calcium carbide became less and less remunerative, and as the demands of the market for these ferro-alloys became satisfied, definite attention was made to tackle the problem of the direct reduction of iron ores.

It might seem to be rather a hopeless task with the electro-metallurgist has thus set himself; for direct competition with the blast furnace is obviously on the question so far as our own and probably all other present iron producing countries are concerned.

On the other hand, there are certain advantages which can be gained by electric heating, and, although electric reduction of iron ores is at the moment unremunerative, we may expect to hear more of it in the future, when the general development of electric furnace construction is more advanced.

Every ton of pig iron produced in the blast furnace requires very nearly one ton of coke for its production. Of this amount, only one-third is necessary for the chemical reduction of the ore, the balance being employed in producing and maintaining the requisite temperature. This two-thirds of the fuel supply can be replaced by electric heating.

To take the very simplest case. For the reduction of pure oxide of iron.

Theoretically—  
1429 kilos  $\text{Fe}_2\text{O}_3$  } For production of 1000 kilos.  
322 kilos. carbon }

	Calories
For reduction of $\text{Fe}_2\text{O}_3$ . . . . .	1,780,000
For heating and fusing iron maximum . . . . .	430,000
	2,210,000

By oxidation of 322 kilos. C. to  $\text{CO}$ . . . . . 778,000  
By oxidation of 322 kilos. C. to  $\text{CO}_2$  . . . . . 2,603,000  
Leaving to be supplied by electric power 1,432,000  
= 1657 K.W.H. = 2220 H.P.H. = 0.253 H.P.Y.  
per metric ton of pig iron.

In actual practice, so far, only the simple case of reducing the ore and allowing the carbon monoxide to pass unused has been tried, and with this process the following results have been obtained. Various methods, however, have been proposed by Héroult, Harmet and others for utilising the total heat of combustion of the gas. Under these conditions, it should be possible to produce iron ore with a much smaller power expenditure, and perfecting of methods along these lines is a matter of the future.

Recently, thanks to the foresight of the Canadian Government, a Commission was sent to Europe to investigate the electrical methods of producing iron and steel, and their report gives us valuable independent evidence of the power expenditure in the various processes which they studied.

Actual results in practice :—

#### *Power Expenditure per 1000 Kilos. Product.*

	Mean Power on Furnace. K.W.	K.W. Hours.	H.P. Year
(1) Keller (Canadian Commission)— A. Grey pig (4.2 per cent. C., 2 per cent. Si.) . . . . .	613	3420	0.522
B. White pig (3.0 per cent. C., 0.7 per cent. Si.) . . . . .	226	1620	0.25
(2) Stassano (Goldschmidt) . . . . .	80	3155	0.48
(3) Héroult (Canadian Commission) . . . . .	182	3380	0.517
(4) Morrison . . . . .	270	2233	0.34
For comparison with these figures :—			
(5) 70 per cent. Ferro-Chromium Willson Al. Co. (Haber) . . . . .	300?	7950	1.21
(6) 30 per cent. Ferro-Silicon Willson Al. Co. (Haber) . . . . .	300?	5930	0.91

In connection with this table, the following remarks may be made. In experiment (1) A., nearly 10 tons of grey pig iron was manufactured during a 55 hours' run some 28 taps being taken from the furnace. 15,943 kilos. of ore were charged and 54.1 per cent. Fe.

In (1) B., about 6½ tons of pig were produced in 48 hours, but the energy consumption being kept low, only a very small quantity of the impurities in the ore was reduced. The average amount of coke used per metric ton of product in the two experiments was 370 kilos.

In (3): This was a very small scale experiment, less than 1 ton of metal being obtained in 16 hours, the ore was more poor grade, containing about 35.5 per cent. iron, it is therefore surprising that the power expenditure was not higher.

For (5) and (6) it must be remembered that both chromium and silicon oxides require a very much higher power consumption for their reduction (1 kilo. silicon from  $\text{SiO}_2$  requires 6414 Cal. as compared with 1780 Cal. for 1 kilo. iron from  $\text{Fe}_2\text{O}_3$ ).



F. W. Harbord, the metallurgist attached to the Canadian Commission, ably summarises the present economical position of the electric reduction of iron ores. Iron can be produced on a commercial scale to compete the blast furnace, only when electric energy is very cheap and fuel very dear. On the basis taken in this report, with electrical energy at 10 dols. (41s. 8d.) per h.p. and coke at 7 dols. (29s. 2d.) per ton, the cost of production is approximately the same as the cost of casting pig iron in a modern blast furnace." It is even if electric reduction can be successfully introduced in such countries as Chile or Canada, where power is abundant and fuel expensive, there is no bright prospect for it in our own country.

#### Electric Steel Production.

Considering this subject it is necessary to judge the furnace methods entirely on their own merits and according to whether they approach more or less to the usual metallurgical process they are proposed to displace. The whole *modus operandi* of an electric furnace is so different from that of a fuel heated furnace that its advantages and disadvantages are not apparent if judged by a direct comparison of the two methods. It is rather from the product which results in the two cases and from the rate of production that conclusions should be drawn. In the last two or three years much has been accomplished. Experiments have been carried out on a commercial scale and by those who have had a very wide experience in electric furnace work. So that what we have to consider are data obtained in working over long periods, confirmed in most cases by actual tests undertaken by the Canadian Commissioners or independent witnesses.

One of the most important considerations is the power expended in the process. This is briefly summarised in the annexed table. It is, however, almost equally important to consider the quality of the steel manufactured, as also the nature of the raw materials required for the process.

#### Electric Steel Processes.

Authority.	Power on Furnace K.W. Approx.	Materials used.	Yield (per day) Approx.	Power Expenditure per 1000 kilos. Product.	
				K.W. Hour.	H.P. Year.
Canadian Comm.	170	cold pig + scrap	4 tons (high carbon)	832	0-13
Canadian Comm.	170	cold pig + scrap	4 tons (low carbon)	1040	0-16
Engelhardt	170	cold pig + scrap	5 tons	786	0-12
Engelhardt	170	1/3 molten pig + 2/3 cold scrap	5 tons	650	0-10
Engelhardt	736	cold pig + scrap	30 tons	590	0-09
Engelhardt	736	molten pig + cold scrap	36 tons	490	0-075
Canadian Comm.	210—350	miscellaneous scrap + ore + lime	1283 kilos. soft steel in 4½ hours	1100	0-17
Canadian Comm.	215—342	miscellaneous scrap + ore + lime	2341 kilos. soft steel in 5½ hours	718	0-11
Canadian Comm.	215—342	miscellaneous scrap + ore + lime	2341 kilos. high C. steel in 8 hours	1100	0-17
Combes	215—342	molten over-blown Bessemer steel	2500 kilos. low C. steel in 1 hour	120	0-018
Harbord	?	cold pig and scrap	—	—	0-186
Canadian Comm.	177	cold pig and scrap	1650 kilos. in 6 hours	804	0-125

\* Not actual test runs.

The first place there seems to be good evidence to show that steel, equal in quality to the best Sheffield steel, can be produced in the electric furnace. This can be accomplished either in such a furnace as that of the Siemens, in its present form, is used almost entirely to heat up carefully chosen raw materials, and does not involve considerable refining of the material. On the other hand with the Héroult furnace such a product can be obtained starting with almost any grade of raw material. This process relying essentially on its capability of melting and completely refining pig iron or ordinary steel. The economical advantages of using a small quantity of raw material for producing high quality steel will doubtless tell in favour of such a

process. It is largely to such possibilities of refining and to the relatively high cost of fuel per ton of product for the manufacture of crucible steel, that the electrical processes owe their advantages.

From the table it will be seen that in nearly all the examples given the whole operation of melting and refining the raw material has been effected by electric heating. In our own country where coal is cheap it is almost certain that much of this heating could be more economically carried out by the combustion of fuel. In the case where molten iron or low grade steel can be run into the electric furnace, it will be seen that the power expenditure required for refining it and bringing up its quality to that of a crucible steel is indeed very low. Along such lines as these, the electric furnace may be expected to find still wider applications than to the manufacture of high grade crucible steel.

Space does not permit of a detailed description of even the more important furnaces which are being used for steel manufacture. The following notes will, however, serve to point out some of the recent progress which has been made, and a short list of publications is given which will enable the reader to obtain further details of the several processes.

#### Héroult Furnace.

At La Paz in the South of France, a 3-ton furnace has been regularly working since the end of 1900, and has turned out more than 3000 tons of high quality steel. More recently a plant has been installed at Korfors in Sweden, whilst within the last few months a company has been floated in Germany with £50,000 capital, to work the Héroult steel process. At the present time a 50-ton furnace is in course of construction at La Paz, where also other developments of the method are being perfected.

#### Kiellin Furnace.

This has been worked for some years at Gysinge in Sweden, and the German rights have been recently taken over by Siemens and Halske, of Berlin. The 170 K.W. furnace is capable of turning out over 5 tons per day, and with a 736 K.W. furnace now under construction, it is hoped

to raise this to 30—36 tons. Recent improvements enable refining of the crude steel to be satisfactorily accomplished by adding the necessary amount of iron ore to the slags.

#### Other Furnaces.

At Livet the Keller steel furnace was shown to the Canadian Commission and seems to be very similar in function to that of Héroult. Captain Stassano has continued his work with the rotating furnace in which the materials are heated by radiation from an arc which is maintained above their surface. In this furnace, both iron ore reduction and steel production have been carried out on a satisfactory scale. The crucible furnace of P. Girod of Courtepin (Switzerland), and Ugine (Savoie),

has been used almost exclusively for the manufacture of high grade ferro alloys such as are required for the manufacture of special steels. Its ingenious construction may, however, render it of still wider application.

Gustave Gin has considerably modified his original process of steel production by arranging the narrow channels, in which the metal is heated by the resistance which it offers to the passage of the electric current, in direct connection with wide basins in which the refining is effected. This method is being applied at Plottenberg in Westphalia.

A somewhat similar modification has been adapted to the induction furnace by Messrs. Schneider and Co., of Creusot, narrow tubes surrounded by the high tension coils being arranged in series with a reservoir to which the metal to be treated is added and in which the refining is effected.

With these modifications many of the difficulties due to the rapid corrosion by the slags of the refractory lining of such narrow channels should be overcome.

#### SHORT BIBLIOGRAPHY OF MORE RECENT PUBLICATIONS.

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### New York Section.

Meeting held at Chemists' Club, on Friday, March 24th, 1905.

RUSSELL W. MOORE IN THE CHAIR.

#### GAS AS A SOURCE OF POWER.

##### GENERATION OF PRODUCER, MOND AND BLAST FURNACE GASES.

BY WILLARD L. CASE.

This paper claims little originality in itself; it is an arrangement of facts and data obtained from various authoritative sources; quotations are freely made from valuable papers read at one time or another before the Technical Societies, especially from the very practical papers of Mr. Alexander M. Gow and Mr. J. R. Ribbins.

The gas engine has proved its worth and demonstrated its ability to work successfully on all our commercial gases, producing a conversion efficiency greatly in excess of that obtained by any other heat motor.

The problem of a fuel gas supply, of proper quantity and quality to serve a modern power plant, has worked itself out and down to the very basis you have outlined:—

"Blast Furnace and Coke Oven Gases"—by-products of extensive industries—for those power plants in localities adjacent to or which can be served from these works; "Producer Gases"—of which "Mond Gas" is one—for the average or general power plant installation.

The future progress of the gas engine depends upon all these three gases; but more particularly upon producer gas—a gas manufactured especially for power and possible of generation and use in any locality.

If we set forth, even in a general way, the specifications for an ideal power gas and note the general characteristics of the various commercial gases in comparison therewith,

we have evidence as to why this problem has so determined itself:—Very briefly, we want a gas uniform in quality and clean, containing a low percentage of hydrogen and inert gases; a gas capable of production in a process of the least complexity of apparatus and of the greatest simplicity in operation, and capable of production from the most readily available fuels and at the least possible cost.

To secure a gas of the greatest possible uniform composition, it is necessary that it be generated by a process which, more nearly than any other, maintains constant all conditions affecting its generation; for reason the process, in operation, should approach the continuous rather than the intermittent; the latter involves periodical alterations of generating conditions. A gas is an essential requisite, and therefore the gasifier of the fuel should be wholly completed within the generator and the gas leave the generator free from all impurities that cause trouble in the engine by scouring fouling valves and cylinders; no cleaning apparatus, other than a simple scrubber for the purpose of removing dust held in suspension, should be required.

For the composition of the gases we would have a percentage of inert gases and of free hydrogen as possible—the reasons for which are evident—the less the gas, the less volume there is to be handled and the lower the percentage of hydrogen the less will be the flame temperature of the mixture and the slower the combustion, which permits of higher degrees of compression and a consequent greater efficiency in the engine cylinder.

In order to produce a gas at the lowest possible cost the gas plant must have the least complexity of apparatus and operation; there must be the fewest possible number of distinct operations and auxiliaries; for, while there are several by-product recovery systems which lessen the cost of gas production by the recovery and sale of by-products, it is not advisable, nor is it desirable, for an average power plant to engage in operations entirely distinct from its own special field of work. Furthermore the gas process itself must give a high conversion efficiency and must furnish a product under these conditions of the cheapest grades of fuel.

Before outlining the characteristics of the various commercial gases it may be advisable to first note some general conditions.

All fuel may be converted into gas; but whether gases of such a conversion are combustible or not depends upon the nature of the materials used and the method of their gasification.

The complete combustion of fuels produces incombustible waste gases containing carbonic acid and water vapor, nitrogen and possibly some oxygen of the air and their incomplete combustion produces, in addition to the combustible products containing hydrogen, carbon monoxide, hydrocarbons and possibly tar and smoke as products of distillation.

In the first process four operations take place—the first elements are vaporized, distilled, gasified and burned; the second, the fuel is vaporized, distilled and gasified and this is the process of making fuel gas.

The commercial gases are designated according to the methods employed in their manufacture or to the materials used. They are: natural gas, retort gas, water gas, oil gas, carburetted water gas, producer gas, coke oven gas and blast furnace gas. These gases differ from each other in the proportion of their constituent gases, which are oxygen, hydrogen, carbon dioxide, carbon monoxide, methane, ethylene, nitrogen and sulfur compounds in small quantities. The value of these constituents will be briefly noted:—Oxygen is not to be considered as having any heating value; to the extent it appears that much less oxygen will have to be supplied in order to burn the gas.

Hydrogen appears either as free hydrogen or combined with carbon as hydrocarbon. It has a calorific value of 320 B.T.U. per cu. ft.

Carbon dioxide has no power to produce heat; it is an inert gas acting only as a diluent and reducing the heating value of the mixture.

Carbon monoxide has the same calorific value as hydrogen—320 B.T.U. per cu. ft.



thane has a calorific value of 1000 B.T.U. per cb. ft. a slow burning gas, and for this reason a particularly suitable constituent of a gas for engine use.

Hydrogen, often given as "Illuminants" in analysis, has a calorific value of 1600 B.T.U., but appears to only a small extent in the commercial gases.

The illuminants or heavier hydrocarbons form a very small percentage of commercial power gases.

Hydrogen and sulphur have no heat value and act as a check to the mixture retarding its combustion and reducing its calorific value.

The typical analysis of the commercial gases, which sets forth their general characteristics follows:—

	Natural Gas.	Retort Gas.	Water Gas.	Oil Gas.	Carburetted Water Gas.	Producer Gas from			Coke Oven Gas.	Blast Furnace Gas.
						Anthracite.	Bituminous	Coke.		
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
H <sub>2</sub> .....	3.0	46.0	48.0	32.0	40.0	20.0	10.0	10.0	50.0	1.0
CH <sub>4</sub> .....	92.0	40.0	2.0	48.0	25.0	—	3.0	—	36.6	—
C <sub>2</sub> H <sub>6</sub> .....	3.0	5.0	—	16.5	8.5	—	0.5	—	4.0	—
Carbon monoxide	—	6.0	38.0	—	19.0	25.0	23.0	29.0	6.0	27.5
Dioxide	—	0.5	6.0	—	3.0	5.0	5.0	4.5	1.5	11.5
N <sub>2</sub> .....	2.0	2.0	5.5	3.0	4.0	49.5	58.0	50.0	2.0	60.0
S .....	—	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	—

Water gas has a calorific value of about 1000 B.T.U. and requires 9.73 cb. ft. of air per cb. ft. of gas for combustion, the resultant mixture having a value of 91 B.T.U. per cb. ft.

Coal gas, as it was formerly called, has a calorific value of 668 B.T.U. and requires 6.05 cb. ft. of air for combustion with a resultant mixture containing 92 B.T.U. per cb. ft.

Gas from retort coke contains 295 B.T.U. per cb. ft. and requires 2.35 cb. ft. of air for combustion, the resultant mixture containing 88 B.T.U. per cb. ft.

Retorted water gas has a calorific value of 575 B.T.U. and requires 5.25 cb. ft. of air per cb. ft. of gas for combustion, the resultant mixture containing 92 B.T.U. per cb. ft.

Gas contains 846 B.T.U. per cb. ft., requires 8.07 cb. ft. of air for combustion, and contains 93 B.T.U. in the mixture.

Commercial gases from both anthracite and bituminous coals differing in analysis, have the same calorific value of 144 B.T.U. per cb. ft. The anthracite gas contains 1.2 cb. ft. of air for combustion, and contains 92 B.T.U. in the mixture, while the bituminous gas contains 1.2 cb. ft. of air, and contains 65.5 B.T.U. in the mixture.

Gas from coke has an average value of 125 B.T.U. per cb. ft.; requires 0.98 cb. ft. of air for combustion with a resultant mixture of 63 B.T.U. per cb. ft. Water gas has a value of 603 B.T.U. per cb. ft.; requires 5.6 cb. ft. of air for combustion, and contains 92 B.T.U. in the mixture.

Blast furnace gas has a heat value of 91 B.T.U., and requires 1.72 cb. ft. of air for combustion, with a resultant mixture containing 53 B.T.U. per cb. ft.

The values given for the air for combustion and for the values of the mixtures are based upon theoretical calculations. It is interesting to note that where the gases are not greatly adulterated by the addition of an inert nitrogen constituent there are an abundant number of heat units available per unit of explosive mixture.

Considering the use of these various commercial gases for power purposes, we must briefly note:—

Water gas, very desirable for engine use, is restricted to localities. Coke oven and blast furnace gases, and other engine gases, are by-products of extensive operations, and their production and utilization are the same.

Coal gas, oil gas, and carburetted water gas are all suitable for engine use, but are too costly for general use.

As made in America, at least, is too expensive for general use, owing to the cost of raw fuel and the inefficiency of the producing systems; in addition

to this, is the apparent difficulty of its pre-ignition and back firing in the engine cylinder, due to its high percentage of hydrogen. This fact also prohibits that degree of compression which enables the system to operate at its highest efficiency. The raw fuel used in its manufacture is coke, and the process in general is similar to that employed in generating producer gas, except that the production of water gas is always intermittent.

In passing, it may be of interest to note that water gas processes are being exploited in Europe, which claim an efficiency of from 75 to 85 per cent. in the conversion process—I refer to the Dellwik-Fleischer and the Kramers-Aarts systems. It has also been stated by the syndicates

controlling these systems, that engine builders in Europe have overcome the difficulties of working on so high a percentage of hydrogen gas, that a number of engines are operating under a guarantee of a gas consumption not to exceed 31 cb. ft. of gas per horse power hour, while tests show a consumption of less than 28.5 cb. ft. This, according to claims of the syndicates above mentioned, is a horse power per hour per pound of coke, which they state they will guarantee.

If these statements are facts, it means that for the power problem, in certain special instances, we have another means of satisfaction. I do not refer so much to the generation of a gas for direct engine use (for coke in any one locality will always exceed in price that of an ordinary coal), but reference is made to the power problem in the vicinity of by-product coke works, where, instead of using 60 per cent. of the gas, given off by the coking coal, for heating the ovens and having available a surplus of only 40 per cent. for light or power purposes (or to let go waste as some of the plants now do) they make all the gas given off an available surplus by heating the ovens with water gas made from coke. In this way coke, for which there may be no satisfactory market, may be disposed of, and we have available from the coke plant, at small cost, a satisfactory engine gas which may be transmitted many miles without loss of energy and which may be utilised at any point or points along the distributing line for power. This, however, affects only the power problem in special fields.

For the general and average or the universal power plant proposition, it is evident from the brief résumé of the commercial gases outlined that it is the producer gas process alone which is susceptible of the development desired—a process capable of universal application—such as producer gas has already proven itself to be.

While producer gas is low in energy, it is a very satisfactory engine gas, the presence of considerable quantities of inert constituents having no detrimental effect upon the operation of gas engines other than occasioning the special designing of ports and passages to accommodate the large quantities of gas used. The efficiency of the various producer gas processes ranges between 70 and 85 per cent., depending largely upon the design of the producer and its ability in completing the gasification of heavy hydrocarbon distillates. It is the cheapest of all the commercial gases, costing less to generate, requiring the least amount of apparatus auxiliary to the generator, requiring less attendance and utilising any available fuel to almost equal advantage—coke, coal, wood, the lignites, peat and other materials have already been used successfully.

There are many variations in the methods and apparatus employed for generating producer gas. In general the

process consists in simply passing air, or air and steam, through a body of fuel, enclosed in a suitable brick-lined generator; usually the process is a continuous one, fuel being fed as needed and the steam and air blasts being introduced simultaneously.

In the ordinary producer, when coke or anthracite coal are the fuels gasified, the gas comes off comparatively clean and requires little scrubbing for use in gas engines; when bituminous coal is gasified the gas is extremely dirty, and contains a large amount of tarry vapours, so that it is necessary to thoroughly scrub it before it is adaptable to engine use.

It is because of this difficulty—the necessity of extensive scrubbing and cleaning systems with gas made from bituminous coal—that practically all our producer systems, generating a gas for engine use, operate on anthracite or coke.

A typical analysis of producer gas from anthracite and bituminous coals and coke is that indicated in the foregoing table; both the coal gases have a calorific value of 144 B.T.U. per cb. ft., while the coke gas has a value of 125 per cb. ft. This difference in heat value is due to the raw fuel used and the resultant necessary methods of gasification—notably the amount of steam introduced and decomposed.

All three gases show about 5 per cent. of carbon dioxide, owing to the burning of some of the carbon monoxide, but to make a gas even of the above analysis demands that the producer be kept in the best working condition and handled with skill.

It was stated that the efficiency of the producer gas process varied from 70 to 85 per cent., according to methods and apparatus employed. The efficiency in any instance may be determined by dividing the net heat output by the gross heat input; or calorific value of gas per cb. ft.  $\times$  gas yield per lb. of fuel—calorific value of fuel used per lb.

As an example of the efficiency attained in average producer practice, it may be interesting to call attention to a summary of investigations for producer practice made at the works of the Pennsylvania Steel Co., Steelton, Pa.

The coal used was bituminous, containing carbon 75.68 per cent., ash 7.12 per cent., moisture, 4.00 per cent.

Its heat value per lb. was 14,920 B.T.U. The amount of gas made per lb. of coal was 70.15 cb. ft. Its composition by volume was (dry gas)—

CO <sub>2</sub>	..	..	..	..	5.7
CO	..	..	..	..	22.0
CH <sub>4</sub>	..	..	..	..	2.6
C <sub>2</sub> H <sub>4</sub>	..	..	..	..	0.6
H	..	..	..	..	10.5
O	..	..	..	..	0.4
N	..	..	..	..	58.2

Its calorific value per cb. ft. was 154.5 B.T.U. The efficiency of conversion was 78.4 per cent., as follows:—

	Per cent.	
Amount lost as carbon in ash .....	2.1	of value of coal.
Amount lost by radiation and conduction ..	5.1	" "
Amount lost in sensible heat of steam ..	0.7	" "
Amount lost in sensible heat of dry gas ..	13.7	" "
Amount of total loss .....	21.6	" "
Amount made available in producer gas ..	78.4	" "
Total value of coal .....	100.0	" "

Before noting the several methods and various types of apparatus used for generating producer gas it may be interesting to point out what is desirable in the way of a producer.

First of all, we would like to have a continuous gasification process, or, as was previously noted, a process that involves the least possible alteration of condition affecting generation; it must be a process and apparatus capable of wide demands in the way of output without serious variations in the quality of the gas; the variable loads of general power service demand this.

The producer, or generator, should be provided with a continuous fuel feed in order to preserve therein a

uniform depth of fuel; this feed and its mechanism should be positive, adjustable and easy running.

The producer should carry a fuel bed of considerable depth to insure uniform gas and complete gasification and means should be provided for maintaining a fuel bed and preventing packing so that the resistances to the blast and the irregularity of the process are minimised.

An ash bed, of sufficient depth to prevent loss of fuel and of internal heat, should be kept beneath the bed; means should be provided for the removal of without detrimentally disturbing the fuel bed.

The steam and air blasts should be so introduced as to secure uniform distribution below the fuel bed and throughout its whole body.

In addition to this we would specify for this producer a requirement which no single producer or generator on the market can now satisfy. It should be so constructed that, by a simple operation, it should effect the conversion into fixed gases of all the combustible constituents of bituminous coal, and deliver a gas for engine use that needs no cleaning other than the removal of dust.

As regards the various types of producers in operation, they all consist essentially of a cylindrical shell lined with fire brick and provided with a sealed feeding hopper at the top; a gas outlet at the bottom; a central or transverse tuyère for the steam air blast, and a fixed bar grate or a revolving bottom water seal, for removing ashes while the producer is in operation.

There are four distinct methods of operation in consequent modification of producer design to them, viz.:—

Producers, operating to furnish an engine gas, the first method, successfully handle anthracite coals; in some cases also, the semi-bituminous coals, provided the proper additional scrubbing appliances are attached to the latter.

The second method is a recent development, and for its object the generation of a gas at the pressure demanded by the load upon the engine; and for this purpose the engine is arranged to furnish the suction at the producer, upon its inspiration stroke employing this method, coke or anthracite fuels are the materials gasified.

The re-entrant method was adopted for bituminous coals with the object of gasifying the tar vapours from the producer. By this method the gases are not taken from the top of the generator, but from openings considerably below the top of the fuel bed and about halfway down the chamber walls. It is claimed that the coal, in the upper part of the producer, undergoes distillation to the coke stage; and the liberated tar vapours, which are forced to descend through the hot fuel bed, reach the outlets, are largely broken up into fine droplets but this is only partially true, for it is admitted that this method is not suitable for gasifying coals of a caking nature.

The last-named method, the intermittent system developed in the Loomis-Pettibone Producer, is a method in producer practice by which we can directly gasify bituminous coals and produce therefrom a gas suitable for engine use without extensive cleaning apparatus. Two generators are employed, one in series at the top, and provided with inlet and outlet ports at the bottom.

In general, the process follows that of water-gas on the blow, the generators operate in parallel; at the top of the generator and comes into contact with the fresh fuel; the products of combustion, with any distillates from the fresh fuel, are drawn upward through the deep charge of incandescent fuel through the bottom of the producer; they then pass through the boiler, where their high temperature is utilised to generate steam; they are further cooled about atmospheric temperature in their passage through the water-sprayed, coke-filled trays of the holder, whence they pass to a special holder.

When the fuel bed has been raised to the desired temperature, the air blasts are discontinued; at



isting the valves and throwing the generators in series, m is admitted under the grate in one generator and is ocated at the temperature of the fire, forming water-on its passage up through the hot fuel bed, across the connecting pipe to the second generator and down ough the latter; it then passes out from the bottom is generator to the boiler, the scrubber and water gas ler. The next time water gas is made the direction of a is reversed—the advantage of which is evident. The versed—the advantage of which is evident. The s are finally properly mixed in the desired proportion engine use.

re essential feature of this arrangement and process is, with bituminous coals, the tar vapours, liberated the green fuel in one generator, are forced through ot fuel bed of the second generator, where they are erted into fixed gases.

us system has other important advantages. While generators are employed the apparatus of the plant pact, simple and efficient in operation, and it readily ts itself to varied and wide demands; and, when ed to gas generation for power purposes, has proved capable, under all rates of production, of maintaining nearly uniform conditions in the fuel bed which are al to a gas of uniform quality.

haps no better idea of the capabilities of the system is direction can be had than by briefly quoting from a y John Langton, read before the American Institute ning Engineers in 1903. It refers to the power plant e Mectezuma Copper Co., Nacozeni, Mexico. The r plant consists of eight gas engines, each direct l to a 65 kw. direct current generator.

he original intention was to make producer gas and gas at Nacozeni in the usual manner, by alternate ng and steaming; but in a plant operating only one producers, as at Nacozeni, the quality of the mixed as too variable. The method of gas making was re modified by introducing steam pipe connections, ing graduated regulation, to permit the introduction am together with the air to the top of the fire; and s means the excess heat of the fire, caused by the air ig, was concurrently used to make water gas. But ler to maintain the necessary state of equilibrium es an adjustment of air and steam, rather too fine sy every-day working, for which reason the method ed is to admit somewhat less top steam than could d, in order to allow the fire to increase slowly in tem- re; and then, without allowing the temperature ome excessive, to make a short water gas run, which ightly pulls the fire, and to resume immediately the g of mixed gas from top steam. This also dis- es the heat more uniformly throughout the column , and in a manner shakes it up enough to prevent mation of holes or masses of clinker. The water ad separately by this method and delivered into er gas holder, is gradually fed from the latter into n holder which supplies the gas engines, the water lder being weighted to give an inch or two greater re than that of the main holder. The rate of feed olled by a throttle valve, in a pipe connecting the lders, which the operator manipulates so that the feeding water gas approximately equals the rate roduction. No particular accuracy is required, nor as taken to regulate the quantity of water gas made tely. The operator is governed principally by the ature of the fire, as indicated by its appearance, the rise of steam pressure on the boiler. If the fall water gas holder necessitates the making of water ore the fire seems quite hot enough, the throttle opening is slightly lessened, and *vice versa*. This is point which varies much during the day or even ay to day.

his method it has been found quite easy to make eh that the variations in its quality, shown by sand calorimetric readings, have no observable effect ie working of the engines or upon their efficiency." nalysis of the gases made in the producer from site and bituminous coals and wood is here indi- each analysis being the average of a consecutive test:—

	Anthracite Coal.	Bituminous Coal.	Wood.
	Per cent.	Per cent.	Per cent.
CO .....	21.60	21.32	13.27
H .....	12.68	13.08	20.97
CH <sub>4</sub> .....	1.86	2.35	2.61
C <sub>2</sub> H <sub>6</sub> .....	0.18	0.20	0.28
CO <sub>2</sub> .....	8.10	7.66	15.96
O .....	0.20	0.04	0.11
N .....	55.38	55.35	46.80
Calorific value (B.T.U.)	100.00 131.1	100.00 133.47	100.00 146.22

It is noted that, for more than three years, the gas plant at Nacozeni has been furnishing the engines with producer gas made from wood and the entire plant is efficient and satisfactory.

In general, it may be said that whatever the nature of the gas used, an engine of proper design will consume 10,000 to 12,000 B.T.U. per brake h.p. per hour at or near full load. With producer gas of 125 B.T.U. per cu. ft. (the average value of anthracite gas) the consumption will approximate 80 cu. ft. per brake h.p. hour, and it is evident, from actual demonstration, that a well-equipped gas power plant, operating on producer gas from any of the coals should show a duty of at least 1 lb. of coal per indicated h.p. hour.

The stand-by losses of such a plant are very small in a good producer—the consumption of coal during these periods averages about 3 lb. of coal per hour in plants averaging only 250 h.p.

#### Mond Gas.

Mond gas, really a producer gas, is a representative of the ammonia recovery systems.

The fuel used is any description of free burning rough slack; it is claimed for the producer that by the use of an especially long fuel feeding bell, extending well down into same, the green fuel therein undergoes distillation, resulting in the removal of the tar vapours by forcing them down through the hot fuel bed, but this is subject to limitations, for a coal of strongly coking nature is not desired, nor is it suitable for use in this producer.

The advantages of the Mond system are the use of a cheap coal and the recovery of a valuable product—ammonia. Its disadvantages are that when arranged to recover ammonia from the coal a great complexity of costly plant, apparatus, and operation is demanded, that when installed without the recovery system, while producing excellent results, it is on the same basis as other systems which employ only one generator—i.e., bituminous coals are not satisfactorily handled, especially if they be of a strongly coking nature.

The Mond system may be an attractive proposition for just such an installation as they are now making in Great Britain, where a central generating station of 40,000,000 cu. ft. daily capacity will distribute this gas to numerous towns and through a district covering 123 square miles. This is one of five contemplated stations of like character to complete the system within this district, but it would seem that so extensive a field were really the province of the by-product coke oven plant, and that the Mond recovery system fitted best that proposition about half way between the coke oven and the ordinary producer gas systems.

The apparatus of the Mond system is briefly noted in the description of the gas-making process, following.

The producer is provided with a water seal, and is so constructed as to allow the ash, which is the only residue, to descend into the water, from which it is easily removed without interfering in any way with the working of the producer.

The process of combustion in the producer is carried out at a comparatively low temperature, with the two-fold object of preventing the formation of clinkers in the producer, and of providing against the destruction of ammonia. This is accomplished by introducing into the producer a blast of hot air and steam. The quantity of steam required, when it is desired to recover the ammonia from the gas is equal to 2½ tons per ton of fuel gasified, but of this about one ton is automatically recovered and

used over and over again. In those installations where ammonia recovery is not made the steam required is about one ton per ton of fuel.

After leaving the producer, the gas passes through a regenerator so arranged that part of the heat of the gas and steam entering it is transferred to the blast of air and steam on its way from the air-heating tower to the producer, the gas being consequently cooled to a corresponding temperature.

After leaving the regenerator the gas is delivered to a mechanical washer, where, by intimate contact with water, the temperature of the gas is further reduced, and all soot and dust are removed from it.

The next step is the recovery of the ammonia contained in the gas, and for that purpose it is passed through an acid tower where the ammonia is completely absorbed by a dilute solution of sulphuric acid. This acid solution circulates through the acid tower again and again until it contains from 36 to 38 per cent. of sulphate of ammonia. Continuity of the process is provided by adding, from time to time, fresh supplies of sulphuric acid and withdrawing corresponding quantities of sulphate liquor, which latter are then evaporated, yielding solid sulphate of ammonia of good saleable quality.

After the gas has been washed of its ammonia products, it passes through a final cooling and cleaning water-tower and is then ready for use. As the gas is cooled in this final tower the steam with which it was burdened condenses, and the cleaning water, which entered the tower cold, is delivered hot; and this, after passing through suitable tar separators, is again pumped to the air-heating tower, where it serves to heat the air required for the producer blast.

Into the air-heating tower a blast of air is forced by a blower, and, in its contact with the descending stream of hot water, becomes heated and saturated with vapour; it is thence carried through the regenerator and to the producers as already noted.

The water which was delivered hot to the air-heating tower, after heating the blast, is drawn off sufficiently cold to be returned to the top of the gas cooling tower to repeat the cycle.

This method of continuously employing the water in circulation as the heat carrying agent between the hot gas in one tower and the cold air in another, and the method of recovering from the hot gas, by this continuous cyclic exchange of heat, a large proportion of the steam required for the producer blast, are important features in the economy of this process.

The distinctive feature of the entire process is the economic production of a good engine gas from very cheap coals; the economy of the process being very greatly enhanced by the recovery of ammonia and its conversion to a saleable ammonium sulphate.

The Mond system as installed for power plants under 5000 h.p. does not warrant the installation of the ammonia recovery process.

The following is a typical analysis of Mond gas, being the average of several analyses at plants with and without the recovery system:—

	Without Ammonia Recovery.	With Recovery.
	Per cent.	Per cent.
CO .....	11.0	13.8
H .....	27.5	24.3
CH <sub>4</sub> .....	2.0	2.0
CO <sub>2</sub> .....	16.5	13.9
N + H <sub>2</sub> O .....	43.0	46.0
	100.0	100.0
Total combustible in the gases .....	40.5	40.1
Calorific value .....	145.6	144.2

The coal used was slack, with an average analysis in both instances of:

	Per cent.
Moisture at 100° C. ....	8.6
Volatile matter (excluding carbon) ...	18.29
Total carbon .....	62.69
Ash .....	10.42
	100.00

The calorific value of the dry fuel was 12,213 B.T.U. per lb. The average production of gas per ton of fuel consumed, by either process, is about 140,000 cb. ft. of gas of a calorific value of 140 B.T.U. The efficiency of the process of fuel conversion does not fall short of 90 per cent.

Tests have demonstrated that this system is capable of producing power in a good engine with a consumption in the producer, of 1 lb. of coal per h.p. hour.

It may be interesting to note the stand by losses of the system:—

It is stated that the stand by losses of a 1000 h.p. plant are about 225 lb. of fuel per night of 14 hours, and that when standing for eight days, they are at the rate of about 7½ lb. per day. After the week-end stoppage, the time required for starting is only three minutes for such a plant.

It is evident that, for ordinary installations, the weight of the Mond system approximates the average production of the plant; and for the large central power station it exceeds same by reducing the cost of power by the value of the ammonia sulphate recovered. It is claimed that a 20,000 h.p. plant under continuous operation, the production of ammonium sulphate will approximate nearly 3000 tons per year. The net profits of this, after deducting all costs of production, will approximate 1.75 dols. per gallon of fuel gasified; this figure was slightly exceeded at the works of Messrs. Brunner, Mond and Co., England, during a 12 month operating period. At the "Mond" plant in America, where 150 tons of coal gasified per day, it was found that the value of the products recovered, after deducting the cost of labour, repairs and chemicals required, reduced the cost of some 50 cents per ton to the plant.

#### Blast Furnace Gas.

It has been stated by reliable authorities that the amount of available power lost in the waste of blast furnace gases varies from one and half to two million h.p. per hour.

The generation of blast furnace gases and the surplus available for power in any one instance, may be determined thus:—

To produce one ton (2000 lbs.) of pig iron requires a furnace charge of:—

Ore .....	3,400 lbs.
Coke .....	2,000 lbs.
Limestone .....	1,000 lbs.

Assuming for these factors a good average quality would have an analysis something like this:

Coke.—Good hard coke, 85 per cent. fixed carbon.  
Limestone, 42 per cent. CO<sub>2</sub>, containing 115 lb. of carbon per 1000; and for the pig iron producing an analysis approximating—

	Per cent.
Iron .....	93.59
Carbon .....	3.75
Silicon .....	1.50
Manganese .....	0.80
Phosphorus .....	0.40
Sulphur .....	0.05
Total .....	100.00

For the furnace gases, analysis by volume, with weight calculated upon the basis of 1000 cb. ft. at 62° F. we have:

CO <sub>2</sub> .....	11.7	1000 cb. ft.=13,572 lbs. containing 3.70 lbs. carbon
CO .....	27.5	20,268
H .....	0.8	0.042
N .....	60.0	44,257
	100.0	78,139
		12,355

All the carbon charged into the furnace must appear in the pig iron produced, and in the furnace gases evolved. The furnace charge contained 1815 lb. of carbon, being 1700 lb. in the coke and 115 lb. in the limestone. The pig iron produced from the above charge contained 75 lb. of carbon as the analysis showed. Therefore each ton of pig iron produced, there went to the 1740 lb. of carbon. From the weight of the gases evolved above every 1000 cb. ft. contains 12,355 lb. of carbon. Therefore, for each ton of iron produced, there was evolved 141,000 cb. ft. of gas.



the analysis of the gas shows it to be 28.3 per cent. combustible, and to have a heating value of 90 B.T.U. per cb. ft., or a total heating value of 12,690,000 B.T.U. per ton of fuel.

2000 lb. of coke from which this heat was derived contained 24,650,000 B.T.U. Hence, we have for the thermic reaction of the reduction of the ore, sensible heat of slag and metal, radiation, &c., the difference between these two figures or 11,960,000, which is to say about one half of the heat potential contained in the gas which was charged into the furnace, is contained in the gas leaving the furnace. Furthermore, this heat potential is in the best possible condition for conversion into power; it is in the shape of a combustible gas, which is clean, and that without expensive or extensive apparatus, is admirably adapted for use in gas engines. If all the gas evolved is not available for use as power; it still must be used to heat the blast.

The analysis of the above gas shows 60.0 per cent. oxygen (derived from the air) which is by volume 10 per cent. nitrogen. It follows that the amount of oxygen required to produce this gas must be in the proportion of 1 to 79. That is to say, for each 1000 cb. ft. of gas, 760 cb. ft. of air were supplied. But we saw that one ton of iron evolved 141,000 cb. ft. of gas. Therefore, must have been supplied for each ton of iron 107,160 cb. ft. of air.

At 62° F. weigh 76 lb. Or the weight per ton of pig iron is 8144 lb. Taking the specific weight of air at 0.25, which is sufficiently high to account for contained moisture, we have to heat the air through  $F = 2,036,000$  B.T.U.

the stoves are of low efficiency, and to be on the safe side and allow for losses in radiation and imperfect combustion, we assume an efficiency of but 50 per cent. will double the above requirements, and give for heating the blast 4,072,000 B.T.U. With well designed equipment of sufficient capacity this should be more than enough.

For purposes other than heating the blast, there is therefore from one ton of iron produced 8,618,000 B.T.U.

The original ton of coke contained 24,650,000 B.T.U.

After heating the blast we have in the form of gas 100 B.T.U. remaining or 35.0 per cent. of the total value of the coke.

To determine the amount of power this heat will produce, divide the total heat available which is 8,618,000 B.T.U. by that required to produce a h.p. hour, say, 2,036 B.T.U., and we have more than 700 h.p. hours amount available in the gas evolved from the production of one ton of pig iron. This is a conservative estimate. All of this power is not available for general use. A part of this must be used for driving the blowing engines and machinery about the blast furnace. The amount of power required for the production of a ton of pig iron may be estimated as follows:

For one ton of iron produced is 107,160 cb. ft. of air.

If we consider a furnace having a capacity of 360 tons per day or 15 tons per hour, we would require engines of delivering 26,790 cb. ft. of air per minute.

To furnish this amount of air at 10 lb. pressure, and at 10 per cent. for friction load, there would be required 1200 h.p. In addition to this, there are other requirements of machinery to be driven which would make the total amount of power required to operate a furnace of this capacity approximately 1500 h.p., but the total available on this size furnace, as our figures indicate, is 1000 h.p. per hour. Therefore, we have a surplus of 500 h.p. above all the requirements of the furnace of 900 h.p. per hour. Dividing this figure by the tonnage per hour of the 360-ton furnace, or by 15, we have, as the power producing capacity of the modern blast furnace, 600 h.p. per hour per ton of iron produced per hour, or 25 h.p. per hour for every ton of iron produced per day.

There is within a reasonable degree of certainty the possibility of an available blast furnace gas supply for the use of the power plant, without interruption, no less than three blast furnaces can be considered sufficient to supply a power plant which is intended to produce power for the general market; for in any group of at least, one will at some time be out of blast for

refining and another may be stopped because of a shortage of raw materials, trade or labour conditions, accidents or trouble in operation or for other causes. With a group of three blast furnaces we are well assured that at least the surplus gas of one will always be available, and the essential condition of the power plant, that of uninterrupted service, will be afforded.

## UTILISATION OF GAS FROM SUCTION PRODUCERS.

BY DR. OSKAR NAGEL.

Producer gas power plants are built for generating, out of a suitable fuel, a mixture of carbon monoxide and hydrogen called "Dawson Gas," which, if used in gas engines, allows an exceedingly advantageous utilisation of the fuel. Up to a few years ago producer gas has been made almost exclusively in so called pressure gas producers by evaporating water in a separate boiler and by leading the steam, mixed with air, by means of a steam blower or fan, through the glowing fuel whereby the steam is decomposed to hydrogen and the coal burned to carbon monoxide. This mixture of combustible gases is led through a scrubbing arrangement for removing the dust and tar, then through a gas holder for equalising the fluctuations of the pressure, and from here to the engine.

It is evident from this description that for generating gas by this method a boiler and a gas holder is required, which entails considerable cost of construction and attendance, and requires also a large floor space. Another disadvantage of the pressure system is, that it cannot be installed inside the city limits as it is not without danger on account of the possible leakage of gas. It was, therefore, an object of inventive engineers to supplant this pressure system by a safe and simpler construction in which no stock of gas is kept on hand, and in which no leakage can possibly occur. This has been fulfilled by means of the so-called suction gas producer, in which the pressure is supplanted by the suction of the moving gas engine. The use of a boiler and a gas holder is done away with in this system, as the engine is sucking just as much air and steam through the fuel as to generate the necessary amount of gas for the work required. This type has been very well developed on the Continent, and is especially to be recommended for units up to 250 h.p.

In a Suction Gas Producer plant the boiler is supplanted by an evaporator which, in small plants, is built frequently on the top of the producer in the form of a water-jacket, and in large plants close to the producer in the form of a tubular evaporator. This evaporator is generating the steam required by utilising the waste heat of the producer and of the gas, which is of considerable advantage as compared to the old system, the firing of a separate boiler being dispensed with. The heat of the gases, respectively of the producer, is entirely sufficient for furnishing the quantity of steam required for the generation of an effective power gas.

The utilisation of fuel in Suction Gas Producers is higher than in Pressure Producers, and is reaching 80 per cent. or more. The transformation of steam into hydrogen and the formation of carbon monoxide is taking place so quickly that the producer is always making the amount of gas required and is able to start suddenly from a low to a full load.

The advantages of a Suction Gas Producer are: automatic generation of the gas by the engine; highest and best utilisation of fuel; no boiler and no gas-holder is required; can be erected without danger in any convenient place; easy to start and to run; no soot, no smoke, no odour; no explosion possible; small floor space required.

A complete Suction Gas Producer Plant consists of a blower which up to 150 h.p. is driven by hand, a producer, an evaporator, an overflow water-pot, a scrubber, and a small equalising tank. In plants above 75 h.p. a sawdust scrubber is advantageously inserted behind the wet scrubber, and in plants where two or more engines are fed from the same producer a small gas-holder with automatic regulation is used.

The producer consists of an iron shell lined with fire bricks and provided with a suitable hopper. The grate area, according to the quality of fuel is 0.8 to 1 sq. ft. for every 10 h.p. The scrubber consists also of a sheet iron shell and is filled preferably with broken coke. If a good quality of fuel is used, the scrubber has to have a capacity of at least 1 cb. ft. for every h.p.

Before starting the engine the fuel in the producer has to be heated up by means of a blower until the gas is burning well on the test cock. When this point is reached the blower is stopped and the engine started in the usual way. The engine is now drawing by her own sucking action the necessary amount of air and steam through the fuel, and is producing her own power gas.

From the producer the gas is drawn through the scrubber and the equalising tank to the engine. The gas-making process continues as long as the engine is moving, but as soon as the engine is stopped the gas making is also stopped.

Anthracite, charcoal or coke can be used equally as well for generating gas in a Suction Gas Producer. It will take, according to the ash content, 1 to 1½ lb. of anthracite or charcoal, or 1½ to 1¾ lb. of coke for developing 1 h.p. hour. With anthracite (pea) at 5 dols. per ton, 1 h.p. hour will cost about one quarter of a cent. This is about one-sixth the cost of illuminating gas power at a price of 75 cents per 1,000 cb. ft. of gas, or one-eighth the cost of gasoline power, figuring gasoline at 16 cents per gallon.

An ordinary illuminating gas engine has to undergo some slight changes before it can be used for producer gas. The compression has to be increased to at least 105 lb. and the ratio of gas to air has to be arranged 1:1½. The gas inlet has to be increased, and the air inlet decreased to the ratio above named.

### COKE OVEN GAS.

BY C. G. ATWATER.

The forms of gas that have already been referred to, viz., producer gas, Mond and blast furnace gas, are products of an operation involving partial combustion. In either case solid fuel is completely reduced to gaseous form, no carbon remaining in the residual ash if possible to extract it, this gasification being the main object of the operation in the first two instances, and incidental to the smelting of iron in the latter. The production of coke oven gas is distinguished from these operations in that it is the result of the destructive distillation of bituminous coal under the exclusion of air, and may be said to precede them in the cycle of operations. The object of such destructive distillation is primarily the production of coke, a raw material for both the blast furnace and gas producer. Incidental to this process is the evolution of the volatile portion of the coal in the form of gas; the gas, therefore, is a by-product. The production of gas by this method is exactly analogous to the distillation of coal in the ordinary gas retort, such as Murdoch used in 1798, in what we are told was the first method invented for the manufacture of illuminating gas, and which in modern form is still an integral part of a majority of existing illuminating gas works. In the retort, however, the gas is the principal product and the coke the by-product. Practically all that will be said in this paper of coke oven gas, as a source of power, would apply equally well to the use of illuminating gas, with the difference that the high cost of generating illuminating gas usually prohibits its use for power generation except in small units and under special circumstances. A short thermal calculation will show the truth of this and indicate approximately the limits with which city gas may be economically used for power generation.

Assuming 650 B.T.U. per cb. ft. as the average value of illuminating gas sold at 1.00 dol. per 1000 cb. ft., we have 650,000 B.T.U. for 1.00 dol., or 1,000,000 B.T.U. cost 1.54 dols. Assuming coal at 3.00 dols. per ton (of 2000 lb.) having 13,000 B.T.U. per lb., a million B.T.U. costs but 8.6 cents. This great discrepancy in cost is reconciled to some extent by the greater efficiency of the gas engine, which delivers, roughly, a brake h.p. per hour from

20 cb. ft. of gas, costing 2 cents., whereas the steam boiler and engine combination requires about 3 lb. of coal per hour per h.p. in moderate sizes, at a cost of 0.9 cent. This would be increased somewhat by the cost of coal handling and labour in the boiler house. It is, therefore, clear that illuminating gas at 1.00 dol. per 1000 ft. has a wide field as a source of power, but it is also apparent that at a cost of, say, one-fourth or one-fifth the value assumed above, it would become a prominent factor.

In order to make clear the analogy between coal made from the gas retort and from the by-product coke oven, the following analyses are submitted as typical

	Coke Oven Gas.	Retort Gas.
	Per cent.	Per cent.
Methane .....	39.6	36.02
Other hydrocarbons .....	5.4	4.75
Hydrogen .....	37.6	47.04
Carbon monoxide .....	5.8	8.04
Carbon dioxide .....	3.5	1.80
Oxygen .....	0.4	0.39
Nitrogen .....	7.7	2.16
B.T.U. ....	693	693

The coke oven gas in this instance is that known as the rich portion, and is given off during the first part of the coking time, this method of operation being known as the division or fractioning of the gases. In this the more valuable portion of the gas is reserved for illuminating or power purposes, the remainder serving to the coking ovens. As coke oven gas for illuminating is usually treated in this way, it is proper to select a fractioned gas for comparison with the illuminating gas from retorts. The principal characteristic of the fractioned coke oven gas is that the methane is approximately the same percentage or a little higher than the hydrogen. This is an advantage in gas engine work, as it diminishes the chance of pre-ignition under compression in the cylinder, although in neither case is this liable to cause trouble. If there was no probability that any portion of the coke oven gas would be used for illuminating purposes, the fractioning process might be eliminated and a single condensation system installed in place of the double one. Under these conditions the surplus gas available for gas-engine use would be the average of the whole product, and might be represented by the following average analysis:—

Methane, 33.9 per cent.; other hydrocarbons, 8.1 per cent.; hydrogen, 44.4; carbon monoxide, 6.2; carbon dioxide, 2.9; oxygen, 0.3; nitrogen, 8.5 per cent. B.T.U. 693.

In considering the by-product oven as a source of power, the efficiency of the process should be determined. This is shown in the following table of the heat balance giving the British thermal units originally contained in the coal, and their distribution among the various products recovered:—

#### Distribution of Heat Units in Coal.

100 lb. of dry Coal Yield.	B.T.U. per lb.	Total Calorific power B.T.U.	Per cent. of dry coal
71.13 lb. of coke .....	12,645	899,456	
3.38 lb. of tar .....	12,210	51,410	
229 cb. ft. of surplus gas ...	686	157,504	
234 cb. ft. of heating gas ...	567	132,835	
Ammonia liquor, sulphur in purifier and loss .....	—	2,496	
Total=100 lbs. dry coal ...	—	1,243,700	100

These figures are taken from Dr. Schniewind's entitled "The Production of Illuminating Gas from Ovens." From this table it is evident that the percentage of the total heat required for the conversion is 10.7 per cent. of the whole heat available. This efficiency of practically 11 per cent., and compares





operation of the by-product portion of the producer plant, a coal high in percentage of nitrogen must be employed. After a careful ultimate analysis of the slack used in the Mond producer in England, we were fortunate in finding one corresponding closely to it in the Hocking Valley coal fields. It is a coal approaching a lignite in composition, having 6 to 7 per cent. of water of constitution, and a high percentage of oxygen, and is especially desirable because of a high percentage of nitrogen. The analysis of the English coal and the Hocking Valley are as follows:—

	Hocking Valley Nut Coal.	English Producer Coal.
	Per cent.	Per cent.
Moisture (chemically combined)	7.84	6.85
Volatile matter .....	27.95	33.14
Fixed carbon .....	50.75	48.93
Ash .....	13.46	11.10
Sulphur .....	1.50	1.68
Nitrogen .....	1.45	1.35

The relation of the hydrogen to the oxygen in the coal, which is an important factor in the clinkering and the yield of ammonia and tar, is as follows:—

	Hydrogen.	Oxygen.	Available Hydrogen.
	Per cent.	Per cent.	Per cent.
English coal .....	3.90	12.08	2.32
Hocking Valley .....	4.65	10.86	3.26

The Mond gas at Detroit is somewhat different from that obtained in England, as the following comparison shows:—

	Mond Gas.	
	Detroit.	England.
	Per cent.	Per cent.
Carbon dioxide .....	14.6	16.5
Oxygen .....	0.5	—
Carbon monoxide .....	10.3	11.0
Methane .....	5.3	2.0
Hydrogen .....	23.5	27.5
Nitrogen .....	55.8	43.0
Total combustible .....	39.1	40.5
Gross B.T.U. per cb. ft. ....	163.5	145.5
Net B.T.U. per cb. ft. ....	146.6	129.7

The yield of ammonia amounts to 70 to 75 lb. of sulphate per long ton of coal. Tar amounting to 55 to 65 lb. per ton of coal is also recovered; this is much lighter in gravity than the ordinary coal tar and has little value except as a fuel and as such is worth about 1s. per gallon.

### Taylor Producer.

I might say a few words in addition to what has already been stated about ordinary producer gas.

For the production of gas to be used under drying furnaces we have at the works of the Solvay Process Co. at Syracuse, 30 Taylor Producers, which gasify 134 tons of anthracite buckwheat coal per day. The air is introduced by means of live steam injector, and the coal for the steam used is about 10 per cent. of that gasified. These producers are not supplied with automatic and continuous feed. The analysis of gas advertised as attainable by the promoter of the Taylor producer is seldom obtained in practise. The temperature of the producer chamber above the fuel bed is so high, due to uneven covering of the bed and the holes through the bed, that the water is dissociated, hydrogen formed and the percentage of carbonic acid gas increased.

Temperatures taken with electrical pyrometers at various points in the producer were as follows:—

	Number of Producer.			
	1	3	5	7
	°C.	°C.	°C.	°C.
Temp. at top of fuel ...	950	955	965	976
2 ins. above surface ....	900	910	910	905
1 ft. above surface .....	650	650	660	650
2 ft. above surface .....	600	600	605	595
at outlet.				

The analyses of producer gas, as made at Syracuse and that advertised by Mr. Taylor, are:—

	Syracuse.	Mr. Taylor
	Per cent.	Per cent.
Carbon dioxide .....	8.4	4.5
Oxygen .....	0.2	0.6
Carbon monoxide .....	22.7	25.5
Methane .....	1.0	1.0
Hydrogen .....	16.2	12.0
Nitrogen .....	51.5	56.4
B.T.U. per cb. ft.—Gross .....	136.4	131.7
B.T.U. per cb. ft.—Net .....	127.5	124.8

### Theoretical Considerations.

I wish to call attention to a few theoretical considerations which have a bearing upon the efficiency of the various gases in the gas engine. The following table gives the analysis of the gases, their heat value, the theoretical amount of air required for combustion and the corresponding pressure and the relative volume of gas before and after combustion under the same conditions of temperature. The sample of coke oven gas represented that which is available during the first eight hours of the coking process.

Composition: Per Cent. by Volume.

	Taylor Producer.	Mond Producer.	Coke Oven.	Blast Furnace.	Natural Gas (Pittsburg).	Natural Gas (Ohio).
Carbon dioxide .....	8.4	14.6	1.8	11.7	0.8	0.2
Benzene .....	—	—	1.0	—	3.6 (ethane)	—
Ethylene .....	—	—	4.8	—	0.7	0.2
Oxygen .....	0.2	0.5	0.2	—	1.1	0.4
Carbon monoxide .....	22.7	10.3	4.2	27.5	1.0	0.6
Methane .....	1.0	5.8	36.7	—	72.2	92.8
Hydrogen .....	16.2	23.5	45.5	—	20.0	1.9
Nitrogen .....	51.5	45.8	5.8	60.8	—	3.8
Calories per M <sup>2</sup> :—Gross .....	1280	1533	6071	835	8185	8901
(0°C and 760 mm.) }—Net .....	1196	1376	5454	835	7352	8012
B.T.U. per cb. ft. :—Gross .....	136.4	163.4	647.2	89.0	872.0	948.0
(60° F. and 30") }—Net .....	127.5	146.6	581.2	89.0	783.7	854.0
Combustion with the theoretical quantity of air—						
Vol. air per 1 vol. gas .....	1.00	1.27	5.64	0.65	7.92	8.79
Theoretical temperature °C. ....	2678	2634	3450	2227	3380	3331
Theoretical pressure atm. ....	8.0	8.0	12.2	7.5	12.2	12.2
Theoretical pressure, lbs. per sq. in. ....	131	131	179	110	179	179
Vol. decreased by combustion .....	9.8	7.5	3.7	8.4	0.0	0.1
(original vol.=100 per cent.)						

Sp. Hts. at const. vol. used in calculation: Water, 0.37; carbon dioxide, 0.17; nitrogen, 0.17.



Composition : per cent. by Volume.

In the theoretical calculations in this paper the following values have been used :—

	Calories per M <sup>3</sup> (0° C. and 760 mm.)		B.T.U. per cu. ft. (60° F. and 30 ins.)	
	Gross.	Net.	Gross.	Net.
Hydrogen .....	3061	2600	326.2	277.1
Carbon monoxide .....	3036	3036	323.5	323.5
Ethane .....	9478	8531	1010.0	909.1
Ethylene .....	16558	15151	1764.6	1614.6
Acetylene .....	14900	13957	1588.0	1487.4
Ethylene .....	13857	13391	1476.7	1427.1
Benzene .....	35725	34298	3807.2	3655.1
Coal gas { 1/4 C <sub>6</sub> H <sub>6</sub> } { 3/4 C <sub>2</sub> H <sub>4</sub> }	20096	19042	2141.6	2029.3

By gross is meant that the temperature is brought to the same point before and after combustion (figured for 0° C.) and that the water formed is condensed.

By net is meant that the temperature is brought to the same point before and after combustion (figured for 100° C.) and that the water is not condensed.

Calculations based on Thompson's results "Thermomische Untersuchungen."

The practical value of efficiency of a fuel gas within the cylinder of a gas engine is ordinarily considered to be in direct proportion to the heat units of that gas, but this is not strictly true: fuel gases of the various kinds have different percentages of a number of different gases each having its own individual qualities which in the explosion of the transference of thermal energy into mechanical. For instance, there is a difference in the inflammation temperature of the various constituents of the gases: hydrogen ignites at 550° C., carbon monoxide at 655° C., methane at 656° C. It is said that a gas containing a large percentage of hydrogen is particularly liable to pre-

ignition. While we know the temperature of ignition of the gases singly, nothing is known concerning the ignition temperature of a mixture of these gases in various proportions at atmospheric and other pressures. Experiments in this direction would doubtless be of great assistance to designers of gas engines.

Then there is the question of propagation of flame and its relation to the economical production of power in the gas engine. The normal propagation of flames (according to Berthelot) of hydrogen, is 4.3 meters per second, methane 0.62 meters, and carbon monoxide 2.0 meters per second.

The experiments made at the Institute of Technology in Boston give the rapidity of explosion of hydrogen with the theoretical quantity of air as more than 10 times that of illuminating gas. Berthelot says when two combustible gases, such as hydrogen and carbon monoxide are burned in oxygen, the rate is by no means the mean of that of the two gases. They appear to burn separately each with its own rapidity. Further, water, one of the products of explosion, dissociates at 874—900° C., and may this not take place at the expense of thermal energy and may it not happen that there should be sufficient cooling of the cylinder to prevent recombination and giving up of that heat before the exhaust opens? The dissociation of carbon dioxide begins at 1300° C., but, of course, this is never reached. All of these considerations doubtless have some bearing on the efficiency of the gas for power development.

Mean Pressure Efficiency and Calorific Values.

From the Technology measurements of the mean pressures obtained during the first 0.2 second after explosion, using all proportions of air to gas, it appears that, in the case of water gas, the best efficiency results when using that quantity of air which gives a theoretical maximum pressure of about 8.4 atmos. (124 lb. per sq. in.). Using this quantity of air with the above gases (except the blast furnace gas) the following results are obtained :—

	Syracuse Producer.	Detroit Producer.	Coke Oven.	Blast Furnace.	Natural Pitts.	Natural Ohio.
Vol. of air per 1 vol. gas .....	1.09	1.50	8.93	0.65	12.4	13.5
Theoretical temperature, °C. ....	2560	2435	2358	2227	2313	2302
Theoretical pressure (max.) atm. ....	8.4	8.4	8.4	7.5	8.4	8.4
Theoretical pressure, lb. per sq. in. ....	124	124	124	110	124	124
% of mean pressure efficiency equal vol. of gas ..	1	1.20	4.76	0.70	6.41	6.96
% of calorific values of equal vol. of gas ..	1	1.18	4.56	0.70	6.15	6.70

In the following charts, one, of some explosion experiments made with the Mond gas at Detroit under direction of R. F. Shattuck, and the other of some explosions of illuminating gas of 721 B.T.U. (gross) mixed with various percentages of air, made by a student at the

Institute of Technology in Boston, it will be observed that the maximum pressure obtained is about one-half the theoretical; further, that this maximum pressure is obtained when 80 to 85 per cent. of the theoretical air necessary for combustion is used.

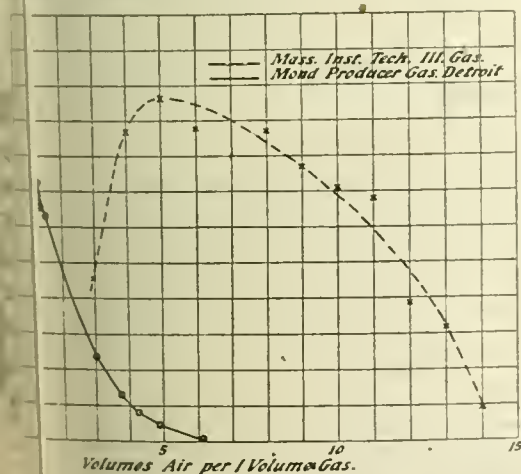


FIG. 1.

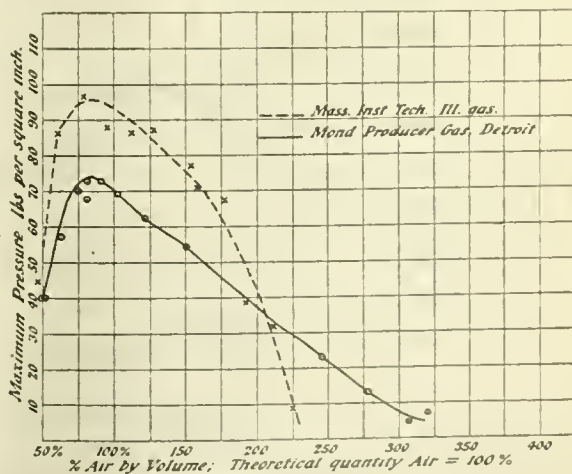


FIG. 2.

### Coke Oven Gas.

We now come to the consideration of retort coke oven gas for gas engines. While it is true that a coke oven gas is similar in analysis to coal gas, or illuminating gas made in the well-known gas retort, the composition of the coke oven gas is within the control of the operator: the ovens may be so regulated that the hydrogen may be low or high in percentage; that the carbon dioxide may be reduced to a minimum or almost eliminated, or it may be of such a percentage as to materially deteriorate the gas for illuminating or power. This is made possible because of the large size of the charge of coal in the by-product oven: the possibility of regulating the temperature of coking and the time of coking. In coal gas manufacture, a small retort of 300 or 400 lb. capacity, fired with coke and coked in five or six hours, is used. In the by-product oven, eight or nine tons of coal are coked in a space approximately 30 ft. long, 8 ft. high, and 17 in. wide, during a period of 22 to 24 hours: by manipulating properly the valves between the oven and the hydraulic main, turning the gas first into one and then into the other main, the quality of the gas may be regulated to a nicety: by the proper regulation of the supply of the gas to the oven for the coking process and by the regulation of the temperature of the flues by electrical pyrometers and Seger cones, the temperature of the distillation within the oven may be maintained at any desired degree. We may thus obtain by proper manipulation gas of varied composition, as is shown by the following analyses:—

### Analyses of Gas.

	Gas first 8 hours.	Gas for 16 hrs. after.	Average Gas for 24 hours.	Enriched Gas as delivered.
	Per cent.	Per cent.	Per cent.	Per cent.
Carbon dioxide	1.7	1.9	1.8	1.6
Benzene	0.5	0.2	0.3	0.9
Ethylene	4.7	1.5	2.9	4.8
Oxygen	0.4	0.5	0.5	0.5
Carbon monoxide	4.8	4.5	4.6	4.8
Methane	42.0	32.0	36.5	42.0
Hydrogen	35.0	51.0	43.8	35.0
Nitrogen	10.0	8.4	9.5	10.4
B.T.U. per cu.ft.				
Gross	683	565	618	701
Net	614	502	551	631
Calories per M <sup>3</sup>				
Gross	6078	5027	5500	6235
Net	5466	4471	4901	5618

Nine hundred thousand cu. ft. per day of enriched gas of 18 candle power were delivered during the year 1901 from the Somet-Solvay Co. plant of 40 ovens at Chester, Pa., to the Chester Gas Co., which, in turn, dealt it out to consumers for illuminating, gas engines, and fuel purposes.

Gas of the quality shown in the table of analyses, containing a high percentage of benzene and methane, and low percentage of hydrogen, is formed during the early stage of the coking process. The gas formed in the latter part is practically devoid of benzene and ethylene, the illuminants, and high in percentage of hydrogen. As it is desirable for power purposes to have a gas of minimum hydrogen to avoid possibility of pre-ignition, gas of quality represented by the first analysis is the best.

The following chart shows how the B.T.U. falls off the tenth hour, and likewise how the per cent. of methane diminishes and the hydrogen increases.

The distillation process proceeds from the top downward, and the heat reaches the centre of the mass of coal very slowly.

Experiments were made and temperatures taken by electrical pyrometer every 15 minutes from several locations in the oven and also above the mass of coal: here, the lowest temperature was about 720° C. The temperature of the heating flues, three in number, horizontally placed was 1050—1150° C.

### Quality of Gas Dependent on Composition of Coal and Time of Oven.

The quality of the gas is not only dependent upon heat of the oven, but also very largely upon the quality of the coal. This is well known and recognised when considering the Pennsylvania bituminous coking and coals and their relation to heavy hydrocarbons or illuminants in the gas, but that different coals when coked in tight ovens, which exclude the air give varying percent of carbon dioxide, is not well known. Some coals of the Illinois and Indiana region and the Far West, more or of a lignitic nature, give a gas containing as much as 8 per cent. of carbon dioxide gas, whereas a Pennsylvania coal under the same oven conditions would give only to 2 per cent. This naturally would cut down the B.T.U. considerably, and reduce largely the efficiency in the



FIG. 3.



gine. The reason for this high per cent. of CO<sub>2</sub> the gas is the high percentage of oxygen in the coal. analysis of an Illinois coal, Big Muddy, for tance, shows 12 per cent. oxygen. In it there is a large ss of oxygen over that required to combine with rogen in the coal, and this excess combines with carbon form an abnormally high percentage of carbon oxide and dioxide.

### Coke Oven Gas at Detroit and Milwaukee.

t will be observed from the following table that the gas Detroit and Milwaukee is considerably richer in heat s than that previously described as being made at ster. The increase in energy for gas engines per unit s is due to the greater amount of benzene, toluene and ne it contains. The process by which this is accom- is may be described as follows:— a before stated, the gas evolved during the early part he coking period is richest in heat-giving constituents ; hence this rich gas, that evolved during the first 7 or urs, is separated from that made during the remaining ours, and afterwards further enriched by means of benzene and its homologues taken from the lean gas. he Semet-Solvay coke ovens, 120 at Detroit and 80 at raakee, during the year 1904 have delivered to the companies of these cities gas of about 675 B.T.U. (gross) of 19 to 21 candle power, at the rate of 2,700,000 cb. ft. 1,900,000 cb. ft. per day.

### Analysis of Gas for February, 1905.

	Milwaukee.	Detroit.
	Per cent.	Per cent.
n dioxide .....	1.4	1.3
ne .....	1.3	1.2
ee .....	4.3	4.2
u .....	0.4	0.5
n monoxide .....	4.0	5.1
ne .....	36.8	35.5
gea .....	47.0	48.0
gen .....	4.8	4.2
per cb. ft.—Gross .....	692	679
per cb. ft.—Net .....	621	610
es per M <sup>3</sup> —Gross .....	6154	6044
es per M <sup>3</sup> —Net .....	5528	5430

### Daily Production During First Half of March, 1905.

	Coal Coked.	Gas Delivered.	Gas per Ton Coal.
	Tons.	M.	Cub. Ft.
Milwaukee .....	588	1,999	3400
Detroit .....	888	2,752	3100

M=1000 cb. ft.

### Objection to Coke Oven Gas on Account of Sulphur.

Objection to the use of coke oven gas, without previous treatment to remove the sulphur, cannot be invariably maintained. Our own experience at Syracuse for several years with a 125 h.p. Westinghouse engine developing 85 B.H.P.—90 lb. pressure—on coke oven gas of 450 B.T.U. (net) (28 cb. ft. gas per B.H.P.), made from a coal containing 1.1 per cent., is that no serious corrosion has taken place due to sulphuretted hydrogen or sulphuric acid.

If, however, water were mixed with the lubricating oil in the crank case, enough sulphuric acid would be soon absorbed to cause attack on the metal.

Of twenty-two gas engine installations in Germany, of a total of 13,000 h.p., working on coke oven gas, 11 or 50 per cent. do not find it necessary to purify the gas. The others use bog-ore or saw dust. With efficient tar extractors and ammonia washers, tar and dust are readily removed. One of these German installations was using a gas with 0.2 per cent. sulphur without injurious effect on the iron.

### Pre-Ignition.

Pre-ignition or explosion before the completion of the compression is said to more often happen with coke oven than with other fuel gases, like producer and natural gas, and the reason given for it is the high percentage of hydrogen. Authorities vary as to the cause of pre-ignition. If pre-ignition is chargeable to high percentage of hydrogen, coke oven gas is no more liable to pre-ignition than Mond producer, or ordinary producer gas; unquestionably we must consider the percentage of hydrogen in the explosive mixture. By the following it will be seen that the coke oven gas, used in the above table of gases, when mixed with that amount of air which gives the maximum efficiency in the engine, contains less hydrogen than the proper mixture of producer gas and air.

7.5 Atmos.

	Syracuse Producer.	Detroit Producer.	Coke Oven.	Natural Pittsburg.	Natural Ohio.	Blast Furnace.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
gea .....	7.77	8.16	4.60	1.50	0.13	0.00
n monoxide .....	10.88	3.00	0.42	0.08	0.04	16.67
ne .....	0.48	3.08	3.70	5.38	6.37	—
ene .....	—	—	0.48	0.05	0.01	—
ne .....	—	—	0.10	C <sub>2</sub> H <sub>6</sub> =0.27	—	—
n dioxide .....	4.03	6.04	0.18	0.06	0.01	7.09
n .....	0.09	0.44	0.02	0.08	0.03	—
gen .....	24.69	19.28	0.58	—	0.26	36.85
.....	52.06	60.00	89.02	92.58	93.15	39.39

ignition is not common with small engines up to p., and with large engines is no more frequent with oven gas than with other fuels. Of eight managers uts using coke oven gas in engines up to 750 h.p., opinion was asked concerning pre-ignition, two l that they had had some pre-ignition, and six had been troubled with it, though the hydrogen ran h as 50 per cent. in some instances. One of the ers who had trouble said that he had overcome it rying the compression in inverse proportion to the of the gas mixture.

s of the greatest authorities in England, who has led many engines of various types and worked them ases of different kinds, in writing to our company hat he had used coke oven gas in a 40 h.p., 107 lb. ession, and 140 h.p., 95 lbs. compression engine at being troubled with pre-ignition, that he had

worked a Vogt engine to a pressure of 200 lb. on coal gas, practically the same as coke oven gas without trouble, and many others from 100 to 650 h.p. He further says, "that probably when a gas contains more than 30 per cent. of hydrogen the additional hydrogen has but little effect upon the question of pre-ignition." He further states, "in probability the effect of free hydrogen in producing pre-ignition is not the question of temperature at which free hydrogen combines with the oxygen of the air present, but has to do with the effect of free hydrogen on the iron of the cylinder and possibly on the layers of partly burned oil."

I believe coke oven gas to be the power gas of the future, in places where it is impossible to get blast furnace gas or natural gas, on account of its high calorific value, freedom from dirt and tar, and its adaptability to pumping great distances under pressure in comparatively small pipes.

## DISCUSSION.

Dr. F. SCHNIEWIND remarked that New York City consumed, in 1903, approximately 6,000,000 tons of anthracite and 3,000,000 tons of bituminous coal. The inevitable rise in the price of anthracite, keeping pace with the depletion of the mines and the universal objection to the further introduction of bituminous coal, because of its smoky nature, would, sooner or later, result in the use of coke as a substitute for other forms of solid fuel. The surplus gas from the coke ovens, supplying the coke to the city, could be used in gas engines for the generation of power, and would supply a large amount of that now required in the traffic and manufactures of the city. In the great cities of the west, where only bituminous coal was used, the smoke nuisance had already become a serious matter. The only relief for them appeared to be in the use of smokeless fuel, such as coke. The soft coal now used could be transformed into this shape in a by-product oven, the smoke-forming elements being recovered in the form of gas for power or illuminating purposes, and a cleaner and more economical fuel would be the result.

An advantage would be gained not only in regard to the solid fuel, but to the gaseous as well, as the coal gas produced from the coke ovens was far superior to producer or blue water gas for distribution purposes, and better adapted to gas engine use than the water gas, because of its low percentage of hydrogen. It was also coming to be generally recognised that for continuous production in large quantities coal gas was cheaper than carburetted water gas. The introduction of the by-product coke oven as a source of supply for fuel, light and power, seems, therefore, to be a necessary and inevitable accompaniment of our progress in civilisation.

Dr. F. MEYER said that the plant where he gained his experience with gas as a source of power was built 25 years ago. As far as he knew, it was the first zinc plant which entirely relied on gas as a power. The gas used was illuminating gas, made in a plant owned by the smelter. Later on, when steam was needed for the manufacture of liquid sulphurous acid, boiler plant was added, which also furnished the power for the compressors and the pumps used in the acid plant. The compressors used in the sulphuric acid plant, which worked according to a contact process, were also steam-driven; the rest of the machinery, *e.g.*, crushers and rolls, clay-grinding and retort-making machinery, electric light plant, shops, &c., were operated by gas engines, varying from 1 h.p. to 50 h.p.

Mr. Atwater mentioned that a h.p. hour generated from city gas cost about 2 cents. In their case, where the gas was generated in their own plant, the cost was far less; for example, with coal costing about 2.50 dols. per metric ton, a cb. m. of gas cost 5 pf. The coal was not a good gas coal, as it only developed about 30 cb. m. of gas per 100 kilos. of coal. That part of the coke which was not used for heating the retorts was sold, and also the gas water and the tar. After deducting the returns from these sales from the gross cost, the net cost of one cb. m. of gas was almost exactly 3 pf. Taking three-quarters of a cb. m. for 1 h.p. hour, the cost of 1 h.p. hour worked out at  $2\frac{1}{4}$  pf., equal to a little over half a cent or only quarter of the price mentioned by Mr. Atwater. This cost would, of course, be still reduced if producer gas or water gas were used instead of illuminating gas.

One thing must, however, be said in favour of the steam engine, compared with the gas engine—*i.e.*, the greater reliability of the former engine. The cost of keeping the gas engine in repair was large, and a staff of good machinists and engineers was required to keep it in proper condition.

In large works where the gas engines were scattered about there might also occur heavy losses from leaking pipes, if these were buried in the ground, as usually the case in older installations, but, as a whole, gas would in almost every case be a cheaper source of power than steam.

Mr. E. A. UEHLING said that every blast furnace could be considered as a gigantic gas producer, and the blast furnace gas, although low in calorific power, was never-

theless admirably adapted for direct utilisation in the gas-engine. Because of its susceptibility to high compression without danger of pre-ignition, it was better adapted for engines of large units than almost any other gas.

In his pamphlet, "The Blast Furnace as a Power Plant" he had endeavoured to calculate on a conservative scientific basis, the amount of power that should be available over and above the furnace requirements. The results showed that, with a fuel consumption 2000 lb. of coke per gross ton of iron, there should remain a surplus of over 800 h.p. per ton of iron produced per hour. Since in America the production of pig iron is now above 20,000,000 tons per annum, or 2283 tons per hour, over 1,800,000 h.p. were generated which could be made available, if every furnace in the country were equipped for the full utilisation of the gas produced. While it might be seriously questioned that that amount of power could ever be realised, the fact none the less remained that it is still practically all of it wasted.

Most of those who had written on that subject gave a much lower figure than the above, basing their calculations on a reduced amount of power available on the irregularity of the furnace running, and upon a much higher assumption of gas for heating the blast. His own opinion was that when the value of the blast furnace as a source of power became fully recognised, it would tend to improve the blast furnace practice to an extent which would make irregularities very much less frequent, that, with properly constructed hot-blast stoves running on purified gas, the consumption of gas for heating the blast would be very materially reduced.

The manner in which blast furnace gas was utilised was most irrational. With few exceptions, the methods employed for purifying blast furnace gas were most crude and ineffective. Even where washing was resorted to it was generally done very imperfectly, although the gas was deprived of a considerable amount of solid matter, it was generally saturated with steam, and consequently the beneficial effect of relieving the gas of dust was over-balanced by contamination with water vapour. For that reason, both boilers and especially hot-blast stoves, used a much larger amount of gas than they should. There was no hot blast stove in operation at the present time, the heating surface of which could not be doubled or possibly trebled if perfectly purified gas were available.

When it is considered that the first blast furnace gas engine of large power (500 h.p.) shown in public exhibition by the Cockerill Company at Paris in 1855, the progress made in Continental Europe, especially in Germany, was marvellous, there being upwards of 300 h.p. in use and under construction, and there was hardly an iron works of considerable size that had not installed one or more of these engines; whereas in America there was but one steel company that had made a serious attempt towards the utilisation of the blast furnace gas for power direct, namely, the Lackawanna Steel Company, who had ordered 40,000 h.p. of blast furnace gas engines, probably one-half of which were running.

Dr. J. D. PENNOCK, in reply to Dr. Schniewind, asked the question as to how much steam was used in blowing the producer and if it were not a fact that the steam necessary was a considerable item, said he was unable to give the exact figure, but that the steam was a very considerable item there was no doubt. In fact, the steam blowing the Mond producer cost about as much as the labour for operating. The tendency of the works was to use a large amount to reduce the chloride, the tendency of the manager was also to use a large amount, for thereby he increased the yield of ammonia.



Scottish Section.

THE IDENTITY OF THE HYDROLYTIC PRODUCTS OF STARCHES OF VARIOUS ORIGINS.

BY JOHN S. FORD AND JOHN M. GUTHRIE.

investigations of the hydrolysis of starch by malt  
se, potato starch has in general been employed,  
no doubt to the relative ease with which it can be  
ted and purified. In an early paper on starch  
ysis, C. O'Sullivan (Jour. Chem. Soc., 1876, 2, 141),  
that, though his experiments were carried out  
y with potato starch, he satisfied himself that other  
es, as rice, wheat, maize, &c., gave identical results,  
admit that starch is a chemical entity, it seems only  
able to expect that the origin of the substance  
not affect its chemical composition, even though it  
ise to polymorphic granules which in the crude state  
p impurities differing in nature and amount. Even  
iced from these impurities we would not expect the  
s solid starches to be dissolved or attacked at equal  
s malt extract, but when reduced to homogeneous  
by treatment with boiling water, and so brought  
practically similar physical state, it might be pre-  
that malt extract under like conditions would give  
similar transformation products whatever source  
rch was obtained from. This view has received  
acceptance (though probably the statement of  
ullivan (*loc. cit.*) has been lost sight of) until  
e, and the results of the experimental investigations  
with potato starch have received practical applica-  
the brewing industry and elsewhere, in connection  
e hydrolysis of other starches. We do not propose  
into the question of how far the relationship holds,  
not hold, between the hydrolysis of starch pastes  
, and that of the starch of germinated grain in the  
ua under brewery conditions. The object of this  
to discuss certain recent statements as to the non-  
of the products of hydrolysis of starches of  
t origins under laboratory conditions.  
O'Sullivan (Jour. Chem. Soc., 1904, 85, 616)  
as a series of experiments, made with seven different  
reparations, and concludes from these, that potato  
shaves differently to the other starches, and there-  
at the products of the hydrolysis of other starches  
be inferred from the result obtained with potato  
Ling (Fed. Inst. Brew., 1903, 9, 452) arrived at a  
conclusion. In a communication by one of us  
1904, 414) it was stated that rice, barley, maize,  
potato and arrowroot starch pastes were found  
ntical as regards their products of hydrolysis when  
with malt extract under like conditions. Und-  
d work with other starches had confirmed the  
on that the origin of the starch was without effect  
ds the nature of the products of hydrolysis, pro-  
starches were sufficiently purified and free from  
es which inhibit amylolytic action. The starches  
re prepared by ourselves directly from the plant  
with the exception of the arrowroots, which were  
l commercially and subjected to purification) in  
al manner. The crude starches were purified by  
at with 0.2 per cent. caustic soda and hydrochloric  
ashed with distilled water, and extracted with  
and ether, when necessary. The specimens were  
air, and then further at 25°-30° C. It is more  
ossible that starches so obtained contain varying  
s of starch cellulose\* which may cause slight  
es in the hydrolytic products. Our methods of  
tion are at present, however, not sufficiently  
to note such differences with any degree of cer-  
With regard to the general purity of such prepa-  
the potato starch we used as a standard gave the  
g results:—

Ash .....	0.17 per cent.
N. as albs. ....	0.05 per cent.

Its reaction was neutral to rosolic acid and acid to phenol-phthaline, this latter reaction being due to the presence of acid phosphates.

In Table 1, we record the results obtained. In each experiment the starch (5 grms. dry) was gelatinised as usual, cooled to 65°, and converted with 25 c.c.'s malt extract (=10 grms. malt) which had previously been heated for 10-15 minutes at 65°.

The conversions were made to definite volumes, and the sp. gr., optical rotation, and copper-reducing power, observed. Similar values were obtained for the malt extract used. The copper reduction was not determined in all cases. Our experience has convinced us of the validity of "the law of relationship" propounded by Brown, Morris and Millar (J. Chem. Soc., 1897, 71, 115), hence determinations of the solids and their optical rotation is all that is necessary. The copper reductions obtained were in good agreement with the theoretical values. We also made several experiments using precipitated diastase (of malt) as the hydrolytic agent, the results were similar to those obtained with malt extract. In the paper by one of us already referred to, the influence of metallic and other impurities on amylolytic action was fully discussed, and in a recent paper on malt analysis (Jour. Inst. Brew., 1905, 11, 206) we pointed out that solid starch readily absorbs from solution substances which may interfere with normal hydrolysis. Our experience of this has been so repeatedly confirmed that we have no hesitation in saying that where other workers have found apparent variations in the hydrolytic products of different starch preparations under like conditions of hydrolysis, these differences are due to impurities in the starches in question, and not to a difference in the starch *qua* starch.

In view of the contradictory statements of J. O'Sullivan (*loc. cit.*) and ourselves, we communicated with Mr. O'Sullivan, suggesting an exchange of samples. Mr. O'Sullivan kindly sent us a specimen (A 4) of his potato starch, which, on comparison with our own standard No. 27 in the usual manner, gave the following results:—

	A4.	No. 27	
Hydrolysis with malt extract at 60° ..	158.7	153.3	{ [α] <sub>D</sub>
Hydrolysis with precipitated diastase at 60°	167.8	143.8	
3.0 grms. starch + 0.2 grm. (a) diastase ..			

A further examination of the A 4 starch showed that it contained copper to the extent of 0.035 per cent. Our former experience of the influence of traces of copper on amylolytic action indicated that this amount of copper might be sufficient to account for the difference in hydrolysis of the two specimens. To obtain confirmatory evidence, a portion of No. 27 starch was shaken with a very dilute solution of copper sulphate, then thoroughly washed with distilled water and dried as usual. The reaction to indicators was the same as that of the starch before this treatment. This "copper starch," which contained 0.06 per cent. of copper, was added to a quantity of No. 27 so as to give a mixture containing 0.035 per cent. A comparison\* was then made between this mixture and No. 27, as under:—

	No. 27.	No. 27 + 0.035% Cu.	
Hydrolysis with malt extract at 60° ..	153.4	160.5	{ [α] <sub>D</sub>
Hydrolysis with precipitated diastase at 60°	167.8	189.2	
5.0 grms. starch + 0.2 grm. (b) diastase ..			

This amount of copper (0.035 per cent.) is thus sufficient to bring about a marked reduction in the maltose formation, and hence in the nature of the hydrolytic products.

\* The results in this experiment are not directly comparable with those above, being obtained some months later with other malt extract and diastase preparations. Owing to the small quantity of "A 4" at our disposal we were unable to make direct comparison between it and our "27+Cu" under like conditions. The recurrence of similar figures in the two sets of experiments is accidental.

It will be noticed that the difference is much more evident in the conversion with precipitated diastase than in that with the malt extract. The cause of this difference has been indicated elsewhere by one of us, and will be alluded to further in another publication. We may remark here, that in general the hydrolysis is more influenced by impurities in the starches, when precipitated diastase is employed. Mr. O'Sullivan informed us that after re-treatment of his A & starch with dilute hydrochloric acid he obtained with it hydrolytic products similar to those yielded by our No. 27 under like conditions, and that he found his preparation was then free from copper. He dissents, however, from our conclusion that the presence of copper in his potato starch accounts for the difference he obtained in its hydrolytic products and those of his other starches.

We find it somewhat difficult to follow his objection to our method of experimental proof, but, as he promises an early contribution as to why potato starch sometimes differs from the cereal starches, we simply record our results, which quite apart from the question of the influence of copper, seem sufficient proof that Mr. O'Sullivan's generalisation—as to potato differing from the other starches in regard to hydrolytic products—cannot be considered established.

TABLE I.

*Conversions with Malt Extract (of 10 grms. Malt) per 5 grms. Starch at 65° for 1½ hours.*

Source of Starch.	[α] <sub>D</sub> 3.97
Potato { Controls of .....	161.0
" same .....	160.7
" specimen .....	159.5
" .....	160.7
Pea .....	161.0
Barley .....	160.8
Wheat .....	161.0
Oats .....	162.0
Maize .....	160.0
Tous les Mois .....	159.7
Arrowroot Maranta .....	161.0
Rice .....	161.5
Lentil .....	160.0
Banana .....	159.7
Barley, malted .....	160.7
Barley, malted .....	160.8
Potato (commercial) .....	163.4
Potato (purified) .....	161.0
Rye .....	163.2
Buckwheat .....	164.0
Chestnut .....	166.9
Dari .....	163.7
Millet .....	162.6

The last five starches were obviously impure and did not yield homogeneous pastes. Successive purifications lowered the angle in each case. The chestnut starch contained evident traces of something other than starch, which, however, we could not remove by the methods available.

TABLE II.

*Conversions with Precipitated Diastase (a) 0.2 grm. per 5 grms. Starch at 60° for 1 hour.*

	[α] <sub>D</sub> 3.93 R. 3.93	
SERIES I.—		
Maize .....	174.7	40.5
Wheat .....	175.6	43.8
Potato .....	174.0	43.8
Arrowroot .....	175.4	40.7
Barley, malted .....	174.4	45.0
Rice .....	175.0	44.0
Potato .....	174.5	43.9
SERIES II.—0.4 grm. diastase ( <i>b</i> ) 2 hrs. at 60°		
Banana .....	153.1	74.0
Oat .....	155.4	72.6
Barley .....	154.3	74.5
Potato .....	154.2	73.3
Dari .....	156.4	74.4

## Sydney Section.

*Meeting held at Sydney on Wednesday, April 12th, 1904.*

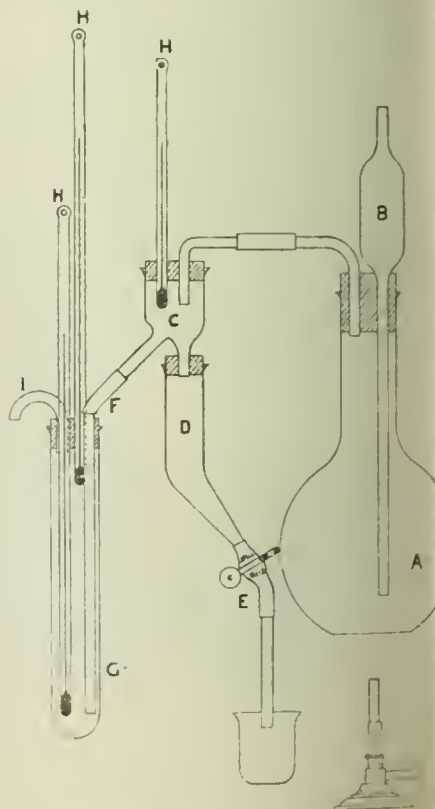
PROFESSOR A. LIVERSIDGE, F.R.S., IN THE CHAIR.

### THE TEMPERATURE OF SOLUTIONS HEAT BY OPEN STEAM.

BY THOS. STEEL, F.C.S., F.L.S.

The fact that it is possible to heat solutions by the use of open steam to temperatures higher than that of steam itself does not appear to be so well-known, of interest and importance warrant. I have not seen direct reference to this point in works on physical and, indeed, am only aware of two references therein literature. The first allusion with which I am acquainted is in Report of the British Association, 1869, Trans. and 1870, Trans., 64, where Peter Spence recorded an accidental discovery of the phenomenon and gives the results of a series of laboratory experiments on the determination of the b. pt. of saturated solutions of various salts blowing in steam at 100° C. Spence gives no explanation of the cause of the phenomenon but contents himself with recording the results of his experiments. The reference to the matter occurs in a recent public Zeits. Ver. Deuts., Zucker-Ind., 1904, 1159, in a paper by H. Claassen on the "Boiling Point of Sugar Solution" (See this J., 1904, 1105 and 1228.) In this paper Claassen points the fact out clearly and gives a brief theoretical explanation.

It is my purpose in the present paper to give a description of an apparatus which I have used, details of some illustrative experiments, and to give the theoretical considerations governing the phenomenon under discussion.





the accompanying illustration of the apparatus used, 32 oz. flask fitted with a 100 c.c. pipette; B is a safety C is a tube for removing water from the steam flowing the temperature of the latter to be observed; a tube in which condensed water may gather; E is a r joint fitted with a spring clip, connecting to a leading to a small beaker placed beneath; F is a r joint connecting the tube which leads the steam be large test-tube G; H, H, H, are thermometers; and a tube for carrying off surplus steam. When the atus is in use C is wrapped round with a piece of wool, while the tube G is inserted into a cylinder with the same insulating material. The water flask A is boiled, the clip at E being left open until apparatus is warmed up and steam issues freely. As accumulates in the tube D during the course of the ments it may be discharged by opening the clip. eug a solution in the tube G, and allowing the steam a through it, the temperature will rise steadily until t is reached at which it will remain for a time, and radually fall. If the steam be allowed to escape at oment by opening the clip at E, and the tube G oved with its fittings in place, and heated to boiling a lamp, the temperature reached will, as a rule, y little higher than that which was attained by of the steam. In many cases, by having a quantity powdered salt present so as to keep the solution in uted state, the b. pt. of a saturated solution, mperature very near that point, may be readily l and maintained. Under the conditions of my uents the steam passing through the tube C has a ature of 99.0° which rises to 99.2 or 99.3° when ed to the hydrostatic pressure in the tube G. The escaping from G has a temperature of 99.0°. Some of platinum foil or bits of porous clay pipe are in s placed in the solutions for the purpose of pro- steady boiling.

The following table the temperatures attained by on-saturated solutions, when heated by steam he above conditions, are stated, as also the tem- es at which the same solutions boil when heated lamp:—

Non-saturated Solutions.

	Boiling Temperatures.	
	With Steam.	Over Lamp.
l phosphate .....	103.0	103.5
carbonate .....	104.2	104.5
a nitrate .....	105.5	106.5
na chloride .....	111.5	112.5
acetate .....	112.5	114.0
litate .....	117.5	118.5
n acetate .....	147.0	152.0
chloride .....	149.2	150.0
m nitrate .....	155.0	156.0
m nitrate (stronger) .....	163.0	164.0

ll be noticed that in all cases the temperature by heating over the flame is somewhat higher it attained by means of steam. The temperatures y the various solutions depend, of course, on eutralizations. With a strong solution of ammonium steam at atmospheric pressure is competent to e temperature to 163°. In carrying out this ent steam was passed direct into moist ammonium and the temperature mentioned was quickly a spite of the fact that there is a considerable effect when this salt is dissolved.

ated solutions, as I have before mentioned, may d in the same way, by having a quantity of the d salt present in the hot solution. In the next e given the temperatures attained by the use of ith saturated solutions of a number of salts, and, eparison, the b. pt. of the same solutions as d by heating over the lamp and also as published s' Dictionary of Chemistry, and elsewhere.

Saturated Solutions.

Boiling Temperatures.

With Steam. Over Lamp. Boiling Points\*

Potassium chlorate..	103.3	103.5	104.2
Zinc sulphate .....	103.5	103.8	104.4
Sodium carbonate ..	105.2	105.5	104.6
Potassium chloride	108.0	108.2	108.3
Sodium chloride ....	108.0	108.2	108.4
Potassium nitrate ..	114.0	115.0	115.0
Ammonium chloride	114.0	115.0*	114.2

\* The b. pt. of a saturated solution of zinc sulphate is by Griffiths and is given in Coney's Dictionary of Chemical Solubilities, p. 459, that of potassium chloride is the figure found by Legrand and quoted in Clarke's Rules, Tables and Data, p. 369; all the others are given on the authority of Legrand in Watts' Dictionary of Chemistry, vol. iii., p. 89.

As is the case with non-saturated solutions the tem- peratures reached by the use of steam are somewhat lower than those obtained by boiling over the lamp, while the latter figures are sometimes higher and sometimes lower than the published b. pts. for saturated solutions of the salts experimented with. In this connection it should be explained that the salts used by me were the ordinary commercial ones sold by reputable dealers for laboratory use.

When dealing with very soluble substances such as calcium chloride, the solubility of the salt prevents saturation being reached. When steam is blown into granular calcium chloride, a solution is formed having a temperature of 149.2°, while by heating over the flame this solution boils at 150°. If a saturated solution of the same salt is prepared by stirring powdered calcium chloride into the above solution kept boiling over a flame, the pasty mass formed boils at 175°. If now the tube containing the hot saturated solution be quickly placed in the lagged holder, and steam passed in, the solution does not remain at the same temperature, but steadily cools. If the steam be now turned off, the contents of the tube allowed to cool somewhat, and steam again turned on, the temperature rises to a few degrees below the point at which it stood in the first instance. With ammonium chloride, treated in the same manner, the steam merely passes through and does not form a solution, consequently the contents of the tube do not rise above the temperature of the steam itself. On adding a little water, a saturated solution is formed which becomes heated to a temperature of 114.0°, or only 0.2° less than the b. pt. for a saturated solution of this salt given in Watts' Dictionary, while on heating over the lamp it boils at 115.0°, which is 0.8° higher. A saturated solution of zinc chloride is stated in Watts' Dictionary to boil at 172°. With the apparatus described it is possible, by starting with the powdered salt into which steam is passed direct, to heat a saturated solution in which is suspended an excess of the salt, as high as 177°. Doubtless in this case the heating effect is aided by the heat of solution of the zinc chloride.

The theoretical explanation of the results of the experi- ments above described is comparatively simple. When water is heated the pressure exerted by its vapour increases until, on the attainment of b. pt., it equals that of the atmosphere. The boiling point of any solution under ordinary atmospheric conditions, is that temperature at which its vapour pressure is equal to the pressure of the atmosphere. The effect of the solution in water of any substance such as a salt, is to reduce the vapour pressure of the liquid and hence to raise the temperature to which it must be heated before it will boil. It thus comes about that saline solutions have b. pts. higher than that of water. Now when steam at the boiling point of water is passed into a saline solution, the vapour pressure of the steam being equal to that of the atmosphere, but greater than that of the solution, the steam condenses in the solution and continues to do so as long as the latter has a lower vapour pressure, or in other words, so long as the solution is not at boiling point. When this point is reached the steam merely blows through the liquid, a sufficient quantity condensing to replace the heat lost by

radiation, &c. It is to the liberation of the latent heat of the steam on condensation, that is due the heating effect which we have been considering. When we reflect how great is the amount of this latent heat (some 537 calories for each cubic centimeter of water condensed from steam) we can readily understand why such striking thermal effects are produced.

The fact of condensation taking place causes dilution of the solution with consequent reduction of b. pt., unless a supply of the solid salt is maintained so as to keep the solution constantly saturated.

Taking into consideration all the facts, in my opinion the temperature to which a solution is heated by steam is a truer measure of its b. pt. than that obtained by the application of direct heat. It is well known that the temperature of boiling water varies within quite considerable limits according to the nature of the vessel in which it is contained, and the b. pt. of liquids other than solutions of solids, is always determined from the temperature of the vapour. It is equally well known that saline solutions are very readily superheated when boiled over a flame, and it is highly probable that the b. pt. determined in this way will tend to be too high.

When alcohol of sp. gr. 0.816 is placed in the tube and steam injected, condensation takes place until the liquid becomes heated to boiling, and when this point is reached the liquid has a temperature of 79.1°, that of the escaping vapour being 78.1°. This difference is due to the fact that the vapour is richer in alcohol than the liquid, and accordingly, having a higher vapour pressure, comes away at a lower temperature. The fact that the water vapour escaping from a boiling saline solution has the same temperature as that from boiling water, is due to the same cause.

While experimenting on heating saline solutions with steam, it is interesting to observe the effect on the thermometer placed in the vapour space of the boiling-tube, when, through splashing, its bulb becomes covered with the saline solution. When a saturated solution of a moderately soluble salt is under observation and a portion of the liquid carrying particles of the solid salt splashes on to the thermometer bulb, the temperature at once rises to and remains at the same point as the boiling liquid itself. The film of saturated solution on the bulb, being enveloped in steam at 99°, behaves precisely like the mass of solution and maintains the thermometer at the b. pt. of the solution. Sodium chloride shows this extremely well.

The condensation of water from the atmosphere on particles of substances like sugar or salt, when the air is laden with moisture, is due to the same cause, the difference in vapour pressure of the film of solution adhering to the salt, and that of the moisture in the atmosphere, transference of water vapour always taking place in the direction of least vapour pressure. This was originally termed "invaporation" by Graham, who experimented with saline solutions in air saturated with water vapour, and determined the rate of condensation in the solutions. ("Edinburgh Jour. of Science," 16, 1828, 249. Report British Association, 1886, 207.)

In the course of some of my earlier experiments I used a vessel of boiling water in which to place the tube containing the solution under observation, but I quickly found that, far from being as efficient as the cotton wool lagging subsequently used, the boiling water actually cooled the tube.

A knowledge of this property of steam whereby solutions are heated to temperatures considerably above that of the steam itself, may be of practical importance in chemical industries where saline solutions require heating to temperatures greater than 100°. Again, in some cases, as for instance, in the course of operations in the manipulation of sugar and other organic substances, considerable over-heating may readily occur through the mistaken idea that the temperature of the steam used determines the limit of heating possible.

#### DISCUSSION.

Mr. W. A. Dixon said he had found that a steam spray immediately destroyed the prickly pear; was this partly due to the temperature being raised?

Dr. R. GREIG SMITH thought this matter had explained in a clear and forcible way, and inquired the temperature effect of direct steam on agar wool. This substance was used for bacteriological purposes and could only be obtained as a solution after long and tedious digestion. Would direct steam hasten the process?

Mr. T. STEEL, in reply, said the efficiency of steam killing prickly pear would be due to liberated latent heat and thorough distribution; but unless the steam diffused into the sap, the temperature would not rise above that of the steam itself. As regards the effect of direct steam on agar-agar, he had no doubt this substance would behave in the same manner as salt.

## Obituary.

### THE RT. HON. SIR BERNHARD SAMUELSON BART., F.R.S.

CHEVALIER OF THE LEGION OF HONOUR. CHAIRMAN OF THE ROYAL COMMISSION ON TECHNICAL EDUCATION. FORMERLY PRESIDENT OF THE IRON AND STEEL INSTITUTE (1883-4). ORIGINAL MEMBER OF THE SOCIETY OF CHEMICAL INDUSTRY.

Sir Bernhard Samuelson was born November 1820, and was the son of Mr. Samuel Henry Samuelson, merchant, of Liverpool and Hull. He was educated privately, and entered on his mercantile career at the fifteenth year as apprentice in a general mercantile office in Liverpool. Shortly after the expiration of his indentures, he was placed in charge of the financial transactions of Messrs. Sharp, Stewart and Co., engineers, of Manchester, and from 1846 to 1848 he was engaged in establishing the railway works at Middlesbrough. He returned to England in 1848, and bought an iron-rolling works and foundry in Banbury. The company was at that time very small, but in his hands it grew into a very large business. Five years after he erected his blast furnaces at Middlesbrough, which he subsequently added collieries and iron mines. In 1853, Mr. Samuelson made the acquaintance of the late Mr. Vaughan, and these two subsequently transformed Cleveland into the greatest iron-producing centre in the world. Not content with making iron, Mr. Samuelson determined also to manufacture finished iron, and in 1870, he erected the British Iron works at Middlesbrough, which cover 200 acres. His preliminary experiments in steel-making cost him £25,000. Sir Bernhard Samuelson was the first ironmaster in this country practically to reduce the merits of the closed coke-oven, with recovery of coal tar and ammonia, and its superiority over the open hearth, which yield smoke and fumes polluting the surrounding country, instead of recovering products of value. To Sir Bernhard Samuelson the nation is indebted more than to any other man for his knowledge of the relative position which England occupies among the competing industrial powers of the European Continent and of the Transatlantic States. For three or four years he occupied the position of chairman of the Association of Chambers of Commerce of the United Kingdom. In 1867, at the request of the Vice-President of the Committee of Council on the Government, he visited the principal manufacturing centres of Great Britain and the Continent, and reported on the education of the industrial population. His report was published in a Parliamentary paper, and was for years referred to in all debates on technical education. This work, he followed up by a similar inquiry, in 1868, into the education of the workmen of our manufacturing industries, and was chairman of a committee, whose reports were adopted by the House of Commons. Sir Bernhard Samuelson was appointed chairman of the Royal Commission on Technical Instruction, the labours of which extended over the years 1882, 1883 and 1884, and ended



examination into the systems in use in all parts of the United Kingdom and a great portion of the European Continent. In this he was associated with the first president of this Society, Sir Henry Roscoe, together with Messrs. Woodall, Redgrave, Swire Smith, Slaggy, and Ph. Magnus. (This Journal, 1882, 139.) The justly report of this work has become the standard authority upon the questions it deals with. It was this work which earned Samuelson his baronetcy in 1884, and he was soon after elected a member of Privy Council. He was also a Fellow of the Royal Society, and a Chevalier of the Legion of Honour, and, in

1871, became the recipient of the Telford Gold Medal for a paper on improvements in iron manufacture. Of the Iron and Steel Institute, he occupied the presidential chair for the two years 1883-1885. In 1878, Sir Bernhard Samuelson was elected president of the Cleveland Ironmasters' Association, and he was the first president of the Agricultural Engineers' Association. As an employer, he was liberal and considerate to his workpeople, whilst he gave generous support to technical schools and other institutes in Middlesbrough and Banbury. He died Wednesday, May the 10th, in his 85th year, after a brief illness.

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France.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3<sup>e</sup>).

PLANT, APPARATUS & MACHINERY.

UNITED STATES PATENTS.  
*Granular Materials; Apparatus for Cooling* — F. Holl, Worms, Germany. U.S. Pat. 7, May 16, 1905.  
Pat. 342,619 of 1901; this J., 1904, 929.—T. F. B.  
*Freezing Liquids; Process of* — J. H. Wallace, San Francisco, and J. B. Speed, Berkeley, Cal. U.S. Pat. 88,804, May 2, 1905.  
The process consists in first evaporating the liquid under conditions of highest temperature and pressure, and then giving up the vapour formed under the same pressure. A second portion of the liquid, which is

contained in a vessel which surrounds that in which the first condensation takes place. The second evaporation takes place at a lower temperature and pressure, and the vapour is condensed at the same lower pressure, and in a vessel surrounding that in which the second evaporation is effected, and gives up its heat, in turn, to a further portion of liquid contained in another vessel surrounding this condenser, in a similar manner as before. This process may be continued at diminishing temperatures and pressures and in similar annular vessels as far as desired.—W. H. C.

GERMAN PATENTS.  
*Centrifugal Apparatus with Air-Heating Device.*  
R. Fänder. Ger. Pat. 157,264, May 13, 1902.  
Below the drum of the centrifugal apparatus is disposed

a heating pipe with a number of branch tubes. The air is heated by means of naked flames issuing from the tubes, and it escapes through openings in the upper wall of the heating pipe. The apparatus is intended chiefly for laboratory purposes, the heating of the air being effected by means of a spirit lamp or the like.—A. S.

*Filter Element for Filter Presses, with Annular Projections on both sides pressing against the Filtering Material.*  
H. Fromme. Ger. Pat. 157,588, June 25, 1903.

THE circular frame of the filter element is provided, just above its lower edge, with an annular projection of triangular cross-section, and the filtering material is held in place by means of a corresponding projection on a lattice-work plate, which is placed on the upper edge of the frame. When several such elements are combined to form a filter-press, the lattice-work plate abuts against the lower edge of the frame of the adjacent filter element, and forms, with the annular projection on the latter, an inlet channel for the liquid to be filtered.—A. S.

## II.—FUEL, GAS, AND LIGHT.

*Wood-gas for Power Purposes and Gas Generators.*  
G. M. Douglas. Inst. of Mining and Metall., April 13, 1905. [Advance Proof.]

THE author describes the use of wood gas for power purposes at the concentrating works and mine of the Moctezuma Copper Co., Sonora, Mexico. The central power station contains ten gas-engines of the Crossley "Otto" type, of which eight are single-cylinder engines,  $18\frac{1}{2}$  in. diameter by 24 in. stroke, giving a maximum of 80 h.p., whilst the other two are double-cylinder engines,  $18\frac{1}{2}$  in. diameter by 27 in. stroke, from which 175 h.p. can be obtained. The engines are connected by belts to dynamos of 65 kw. for the single cylinder, and 150 kw. for the double-cylinder engines. The dynamos are shunt-wound machines operated in parallel, and generate direct current at 260 volts. The current is supplied from the power station by a motor-driven generator giving at 6600 volts 3-phase alternating current of 25 cycles, and at the mine, which is 6 miles distant, is "stepped down" by transformers to 230 volts. The wood-gas is produced in a slightly modified Loomis-Pettibone gas generating plant, consisting of two duplicate sets, in each of which are two generators and a boiler, whilst a wet scrubber and an exhauster of Root's positive pressure type are common to both sets. In starting the gas generators, coke is placed on the grates to a depth of 3– $3\frac{1}{2}$  ft. or more, if the wood to be used contains a large proportion of volatile matter. Small and light wood is fed on to the coke to a depth of about 3 ft., and the blower is set working and the fire started. When the coke is incandescent, fast feeding with heavy wood is necessary, until a bed of incandescent charcoal and partly consumed wood is formed to a depth of about 2 ft. above the coke, when the gas may be supplied to the engines. At intervals steam is supplied to the generators, and a small quantity of water-gas made in order to loosen the bed of fuel, but it is stated that the practice of making water-gas and producer-gas alternately for long periods causes an uneconomical use of fuel and an unsteady supply of gas. The wood gas produced, has a calorific value of 135.6 B.T.U. at 62° F. and under normal pressure, and has the following average composition:—Hydrogen, 19.5; carbon monoxide, 13.45; methane, 2.48; olefines, 0.34; carbon dioxide, 15.45; oxygen, 0.25; and nitrogen, 48.5 per cent. This gas is stated to give better results in the engines than gas from coal having the same calorific value, but in which the proportions of hydrogen and carbon monoxide are reversed. In a run of four days and 23 hours, the output and fuel consumption were as follows:—

Coke placed in generators .....	8,590 lb.
Wood used in firing up .....	7,400 lb.
Duration of run .....	119 hours.

Total amount of ash from generators	14,124 lb.
Amount of coke recovered .....	2,572 lb.
Total amount of wood used .....	138,840 lb.
Total amount of coke used .....	5,018 lb.
Total amount of combustible .....	144,768 lb.
Percentage of water in wood .....	19.8
Percentage of ash in wood .....	10.8
Calorific value of gas (average of 35 tests) .....	116.4 B.T.U. (a)
Total output of power house ...	{ 39,700 kw. h.p.
Average power .....	447.2 elect
Consumption per electric h.p. = 2.6 lb. of wood and 0.11 lb. of coke.	

In summing up, the author states that the great advantage of a gas-engine plant lies in its extreme economy of fuel; in nearly every other respect a gas-engine is a disadvantage compared with a steam-engine.—A.

*Gas; Cleaning of Blast-Furnace* ——— A. S.  
Iron and Steel Inst., May, 1905. [Advance Proof.]

THE dust carried over by the "waste-gas" has been a great obstacle to its successful use in large gas engines for this purpose the gas must be quite free from dust, and removal of the last 0.1 grm. per cu. m., though expensive will pay for itself in longer life and decreased repairs. The cleaning should be effected in three stages:

1. The ordinary dry-cleaning by means of dust chambers and dust-catchers.
2. Wet-cleaning by means of (a) stationary electric "scrubbers," such as the Zschecke cleaner; (b) revolving machines or "atomizers," such as the Tappan apparatus; or (c) slowly revolving "fresh-contact cleaners." The Bian apparatus, the earliest of the fresh-contact cleaner, has proved very effective. It consists of a horizontal cylindrical casing through which the gas is passed from end to end. In its axis is a revolving shaft to which a number of circular perforated discs of a diameter but little less than the inside diameter of the casing are bolted, whilst between these are deflecting plates, attached to the casing. The gas being drawn through the machine is thus compelled to approach the centre after each passage of the perforated discs. The outer shell is filled with water up to the bottom of the centre shaft, the discs and their perforations are, therefore, washed at every revolution of the apparatus, and ascend from the bath covered with thin film of water. The dust which settles to the bottom of the casing is drawn off from time to time by means of sludge pumps. The Sahlin cleaner is an improvement on this apparatus with a view of securing larger capacity, a better wetting of the perforated surfaces, and a more uniform and constant removal of the dust. The gas is drawn through the apparatus by a ventilator, and a safety valve to prevent the drawing in of air in case of interruption to the flow of gas and possible formation of explosive mixtures is provided. This consists of a small gas holder having a diameter of 8 ft. with a lift of 6 in., and so built that it will drop when the pressure falls to a quarter of an inch column. Finally the gas is forced through a drier, whence it passes through a mushroom-shaped chamber into the general gas-main. Gas for the power is drawn from this main by electrically-driven fans, mixed with water, and discharged into a second small chamber whence it is sent to the engines. The total power is as follows:—

To pass 40,000 cu. ft. of gas per minute against 2 in. water,  $36\frac{1}{2}$  h.p.  
To pump cooling water, 8 h.p.  
To finally clean 10,000 cu. ft. of gas per minute 8000 galls. of spraying water per hour, 65 h.p.  
quantity will supply gas engines of from 5000 to 6000 h.p.

*Arc; Metallic [Titanium]* ——— I. Ladloff.  
World and Eng., 1905, 45, 757; Electrician, 1905, 120–122.

THE results of experiments with electric arcs with titanium and mixtures of iron and titanium oxides given. These were employed either for both positive

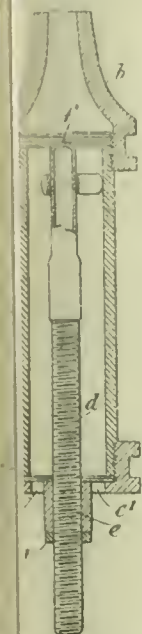


negative electrodes, or in conjunction with a carbon or positive, with good results. The light produced by ferro-titanium and rutile (oxide of titanium and titanic acid) is pure white in appearance, and an efficiency of 3 watts per candle can be attained. In general, the arc obtained is between that of an ordinary arc and the so-called "flame" arcs.—R. S. H.

# ENGLISH PATENTS.

*Electric Fuel; Manufacture of — from Coal Mine Waste or Dust Coal.* T. Rouse and H. Cohn, London. Eng. Pat. 9071, April 20, 1904.

powdered material is mixed with a hot solution of a part of petroleum emulsion (obtained by levigating the lime with petroleum) and four parts of water in 80 parts of water.—J. H. C.



*Burners, Gas-; for Heating Purposes.* A. W. Onslow, Woolwich. Eng. Pat. 24,064, Nov. 7, 1904.

To obtain a powerful, high-velocity flame for use in heating furnaces, rivet forges, annealing machines, &c., and to utilise high-pressure illuminating gas for these purposes, gas-burners are constructed in the following manner:—A gas-supply pipe *d* extends through the end cap *c* of the burner tube *a*, the cap being provided with air inlets *c'*. The supply pipe has a screw-threaded portion *e*, where it passes through the cap, so that its outlet *f* can be adjusted in a proper relative position to the burner nozzle *b*. The supply pipe can be fixed in that position by means of a lock-nut *g*. Different forms of burner nozzles may be employed. By fixing a pin across the burner outlet, and not through its centre, the current of gas is split up on emanating from the nozzle; by this device the pressure of the gas employed can be varied within large limits. The burner may be rendered portable by fitting a wooden handle on it.—R. L.

*Producers; Impts. in —.* W. Towns, Liverpool. Eng. Pat. 29,170, Dec. 30, 1904.

producer, which may be cylindrical or of any other convenient shape, consists of an outer casing lined with refractory material, and supported on girders over the sealed ash-pit. The blast of air, or of air and steam, is conveyed to a chamber in the ash-pit, which has a swinging-out door, and is then distributed both upwards and sideways through the fuel by means of a vertical cone or pyramid, which also acts as a grate to support the fuel. The gas is taken off at the top of the producer through an annular opening communicating with an annular flue which carries the top of the producer. Doors are provided for the purpose of moving the dust which accumulates in the annular flue. The charging chamber, fed from a hopper, is placed at the top of the producer, so that the freshly-charged fuel is being partially distilled, is not overheated and is prevented from adhering to the sides of the chamber.—W. H. C.

*Illuminating; Purification of —.* J. Bernheim and M. Wagner, Paris. Eng. Pat. 9206, April 21, 1904. U. S. Int. Conv., April 22, 1903.

gas coming from the meter is passed for the final purification through a coil in which moisture and hydrocarbons, such as naphthalene and anthracene are condensed, and may be run out through a water-sealed pipe.

The gas then enters the purifier lined with felt and containing three perforated shelves, which are charged partly with a mixture of wood charcoal and wood fibre and partly with a mixture of ferrous chloride, copper sulphate, iron sulphate, ferric oxide and sawdust. The gas coming from the purifier passes through a drier, containing on two shelves layers of hay and animal black and an open box filled with quick-lime. The appliance is intended for private installations.—R. L.

*Gas; Purification of —.* T. Redman, Bradford. Eng. Pat. 9514, April 26, 1904.

IMPURITIES suspended in crude gas can be extracted by causing the gas to pass through fine gauze screens. An endless belt of fine gauze arranged on two rollers is employed, so as to form two screens in the path of the flow of gas and rotating in a suitable casing, the gas passing the screens in two different directions, although maintaining its current towards the gas holder. To keep the perforations clear and to avoid clogging of the fine-meshed gauze, the lower part of the casing may be charged with a suitable liquid, which, by wetting the gauze, assists in removing the impurities both from the gas and subsequently from the screen. The collected impurities descend into a well at the bottom of the casing. Instead of using a rotating screen a stationary one can be employed; in this case the flow of gas is controlled by a reversing valve.—R. L.

*Gas Washers or Scrubbers; Impts. in —.* T. Redman, Bradford. Eng. Pat. 12,659, June 4, 1904.

THE drums of washers or scrubbers of the rotary type are provided with division plates, between which are placed corrugated plates. On rotating the drums the gas is drawn through openings in the drum casing into the spaces between the corrugated plates and brought into intimate contact with their wetted surfaces, being finally expelled and delivered to the next drum or to the outlet at the end.—W. H. C.

*Electrodes; Arc Lamp —.* W. S. Weedon, Schenectady, U.S.A. Eng. Pat. 9190, April 21, 1904. Under Int. Conv., April 21, 1903.

To increase the mechanical strength of titanium carbide electrodes, and to prevent crumbling away of the top part when heated, a core of titanium carbide is encased in a copper sheath, preferably deposited electrolytically. The copper or copper oxide, into which the part adjacent to the arc end of the electrode is converted, vaporises only near the arc end, and until vaporised protects the core so that the only consumption of the titanium carbide which takes place is at the surface from which the arcing takes place.—R. L.

*Electrodes for Arc Lighting.* The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y. Eng. Pat. 14,196, June 23, 1904.

ELECTRODES for arc lamps, consisting of a mixture of oxides of iron and titanium are considerably improved by the addition of chromium oxide. The electrodes are made by charging a thin iron tube with a well-ground mixture of, say, 70 parts of magnetic iron oxide, 30 parts of rutile, and 12½ parts of natural chromite, the whole being initially fused together by an electric arc. The natural chromite gives very good results unless it contains too much aluminium oxide; a mixture of commercial chromium oxide and magnesia may be employed instead of the natural product.—R. L.

# UNITED STATES PATENTS.

*Coke, Compressed; Process of Producing —.* A. D. Shrewsbury. Assignor to the Gas and Fuel Manufacturing Co. of America, Washington, D.C. U. S. Pat. 788,558, May 2, 1905.

THE process claimed consists in discharging the partially

coked material from the coke-oven whilst still in a plastic condition. It is then strongly compressed, returned to the oven and reheated. The process may be repeated as often as is necessary until a block or briquette of the desired density is obtained.—W. H. C.

*Fuel Briquette and Method of Making same.* V. Conti and A. Levy, Paris. U.S. Pat. 790,109, May 16, 1905.

SEE Fr. Pat. 340,244 of 1904; this J., 1904, 745.—T. F. B.

*Gas; Apparatus for Manufacturing* —. B. E. Eldred and C. Ellis, New York. Assignors to Eldred Process Co., New York. U.S. Pat. 789,266, May 9, 1905.

A RETORT bench is combined with a gas producer adapted to gasify bituminous coal. The retorts are provided with a suitable heating device, such as a coke gas generator; the products of combustion of the latter mixed with air in certain proportions, or any other mixture of oxygen and carbon dioxide in predetermined proportions is introduced into the gas producer. Means are provided for mingling the retort- and producer-gases.—R. L.

*Producer Gas; Process of Obtaining* —. A. Desgraz, Hanover, Germany. U.S. Pat. 790,113, May 16, 1905.

SEE Eng. Pat. 24,333 of 1901; this J., 1905, 80.—T. F. B.

*Calcium Carbide Ingots; Utilising Scale from* —. I. R. Edmonds and J. Scales, Sault Ste. Marie, Mich., Assignors to Union Carbide Co., Niagara Falls, N.Y. U.S. Pat. 784,255, March 7, 1905.

THE scale with which ingots of calcium carbide are covered on production, is removed from the ingots, and is subjected, in a sub-divided state, to the action of sufficient water to decompose the contained carbide, the acetylene evolved being collected. The residue is then dried, and, preferably after addition of carbon, is directly smelted in the carbide furnace; or it may be added to the normal furnace charge of lime and carbon.—E. S.

*Electrode; Arc* —. D. A. Holmes, S. A. Tucker and E. Van Wagenen, New York. U.S. Pat. 789,609, May 9, 1905.

THE arc electrode consists of zirconium carbide, mixed with a suitable binding material.—R. L.

#### FRENCH PATENTS.

*Peat-Charcoal; [Artificial Fuel] Process for the Manufacture of* — from Peat. Central Torfkohlen-Ges. m.b.H. Fr. Pat. 349,139, Dec. 8, 1904.

To obtain a solid peat-charcoal from peat, the air-dry material is charged into retorts and heated by producer gas without access of the air, until all moisture and the light hydrocarbons are eliminated, while the heavy hydrocarbons which may be transformed into tar are retained with the carbon of the peat. The necessary temperature varies, and has to be regulated according to the physical and chemical properties of the material, but rarely reaches 400° C. The product obtained in the retorts is a uniform mixture of carbon powder and heavy hydrocarbons and is liable to auto-combustion. Whilst yet hot and still excluding the access of air, it is carried into hydraulic presses with moulds heated to such a temperature that no radiation of the heat of the material can take place. The product leaving the presses, being physically and chemically different from the original peat, does not absorb any moisture even after cooling, is not friable and is greatly enriched in carbon.—R. L.

*Gas and Air; Process and Apparatus for Preparing Mixtures of* —. Selas Ges.m.b.H. Addition, dated July 11, 1904, to Fr. Pat. 338,967, Aug. 19, 1903.

IN connection with the apparatus described in the main patent (Eng. Pat. 17,788, 1903; this J., 1904, 859), special check valves are provided on the suction pipes, so that during each suction period, the valves on the return suction pipes are opened as well as the suction valves, whilst all the pipes are closed during the delivery stroke.

Furthermore, means are provided for opening and closing the suction and return pipes during the working of the compressor.—C. S.

*Gases Free from Tarry Matter and of High Calorific Value; Process and Generator for Producing Combustible* —. Fr. Pat. 349,107, Nov. 10, 1904.

SEE Eng. Pat. 21,333 of 1904; this J., 1905, 80.—T. F. B.

*Gases; Process for Treating [Drying]* —. J. G. Fr. Pat. 349,109, Nov. 19, 1904.

SEE Eng. Pat. 25,213 of 1904; this J., 1905, 539.—T. F. B.

*Mantle; Self-lighting* —. E. A. L. Rouzeville and S. Michaux. Fr. Pat. 349,023, Nov. 9, 1904.

THE interior surface of an incandescent mantle is wholly or partially impregnated with a mixture of platinum or a platinum compound and a refractory material, as alumina, lime, magnesia or silicates, preferably with aid of a volatile liquid. After the first ignition the action of the gas on the platinum will render it incandescent whereby the gas is lighted. The substance made deposited on the central or lateral rod which supports the mantle. A suitable mixture of material for 200 mantles, consists of 3 grms. of platinum chloride, 0.01 grm. of magnesia, and 60 grms. of oil or essence of turpentine.—R. L.

*Filament, Indestructible, for Lighting and Heating* —. G. Michaud and E. Delasson. First Addition, Dec. 7, 1904, to Fr. Pat. 346,307, Sept. 17, 1904 (this J., 1905, 125).

THE filament may be coloured by adding metallic salts to the ingredients used, in order to obtain a coloured flame. Thus, chromium oxide (e.g., 2½ per cent.) destroys the greenish hue of the mantle flame and imparts a colour analogous to that of the electric light.—C. S.

#### GERMAN PATENTS.

*Gas, Illuminating; Process for Increasing the Yield by the Introduction of Water-Gas into the Retort* —. W. Bentz. Ger. Pat. 157,470, March 29, 1903.

THE claim is for the introduction into the gas retort at the commencement of the gasification process, of a gas, which has been produced in the known manner passing steam through the residual coke in an air retort.—A. S.

*Gases, Illuminating and Heating; Process for the Recovery of Carbon Disulphide from* — [by means of Old Distillation of Vinasse]. Rositzer Zucker-Raffin. Ger. Pat. 157,563, May 19, 1903.

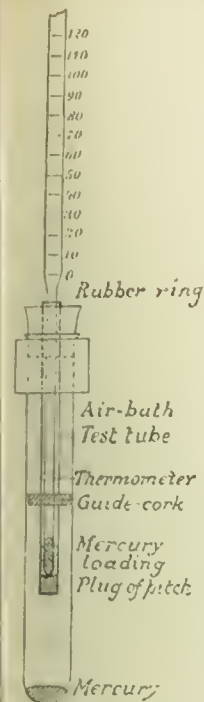
THE gases are washed with oil obtained by the distillation of vinasse. It is stated that this oil not only removes carbon disulphide, but is also a solvent of naphthalene.—A.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

*Pitch, Asphalts and Similar Substances; Determination of the Melting Point of* —. M. Wendtner. Z. a. Chem. 1905, 18, 622—625.

THE method of Kraemer and Sarnow (this J., 1903, 100) gives varying results owing to the difficulty of making the plugs of pitch of uniform shape and exactly the same depth, but especially also owing to differences in the rate at which the temperature rises during the determination. The author has accordingly modified the method in the following manner:—The heating-bath is brought to a temperature about 10° C. above the melting-point of the pitch, as determined in a preliminary test, and is maintained at this temperature during the determination. In the heating-bath is placed a wide test-tube containing a narrower tube closed at the end by the plug of





The pitch is covered with mercury, into which a thermometer dips, and the m. pt. is taken as the temperature indicated by this thermometer at the moment (invariably after about 8–10 mins.), when the mercury drops through the plug of pitch. Three or four plugs of pitch are prepared for each determination in the following way:—A glass tube 16 cm. long and 8 mm. wide, 1 mm. thick, and with one end ground perfectly flat, is fixed in a clamp, and a glass rod 20 cm. long and 7½ mm. thick is inserted from below until the end is exactly 10 mm. from the upper end of the tube. Into the hollow space left in the upper portion of the tube, a drop of water is introduced, and the glass rod is turned a little, so that the capillary space around it becomes filled with water. The water is then removed by filter paper and by gently warming the tube. The molten pitch, in a thinly fluid condition, is dropped into the hollow space, allowed to cool, the excess cut off level with

edge of the tube, and the glass rod withdrawn. Interior of the tube is now dried by means of a glass covered with filter paper, and 10 grms. of mercury introduced. The thermometer is fixed in the tube by means of a rubber ring, so that its bulb is, as far as possible, immersed in the mercury, but does not touch the pitch. The tube is then suspended within the wide tube (20 cm. long by 25 mm. wide) which serves as an air-bath, by means of a cork 20 mm. high, and a guide-rod (see Fig.). The wide tube is provided with a cork stopper by which it can be suspended from the cover of the air-bath. In the preliminary test, the water in the air-bath is brought to the boil, the air-bath containing the test tube, closed by the plug of pitch, is introduced, and the temperature at which the mercury drops through the plug is noted. The air-bath is then removed, allowed to cool to the ordinary temperature, and fitted with a glass tube with a pitch stopper. The heating-bath is allowed to cool to a temperature of 10° C. above the m. pt., and is maintained at this point during the true determination, which is carried out in the same way as the preliminary test. Two or three control tests should be made, and the results should not differ by more than a few tenths of a degree.—A. S.

*Adulterants in Natural Gum: Detection of Adulterants in Natural Gum* — B. Malenkovic. XXIII, page 638.

#### ENGLISH PATENTS.

*Refraction of Fluids [Petroleum, &c.]*. T. van der Linden, London. From W. van der Heyden, Yokohama, Japan. Eng. Pat. 10,797, May 10, 1904.

Eng. Pat. 346,860 of 1904; this J., 1905, 236.—T. F. B.

*Carbonaceous Compounds; Process of Making —, and Separating them from Sulpho-hydrocarbons or Sulphurous Compounds*. H. S. Blackmore, Mount Vernon, U.S.A. U.S. Pat. 19,744, Sept. 13, 1904.

U.S. Pat. 346,275 of 1904; this J., 1905, 127.—T. F. B.

#### UNITED STATES PATENTS.

*Wood-Distilling Apparatus*. Z. E. Fivens, Hickla, Miss. U.S. Pat. 789,271, May 9, 1905.

The apparatus consists of a cylindrical body tapering towards its upper end and containing a furnace in its lower portion; a smoke-box, with chimney stack attached to it in its upper portion; and a retort chamber arranged between the furnace and smoke-box. The partition between the furnace and retort chamber is of conical shape; it is formed of spaced sheets and is inclined towards an outlet valve. Cylindrical flues pass from the furnace through the retort chamber to the smoke-box.—R. L.

*Distilling Apparatus [for Wood]*. W. B. Harper, Lake Charles, La. U.S. Pat. 789,691, May 9, 1905.

A HORIZONTAL rotatable retort shell with fixed heads is heated by a furnace. A steam-supply pipe enters the retort through one of the heads, and valved vapour-outlet pipes pass out through the heads. Through the centre of the front head of the retort passes a feeding-conveyor, extending into the retort, and through the rear head, a discharge-conveyor. A chain, fixed at the front end of the retort, extends loosely along the bottom, and serves to carry the material forward to the discharge end, where it is raised by lifting-plates and delivered to the discharge-conveyor. In connection with the discharge-conveyor is a pressing-device, by which any liquid is separated from the residue, this liquid passing out through a pipe at the bottom of the rear head of the retort.—A. S.

#### IV.—COLOURING MATTERS AND DYE-STUFFS.

*Organic Compounds; Solubility of some — in Water at Different Temperatures*. J. Dolinski. Chem. Polski, 1905, 5, 237–240. Chem. Centr., 1905, 1, 1233.

THE author determined the solubility in water, at temperatures ranging from 0° to 100° C., of four organic acids largely used in the manufacture of dyestuffs. The solubility of *α*-naphthylamine-*o*-monosulphonic acid (grms. of substance in 100 grms. of solution) was as follows:—0° C., 0.24; 10°, 0.32; 20°, 0.41; 30°, 0.52; 40°, 0.65; 50°, 0.80; 60°, 1.00; 70°, 1.36; 80°, 1.78; 90°, 2.35; and 100° C., 3.10 grms. The results obtained with the three other acids are expressed in the following formulae wherein *x* is the percentage solubility (grms. of substance per 100 grms. of solution) and *t* is the temperature:—

For picric acid:  $x = 0.67 + 0.013t + 0.000195t^2 + 0.0000028t^3$

For sulphanilic acid:  $x = 0.64 + 0.0152t + 0.00041t^2$

For naphthionic acid:  $x = 0.027 + 0.00024t - 0.00000255t^2 + 0.000000205t^3$ .—A. S.

*Anthragallolamide*. F. Böck. Monatsh. Chem., 1905, 26, 571–593.

THIS compound is obtained by the addition of a concentrated solution of ammonium chloride to anthragallol dissolved in excess of dilute potassium or sodium hydroxide solution. It is also produced by exposing finely powdered anthragallol to the action of ammonia and subsequently heating the ammonium salt at 130° C. until it ceases to lose water, and all excess of ammonia has been removed. The amide so obtained is of great purity; it forms with alkali a fine blue solution, is very sparingly soluble in most organic solvents, but dissolves readily in hot pyridine, nitrobenzene, and aniline. It yields an anhydrous diazo compound when subjected to the action of amyl nitrite in strongly acid alcoholic solution, which is converted into xanthenpurpurin when reduced in alkaline solution by stannous chloride.—D. B.

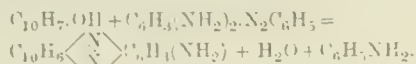
*Flavinduline; Condensation of —, with Methylene Compounds*. F. Sachs and G. Bargellini. Ber., 1905, 38, 1712–1715.

ONE of the authors has previously shown that flavinduline, as a type of the azonium bases, readily reacts with methylene compounds, yielding characteristic colorations

this J., 1899, 129). The condensation product with deoxybenzoin had been prepared, and from the fact that its alcoholic solution when treated with a few drops of hydrochloric acid, yielded an intensely blue-coloured salt, it was concluded that the two different colours were due to the presence of two different chromophoric groups of the ortho- and paraquinone types. In continuing this investigation, the authors were able to confirm the existence of two isomeric salts in the two coloured solutions, but attempts made with a view of obtaining a similar pair of salts from other known types of the same series gave negative results. The condensation products of flavinduline with the following compounds were prepared:—Ethyl acetate, benzyl cyanide, acetylacetone, ethyl malonate, ethyl cyanoacetate, and malononitrile. In each case the same tinctorial effects were produced, but the new compounds gave by analysis a molecule less water than the substance  $C_{19}H_{19}N_2O_2$  which had been obtained previously by the condensation of flavinduline with deoxybenzoin.—D. B.

*Naphthazines [Azine Dyes] from o-Aminonazo Compounds; New Synthesis of* — F. Ullmann and J. S. Ankersmit. Ber. 1905, 32, 1811–1822.

When *o*-aminonazo bodies are heated with  $\beta$ -naphthol or its hydroxy derivatives, naphthazines are formed with elimination of aniline and water. Thus if Chrysoidine is used, we have



The 2,7- and 2,3-dihydroxy derivatives of naphthalene react even more vigorously than  $\beta$ -naphthol. The Chrysoidine may be replaced by benzencazo-tolylendianiline, *o*-aminoazotoluene or benzencazo- $\beta$ -naphthylamine. The temperatures of reaction employed varied between 150 and 250° C. The products are yellow bodies, the solutions of which show green or blue fluorescence. By the action of 2,3-dihydroxynaphthalene on benzencazo-*m*-tolylendianiline, aminoanilidonaphthotolazine was also formed as a by-product, by the interaction of aniline with a hydroxy-group of the primary product.—E. F.

*Dyestuffs: Differentiation of Blue Sulphur* — A. Lüttringhaus. XXIII., page 638.

#### ENGLISH PATENTS.

*Indoxyl, its Homologues and their Derivatives. Improved Manufacture of* — O. Inray, London. From the Basle Chemical Works, Basle, Switzerland. Eng. Pat. 15,223, July 7, 1904.

INDOXYL is formed by heating together an alkali salt of phenylglycin, metallic sodium and an alkali in presence of alcohol. The alcohol prevents decomposition and increases the yield. The phenylglycin may be replaced by its homologues or derivatives, substituted indoxyls being thus obtained. For example, 15 parts of sodium and 40 parts of the potassium salt of phenylglycin are added, with stirring, to 140 parts of anhydrous alkali hydroxide at about 250° C. Thereupon 10 parts of absolute alcohol are added as vapour, in a short time, and with increasing rapidity by the aid of a current of hydrogen, and the heating continued until the amount of indoxyl no longer progresses. The hydrogen takes no part in the reaction, and the alcohol may be added as vapour or liquid in absence of hydrogen (see also U.S. Pat. 761,440 of 1904; this J., 1904, 712).—E. F.

*Dyestuffs [Azo]: Manufacture of Yellow Mordant* — O. Inray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Höchst on the Maine, Germany. Eng. Pat. 14,972, July 4, 1904.

SEE Ger. Pat. 158,148 of 1904; this J., 1905, 512.—T. F. B.

#### UNITED STATES PATENT.

*Dyestuff, Azo.* P. Julius and E. Fussenegger, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 789,096, May 2, 1905.

SEE Fr. Pat. 348,588 of 1904; this J., 1905, 494.—T. F. B.

#### GERMAN PATENTS.

*Dyestuff, Sulphide; Process for Preparing a Violet* — Kalle und Co. Ger. Pat. 157,733, June 12, 1903.

A SULPHIDE dyestuff which dyes red-violet shades fast to washing, soaping, and light, is obtained by m trihydroxyphenylrosinduline (see Ger. Pat. 158,077, abstract) with sodium sulphide and sulphur.—T. F. B.

*Trihydroxyphenylrosinduline [Azine Dyestuffs]; Process for Preparing* — Kalle und Co. Ger. Pat. 157,733, Dec. 4, 1902, and 158,100, Aug. 29, 1903.

SUBSTANCES such as the dyestuffs obtained combining diazo compounds with  $\alpha$ -naphthylamine which can be converted into 1,4-naphthylenediamine are heated with *p*-aminophenol and hydrochloric trihydroxyphenylrosinduline being produced. The compound may also be obtained by heating 1,4-naphthylendianiline with *p*-aminophenol and hydrochloric acid and then oxidising the product, preferably with an *o*-nitro-compound; also by heating  $\alpha$ -naphthylamine an aromatic nitro compound (or else  $\alpha$ -nitronaphthylamine) with *p*-aminophenol in presence of hydrochloric acid. The second patent relates to the use of *p*- or *m*-nitro as the oxidising compound in the above process; compounds may take the place of a portion of the *p*-aminophenol. The following example of the process is given: 28.5 kilos. of benzencazo- $\alpha$ -naphthylamine hydrochloride and 40 kilos. (4 mols.) of *p*-aminophenol are heated five hours at 160°–170° C., and the crude product with hot dilute hydrochloric acid.—T. F. B.

*Trihydroxyphenylrosinduline [Azine Dyestuffs]; Process for Preparing* — Kalle und Co. Ger. Pat. 157,733, Oct. 17, 1903. Addition to Ger. Pat. 158,077, 1902.

TRIHIDROXYPHENYLROSINDULINE may be obtained heating together the substances described in Ger. Pat. 158,077 (see above) in aqueous solution, instead of melting them together as there described.—T. F. B.

*Nitriles; Process for Preparing Acid* — H. Bueche. Ger. Pat. 157,710, Jan. 28, 1902.

SUCH salts or compounds of aromatic amines or derivatives which liberate hydrocyanic acid from cyanide and give a neutral reaction product, are mixed with alkali cyanide in molecular proportions, in presence of some solvent which has little or no solvent action on the cyanide, and an aldehyde or ketone is added to the mixture, resulting in the formation of acid nitriles. The preparation of the nitrile  $C_6H_5.NH.C_6H_5.CH(CH_3)CN$  (aniline hydrochloride, potassium cyanide and acetaldehyde solution, is described. One of the advantages claimed for this method is that no free hydrocyanic acid is generated during the reaction.—T. F. B.

*Nitriles; Process for Preparing Acid* — H. Bueche. Ger. Pat. 157,840, Nov. 14, 1901.

ACTO nitriles of the general formula,  $R.NH.CH(R')$  where R represents an aryl radical and R' an  $\alpha$ -hydrogen (excepting  $\omega$ -cyanomethylamine and its derivatives), are produced by the interaction of equimolecular weights of the bisulphite compounds of Schiff's base,  $R.N:CH(R').NaHSO_3$ , and an alkali cyanide in aqueous solution.—T. F. B.

*Nitriles; Process for Preparing Acid* — H. Bueche. Ger. Pat. 157,909, Nov. 14, 1901, and 157,910, Jan. 28, 1902.

NITRILES similar to those prepared according to Ger. Pat. 157,840 (see above) are obtained by adding an alkali cyanide to a mixture of an aromatic amine, an aldehyde (or ketone), and a bisulphite or sulphurous acid. The process avoids the isolation of the Schiff's base, which is not always easy, as in the case of  $\beta$ -naphthylamine. The second specification relates to the preparation of nitrile  $R.NH.CH(CH_3)CN$ ; for this purpose acetaldehyde is used instead of formaldehyde or an aromatic aldehyde.—T. F. B.



**Anthracene Derivatives [Azine Dyestuffs]; Process for Preparing** —. Act.-Ges. f. Anilinfabr. Ger. Pat. 7,861, Jan. 31, 1904.

ANTHRACINE derivatives are obtained by melting *o*-amino-compounds with  $\beta$ -naphthol. For example, 10 parts hydroquinone are added gradually to 15 parts of melted  $\beta$ -naphthol, and the mixture heated at about 210–215° C., high temperature aniline and water distil off. The *o*-aminonaphthazine is purified by heating with  $\beta$ -naphthol. The product is identical with that obtained from  $\beta$ -naphthylamine and quinone-dichlorodimide, giving cotton orange shades. Similar products are obtained by the use of benzene-*o*-*m*-toluylene diamine, *o*-amino-azobenzene.—T. F. B.

**Dyeing, Process for Preparing a Yellow Sulphide** —. Chem. Fabr. Weiler-ter-Meer. Ger. Pat. 157,862, March 24, 1904.

YELLOW dyestuffs which produce fast, pure greenish-yellow shades on cotton are obtained by heating benzidine with *o*-*m*-methylenbenzimidazole with sulphur to high temperatures.—T. F. B.

**Amides; Process of Preparing** —. A. Einhorn. Ger. Pat. 158,088, Sept. 23, 1902.

AMIDES are obtained by allowing formaldehyde to react with aromatic amides in acid solution for a short time. It is stated that secondary reactions occur if the reaction is prolonged.—T. F. B.

**Formic Acid, its Homologues, and their Substitution Products; Process for Preparing** —. Chem. Fabr. n-Heyden, A.-G. Ger. Pat. 158,089, Oct. 30, 1901.

ALCOHOLIC *o*-CARBOXYLIC acid derivatives of the general formula  $R.CO.C_6H_4.NR''CH_2COR'$  (where R and R' are hydroxyalkyl, amino, or alkylamino groups, and R'' represents hydrogen or acid radicals) are heated with alkali compounds of ammonia or its substitution products (the sodium derivative of acetanilide) in presence of an indifferent solvent, at a temperature of about 130° C. Yield of indoxyl derivative is stated to be about 90 per cent. of the theoretical yield.—T. F. B.

**Aniline Acid and Formaldehyde; Process for Preparing a Condensation Product from** —. Badische Anilin und Soda Fabrik. Ger. Pat. 158,090, Oct. 15, 1903.

CONDENSATION product similar to that obtained according to Ger. Pat. 117,924 (by condensation in ether) is used by the interaction of equimolecular weights of aniline acid and formaldehyde in aqueous solution for a long period. It is probable that hydroformaldehyde-anthranilic acid is produced as an immediate product. The resulting products are of use in the preparation of indigo; thus, with hydrocyanic acid salts, they are converted into *o*-cyanomethyl-anthranilic acid or its salts.—T. F. B.

**Dyeing, Indigo; Process for Preparing Compounds** —. Badische Anilin und Soda Fabrik. Ger. Pat. 158,025, Oct. 27, 1903.

INDIGO dyestuffs with concentrated aqueous solutions of alkalis or alkaline earths, or with alcoholic solutions of alcoholates, at the ordinary temperature, reaction products are obtained which are slightly soluble in alcohol. They are easily resolved by water into the dye and the hydroxide, and, owing to the dyestuff being then obtained in a finely divided condition, are thus well suited for the preparation of "fermentation dyes"; the compounds may also be used for silk dyeing.—T. F. B.

**Phenolic Oxidation Products [and Sulphide Dyestuffs] from *p*-Chlorophenol; Process for Preparing** —. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 158,091, Dec. 20, 1903.

LIKE other *p*-substituted phenols, *p*-chlorophenol, on oxidation in aqueous solution together with one of an alkylated *p*-diamine or *p*-aminophenol, com-

pounds resembling indophenols, and containing an *o*-quinonoid grouping:—



where X represents a mono- or dialkylamino, or a hydroxy group. These compounds are converted into azo derivatives by reduction with sodium sulphide, and these latter are converted into sulphide dyestuffs by heating with alkali polysulphides. For example, the product from *p*-chlorophenol and dimethyl *p*-phenyl-medianiline gives a blue dyestuff, converted to green in presence of a copper salt.—T. F. B.

**Dyestuffs of the Anthracene Series; Method of Preparing** —. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 158,257, March 10, 1904.

ANTHRACENE dyestuffs, dyeing wool violet to red shades, modified on chroming to green, are obtained by sulphonating the compounds produced by condensing 1-hydroxy-2-methoxy-4-halogenated anthraquinones with aromatic amines.—T. F. B.

**Hydroxyanthraquinoneglycollic Acids or Esters; Process for Preparing** —. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 158,277, Jan. 27, 1904.

MONOHALOGEN substituted acetic esters react with salts of hydroxyanthraquinones, forming the esters of the hydroxyanthraquinoneglycollic acids; these are easily saponified to obtain the free acids. The following compounds are described:—1- and 2-hydroxyanthraquinone-mono-glycollic ethyl ester, Alizarin-2-mono-glycollic ethyl ester, and Anthrachrysone-3,7-diglycollic ethyl ester.—T. F. B.

***o*-Dimethoxyanthraquinones [Anthracene Dyestuffs]; Process for Preparing** —. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 158,278, Feb. 11, 1904.

ORTHO-DIMETHOXYANTHRAQUINONES may be obtained by heating with alkali, in methyl alcohol solution, such nitromethoxyanthraquinones as have their substituent groups in the *o*-position to one another. Other nitromethoxyanthraquinones are not subject to this reaction, neither are nitrohydroxy- or nitro-aminoanthraquinones. The new dimethoxy compounds serve as intermediate products for the preparation of dyestuffs.—T. F. B.

**Dyestuffs, Sulphide; Method of Preparing Yellow** —. K. Gehler. Ger. Pat. 188,662, Feb. 27, 1904.

THE product obtained by the condensation of 2,4-tolylene-diamine and *p*-toluenesulphochloride (2 mols.) is heated with sulphur to a high temperature, preferably in presence of some high boiling aromatic amine; by heating the resulting products with an alkali hydroxide or sulphide, dyestuffs are obtained which dye fast yellow shades, scarcely modified by chroming.—T. F. B.

## V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

**Chromaline D [Mordant].** A. Abt. Bull. Soc. Ind. Mulhouse, 1905, 75, 84–86.

CHROMALINE is prepared, according to Fr. Pat. 291,471, by the reduction of chromic acid with glycerol or other polyhydroxylated aliphatic compounds under such conditions that the latter are not completely oxidised. The author states that better effects are produced by printing on wool with the help of this mordant than when chromium acetate or fluoride is used, and that the difference is especially noticeable in the case of certain mordant dyestuffs, for instance, Anthracene Brown. When equivalent quantities of the three mordants, i.e., quantities containing equal amounts of chromium, were used, Anthracene Brown yielded bright, very fine and intense shades when fixed with chromaline, whereas the shades obtained with

chromium acetate were weaker, redder and less beautiful; with chromium fluoride the shades were greener and duller. The results obtained when equal quantities of chromaline of 25 B. (containing 7.5 per cent. of chromium oxide) and of chromium acetate of 20 B. (containing 11.5 per cent. of chromium oxide) were used, differed but little in shade and intensity from those described above. The author also states that the results obtained by the use of chromaline in printing on wool are faster to fulling and sharper than those obtained with other chromium mordants. He ascribes these results to the fact that chromaline is dissociated much more easily than the other compounds. —E. F.

*Chromaline [Mordant]: Report on A. Abt's Note on —.* R. Kaeuffer, Bull. Soc. Ind. Mulhouse, 1905, 75, 86—88. (See preceding abstract.)

THE author is unable to confirm the results of A. Abt. It is true, he says, that the brown produced with Anthracene Brown and chromium acetate is less intense and redder than that produced with the help of chromaline; but, on the other hand, a distinctly brighter and better brown is produced with chromium fluoride than with either of the other mordants. Similar results were obtained with Alizarine S. Anthracene Blue, Mordant Yellow R (Badische), and Alizarine Blue-black (Bayer). The results obtained with the aid of chromium fluoride were sometimes less clear than those obtained with chromaline, but of greater practical value. When equal quantities of chromaline of 25 B. and of chromium acetate of 20 B. were used for fixing, the shades produced with the latter were generally faster to fulling and to potting. When employed in equivalent quantity, chromaline yielded faster shades than the acetate, but they were not as fast as those produced with chromium fluoride. Scouring tests did not show appreciable differences. The author steamed in a wooden chest in his experiments, whereas A. Abt used an autoclave, which may account for differences. —E. F.

*Trinitrobenzene Derivatives on Wool and Silk; Dyeings of —.* E. O. Sommerhoff. Z. Farben-u. Textil-Ind., 1905, 4, 209.

ON boiling woollen yarn with distilled water containing 0.1 gm. of trinitrobenzene per litre, the wool is coloured a faint yellow. If ordinary spring water be used, a reddish-brown coloration is obtained. Silk behaves similarly. The trinitrobenzene separates unchanged on cooling. If picryl chloride be used with distilled water, the wool takes a deep orange-red colour although the dye-bath remains a pale yellow. With silk an orange-yellow colour is obtained. In neither case is free hydrochloric acid liberated so that the colour cannot be due to the formation of picric acid, which would, besides, dye wool a light yellow. These results are favourable to the "chemical theory" of dyeing. —A. B. S.

*Aniline; Oxidation on the Fibre of the Higher Homologues of —.* S. Kirpitschnikoff. Z. Farben-u. Textil-Ind., 1905, 4, 233—234.

ORTHO- meta- and para- toluidine, xyloidine and emuidine were printed on cotton material and oxidised on the fibre with sodium chlorate and potassium ferrocyanide in the manner usual in the production of Aniline Black. The colours obtained were: —o-toluidine, dark violet; m-toluidine, blackish-violet; p-toluidine, chestnut-brown; xyloidine, black; emuidine, brown. The dyeings are stated to be little changed by soaping, but are inferior to those with Aniline Black, in fastness to dilute sulphuric acid, chlorine and light. The nearest to Aniline Black in point of durability is Xyloidine Black. —H. L.

*Paper Yarn and its Uses.* C. Beadle. XIX., page 633.

#### ENGLISH PATENTS.

*Flax, Jute and Similar Fibres; Process of Treating — for the purpose of Bleaching.* G. de Keukelaere, Brussels. Eng. Pat. 13,773, June 17, 1904.

It is stated that "all the organic and other substances" which retard the bleaching of flax, jute and similar fibres

may be removed by "scalding" the fibres in a solution of an alkali or alkaline earth sulphide (e.g., a 5 to 15 per cent. sodium sulphide solution) for about half an hour; fibres are then washed and rinsed in a dilute acid solution and the process repeated twice or thrice; the bleaching is then proceeded with in the usual way. —T. F. B.

*Warps; Method of and Apparatus for Printing*

G. Morton, Carlisle. Eng. Pat. 9341, April 23, 1904.

THE invention relates to the printing of warp yarn in the production of figured woven fabrics such as laces or tapestry carpets. The warps are fed through a frame on to a beam, below which are a series of colour type blocks, which are controlled by Jacquard or similar mechanism, press the yarn on to the colour pads; blocks are mounted on a suitable frame which oscillates up and down. At each downward stroke certain of the type blocks are rendered inoperative by tension of harness threads controlled by the Jacquard. The colour pads are connected with drains or troughs which automatically feed with the colour mixture. —E. F.

*Discharges on Dyed Materials; Production of Colour*

J. Y. Johnson, London. From Badische Anilin- und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Pat. 15,943, July 18, 1904.

SEE Fr. Pat. 344,681 of 1904; this J., 1904, 1213. —T.

*Discharging Pastes [Hydrosulphites] for use in*

*charging Dyed Textile Fabrics; Manufacture of —.* J. Y. Johnson, London. From Badische Anilin- und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Pat. 15,944, July 18, 1904.

SEE Addition of Aug. 8, 1904, to Fr. Pat. 297,370 of 1903; this J., 1905, 87. —T. F. B.

#### UNITED STATES PATENTS.

*Felt Cloth; Process of Making —.* J. B. L. Philadelphia, Pa., U.S.A. U.S. Pat. 789,098, May 2, 1905.

THE materials of which the felt is to be made, after cut up into "short length fibres," are partially saturated with oil, and thoroughly dried. They are then saturated with warm oil, after which the felting is completed. The fabrics produced, while they are still impregnated with oil, are finally "finished" with a paper, and, if desired, are pressed by means of hot rollers. The dyeing and felting, instead of being performed separately, as described, may be effected simultaneously while the materials are saturated with oil. —E. B.

*Mercerising, &c.; Machine for —.* W. H. Cronin and W. Horrocks, Radcliffe, England. U.S. Pat. 789,260, May 9, 1905.

SEE Eng. Pat. 10,255 of 1903; this J., 1904, 659. —T. B.

*Warps; Apparatus for Printing — on Printing Drums.* F. Schmidt, Oberschöneweide, Germany. U.S. Pat. 789,068, May 2, 1905.

A COMBINATION of the following apparatus is claimed: A printing-drum with crown-teeth arranged at one end of it; a pattern-drum of smaller diameter than the printing-drum; a shaft carrying (i.) a toothed wheel engaging with the crown-teeth on the printing-drum, (ii.) a second wheel engaging with gear on the pattern-drum, and (iii.) a third wheel gearing with a wheel on a second shaft on which is fixed an operating wheel; an indicating device arranged near the printing-drum, pattern-drum and the indicator are movable relative to each other, their movement imparting, through transmitting gear, a corresponding movement to the printing-drum. —E. B.

*Warps; Double Printing-Drum for Printing —.* F. Schmidt, Oberschöneweide, Germany. U.S. Pat. 789,069, May 2, 1905.

CLAIM is made for apparatus for printing yarns in the



various, comprising two printing-drums of different diameters bearing crown wheels, the drums being connected by a pattern drum; a transmitting device for giving motion to each of the printing-drums, when in operation, the drums moving with different angular velocity; an indicating device, arranged to indicate the position of the pattern-drum; and a shafting and gearing, arranged to use the movement of the pattern-drum to be transmitted to each of the printing-drums.—E. B.

#### FRENCH PATENTS.

*Artificial* ——. L. Bergier. Fr. Pat. 349,131, March 10, 1904.

Wool is scoured, treated with a boiling 2 per cent. solution of hydrochloric acid, dried at 120°–130° C., and then treated in a mixture of 30 litres of nitric acid (40° B.) and 50 litres of sulphuric acid (66° B.) per 2 kilos. of wool. After 20–25 minutes the nitrocellulose is removed, washed with water and then with alcohol, and dried in ether-alcohol (3:1); the pyroxylin is then dissolved into threads in the usual way, and these are dyed by immersion for some hours in a solution of pyridine chloride at a temperature of 60° C., washed with water and then with dilute hydrochloric acid, again washed with water, and dried.—T. F. B.

*Centrifugal Machine with Circulation of Liquid* [for textiles]. J. Selwig. Fr. Pat. 348,673, Nov. 16, 1904. This machine is designed for treating textile and other materials with a circulating liquid, the cage being run at high speed, and afterwards for draining them by running at high speed after the liquid has been withdrawn.

This object is attained by a small annular space is left between the perforated central cone of the cage and the main support supporting the driving spindle, and communication is established between this space and the fixed casing of the machine, either by pipes or by channels leading to the bottom of the casing. When the machine is run, the centrifugal force produces a depression in the surface of the liquid nearest the central cone of the cage, and consequently the liquid in the annular space flows through the perforations into the cage, and is constantly replaced by the return flow through the channels communicating with the outer casing.—C. S.

*Washing Materials; Machine for Washing and Rinsing* ——. F. Bernhardt. Fr. Pat. 348,784, Dec. 12, 1904.

This machine consists of a long trough with a perforated bottom placed close to the surface of the liquid. The bottom consists of a series of shallow perforated plates, which run in a longitudinal direction, and are hinged to the surface of the liquid. Each curved plate is joined to the next by a short plate which is not perforated and may be either horizontal, or corrugated in any suitable manner so as to offer resistance to the movement of material lying on it. These plates are very close to the surface of the liquid. Above each plate is a series of spraying pipes through which a strong current of water or washing liquid is forced on to the material on the plates, the closeness of which to the surface of the liquid prevents the material being submerged, and so escaping from the action of the sprays. The material is fed in at one end of the machine and discharges from one plate to the next by an arrangement of rollers which follow the curved bottoms of the intermediate spaces. The liquid can be circulated by means of a pump.—A. B. S.

*Scouring Machines Suitable for Treating* — [with wool]. J. W. Fries. Fr. Pat. 349,145, Dec. 12, 1904.

Eng. Pat. 26,084 of 1904; this J., 1905, 273.—T. F. B.

*Scouring Loose* — by the aid of Electricity. J. M. Baudot. Fr. Pat. 349,042, Dec. 13, 1904.

Wool, in the loose state, is placed upon an endless, travelling apron; and thus conveyed, between this and a second endless apron, through a wood or slate scouring-tank. The scouring apron is composed of metal bars, placed parallel to one another upon two endless chains. This constitutes

an electrode, being connected with a terminal of a source of electric current; a curved, perforated metallic plate, fixed a little below the surface of the scouring bath, forms the second electrode, and the upper apron, which is made of pervious textile material, acting as a diaphragm. Heat is supplied to the bath by a steam pipe. At the commencement of the operation of scouring, several minutes' action is required to effect the removal of the fatty, &c., matters from the wool during its passage through the tank, but, as the potash and other salts extracted from the wool accumulate, the action becomes more rapid. The heavier matters pass to the bottom of the bath; the fatty matters rise to its surface. The valuable constituents of the unscoured wool are afterwards recovered.—E. B.

*Embossing or Printing of Fabrics; Blocks for* ——. E. Roudet. Fr. Pat. 348,836, Feb. 24, 1904.

The printing block consists of a rectangular frame one side of which is adjustable by means of screws. This frame is filled with a number of cylindrical "pins" of the same length, made of steel or other material. These are packed parallel in the frame so that only their ends project. By loosening the screws, any required number of these can be made to project beyond the surface of the remainder, and so form any required pattern when used for embossing or printing.—A. B. S.

*Fabrics, Papers, Leathers, &c.; Decoration of* ——. L. Guetton-Dangon. First Addition dated Feb. 27, 1904, to Fr. Pat. 348,837, Feb. 24, 1904.

INSTEAD of mounting the "rubbers" firmly on a table so as to always give a plane rubbing surface, each of the separate rubbers is pressed into the engraving by means of a spring, and so gives a more delicate design.—A. B. S.

*Fabrics, Papers, Leather, &c.; Ornamentation of* ——. L. Guetton-Dangon, Fr. Pat. 348,977, Feb. 29, 1904.

A HOLLOW cylinder is employed which is perforated with the required design. Inside this are placed rubbers, or metallic brushes, preferably heated, which are pressed by means of springs so that they act through the perforations to produce effects on the surface of the material, which is passed over the cylinder. The fabric can be on another cylinder or on a plane surface and both the fabric and the pattern cylinder can be given suitable movements so as to obtain the required effects on the fabric.—A. B. S.

*Tissues, Process and Apparatus [Blocks] for Printing* ——. F. Rose. Fr. Pat. 349,138, Dec. 8, 1904.

A PRINTING-block is prepared in two or more pieces which fit together. A portion of the design is engraved upon one of the pieces, in which holes are arranged, the rest of the design being engraved upon raised parts of the other pieces, which fit into the openings in the first piece in such a manner that the printing surface of the whole block is in one plane. Each piece is further provided with an auxiliary colouring block, bearing projections or openings, as the case may be, upon which it is placed during the operations of applying colour to it, and removing the excess of the latter from it. After detaching the auxiliary blocks, the various parts of the printing block, which may conveniently be supplied with different colours, are fitted together to form a composite block, with which the printing of tissues is then accomplished in the usual manner.—E. B.

*Textile Materials; Preparation [from Starch and Gluten] for Finishing* ——. Erste Triester Risschäl-Fabriks-Act.-Ges. Fr. Pat. 349,074, Dec. 17, 1904.

RICE flour rich in gluten, or a mixture of ordinary rice flour with a sufficient quantity of gluten to bring the total content in the latter up to 8 per cent., is gently heated with steam to soften it, and is then completely cooled. It is then treated for an hour with an alkali, e.g., ammonium carbonate (one part in a 5 per cent. solution, for 20 parts of the proteid matter) to dissolve the gluten. Lactic acid (two parts of the anhydride for five parts of the proteid) is next added. After being well stirred, the mass is evaporated to dryness, the dry product ground to powder

and stirred. The lactic acid may be produced by the decomposition of a portion of the starch. Acetic acid may be employed instead of it.—E. B.

#### GERMAN PATENT.

*Dyes, Sulphide: Process for Producing* — on the *Fabrics, Act. Pat. 1 Anilinfabr. Ger. Pat. 158,328, March 14, 1904.*

Blue or black shades may be obtained on fibres by printing or padding the material with a mixture of an alkali polysulphide and an aminohydroxy, nitrohydroxy, or nitroaminohydroxy derivative of the benzene series, and then steaming. The shades obtained are stated to be clear and fast: it is also stated that the fibres are not weakened. *p*-Aminophenol, dinitrophenol, and nitroaminohydroxydiphenylamine give black shades by this method, whilst the sulphophenol from *p*-aminodimethylaniline and phenol, gives blue shades.—T. F. B.

### VI.—COLOURING WOOD, PAPER, LEATHER, &c.

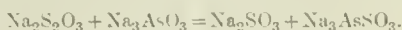
*Fabrics, Papers, Leathers, &c.: Decoration of* — L. Guetton-Dangon. First Addition dated Feb. 27, 1904. to Fr. Pat. 348,837, Feb. 24, 1904. V., page 617.

*Fabrics, Papers, Leather, &c.: Ornamentation of* — L. Guetton-Dangon. Fr. Pat. 348,977, Feb. 29, 1904. V., page 617.

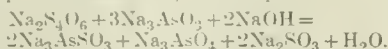
### VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

*Tetrathionates: Reduction of* — to Sulphites by Arsenite and Stannite. A. Gutmann. Ber., 1905, 38, 1728—1734.

WEINLAND and the author have previously shown (this J., 1899, 80) that by the action of sodium arsenite on sodium thiosulphate, one atom of sulphur is withdrawn from the latter, whereby it is converted into sulphite, whilst, at the same time, sodium monosulphoxyarsenate is formed from the arsenite.



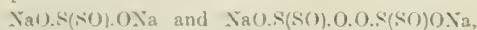
The behaviour of sodium tetrathionate to sodium arsenite and sodium stannite in alkaline solution, has now been investigated. It was found that by the action of sodium arsenite on sodium tetrathionate in sodium hydroxide solution, tertiary sodium arsenate is always formed, in addition to sodium sulphite and monosulphoxyarsenate. No formation of sodium sulphate, sulpharsenate or disulphoxyarsenate ( $\text{Na}_3\text{AsS}_2\text{O}_6$ ) could be detected. Quantitative experiments showed that the reaction proceeds according to the equation:—



This behaviour of sodium thiosulphate and tetrathionate is not in accord with the formulæ generally accepted for these compounds, viz.,



but points rather to the formulæ



respectively. Sodium stannite reduces sodium tetrathionate in a similar manner to sodium arsenite, sodium sulphite, sulphostannate and stannate being produced.

—A. S.

*Calcium Sulphate in Ammonium Sulphate Solution.* E. C. Sullivan. J. Amer. Chem. Soc., 1905, 27, 529—539.

THE author determined the solubility of calcium sulphate in solutions of ammonium sulphate at 25° C. The results obtained are shown in the following table:—

Concentration of Ammonium Sulphate.	Weight of Calcium Sulphate Dissolved.	Concentration of Ammonium Sulphate.	Weight of Calcium Sulphate Dissolved.
Gm.-mols. per litre.	Grms. per 100 c.c.	Gm.-mols. per litre.	Grms. per 100 c.c.
0.00	0.2083	0.06250	0.44
0.0009768	0.2048	0.1250	0.44
0.001953	0.1996	0.2500	0.46
0.007812	0.1807	0.7500	0.23
0.01564	0.1658	1.5000	0.23
0.03125	0.1540	3.0000	0.459

The curve is similar to that found by Cameron Seidell (this J., 1902, 549; 1904, 865) for the solubility of calcium sulphate in sodium sulphate solution.—A. S.

*Calcium Sulphate: Solubility of* — in Solutions of Salts. F. K. Cameron and B. E. Brown. J. of Chem., 1905, 9, 210—215. Chem. Centr., 1905, 1.

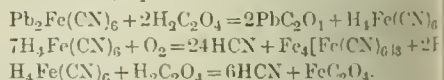
THE solubility of calcium sulphate in solutions of ammonium chloride and nitrate at 25° C. was determined. Maximum solubility was observed in both cases 10.88 grms. of calcium sulphate in a solution containing 210 grms. of ammonium chloride per litre, and 12.20 in one containing 750 grms. of ammonium nitrate per litre. The solubility curve is tolerably steep in the vicinity of maximum point in the case of ammonium chloride, very flat in the case of ammonium nitrate. The solubility of calcium sulphate in saturated solutions of salts was also determined, the following results obtained:—

Salt.	Grms. of Salt per Litre.	Grms. of Calcium Sulphate per Litre.
Sodium chloride .....	318.3	5.52
Sodium nitrate .....	668.4	7.16
Sodium sulphate .....	254.6	2.58
Magnesium chloride ...	476.5	1.09
Magnesium nitrate ...	615.1	15.26
Ammonium chloride ...	375.3	7.8
Ammonium nitrate ..	—	7.55

Calcium sulphate is insoluble in saturated solutions of calcium chloride and nitrate. (See also this J., 1865.)—A. S.

*Lead Ferrocyanide: Action of Oxalic Acid on* A. Leuba. Ann. Chim. anal. appl., 1905, 10, 143. Chem. Centr., 1905, 1, 1463.

IF lead ferrocyanide be boiled for two to three hours with oxalic acid solution, there are produced ferrous ferrocyanide, which forms with the excess of oxalic acid, a golden-brown solution, a white precipitate of lead oxalate, a precipitate of Prussian blue, and hydrocyanic acid. The formation of Prussian blue is due to a secondary reaction, as is shown in the following equations:—



When boiled with sulphuric acid, lead ferrocyanide decomposed, in an analogous manner, into lead sulphate, Prussian blue, and hydrocyanic acid.—A. S.

*Mercuric Iodide: Action of* — on Sulphuric Acid on the Mercuric Sulphates. A. Ditte. Comptes Rendus, 1905, 140, 1162—1167.

THE author has in 1878 demonstrated the existence of the volatile compounds  $\text{HgSO}_4$ ,  $\text{HCl}$  and  $\text{HgSO}_4$ , but no analogous iodine compound is formed. The reaction of hydriodic acid on mercuric sulphate or of sulphuric acid on mercuric iodide. When the latter two compounds are heated together, mercuric iodide slowly sublimes, and at a higher temperature some iodine is formed and also sublimes, while the liquid after cooling deposits groups of white silky needles.



iodine is produced, according to the author, by the action on the iodide of sulphur trioxide resulting from partial dissociation of the sulphuric acid:  $\text{HgI}_2 + \text{H}_2\text{SO}_4 = \text{HgSO}_4 + \text{SO}_2 + \text{I}_2$ . No dissociation of mercuric iodide occurs at the temperature of the experiment. On heating mercuric iodide to Nordhausen sulphuric acid, a liquid is at once formed, which, on heating, evolves a dioxide. On continued heating, the colour gradually disappears, and the liquid on cooling deposits mercuric sulphate, and, after some time, a crystalline  $\text{HgI}_2 \cdot 3\text{HgSO}_4$ . A number of compounds of mercuric iodide with normal and basic mercuric sulphates are obtained by digesting mercuric iodide with sulphuric acid of various strengths in which has been dissolved as mercuric sulphate as it can take up.—J. T. D.

*Solubility of — in Benzyl Chloride.* J. russk. J. russ. phys.-chem. Ges., 1905, 37, 92—99. (M. Centr., 1905, 1, 1207—1208.) Benzyl chloride melts in benzyl chloride at 106.8° C., and forms two layers, the upper one a solution of sulphur in benzyl chloride, and the lower one a solution of benzyl chloride in sulphur. Above 124.2° C. the two liquids are miscible in all proportions. The results of the solubility determinations were as follows:—

Temperature of sulphur per 100 grms. of solution (upper layer) .....	—	0°	17°	35°	46.1°	63.3°	78°
.....	—	0.99	1.78	2.57	3.64	6.15	9.88
Temperature of sulphur per 100 grms. of solution (upper layer) .....	99.1°	109.6°	114.6°	118.8°	121.4°	130°	131.2°
.....	19.89	—	—	37.20	40.04	49.71	56.20
Temperature of sulphur per 100 grms. of solution (lower layer) .....	—	90.62	87.99	—	85.02	80.07	72.23

*and Sulphuric Acids; Behaviour of Mixtures of —* A. Saposchnikow. XXII., page 635.

*Acid; Determination of — by Permanganate in presence of Hydrochloric Acid.* G. P. Baxter and L. Zonetti. XXIII., page 639.

*Iodates and Iodides; Reduction of — for quantitative Determination of their Halogen Contents.* F. Annasch and A. John. XXIII., page 637.

*Mercuric Iodide; New Compound [Iodosmous Acid] of, and Reaction for — [also, for Detection of Iodides].* P. Arz. XXIII., page 637.

*Mercuric Iodide; Detection of Salts of —, Modification of Fehling's Reagent.* J. Bougault. XXIII., page 636.

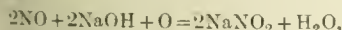
*Carbon Monoxide and Silver Oxide; Reaction between —, and its Application for the Detection of Carbon Monoxide in the Atmosphere.* H. Dejust. XXIII., page 637.

*Carbon Monoxide; A Red Solution of — obtained by means of Carbon Monoxide [Detection of Carbon Monoxide].* J. Bougault. XXIII., page 637.

# ENGLISH PATENTS.

*Improved Process for the Production of —.* S. Eyde, Christiania, Norway. Eng. Pat. 28,613, Dec. 28, 1904. Under Int. Conv., Jan. 22, 1904.

It is stated that nitric oxide in the presence of oxygen and with alkali or alkaline-earth hydroxides to form nitrate, thus:



It is stated that the simultaneous formation of nitrates. In the gases of electric furnaces, containing nitric oxide with much air, are quickly, but if necessary after being brought into contact "with alkalis or earthy substances so that further oxidation of the nitrogen into higher oxides of oxygen is rendered impossible."—E. S.

*Nitrates; Production of Pure — from a Mixture of Nitrates and Nitrites.* S. Eyde, Christiania, Norway. Eng. Pat. 28,614, Dec. 28, 1904. Under Int. Conv., Jan. 26, 1904.

To the solution of mixed nitrates and nitrites produced by the action of nitrous gases on alkali or alkaline earth hydroxides or carbonates, nitric acid is added, and the nitrous vapours evolved are utilised, preferably by returning them to the apparatus in which the mixture of such nitrates and nitrites is produced. The nitric acid in adequate proportion, may be added to the boiling, or to the cold solution of the mixture; but in the latter case a current of air is passed through the solution.—E. S.

## UNITED STATES PATENTS.

*Sulphuric Anhydride and Sulphuric Acid Vapours; Process of Recovering —, from Gases.* M. Schroeder, Berlin; Germany, Assignor to New Jersey Zinc Co., New York. U. S. Pat. 789,634, May 9, 1905.

SULPHURIC acid mists or fogs are passed, with the accompanying gases, through a body of finely-divided material, resting on a perforated support in a horizontal cylinder. The material is saturated with sulphuric acid, and absorbs any free sulphuric anhydride present in such gases.—E. S.

—A. S.

*Sulphur-Burner.* H. Blumenberg, jun., Daggett, Col. U. S. Pat. 788,512, May 2, 1905.

THE burner, which is long relatively to its diameter, has a flat horizontal floor supported by angle-irons, an arched top, an air-supply pipe, a normal and an auxiliary discharge pipe, the latter valved, and a charging trap having a quick-opening door. There is a door at one end of the burner admitting to a cleaning trap. (Compare U. S. Pat. 734,397 of 1903; this J., 1903, 950.)—E. S.

*Perborate; Process of Making [Alkali] —.* O. Liebknecht, Frankfort-on-the-Maine, Germany, Assignor to Roessler and Hasslacher Chemical Co., New York. U. S. Pat. 788,780, May 2, 1905.

SEE Eng. Pat. 22,004 of 1904; this J., 1905, 197.—T. F. B.

*Copper Sulphate; Process of Making —.* A. L. Walker, New York. U. S. Pat. 788,862, May 2, 1905.

OPEN frames, containing "shot copper," are suspended over a vat into which sulphuric acid flows continuously, in such a manner that they can be successively immersed and withdrawn, at frequent intervals, by mechanical means. The vat is heated, and as the heavy crystallisable solution of the sulphate accumulates in the lower part, it is allowed to run off in proportion as acid is admitted to the top of the tank.—E. S.

*Potassium Salts; Process of Making —.* A. J. Swayze, Danville, N.J. U. S. Pat. 789,074, May 2, 1905.

A MIXTURE of crushed potash felspar, gypsum and carbon (or other reducing agent), is heated to fusion in a closed vessel, and the "potassium products" volatilised, are collected in water.—E. S.

*Phosphate Rock; Process of Treating —.* E. J. Machalske, Brooklyn, N.Y., Assignor to F. Darlington, Great Barrington, Mass. U. S. Pat. 789,438, May 9, 1905.

A MIXTURE of an ore containing calcium phosphate, with sodium chloride and an excess of carbon, is heated, electrically or otherwise, to a high temperature, to produce a chloride of phosphorus, and carbides of calcium and of sodium.—E. S.

*Phosphate Rock; Process of Treating —, and Producing Compounds of Phosphorus and Nitrogen.* F. J. Machalske, Brooklyn, N.Y., Assignor to F. Darlington, Great Barrington, Mass. U.S. Pat. 789,439, May 9, 1905.

A MIXTURE of an ore containing calcium phosphate, with an alkali-metal chloride and carbon, is smelted at a high temperature, electrically or otherwise, in the presence of nitrogen, to produce a chloride of phosphorus and cyanamide of calcium and of an alkali metal. The cyanamide is treated with water to produce ammonia and a carbonate of calcium and of the alkali metal.

—E. S.

*Phosphate Rock; Process of Treating —, and Producing Phosphorus Chlorides and Alkali-Metal Cyanides.* F. J. Machalske, Brooklyn, N.Y., Assignor to F. Darlington, Great Barrington, Mass. U.S. Pat. 789,440, May 9, 1905.

ONE portion of the cyanamides of calcium and of an alkali-metal obtained, together with a chloride of phosphorus, as described in the preceding abstract, is treated with water for the production of the carbonates of calcium and of the alkali metal, and the remaining portion of the cyanamides is mixed with the alkali metal carbonate so obtained, and the mixture is heated to obtain the cyanide.

—E. S.

*Chlorates and Perchlorates; [Electrical] Manufacture of —.* M. Coulerin, Geneva, Switzerland. U.S. Pat. 788,631, May 2, 1905.

AS alkali chloride solution is electrolysed to form a chlorate and perchlorate, and the alkali formed is "neutralised" by the addition of lead chloride. The lead hydroxide precipitated is transformed into peroxide.—E. S.

*Alkaline Fluosilicates; Process of Making —.* J. A. Reich, Vienna, Austria-Hungary. U.S. Pat. 789,671, May 9, 1905.

THE process for recovering "alkaline fluosilicates" from the residues formed in the conversion of "alkaline silicofluoride" into alkali by means of lime, consists "in boiling the said residues with substantially as much lime as that necessary for the complete conversion of the alkaline silicofluoride, said boiling being effected during the production of the alkali itself for the sake of obtaining a more intimate mixing of the residues with the lime, treating the residues resulting from said boiling with an acid, and precipitating therefrom the alkaline fluosilicate by means of a salt of the desired alkali."—E. S.

#### GERMAN PATENTS.

*Dissolving Salts; Centrifugal Apparatus for —, with Circulation of the Solvent Liquid.* Brandt and Fude. Ger. Pat. 156,705, Dec. 11, 1902.

THE apparatus consists of a rotating annular perforated drum containing the salt, arranged in a closed chamber into which the solvent liquid is fed. Between the outer wall of the perforated drum and the wall of the outer chamber is disposed an annular stationary division plate provided with suitable openings, and it is claimed that this plate causes an intimate mixing of the solution ejected from the drum in a radial direction by the centrifugal force with the liquid contained in the space enclosed by the drum, whereby rapid and complete saturation of the solvent liquid is effected.—A. S.

*Silicides, Borides, Aluminides, and analogous Compounds; Process for the Preparation of —.* E. Jüngst and R. Mewes. Ger. Pat. 157,615, Feb. 4, 1902.

REFRACTORY halogen compounds of metals are heated in the electric furnace with elements, the halogen compounds of which are more readily volatile and which can be formed by direct union of the element and halogen with evolution of heat; suitable elements are silicon, boron, aluminium, iron, chromium, tin, and phosphorus. For example, calcium ferride,  $\text{CaFe}$ , can be obtained by subjecting a mixture of nearly equal parts of calcium chloride and iron powder to a white heat in a closed electric furnace connected

with a condensing chamber. When the mixture the calcium chloride decomposes; ferrous chloride passes over and collects in the condensing chamber, whilst calcium ferride is tapped off from the bottom of the furnace.—A. S.

#### VIII.—GLASS, POTTERY, AND ENAMELS.

*Fused Silica Tubes [Quartz Glass]; Permeability of —.* M. Berthelot. Comptes rend., 1905, 140, 1159.

TUBES of fused silica are not permeable by hydrogen at the ordinary temperature, even after many days' exposure at  $600^{\circ}$ – $800^{\circ}$  C. the transpiration, if it exists at all, rapid enough to be sensible after an hour's exposure but at  $1300^{\circ}$  C. it is considerable and rapid. The transpiration of hydrochloric acid gas is not sensible till  $1400^{\circ}$  C., that of carbon dioxide is barely so at  $1400^{\circ}$  C. Nitrogen does not sensibly permeate the tubes at  $800^{\circ}$  C. possibly it begins to do so at  $1000^{\circ}$  C., but does so at  $1300$ – $1400^{\circ}$  C., though very much less rapidly than hydrogen at the same temperature. The transpiration of oxygen is somewhat more rapid than that of nitrogen. A volume of air (1.97 c.c. at normal temperature and pressure) was introduced into a tube of 5.35 c.c. capacity which was sealed and exposed for an hour to a temperature of  $1400^{\circ}$  C.; though the capacity of the tube had increased (the softened quartz being blown out by the pressure of the hot gases) to 6.50 c.c., the contained gas had a volume at normal conditions of only 1.58 c.c., and contained 17.7 per cent. of oxygen instead of the original 20 per cent. About one-sixth of the initial volume of nitrogen and about one-third of the initial volume of oxygen had disappeared. The ratio here is very similar to that which the gases of the atmosphere dissolve in water.

—J. D.

*Glass Vessels; Permeability of —.* Berthelot. Comptes rend., 1905, 140, 1286–1292.

WHEN vessels of glass or silica are heated to a temperature at which the walls are softened, the glass acquires properties of a colloidal solid, such as caoutchouc or elastic membranes. The gas enclosed in the heated vessel then passes through the softened glass by diffusion, and air passes inwards. The permeability of the glass is as soon as the temperature is lowered below the softening point. Experiments with closed tubes of different thicknesses of glass, and containing hydrogen, oxygen and carbon monoxide, have proved that the gaseous interdiffusion follows the laws of diffusion through permeable membranes.

—J. D.

#### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

*Calcium Silicates, Magnesium Silicates and Aluminium Silicates [Lime-Sandstone].* E. Thöni. Oesterr. Chem.-Zeit., 1905, 8, 145–148. Chem. Zeit., 1905, 1, 1361–1362.

THE author has attempted to elucidate the conditions occurring in the manufacture of lime-sandstone, and to determine the chemical composition of the silica which the strength of the product is due. Lime in the form of pure calcium oxide, and silica in the form of quartz, chemically pure amorphous silicic acid, and infusorial earth, were heated together in a steam autoclave under a maximum pressure of 25 atmospheres, and in a small autoclave under a pressure of 200 atmospheres. It was observed that if the lime is mixed in the hydrothermal condition with silica, the strength of the product is less than when the hydration of the lime takes place after the heating. The higher the sp. gr. of the silica used, the greater the strength of the product, except when quartz is employed, in this form of silica reacting less readily than other silicates. The strength of the sandstone increases with the fineness of the particles of the constituents, and the strength of the blocks or bricks after moulding is



rance. The best results are obtained by heating moulded bricks for half an hour at 100° C., and then letting them rest until the lime is completely hydrated. Maximum strength is, in general, attained by heating at a pressure for 6-8 hours. An increase of the pressure to 12-15 atmospheres has no noteworthy effect on the strength of the product. The sandstone obtained from nature, in which the proportions of lime and silica were 1, had the greatest tensile strength. At a pressure of 10 atmospheres it is not possible to effect the quantitative hydration of lime and silica, but by increasing the pressure to 200 atmospheres, and with a mixture of equal proportions of lime and silica, free silica could be detected in the product in very small quantities, and free lime only up to 1 per cent. The silicate formed in the lime-sandstone has the composition  $\text{CaO} \cdot \text{SiO}_2 \cdot 2.34\text{H}_2\text{O}$ , but the stage of water in the product varies slightly. In plates of the sandstone, each grain of silica appears surrounded by a darker, finely-granular portion which contains the hydrosilicate.

Hydrosilica, used in its heavy form, combines with lime even at a pressure of 8-10 atmospheres. The silicate formed, has the composition  $\text{MgO} \cdot \text{SiO}_2 \cdot 2.34\text{H}_2\text{O}$ , unlike the corresponding calcium silicate, it is not very resistant to frost.

Mixtures of silica and lime with alumina and aluminium oxide were also exposed to the action of steam, but the blocks disintegrated, and only a very small quantity of silica was combined. Mixtures of lime, silica, and kaolin gave better results. By repeatedly exposing the mixture to the action of steam, after grinding, etc. reaction was effected, especially with a mixture of parts of kaolin, 80 of silica, and 20 of lime. The silicate formed had the composition:  $\text{CaAl}_2\text{Si}_2\text{O}_{10} \cdot 16\text{H}_2\text{O}$ , i.e., nearly the same as that of stilbite,  $\text{Si}_6\text{O}_{16} \cdot 51\text{H}_2\text{O}$ .—A. S.

*Bricks; Effect of Iron Pyrites on Strength* — H. Gerlings, J. Chem. Metall. and Min. of S. Africa, 1905, 5, 229-230.

The presence of iron pyrites in the sand would have no beyond changing the colour to a yellowish or reddish and the brick would require a little more lime to the same resistance to crushing. Ferric oxide reacts only, if at all, with silica, during the steaming of the and may be considered inert save for its colouring ties. Five lime-sand bricks were heated rapidly enough to the m. pt. of Seger cone 6 (about 1300° C.), and taken out while warm. They kept their shape and were white and semi-vitreous, and had not shrunk. These contained 10 per cent. of lime, also 10 per cent. of kaolin and of felspar mixture. Five other bricks containing only 5 per cent. of lime, were heated to the pt. of cone 8 (about 1300° C.); in this case the bricks during clay or felspar exploded and splintered, whilst containing only pure quartz sand and lime were not but became white, and also more porous, owing to the action of combined water.—J. T. D.

#### UNITED STATES PATENTS.

*Objects of Artificial — and Process of Producing same*, R. Hilsberg, Sonneberg, Germany. U.S. Pat. 789,610, May 9, 1905.

U.S. Pat. 344,912 of 1904; this J., 1904, 1218.—T. F. B.

*Binding Material and Process of Making* — L. Grote, Assignor to E. Perry and R. W. Perry, London. U.S. Pat. 789,607, May 9, 1905.

U.S. Pat. 21,842 of 1903; this J., 1905, 198.—T. F. B.

#### X.—METALLURGY.

*Furnace Process; Potassium Cyanide and the Oxygen Reactions in the —*, H. Braune, Erzberg, u. Hüttenw. 1905, 53, 153. Chem.-Zeit., 1905, 29, Rep. 142.

Production of an inferior material in the puddling process even when the best pig iron of good analysis and

fracture is used, has been attributed to the action of nitrogen in the blast furnace. The author considers that it is mainly due to the formation of potassium cyanide and similar products which owe their origin to the use of basic charges together with high pressure and temperature of the air blast. Iron and free nitrogen do not combine directly at any temperature, but if the nitrogen is combined, as in potassium cyanide, combination with the iron can take place very easily, the reaction being accelerated by rising temperature.

Iron oxide is also not attacked by free nitrogen, but it readily reacts with potassium cyanide as follows:—



The potassium cyanate takes up oxygen to form carbonate, which rises to the furnace mouth and is found in the flues and "downcomers."

If bisilicate charges be used, and the iron be blown with the blast heated to 150-200° C., only traces of nitrogen are found in the resulting product.

To remove nitrogen from steel attempts have been made to use titanium-thermit.—B. J. S.

*Steel Process in Fixed Furnaces; Continuous —*, S. Surzycki. Iron and Steel Inst. May, 1905. [Advance Proofs.]

The process is based on the Talbot process but it can be carried out in any fixed furnace of not less than 25 tons capacity. It mainly depends on the arrangement of two or more tapping holes placed one above the other, but not in a vertical line. These are arranged in a cast-iron plate, lined with magnesite bricks and stamped dolomite; they give no trouble since they can neither slip, nor sink, nor be corroded. The tapping holes lead into a double launder; when the molten bath has sunk to the lower hole, it is agitated by means of a rabble so as to clear the hole from metal. Some dry burnt dolomite is thrown in on the charging side, the last drainings are removed from the hole and it is then closed from the tapping side. The whole operation lasts a few minutes only, the hearth remains sound for months, only the slag-line and, in a less degree, the blocks needing repairs. The extent and useful effect of the method as employed at the Czenstochowa works in Poland are shown in a series of tables.—J. H. C.

*Steel, Hardened; Structure of —*, H. W. Kurbatow. J. russ. phys.-chem. Ges., 1905, 37, 169-180. Chem. Centr., 1905, 1, 1441. (See this J., 1905, 334.)

EXPERIMENTS with a steel containing 1.9 per cent. of carbon, 0.02 per cent. of sulphur and phosphorus, and 0.02 per cent. of manganese, showed that during the annealing of the hardened steel at low temperatures, the *martensite* and *austenite* are converted into a network of lamellae of *cementite* surrounded by *troostite*. By annealing at temperatures above 350° C., the *cementite* and *troostite* are converted into *cementite* and *ferrite*. The author concludes from the results of his experiments that the only true chemical individuals present in steel are *cementite* and  $\alpha$ -,  $\beta$ -,  $\gamma$ -, and  $\delta$ -*ferrite*; all other phases which can be recognised under the microscope must be regarded as solid solutions. The names *troostite* and *sorbite* are generally given to those structural elements which acquire a dark colour on etching with acids, but as this dark colour can be explained only by the separation of fine particles of dissolved carbon, *troostite* and *sorbite* must be regarded as solid solutions of carbon in different kinds of *ferrite*. The structural elements which remain light-coloured on etching, and which have been named *martensite* and *austenite* are considered by the author to consist of solid solutions of *cementite* in  $\gamma$ - and  $\delta$ -*ferrite* respectively.—A. S.

*Steel; Studies on the Cooling during the Quenching of —*, P. Lejeune. Bull. Soc. d'Encour., 1905, 107, Rev. de Metall., 299-311.

THE results of the author's experiments, which were carried out in a different manner to those of Le Chatelier, confirm the conclusions drawn by the latter (see this J., 1904, 1030).—A. S.

*Aluminium Steels.* L. Guillet. Bull. Soc. d'Encour., 1905, 107, Rev. de Metall., 312-327.

THE author's experiments were made on two series of steels containing about 0.150 and 0.750 per cent. of carbon respectively, the percentage of aluminium in the steels ranging from 0 to 15. It was found that small quantities of aluminium have practically no influence on the mechanical properties of iron, but when the amount of aluminium is greater than 2-3 per cent., the metal becomes very brittle. No compounds of the two metals are formed; the aluminium dissolves in the iron, and, it is stated, prevents the development of the *perlite* crystals, causing this constituent to separate in a special granular form, to which the brittleness of certain of the steels may be due. The solution of aluminium in iron does not dissolve carbon, but graphite is not separated as would have been expected. When the aluminium and carbon are present in sufficient quantities, *cementite* is found in the steel, although in all of the specimens examined, the amount of carbon was much less than 0.85 per cent. On quenching aluminium steel, *martensite* is produced only in those parts where *perlite* was previously present. It is noted that steels containing a small quantity of aluminium show only a very slight hysteresis, and are thus specially suitable for electrical machines, &c. (See also this J., 1890, 1131.)

—A. S.

*Gold; Precipitation of* — from Cyanide Solutions. W. J. Sharwood. Eng. and Mining J., 1905, 79, 752-754.

THE author describes and compares the various methods for the precipitation of gold from cyanide solutions. In the following table are given some results obtained in the case of plants where zinc shavings and dust are used:—

Material Treated at Plant.	Form of Zinc used.	Average Strength of Solution.	Tons of Solution Precipitated by 1 lb. of Zinc.	Percentage of Zinc dissolved.	Troy ounces Precipitated by of Zinc.		
					Gold.	Silver.	Copper.
		Per cent. KCN.					
Sand, gold and silver .....	shaving	0.32	1.5	84.0	0.31	0.56	
Slime, gold and silver .....	shaving	0.04	5.0	37.0	0.25	0.50	
Rich gold ore .....	shaving	0.5	1.1	40.0	1.10	0.05	
Mixed tailing, gold .....	shaving	0.1	3.3	60.0	0.70	0.01	
Sand, gold and silver .....	shaving	0.2	3.2	79.0	0.16	3.19	
Mixed tailing, gold and silver ....	dust	0.1	2.0	30.0	0.35	0.70	
Low-grade sand, gold .....	dust	0.06	5.0	84.0	0.76	0.30	
Mixed tailing, gold and silver ....	dust	0.08	3.5	60.0	0.31	2.08	
Low-grade slime, gold and silver ..	dust	0.033	5.0	66.0	0.12	0.83	

A comparison of different methods of precipitation with a solution containing about 2.5 dols. of gold and 0.2 dol. of silver per ton, together with about 0.015 per cent. of copper and 0.05 per cent. of free cyanide, gave the following results:—

Method of Precipitation.	Percentage of Contents Precipitated.		
	Gold.	Silver.	Copper.
Saturation with hydrogen sulphide .....	2	97	3
Acidulation .....	65	90	75
Electrolysis for 24 hours .....	100	100	100
Agitation with zinc dust for 15 mins. ....	25	60	3
Agitation with zinc dust and filter-pressing. ....	94	97	4

The author considers that the method of precipitating by zinc shavings is by far the best for small or temporary plants, but that in the case of installations designed for the treatment of 100 tons or more of solution per day, or likely to be in use for several years, the electrolytic and zinc dust processes must be taken into account.—A. S.

*Gold, Re-precipitation of* — from Cyanide Solutions, and Absorption of Gold by a Wooden Leaching Vat. A. N. Mackay. Inst. of Min. and Met., May 18, 1905. [Advance Proofs.]

1. A vat of pyritic concentrates from a Willsley table,

carrying about 30 per cent. of iron disulphide, and about 10 oz. of gold per ton had been put under treatment, and thus reduced to a value of 8 oz. of gold per ton. It was sampled from top to bottom and assayed the following results:—

	Oz.	Dwt.	Grs.
Sample of top foot .....	0	13	0
Sample of middle foot.....	2	2	0
Sample of bottom foot.....	17	8	0
Sample from top to bottom ..	6	2	0

The gold extracted from the upper part had thus reprecipitated in the lower.

Another "face" was then sampled at each 6 inch depth, giving results as under:—

	Oz.	Dwt.	Grs.
Top 9 inches .....	0	11	0
Next 6 inches .....	0	17	12
Next 6 inches .....	1	0	0
Next 6 inches .....	5	8	0
Next 6 inches .....	16	2	0
Bottom 6 inches .....	33	0	0
From top to bottom .....	9	6	0

In another case, re-precipitation being suspected, sludge from a 0.20 per cent. cyanide solution containing about 0.04 per cent. of potassium hydrate per ton was filtered, sampled, and assayed at regular intervals shown below:—

Time.	Slime.			Solution.		
	Oz.	Dwt.	Grs.	Oz.	Dwt.	Grs.
2 p.m.	0	4	0	0	8	
6 p.m.	0	4	18	0	2	
10 p.m.	0	5	12	0	1	
8 a.m.	0	7	0		trace	
5 p.m.	0	7	0		trace	

Complete precipitation had therefore taken place about 18 hours. When a solution was employed containing only 0.01 per cent. of alkaliinity no re-precipitation occurred.

2. A wooden leaching vat had been used for the percolation the "sands" of a roasted sulphate ore. When dismantled, the wood, cocoanut matting, Hessian, were cleaned and separately incinerated, resulting ashes, calculated back to the ton of substance, yielded on assay:—

	Oz.	Dwt.	Grs.
Wood .....	12	8	0
Hessian .....	3	12	0
Matting .....	5	14	0

—J. J.

*Base Bullion; Refining of* — W. Dowling. J. Metall. and Min. Soc. of S. Africa, 1905, 5, 224.

THE base bullion referred to was obtained by amalgamation of slags, produced by the crucible smelting of zinc-gold slimes. The chief impurities were zinc and copper. After retorting, the metal was broken up as much as possible, mixed with (for every 100 parts) 1 of potassium permanganate, 35 of calcined borax, 25 of sand, and melted in a clay-lined crucible. When fused and tranquil, the slag was thickened and skimmed off, and the metal granulated. This treatment was repeated five times, the permanganate being increased the third fusion to 20 parts. The 432 oz. of bullion testing 28 per cent. of gold became at the



er., testing 79 per cent. This was then mixed with bullion to bring the average above 80 per cent.; had not been done a sixth fusion would have been necessary in bringing the bullion up to the standard requirement, a fineness of 80 per cent. The granulation was by resting the crucible on a table about 3 ft. high, pouring in a stream not thicker than a lead pencil into a 12 in. deep, which was kept in constant rotation.

—J. T. D.

er containing Oxygen: Microstructure of —. Girard. Bull. Soc. d'Encour., 1905, 107, Rev. de l'ail., 297—298.

er and cuprous oxide in the molten condition are ally soluble, and on cooling give, when the copper excess, a mixture of a eutectic containing 3.5 per cent. cuprous oxide, and the excess of copper. In mixtures containing an excess of cuprous oxide, however, especially on solidification take place slowly, mixtures of the and of copper without the eutectic, or of copper, us oxide and the eutectic are frequently obtained d of the expected mixture of cuprous oxide and ie. This apparent deviation from the laws of eation of alloys is explained as follows by the author. a beginning of the solidification, crystals of cuprous separate until the molten metal attains the comon of the eutectic, at which point copper also should to separate. The copper, however, remains in a state of fusion, and the oxide alone continues to crystallise, and becoming hypo-eutectoid. When the superfusion, copper is first deposited and then the eutectic phenomena are clearly indicated in the cooling curve, leh is a minimum corresponding to the superfusion, maximum corresponding to the crystallisation of, followed by a step indicating the solidification eutectic. When solidification proceeds rapidly, estals of copper do not appear, the normal mixture ous oxide and eutectic being obtained.—A. S.

ium; Extraction of — from Natural Lead Vana- and the Preparation of Alloys of this Metal. enschmidt. Osterr. Z. Berg. u. Hüttenw. 1905, 201; Chem.-Zeit, 1905, 29, Rep. 141.

At lead vanadate, containing 12—14 per cent. of e acid, and about 50 per cent. of lead, is melted in ace with sodium carbonate and coke. The lead s thereby reduced to the metal, and a slag is formed ung sodium aluminate, vanadate and silicate. ag is melted separately, and submitted to oxidation vert all the vanadium into vanadic acid, then run o water and lixiviated several times. The solution fied from silicic acid by evaporating to a syrup, g with sulphuric acid (66°), and passing through -press. The resulting solution of sodium sulphate adic acid is evaporated to expel the excess of ic acid, and, after washing with water, furnishes a f 92—95 per cent. of the vanadic acid.

order to prepare ferro-vanadium, this product is with ferrous sulphate and sodium carbonate, and cipitate thus obtained dried and treated either in etric furnace or with "Thermit." Copper- and vanadium may be prepared in a similar way.

—B. J. S.

le Ores; Action of Sodium Nitrate on — [and aration of Red Lead]. J. Matschek. Chem.- 1905, 29, 510—511.

author finds that on heating certain metallic sul- -galena, stibnite, copper glance, copper pyrites gentite—with sodium nitrate, a violent reaction take place.

is usually a production of metal from the sulphide, always, and, in trying to repeat some of the experi- it was found that the yields of metal obtained greatly. Potassium nitrate appears to act more ally than sodium nitrate.

venient method for the preparation of minium d) is as follows:—Some potassium chlorate is added ed potassium nitrate and lead is then introduced; ure is heated until no more gas is evolved. The red f lead so obtained is free from litharge.—C. E. F.

Metals; Reciprocal Replacement of — in Aqueous Solu- tions. G. McPhail Smith. J. Amer. Chem. Soc., 1905, 27, 540—551.

The author has found that the metals in the following pairs are able to replace each other in aqueous solution, the first-named, or more electro-positive metal, being, in each case, under ordinary circumstances, more readily replaced by the second, than the second by the first. Potassium-sodium, potassium-barium, sodium-barium, zinc-copper, cadmium-copper, iron-mercury, iron-silver, mercury-silver, mercury-platinum, mercury-gold, silver-gold. The conditions favourable for the replacement of the second, or more electro-negative metal, by the first, are:—(1) High osmotic pressure (i.e., high concentration) of the ions of the second metal; (2) great electrostatic pull, i.e., high solution pressure of the first metal and low osmotic counter-pressure (or low concentration) of the ions of this metal.—A. S.

Copper; Determination of Oxygen in —. S. Dickson. XXIII., page 638.

Ore Sampling; Some Experiments on —. A. T. French. XXIII., page 638.

Gas; Cleaning of Blast-Furnace —. A. Sahlin II., page 610.

#### ENGLISH PATENTS.

Iron and Steel; Manufacture of —. R. M. Daelen, Dusseldorf, Germany. Eng. Pat. 9202, April 21, 1904.

IRON oxide and solid carbon are moulded into briquettes, heated so as partly to reduce the oxide, and then charged into a molten bath of iron or steel. Part of the bath is tapped off from time to time for separate refining, and more briquettes added so as to secure a practically continuous process.—J. H. C.

Steel; Manufacture of —. W. Kaufmann, Vienna, and A. Bonvier, Grenoble, France. Eng. Pat. 16,276, July 22, 1904.

SEE Fr. Pat. 344,906 of 1904; this J., 1904, 1222.—T. F. B.

Solder for Aluminium; Improved —. F. Jackman, J. M. Woodcock and J. Ledgerd, Bradford, Yorks. Eng. Pat. 17,031, Aug. 3, 1904.

THE solder consists of tin, 64 parts; zinc, 30 parts; lead, one part; aluminium, one part; together with a small quantity of rosin.—J. H. C.

Copper; Protecting —, from Destruction by Sea Water. F. Uthemann, Langfuhr, Dantzic. Eng. Pat. 21,661, Oct. 8, 1904. Under Int. Conv., Oct. 10, 1903.

A MORE electro-positive metal, such as iron, is distributed uniformly over the surface of the copper in the form of wire netting, or as a wire spiral, &c. The iron is consumed by electrolytic action, and a deposit of iron oxide is formed on the copper, the latter being thus protected against the action of the sea water.—B. N.

#### UNITED STATES PATENTS.

Steel; Continuous Process of Manufacturing —. H. Knoth, Birmingham, Ala. U.S. Pat. 788,650, May 2, 1905.

THE pig metal for use in an open-hearth furnace is subjected to an oxidising blast to reduce its silicious and carbon contents; to the slag from this purified charge, basic material is added, and it is then utilised in a molten material is added, and the slag so treated is then utilised in a molten condition to purify succeeding charges of pig-metal.—J. H. C.

Case-Hardening [Iron or Steel]; Process of —. C. Lamargese, Rome. U.S. Pat. 788,778, May 2, 1905.

SEE Fr. Pat. 338,199 of 1903; this J., 1904, 610.—T. F. B.

[Iron] Ores, Fine, Process of Treating — D. Baker and W. H. Hearne, Wayne, Pa. U.S. Pat. 788,813, May 2, 1905.

FINE iron ores or residues are moistened and then partially fused in a rotating kiln. Sulphide ores are previously calcined in another part of the same kiln.—J. H. C.

Metals [Gold, &c.]; Process of Reducing — from their Solutions. C. B. Jacobs, East Orange, N.J., Assignor to The Empire Electro-Chemical Co., Port Chester, N.Y. U.S. Pat. 788,584, May 2, 1905.

CYANIDE solutions containing gold and base metals are acidified with hydrochloric acid and then treated with gaseous phosphuretted hydrogen, whereby the gold is precipitated as phosphide.—J. H. C.

Metal [Precious]; Process of Extracting — J. A. Just, Pulaski, N.Y., Assignor to Just Mining and Extraction Co., Rochester, N.Y. U.S. Pat. 788,912, May 2, 1905.

ORES of the precious metals are first chloridised, then treated with an acidified solution of calcium chloride of about 1.40 sp. gr.; and leached with an additional amount of such solution until the extraction is complete. Finally the gold and silver are precipitated by known methods.—J. H. C.

Copper Smelting and Separating — G. Mitchell, Los Angeles, Cal. U.S. Pat. 788,589, May 2, 1905.

SILICIOUS ores of copper are fused in a melting furnace in a reducing atmosphere at a temperature insufficient to form silicates—the molten matte and the silicious residue are separately drawn off for use in the converter.—J. H. C.

[Copper] Matte; Continuously Producing — by Dissolving Ores. R. Baggaley, Pittsburg, Pa. U.S. Pat. 789,648, May 9, 1905.

AIR is blown into a bath of molten copper matte, which is fed by alternate charges of ore containing respectively a large proportion of fuel supply in the form of oxidisable elements or compounds, and of ore containing a high proportion of silica. Portions are withdrawn from the enriched bath, as the additions are made. (Compare U.S. Pat. 722,198, of March 3, 1903; this J., 1903, 424; and U.S. Pat. 746,241, 746,246, 746,249, and 746,260, of Dec. 8, 1903; also U.S. Pat. 766,654, 766,655, and 766,656, of Aug. 2, 1904; this J., 1904, 23 and 869).—E. S.

Furnace; Ore-Roasting — P. A. Wagner, Carrville, Cal. U.S. Pat. 789,303, May 9, 1905.

THE claim is for a combination of an ore-roasting apparatus, a collecting chamber into which the hot products of combustion are brought by a conduit, a water-seal arrangement above the discharge end of the said conduit, and an inspection pipe opening into it from the outside.—J. H. C.

Ore Roaster. J. W. R. Laxton, Lynn, Mass. U.S. Pat. 789,371, May 9, 1905.

THE ore roaster consists of a drum revolving on a horizontal axis with a fixed semi-cylindrical fire-pot and horizontal grate-bars situated within the drum at the centre. The ore is fed into pockets, constructed in the periphery of the drum, extending parallel to the axis of the latter and having an almost cylindrical form. Tubular passages are provided through each pocket parallel with its curved wall, but situated further from the bottom of the pocket than from the upper portions. After roasting, the ore falls out of the pockets upon a conveyor as the drum revolves. Means are provided for collecting the fumes from the roasting ore and from the furnace, separately, through different hoods.—J. F. B.

#### FRENCH PATENTS.

Steel; Manufacture of — Cammell, Laird and Co., Ltd., Fr. Pat. 349,095, Dec. 10, 1904.

SEE Eng. Pat. 28,491 of 1903; this J., 1905, 137.—T. F. B.

Cupola. A. Baillot, Fr. Pat. 349,036, Dec. 5, 1904.

THE hot furnace gases drawn off from above the are employed for heating fresh air, the mixed air and being then forced through the tuyères which are at different levels.—J. H. C.

Brazing of Copper and other Metals. Soc. An. Dissous Du Sud-Est. Fr. Pat. 349,079, Dec. 17, 1904.

AN alloy of copper and tin containing phosphorus five per cent. and tin up to six per cent. is employed as a solder or brazing agent.—J. H. C.

#### GERMAN PATENTS.

Soldering Paste for Cast Iron. E. Herzog, Ger. Pat. 154,519, May 6, 1902.

THE soldering paste consists of a mixture of pure iron powder, free from oxides of iron, with steel, paraffin oil, borax and camphor. A suitable mixture of steel or iron powder, 80—120; paraffin oil, 1—4; borax, 30—50, and camphor, 1—4 parts. The paste, to be joined are well cleaned, coated with the paste, and after addition of borax and solder, heated to bright redness.—A. S.

Ores, Fine, and Ores which Disintegrate on Heating. Process for the Preparation of — for Smelting. Ges. f. Chem. Ind. Ger. Pat. 156,709, Feb. 23, 1904.

ACCORDING to Ger. Pat. 113,863, ores such as log iron, burnt pyrites, &c., in a finely-divided condition, prepared for smelting by mixing them with suitable fluxes and the necessary fluxes, and sintering the mixture continuously through an inclined, rotating reverberatory furnace, the ore mixture being fed at the rear end of the furnace and discharged at the front, the heating flame extended through the whole length of the furnace in the opposite direction. It has been found, however, that in this process, the ore mixture is sintered too soon and frequently stops up the furnace, especially in those parts which are accessible on the outside with difficulty. According to the present patent, only the heating flame or gases is allowed to travel through the entire length of the inclined rotating portion of the furnace, whilst the remainder, after heating the front portion of the furnace, returns in the opposite direction and through an outlet near the inlet for the heating gas. It is claimed that by this method the ore mixture is sintered only when it approaches the discharge of the furnace.—A. S.

Ores of all kinds, Burnt Pyrites and Waste Products. Process for the Briquetting of — W. Budden, Ger. Pat. 157,136, March 22, 1903.

THE ores, &c., are mixed with a double sulphate of an alkali metal and a heavy metal, such as iron, manganese, &c., either in the form of a strong solution, or if the ore contain sufficient moisture, in the solid condition. Briquettes are made from the mixture in the usual manner. If the ore contain ferrous sulphate, only necessary to add an alkali sulphate or bisulphate.—

Air Blast; Process and Apparatus for Heating the means of the Heat of the Slag. Wassily von Isen, Ger. Pat. 157,446, Oct. 10, 1903.

THE air blast is heated by bringing it into contact with a shower or spray of molten slag.—A. S.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A.)—ELECTRO-CHEMISTRY.

Arc; Metallic [Titanium] — I. Ladoff, H., Pat.

Acids, Aromatic Carboxylic; Electrolytic Reduction to the Corresponding Alcohols. C. XX., page 634.



## ENGLISH PATENTS.

*anulator Plats; Improved Method of Preliminary Treatment for ——. H. Leitner, Woking, Surrey. Eng. Pat. 14,128, June 22, 1904.*

invention relates to an improvement on Eng. Pat. of 1904 (this J., 1905, 243), in which an electrolytic formation of Plantic positives consisting of a solution containing 0.5 to 2 per cent. of sodium sulphate, and parts per 1,000 of sodium chloride was claimed, according to the present patent, the salts mentioned are used by equivalent quantities of sulphuric and hydrochloric acids.—B. N.

*ies; Secondary ——. W. Gardiner, Chicago, Eng. Pat. 27,900, Dec. 20, 1904.*

invention relates to an accumulator comprising a receptacle with separating strips of insulating material arranged in pairs on opposite sides of the vessel, the strips having grooves extending over a portion of the top of their inner faces. The positive element consists of a perforated sheet lead, folded transversely into a series of integrally connected folds, within which is the active material, the latter being formed electrolytically. The positive element is supported in the grooves of the insulating strips, so as to be out of contact with any of the cell. Copper wire gauze, plated with silver, in connection with the outer receptacle, and is arranged radially in order to enclose the positive element and binding strips, the wire gauze serving as a support for metallic deposits from the electrolyte, these forming the negative element. The electrolyte is a solution of sulphuric acid, zinc, mercuric and cuprous sulphates.—B. N.

*es and Hydroxyl Derivatives of the same; [Electrolytic Process for the Manufacture of ——. L. Scholvién, Paris, Germany. Eng. Pat. 24,554, Nov. 12, 1904. Under Int. Conv., May 27, 1904.*

Eng. Pat. 347,862 of 1904; this J., 1905, 446.—T. F. B.

## UNITED STATES PATENTS.

*lytic Cells; Apparatus for Agitating the Contents of ——. E. A. Ashcroft, Runcorn, U.S. Pat. 788,506, May 2, 1905.*

U.S. Pat. 12,083 of 1903; this J., 1904, 67.—T. F. B.

*s and Perchlorates; [Electrical] Manufacture of ——. M. Coulern, U.S. Pat. 788,631, May 2, 1904. Page 620.*

*using Liquids; Apparatus for ——. L. Dion, New York. Assignor to the American Electro-Hermetic Co., New York. U.S. Pat. 789,146, May 9, 1905.*

BER, with an insulated interior and with conical openings provided with positive and negative electrodes, a liquid to be treated is delivered through an upper pipe distributed over the electrodes. The liquid, after electrolysis, is discharged from the lower end of the vessel into a settling tank, the latter being provided with overflow connected with the lower ends of filtering chambers, which have conical ends and insulated interiors. The filtering chambers have flexible outlets at their upper ends, the outlets being connected above to an overflow discharge and below to moving filters which are actuated by stationary brushes. The deposited material is thus returned to the settling tank, where it is removed in a suitable manner. Projections extend from the outlets and rotating cams, on a shaft supported by bearings, from the filtering chambers, engage with the outlets for giving a reciprocating motion to the filters.—B. N.

*Acid and its Salts; [Electrolytic] Process for Producing ——. C. Ellis, U.S. Pat. 789,269, May 9, 1905. Page 635.*

## FRENCH PATENTS.

*Wool; Scouring Loose ——. by the aid of Electricity. J. M. Braudot, Fr. Pat. 349,012, Dec. 13, 1904. V., page 617.*

*White Lead; Process and Apparatus for the Electrolytic Manufacture of ——. C. P. Townsend, Fr. Pat. 349,001, Dec. 15, 1904. XIII. A., page 627.*

*Ozone; Apparatus for the Production of ——. by Electric Discharges. U. Liscin, Fr. Pat. 349,071, Dec. 17, 1904.*

Two concentric evacuated tubes are provided with metallic poles to which the high-tension current is led, the discharge taking place between the two glass surfaces. A third pole, taking the form of a wire spiral wound on the inner tube, is connected to earth. Several of such discharge tubes are mounted together in a glass enclosure through which passes a current of air or gas under pressure.—R. S. H.

## GERMAN PATENTS.

*Silicides, Borides, Aluminides and analogous Compounds; Process for the Preparation of ——. E. Jüngst and R. Mewes, Ger. Pat. 157,615, Feb. 4, 1902. VII., page 620.*

*Pulp, Paper; [Electrolytic] Process for the Removal of Chlorine from and Purification of ——. J. F. Colby, Ger. Pat. 157,763, Dec. 28, 1902. XIX., page 633.*

## (B).—ELECTRO-METALLURGY.

*Chromium; Electrolytic ——. H. R. Carveth and W. R. Mott, J. of Phys. Chem., 1905, 9, 231—256. Chem. Centr., 1905, 1, 1364.*

In their experiments on the electrolytic separation of chromium, the authors worked with a diaphragm and with copper cathodes that were withdrawn from time to time for the determination of the separated chromium, fresh cathodes being inserted in their place. The chromium was determined by dissolving in hydrochloric acid, and measuring the hydrogen evolved; chromous chloride is formed quantitatively. With solutions of chromic chloride (containing 100 grms. of chromium per litre), the yield rose from 9.5 to 30 per cent. at 22° C., when the current density was increased from 50 to 70 ampères per sq. dm. No increase of the yield was caused by rise of temperature, but, on the contrary, the character of the deposit was affected injuriously. On passing air through the electrolyte, the yield diminished, owing to oxidation of the chromous salt, the presence of which is necessary for the deposition of metal. Neumann's statements with regard to the influence of the anode solution (this J., 1901, 816) were confirmed; this influence is due to diffusion into the cathode solution. Sulphate solutions behave similarly to chloride solutions. The presence of acid in the solution causes a decrease in the yield, but an improvement in the condition of the deposited metal.—A. S.

*Tin and Zinc; Crystallisation of ——. by Electrolysing their Salts. A. Sapozhnikow, J. russ. phys.-chem. Ges., 1905, 37, 153—156. Chem. Centr., 1905, 1, 1365—1366.*

The author obtains microscopic preparations of tin and zinc crystals in the following manner:—A glass plate is placed on two pieces of glass rod in a shallow dish with a flat bottom. Two wire electrodes (of copper and tin or zinc) are fixed to the glass plate, and the latter is covered with stannous chloride (or zinc chloride) solution. On passing an electric current from two accumulators through the wires, crystals of tin (or zinc) are deposited at the cathode, and after being washed and dried, can be permanently fixed on the glass plate by means of a balsam.—A. S.

## ENGLISH PATENTS.

*Metallic Deposits upon Metal; Production of —. to Prevent the same from Oxidation. A. Lévy, Paris. Eng. Pat. 9836, April 29, 1904. Under Int. Conv., May 1, 1903.*

SEE FR. PAT. 331,669 OF 1903; THIS J., 1903, 1134.—T. F. B.

*Antimony, Improved Process of Electro-depositing* — A. G. Betts, Troy, N.Y. Eng. Pat. 15,294, July 8, 1904.

A SOLUTION, containing 8 per cent. of antimony trifluoride, 2 per cent. of sodium sulphate, and 4 per cent. of sulphuric acid, is electrolysed, using an insoluble anode; metallic antimony is deposited on the cathode, and hydrofluoric acid is formed at the anode, the latter consisting preferably of lead rods wrapped in layers of cloth. By using impure antimony as the anode, purified antimony is deposited, and valuable impurities remain as anode residue.—B. N.

*Metal Mixtures produced as a By-Product in Electrolytic Metal Refining Operations; Improved Process of Treating the* — A. G. Betts, Troy, N.Y. Eng. Pat. 15,298, July 8, 1904.

THIS INVENTION relates to an improved process for treating anode slime, which usually contains free or combined lead, copper, arsenic, antimony, silver and gold in a finely divided condition. The slime is agitated with a hot 4 per cent. solution of ferric sulphate containing 2 per cent. of sulphuric acid; copper, lead and silver are converted into sulphates, and arsenic, antimony and bismuth into oxides or basic sulphates. The silver is precipitated with metallic copper, the solution filtered and the residue washed thoroughly. The insoluble portion is treated with hydrofluoric acid, hydrochloric acid or cream of tartar solution to extract the antimony, and the slime then worked up by fusion or other methods. The free acid in the filtrate is neutralised with copper oxide in a suitable manner, and the reduced solution is passed first through the cathode compartments and then through the anode compartments of an electrolytic cell, using copper cathodes and carbon anodes. Copper is deposited and ferric sulphate regenerated. The arsenious acid is removed periodically from the solution in a suitable manner, as by crystallisation, and the ferric sulphate used over again for treating a further quantity of slime. Instead of ferric sulphate, chromic or permanganic acids may be used, the reduced solution being afterwards re-oxidised by electrolysis or by reaction with lead peroxide. By using fluosilicic acid in combination with these, the reduction by the metals of the slime, and the re-oxidation by lead peroxide may be carried on simultaneously. The resulting solution is treated with copper to precipitate silver, then with lead to precipitate copper, arsenic, antimony, &c., and the solution finally electrolysed to regenerate lead peroxide and the free acid, which may be used for further treatment of slime.—B. N.

#### UNITED STATES PATENTS.

*Metals; Plant for the Electrodeposition of* — A. G. Betts, Troy, N.Y. U.S. Pat. 789,353, May 9, 1905.

THIS INVENTION relates to an apparatus for depositing lead from a suitable electrolyte, and consists of a number of tanks, each tank containing sets of positive and negative unipolar electrodes in series, and with each set arranged internally in multiple.—B. N.

*Copper-Nickel Alloys; Process of Electrolytically Refining* — A. G. Betts, Troy, N.Y. U.S. Pat. 789,523, May 9, 1905.

A SOLUTION of copper and nickel sulphates is electrolysed, using an alloy of copper and nickel as the anode; copper is deposited and nickel sulphate remains in solution. The latter is then electrolysed, using an anode of spongy lead, nickel being deposited on a suitable cathode, and the lead sulphate formed is reduced to spongy lead by making it the cathode in an electrolytic cell, sulphuric acid being simultaneously formed. The acid is then electrolysed, using an anode of copper and a cathode of lead peroxide; copper sulphate is reformed and is returned to the bath in which copper is deposited.—B. N.

*Galvanising, Tinning, or otherwise Plating Wire or other Metallic Bodies; Process of* — G. A. Goodson, Providence, Assignor to Goodson Electric Galvanising Co., Minneapolis. U.S. Pat. 789,690, May 9, 1905.

SEE Eng. Pat. 3798 of 1904; this J., 1905, 550.—T. F. B.

#### FRENCH PATENT.

*Electroplating; Apparatus for* — T. A. F. Fr. Pat. 349,142, Dec. 10, 1904.

SEE U.S. Pat. 781,867 of 1905; this J., 1905, 244.—

#### GERMAN PATENT.

*[Steel Hardening] Metals and Metal Articles; Process of Heating* — in a Bath of Molten Material Prochnow. Ger. Pat. 157,206, July 22, 1903.

IN the hardening of steel, &c., the metal is heated by immersion in a bath of molten material. In order to avoid the injurious action of the heating gases and the material on the walls of the crucible, the patentee proposes to employ an electrically heated bath. A suitable material for the bath is a mixture of six molecules of sodium chloride and one molecule of cryolite at 850°C. with a specific resistance of 0.35 ohm per sq. cm.—

## XII.—FATTY OILS, FATS, WAXES AND SOAP.

*Fats, Vegetable; Composition of Solid* — I. K. Monatsh. f. Chem., 1905, 26, 563—569.

THE author confirms his previous statements as to the presence of mixed glycerides in cacao butter, stilling (Chinese tallow) and Borneo tallow (this J., 1901, 1902, 486; 1903, 1005; 1904, 1152). The different portions of the mixed glycerides were purified by re-crystallisation. Oleodistearin with a m. pt. of 44°C. was isolated from cacao butter, and with a m. pt. above 44°C. from Chinese tallow. Oleodipalmitin with a m. pt. of 38°C. was isolated from cacao butter, Borneo tallow, and, with a m. pt. of 37°C., from tallow.—A. S.

*Linseed Oil in Walnut Oil; Detection of* — G. H. XXIII., page 639.

*Rice Products; Composition and Feeding Value* — C. A. Browne, jun. XVIII A., page 631.

#### ENGLISH PATENT.

*Soaps; Process for the Preparation of* — A. P. Hamburg, Germany. Eng. Pat. 17,965, Aug. 11, 1904.

SEE Fr. Pat. 345,485 of 1904; this J., 1904, 1226.—

#### UNITED STATES PATENT.

*Soap from Hydrocarbon; Process of Forming* — G. Reale, Lauria, Italy. U.S. Pat. 790,154, May 9, 1905.

SEE Fr. Pat. 321,510 of 1902; this J., 1903, 218.—

#### FRENCH PATENTS.

*Fats; Regeneration and Purification of Waste* — E. Roth le Gentil, J. Tachard and V. Alba. Fr. Pat. 349,043, Dec. 14, 1904.

IMPURITIES are precipitated by means of sulphur and the fats recovered by extraction with carbon tetrachloride. The apparatus claimed for the purpose comprises a series of connected tanks with the necessary steam coils, pumps, &c.—C. A. M.

*Soap.* J. B. I. Julhe. Fr. Pat., 349,062, March 1, 1905.

THE product claimed consists of a mixture in any proportions of ordinary soap in powder with potassium or magnesium carbonate, with or without the addition of Aniline Blue, the whole being moulded into cakes by pressure.—C. A. M.





the usual surface enamels, by smoothing the unbuffed grain side of the skin, extracting the grease, and then applying a solution of pyroxylin and boiled linseed oil in a suitable solvent, whereby a thin, transparent and flexible coating is formed upon and adheres to the skin. The enamel is applied on the top of this coating.—A. S.

*Adhesive (Goussin) and Method of Making same.* G. A. Thube and L. Préaubert, Nantes, France. U.S. Pat. 788,857, May 2, 1905.

SEE Fr. Pat. 331,805 of 1903; this J., 1903, 1200.—T. F. B.

#### FRENCH PATENT.

*Glue and Gelatin; Process and Apparatus for Extracting — from Bone.* H. Hilbert and The Bayerische Act.-Ges. für chem. und landwirthschaftl.-chem. Fabrikate. Fr. Pat. 349,045, Dec. 16, 1904.

SOLUBLE nitrogenous bases and their salts, which impart an unpleasant odour to the glue, are eliminated by means of a preliminary washing of the bone meal with water. The apparatus claimed for the purpose consists of a horizontal drum rotating round a hollow shaft which carries a suitable agitating device. The drum is provided with manholes, &c., whilst steam can be introduced through perforations in the shaft. There is also a perforated false bottom on which the meal rests after the washing and extraction of the glue, and the washings and colloidal solutions are driven through the deposit by means of compressed air or other agent.—C. A. M.

#### XV.—MANURES, &c.

*Calcium Nitrate in Agriculture.* E. S. Bellenoux. Comptes rend., 1905, 140, 1190.

EXPERIMENTS carried on for several years, in which potato and sugar-beet were cultivated in neighbouring portions of land, and manured with calcium nitrate and sodium nitrate, showed that for both crops the calcium salt was markedly superior. Calcium nitrate is readily prepared by the reaction of solutions of calcium chloride and sodium nitrate, sodium chloride being deposited, and calcium nitrate remaining dissolved.—J. T. D.

*Vinasse; Manurial Value of —, compared with Ammonium Sulphate and 40 per cent. Potassium Salt.* Lilienthal. Illust. Landw. Zeit., 1904, 34; Z. Spiritusind., 1905, 28, 201.

THE vinasse which contained 3.5 per cent. of nitrogen and 13 per cent. of potash, was employed as a dressing for potatoes (before planting), in conjunction with superphosphate and in comparison with ammonium sulphate and 40 per cent. potassium salt, the proportions being so arranged that each plot received the same quantity of nitrogen, potash and phosphoric acid. The crop was about 2 cwt. per acre less, but the percentage of starch (15.6) in the tubers was 0.9 per cent. higher than with the ammonia and potash fertiliser. In another series, both fertilisers were supplemented with sodium nitrate in one case and with ammonium sulphate in the other, the results working out on the same lines as before, with a small margin in favour of the last-named mixture. The residual effect of the vinasse fertiliser is slightly better (on a succeeding rye crop) than the potash-ammonia mixture, and the superiority of ammonium sulphate over sodium nitrate as an adjunct to the former fertiliser is also manifested here.—C. S.

#### UNITED STATES PATENT.

*Calcium Phosphate; Process of Making Dibasic —.* R. Arens, Marxloh, Germany. U.S. Pat. 789,647, May 9, 1905.

To a solution of monobasic calcium phosphate, heated to about 90° C., a solution is added of calcium bisulphite also containing monobasic calcium phosphate, and the heating is continued, to obtain dibasic calcium phosphate with recovery of the sulphurous acid.—E. S.

#### XVI.—SUGAR, STARCH, GUM, Etc.

*Sugar Factory; Clarification in the —.* R. E. B. Louisiana Planter, 1905, 34, 240—243.

THE methods of removing the impurities thrown out precipitated during clarification are as follows:—settling the juice, either before or after removing "blanket," in the clarifiers or in settling tanks. In cases the settled, or partially settled, juice is brown, brushing pans and boiled and brushed as an adjunct removing the impurities, and then settled in settling tanks. Second, filtering the juice, several devices being utilised a view to economise space and time. Settling thoroughly has been found by repeated tests to remove practically all the precipitated impurities, whilst filtering, some always remain suspended in the juice. The average filtering surface per ton of cane is 1.69 sq. ft. The average press cake is 35 lb. per ton of cane, with an average of 5.7 per cent. of sucrose lost. This indicates a loss of 2 lb. of sugar per ton of cane washing, it is not impracticable to reduce this loss to 0.74 lb. The washings may be used as saturation thus bringing about the same dilution and extraction economising in evaporation.—L. J. DE W.

*Cane Sugar Products; Fermentation in —.* Browne, jun. Louisiana Planter, 1905, 34, 238—242.

THE majority of micro-organisms are unable to work injury within the body of sound canes because the plant generates enzymes, some of which, on exposure to air, produce toxic products which prevent the invasion of bacteria through parts that are bruised or injured. The cane is killed, however, as by being frozen, this is lost; the formation of toxic products does not prevent and bacteria invade the body of the cane through cracks and "dead eyes" and within a few days, especially if the weather becomes warm, the cane will have rotted to such an extent as to be useless for milling. An analysis of the juice from a batch of canes before and after a frost, shows a great decrease in the sucrose, increase in dextrose, free acid, gums, and the product mannitol, &c. While fermentation within the body of a cane is exceptional, it may take place at any time up to the surface, as when the canes are infected by the "pou-à" insect. This insect feeds upon the inner surface of the leaf-sheath causing the reddish discoloration from the enzymes, juice, which exudes from the wounded surface, runs upon the stalk, and, undergoing fermentation, leaves a deposit of gummy matter. This gum, which has a sweetish taste and a peculiar characteristic odour, is found to consist mostly of dextran with a considerable amount of dextrose, and a little mannitol and trace of sucrose.

If sugars intended for storage or long shipment are thoroughly dried, the losses from deterioration would be greatly minimised.—L. J. DE W.

*Molasses from Louisiana Sugar Houses; Composition of —.* C. A. Browne, jun. Louisiana Planter, 1905, 34, 237—238.

INVESTIGATIONS were conducted upon the chemical composition of various molasses to ascertain to what extent the composition is affected by the difference in the process of manufacture. The lowest purity found in third molasses was about 35; in cases where reports are made of purities of 20 or under, these may result from fermentation or inversion of the sucrose, but are usually the consequence of faulty methods of calculation, the degree Brix of dilute molasses being taken instead of the total solids, the direct polarisation instead of the determinate sucrose by the Clerget method. Open-kettle molasses was less exhausted than other grades, having more sucrose and less impurities such as gums, ash, amides, &c. Diffusion molasses has a high percentage of impurities owing to a greater extraction of these ingredients from the bagasse. The effect of liming is very pronounced, molasses which has had the heaviest treatment being highest in gums and compounds. A large part of the compounds designated as gums and acids do not come from the cane, but



result of the action of lime upon the invert sugar of the Clarification with phosphoric acid has a marked effect. Part of the lime is removed as insoluble phosphate, and the percentage of phosphoric acid is usually reduced. The phosphoric acid naturally occurring in molasses does not exceed 0.25 per cent. In cases dilute phosphoric acid is used for washing sugar in the centrifugals and this has been known to improve the appearance of high-grade molasses by making it turbid through precipitation of calcium phosphate. When molasses is left over in the hot room, there is a gradual formation during the summer time of a thick coating of yellowish-white scum. An analysis of a dried scum gave the following percentage composition: Moisture 10.00, chitin 11.30, protein 31.62, fat 5.50, ash 5.58, carbohydrates, &c., 14.00. An analysis of the fat showed it to have almost the same composition and characteristics as butter fat, and to yield over large quantities of butyric acid upon saponification. These scums are of fungoid origin, and are produced from the ingredients of the molasses, the latter, however, undergoing marked deterioration, as shown by the following analysis from the surface of a scum:—Brix 69.66, sucrose 1.72, co-efficient of purity 2.47 per cent. There are thus other factors than impurities which can exhaust molasses of sucrose and produce low purities.—L. J. DE W.

*Artificial*; Saccharification of ——. E. Roux. XVII., page 630.

*Pastes*; Constitution, Saccharification and Purification of ——. L. Maquenne and E. Roux. XVII., page 630.

*Sugars* derived from *p*-, *m*- and *o*-Nitrophenylhydrazine. [Detection and Determination of Sugars.] W. A. Ekenstein and J. J. Blanksma. XXIII., page 630.

*Uses* Cattle Foods. C. A. Browne, jun. XVIII. A., page 632.

*Uses* in Sugar Factory Products; Determination of ——. V. Stanek. XXIII., page 639.

# UNITED STATES PATENTS.

*Juices*; Apparatus for Continuous Sulphuration of ——. A. Magnin, Charmes, France. U.S. Pat. 772, May 9, 1905.

Sugar juice contained in a reservoir is withdrawn by pump and forced through the nozzle of an injector, the nozzle of which communicates with a vessel in which a solution of sulphur dioxide is maintained. The juice thus comes in intimate contact with the gas which it draws through the injector and is discharged therefrom into a juice reservoir.—J. F. B.

*Solutions* [Molasses]; Method of Cleaning and ——. H. P. Baldwin, Hawaii. U.S. Pat. 778, May 9, 1905.

Solutions of any kind, particularly molasses, containing objectionable solid impurities of about the same specific gravity as the solution, are diluted to such an extent that the specific gravity of the liquid is lower than that of the suspended solids, and are subjected to centrifugal action, whereby the solids are thrown out from the solutions.—J. F. B.

*Stalks*, Sugar-cane, Sorghum, &c.; Manufacture of Pulp and Paper from ——. V. Drewsen. U.S. Pat. 789,416, 789,417 and 789,418, May 9, 1905.

# FRENCH PATENT.

*Starch* and Farina; Sieve for Extracting — from Ground or Rased Materials. W. H. Uhlend. Fr. Pat. 318,992, Dec. 14, 1904. Under Int. Conv., Dec. 16, 1903.

Ground or rased material, suspended in water, is

fed by means of a hopper on to a series of flat sieves arranged in steps. The whole system is supported upon a pedestal by which a circular oscillating motion is imparted to the sieves, whilst sprays of water are directed on to the material on each sieve. In this manner the particles are thoroughly stirred about and washed, the starch being collected below the sieves, whilst the exhausted pulp flows away from the end.—J. F. B.

# GERMAN PATENTS.

*Sugar*; Process and Device for Liquefying — in a Centrifugal Apparatus. A. Müller. Ger. Pat. 157,254, Jan. 27, 1904.

In order to expedite the removal of the syrup adhering to the sugar crystals, at the commencement of the "covering" process, a portion of the cold air surrounding the centrifugal machine is sucked in by means of the superheated steam injected into the apparatus, so that a mist, which is free from drops of condensed water is formed. In the apparatus described, a water-separating chamber is arranged above the cover of the centrifugal machine, and is provided with a tangential inlet for the steam and an outlet for the condensed water. The superheated steam introduced into the water-separating chamber passes through a tube which opens below into the drum of the centrifugal machine, and is surrounded by a jacket provided with openings through which air is sucked in. As the sugar becomes heated by the steam, the temperature of the air sucked in rises, and the mist gradually disappears, so that the "covering" agent is first a mist, then saturated steam, and finally dry or superheated steam. It is claimed that in this way the impure sugar is converted in as short a time as possible, and, with the minimum consumption of steam and loss of sugar, into pure, dry crystals.—A. S.

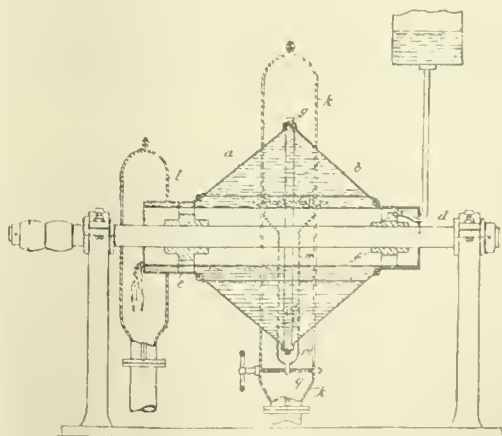
*Syrup*; Process for the Preparation of an Edible — from the Residual Molasses of the Strontia Process. A. Wohl and A. Kolrepp. Ger. Pats. 156,986, Aug. 13, 1903; and 156,987, Nov. 14, 1903.

The residual molasses of the strontia process is treated with lead saccharate, with or without addition of an acid. It is found that in the case of the molasses referred to, the lead saccharate precipitates all non-sugar substances, including those to which the bad taste and odour are due, whereas, with all other kinds of molasses, only colouring matters and the like are removed by lead saccharate.

In Pat. 156,987, claim is made for the use of other insoluble basic lead compounds, such as lead hydroxide and basic lead nitrate, in addition to lead saccharate.

—A. S.

*Starch*; Centrifugal Apparatus on a Horizontal Axis, intended specially for the Manufacture of —. F. Kachl. Ger. Pat. 155,562, Aug. 1, 1903.



The apparatus consists of two conical portions, *a*, *b*, joined together at an obtuse angle. The drum thus formed is mounted on the shaft *d* by means of the two hollow hubs *f*, *e*, of different diameters, one of which (*f*) serves for the introduction of the material to be treated, and the other (*e*) surrounded by the chamber, *l*, as an outlet for the separated water. The plates *g* closing the outlet openings for the separated starch can be displaced during the rotation of the drum by means of a fork *m* mounted on the screw *j*, within the chamber *k*.—A. S.

## XVII.—BREWING, WINES, SPIRITS, Etc.

*Grain: Development of Moist Condition in* — J. F. Hoffmann. *Woch. f. Brau.*, 1905, 22, 249–252.

GRAIN may become moist during storage either by absorption of moisture from the air or by the production of moisture as the result of internal chemical changes. The drier the initial condition of the grain, the more intense will be its capacity for absorbing moisture from the air, and the greater will be the amount of heat developed in the process. This heat stimulates respiration, which gives rise to the production of more moisture and heat, with the result that grain ripened and harvested in dry weather may eventually arrive at a worse condition than grain harvested with more moisture. This effect has been experienced with the barleys of the 1904 crop, as a result of the exceptionally dry summer. Moisture may also be absorbed by grain by a process of precipitation as dew, especially in the spring. The grain in store becomes cooled down to a very low temperature during the winter, but owing to its low conductivity it takes a long time to regain the normal temperature, consequently, when the warm moist air of the spring comes in contact with the grain, there is a copious deposit of dew, the absorption of which causes heat, sweating and mould. The chemical processes which cause changes in the moisture and temperature of grain are those involved by the condensation, hydrolysis or respiration of the carbohydrates and albuminoids. The processes which predominate are the respiration of sugars with production of water and heat, and the condensation of cane sugar to starch with production of water and a slight absorption of heat. The water produced is absorbed by the grain with the further production of heat, and the respiration is thereby stimulated. In a dry season, the chemical condensations which represent the condition of ripeness are retarded in the field, and only take place under the influence of air and moisture during the process of after-ripening in the store.—J. F. B.

*Fermentation Tuns; Internal Coating of* — C. F. Gabel. *Woch. f. Brau.*, 1905, 22, 252–253.

THE author has found that a mixture of brewers' pitch and paraffin constitutes the best and cheapest coating for the interior of fermentation tuns (see this J., 1904, 198–199). The mixture forms a dark-coloured coating on which any residues of yeast are plainly visible when cleaning out, and which penetrates the pores and fills up the cracks in a more satisfactory and permanent manner than any other material. The mixture should be made in the brewery itself, using only the purest materials, and it should be applied by means of the pitch-spraying machine.—J. F. B.

*Beer, Analysis by the aid of the Refractometer.* G. Barth. *Z. ges. Brauw.*, 1905, 28, 303–306.

THE determination of the specific gravity and of the refractive index by means of a Zeiss immersion refractometer, affords a very simple and rapid means for the calculation of the percentages of alcohol and extract in beer (see this J., 1905, 563). The author sets forth the experimental data on which the calculations are based, and deduces the values of the constants employed in solving the equations.

Let *x* be the percentage of alcohol, and *y* the percentage of extract or degrees Balling of the beer, and *r* = the difference between the refractive index of the beer and that of water (both at 17.5 °C.) determined to six decimal places and multiplied by 100,000, whilst *s* = the difference

between the sp. gr. of the beer and that of water (both at 17.5 °C.) determined to five decimal places and multiplied by 100,000; then

$$x = 0.007598r - 0.002923s,$$

$$y = 0.003366r + 0.001303s.$$

The values so found for the alcohol and the extract of beers of ordinary composition agree very well with those determined by the distillation method, and serve as an accurate basis for the calculation of the original gravity of the wort.—J. F. B.

*Brandy; Conditions affecting the Ester [Ester] of —* P. Schidrowitz and F. Kaye. *Analyst*, 1905, 149–152.

THE authors have observed a considerable diminution of the ester value of brandy when the spirit was diluted with ordinary water (New River Co.) and allowed to stand for a few days, whereas, dilution with distilled water had little, if any, effect upon the ester value.

The use of ordinary water also reduces the acidity of the spirit, and has more influence on its colour than distilled water.

The authors have also found that when different brandies are mixed together for blending, the values for total acid, volatile acid and esters in the blended product generally differ very considerably from the mean value calculated from the composition of the original brandies employed. These differences are sometimes above and sometimes below the calculated mean values, and appear to become greater with the lapse of time. The authors remark that the alkalinity of glass bottles used for spirits may have a considerable influence on the composition of the latter.—J. F. B.

*Starches; Saccharification of Artificial* — E. Comptes rend., 1905, 140, 1259–1261.

THE author has studied the saccharification of "artificial" starches (see this J., 1905, 285 and 507) by malt at various temperatures, in comparison with that of ordinary starch paste. After an action lasting for 24 hours the principal product was maltose, no dextrin being produced. At a temperature of 56° C., the portion of apparent maltose produced from the "artificial" starches was 97.9 per cent. (average) in the starches, as against 82.3 per cent. (average) in the ordinary starch pastes. On subjecting the saccharified solution to a process of fractionation, the extracts from "artificial" starches yielded 54.3 per cent. of crystalline maltose, whilst those from the ordinary starch yielded only 30.4 per cent. The dextrins produced from "artificial" starches were "almost completely soluble in alcohol."

At a temperature of 67° C., the proportions of maltose formed were 55.1 per cent. from the "artificial" starch and 45.0 per cent. from the ordinary starch. Maltose which had been heated to 80° C., had practically no effect on a solution of "artificial" starch.

After the reversion of solutions of "artificial" starch the residual soluble portion behaved, on saccharification, in exactly the same manner as the original solution.—J. F. B.

*Starch Pastes; Constitution, Saccharification, and Reversion of —* L. Maquenne and E. Roux. *Comptes rend.*, 1905, 140, 1393–1398.

THE "artificial" starches, prepared by the liquefaction of amylocellulose at 150° C. (this J., 1905, 285, 507; the preceding abstract) and yielding not more than 96–98 per cent. of maltose on saccharification, can be purified, by repeated reversion and refraction of the precipitated amylocellulose, to a point at which the products yield 102 per cent. of maltose when saccharified. Ordinary starch paste, when treated both by the saccharification test and colorimetrically by iodine, contains about 80 per cent. of a substance identical with "artificial" starch, i.e., amylocellulose.

Amylocellulose is partly soluble in boiling water, completely soluble at 150° C.; its solutions are devitrifying power. In the dissolved state it is colored blue by iodine, and is completely converted into maltose



stase at moderate temperatures; in the undissolved it is unaffected by both these reagents. The reagent 20 per cent. of ordinary starch is composed of gelatinous substance which receives the name of amylopectin and to which the gelatinising property of a paste is due. Amylopectin is not coloured by iodine yields no reducing sugar under the action of maltase; it is converted into dextrins by the action of extract which has been heated at 89° C., and the unsaccharifiable dextrin of a normally saccharified paste is the product of the amylopectin. Artificial starch differs from ordinary starch only by the presence of the amylopectin.

Amylocellulose can exist indifferently, between certain of temperature, and in presence of an excess of water, in the solid or the liquid form; these modifications are invertible one into the other (a) by heating under pressure, (b) by cooling the concentrated solutions (reverse). Amylocellulose occurs in the starch granule resembling the liquid modification, capable of dissolving in boiling water and reacting with diastase and possibly it is held there by the amylopectin in the solid form. Amylopectin has the property of reversing the reversion of amylocellulose, both in the granule and in pastes. Conversely any influence to remove the amylopectin favours the reversion of the amylocellulose by reversion. The action of diastases is confined only to the amylopectin present in starch paste, hence such a diastase receives the name of amylopectinase; the saccharifying diastases on the other hand act only on the amylocellulose (when in liquid form).—J. F. B.

*Determination of Extract in —.* C. Bleisch and P. Regensburger. XXIII., page 640.

[*Beet-Molasses Residue*]; *Manurial Value of Compared with Ammonium Sulphate and 40 per Potassium Salt.* Lilienthal. XV., page 628.

#### ENGLISH PATENT.

*Wine and Beer; Materials for Production of —.* Ignier, London. Eng. Pat. 12,962, June 8, 1904.

Use of concentrated grape juice or grape sugar is made as a material for the preparation of whisky or brandy. This material may be mixed with malt if desired. Malt for whisky is fermented according to the process described in Eng. Pat. 3196 of 1904 (this J., 1905, 287) by the use of yeast specially selected from Scotch distilleries. —J. F. B.

#### UNITED STATES PATENT.

*Apparatus for Brewing —.* T. Suzuki, Sumatra, Japan. U.S. Pat. 789,299, May 9, 1905.

The apparatus consists of a closed heating chamber, the nature of which can be regulated, one or more brewing tanks sunk in the chamber and stirring shafts passing freely through the brewing tanks. These stirring

shafts carry several pairs of radial stirring arms, the arms of adjacent pairs being of different radial length; the pairs of radial arms are connected by transverse stirring slats, the whole being so arranged as to bring the arms and slats of adjacent stirrers out of alignment and alternately to thrust the soy from the path of one stirrer laterally into the paths of adjacent stirrers.—J. F. B.

#### GERMAN PATENTS.

*Worts; Process for Obtaining Clear — from Fine-Mesh Mash.* B. Rothenbücher. Ger. Pat. 157,202, Oct. 29, 1902.

AFTER allowing the mash to settle and running off the main quantity of clear wort, the pasty residue is brought on to a filter consisting of a layer of damp sponge, held by slight pressure between two perforated plates.—A. S.

*Filter: Centrifugal — [for Wort].* Brancieri Gross-Crostitz. A.G. Ger. Pat. 157,299, Aug. 2, 1902.

THE filter is enclosed by two cylinders rotating in the same direction but at different rates. The inner cylinder has a screw-thread on its outer surface. Both cylinders are perforated; the inner one retains the coarser particles, whilst the outer cylinder serves for the separation of the finer particles. A filtering layer is formed on the inner surface of the outer cylinder by means of floating loose filtering material, which is moved along by the screw-thread on the inner cylinder, so that a layer of uniform thickness is maintained.—A. S.

*Gases, Illuminating and Heating; Process for the Removal of Carbon Bisulphide from — [by means of Oil from Distillation of Vinasse].* Rositzer Zucker-Raffinerie. Ger. Pat. 157,563, May 19, 1903. II., page 612.

### XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

#### (A.)—FOODS.

*Rice Products; Composition and Feeding Value of —.* C. A. Browne, jun. Louisiana Agric. Exp. Stat., 1904, Bull., No. 77, 430—458.

THE rice is separated by various milling processes into different products, which are used as foodstuffs for animals. In the first place the hulls are removed by passing the grain through milling stones, screens and winnowing machines. The kernels are then decorticated, and the outer cuticle and much of the gluten layer of the grain, together with the germ, constituting the rice-bran or meal, are removed. The final process consists in polishing the grains. For this purpose, the latter are placed in rotating cylinders of wood and wire gauze, the surface of which is covered with soft, tanned hide. In the polishing process a film of gluten and starch cells is removed, and the fine flour thus obtained is called rice polish. The polished grains are then screened into various grades or sizes. In the following table are given the analyses of these products:—

	Water.	Fat.	Ash.	Proteids.	Crude Fibre.	Carbo-hydrates.	Starch.	Pentosans.
raw	10.84	0.59	14.04	5.31	32.91	33.31	—	15.84
hulls	8.97	0.49	13.29	3.50	41.89	27.36	—	17.24
meal (pure bran) I.	8.57	14.30	3.79	13.41	9.51	46.48	18.50	—
bran (16 per cent. hulls, 4 per cent. grits) II.	9.84	9.01	11.55	9.33	14.76	44.26	25.42	8.05
bran III.	10.01	9.03	8.07	9.26	11.00	52.63	—	—
polish (22 per cent. grits)	11.53	5.22	3.46	11.06	3.76	63.97	54.82	3.40
polish	10.70	6.95	2.95	8.53	1.00	69.14	—	—
rice	—	—	—	9.88	—	—	69.07	2.14
ed rice	—	—	—	6.56	—	—	77.55	—

rice hulls have absolutely no food-value, and are, in fact, injurious to cattle, as they are tough and fibrous. Under the microscope are seen to consist on the outer surface of groups of parallel rows of jagged, comb-shaped cells. Judging from the results of analyses, rice meal should contain at least 12 per cent. of proteids and 10 per cent. of fat, but not more than 10 per cent. of crude

fibre and 9 per cent. of ash. The presence of grits or broken grains of rice has been mentioned above. Although these have a high food-value, they are liable to pass through the animal undigested, and so be wasted. Rice meal, more properly called bran, is the most nutritious of the rice foods. The rice polish contains more starch than the bran, but less proteid and fat, and besides being used as a cattle-

food is sometimes employed as stalling material for saunages.

Rice foods frequently become rancid and unpalatable owing to the decomposition of the rice oil by the enzyme, *lipase*. In some cases the oil was found to consist of nearly 90 per cent. of free fatty acids, amounting to 12 per cent. of free acid in the foods themselves. By subjecting the meals to a temperature of 200° F., the enzyme is destroyed, and subsequent production of rancidity takes place only very slowly, if at all. Another method of preventing rancidity consists in removing a portion of the oil. This also increases the food-value of the meal, and the extracted oil has, itself, a considerable commercial value. Rice foods containing the natural amount of oil have a laxative effect on animals, and this would be avoided by reducing the quantity of oil to 2 or 3 per cent.—W. P. S.

*Molasses Cattle Foods.* C. A. Browne, jun. Louisiana Planter. 1905. 34. 236—237.

The commercial mixtures of blood and molasses, many combinations of which are prepared in European countries, offer a supply of very digestible protein, but sometimes undergo rapid decomposition in warm climates. Molasses has an antiseptic action when mixed with blood, and the activity of the bacteria which cause putrefaction is largely suspended, provided that the feed is properly dried, and that the amount of blood used is not excessive. One of the very best absorptive agents for molasses is bagasse; "molaseuit" consists of about 20 per cent. of the pithy part of bagasse and 80 per cent. of molasses. Louisiana manufacturers could greatly improve upon molaseuit, which is deficient in protein, by the addition of cotton-seed meal.

The following table gives the composition of various molasses feeding-stuffs:—

	Blood, Cereal, Molasses.	Corn, Oats, Cotton- Seed Meal, Molasses.	Corn, Oats, &c., Molasses.	Extracted Rice Bran, Molasses.	Molaseuit: Blood Molasses
Moisture .....	15.38	11.90	12.23	8.40	13.98
Fat .....	1.11	3.15	2.30	0.83	0.90
Ash .....	9.52	6.27	7.79	9.70	5.11
Fibre .....	12.98	14.20	12.78	13.00	5.64
Protein .....	16.13	12.75	6.41	14.00	1.94
Sugars .....	15.01	21.65	19.43	5.50	55.94
Other carbohydrates, &c. ...	29.87	20.98	39.06	48.57	16.49

—L. J. DE

*Milk; Presence of Ammonia in — as Evidence of Decomposition.* A. Trillat and Sauton. XXIII, page 637.

#### ENGLISH PATENTS.

*Food Products and other Perishable Organic Substances; Sterilisation of —.* J. A. Ohlsson, Stockholm. Eng. Pat. 7631, March 31, 1904.

To the food, such as milk, is added one per cent. of its volume of sterilised pressed-yeast extract, and one per cent. of hydrogen peroxide, and the mixture kept at a temperature of 37° C. for three hours. (See also Eng. Pat. 6819, 1904; this J., 1905, 341).—W. P. S.

*Milk Foods; Impts. in —.* J. R. Hatmaker, Paris. Eng. Pat. 13,715, June 17, 1904.

COTTONSEED oil, or other vegetable oil or fat is emulsified with skimmed milk, and the mixture dried to a powder. The quantity of oil added may be greater or less than the amount of butter fat originally present in the milk.

—W. P. S.

*Fruit Juices; Preparation of Non-Alcoholic —.* H. Stern, Berlin. Eng. Pat. 2166, Feb. 3, 1905.

THE freshly pressed juice is mixed with a suitable quantity of milk of lime in order to destroy the gummy and albuminous matters; the liquid is then saturated with carbon dioxide and filtered.—J. F. B.

#### FRENCH PATENT.

*Flour; Process and Apparatus for Bleaching.* P. A. Leperche, V. A. Salvadori and V. Denis. Pat. 349,198, Dec. 17, 1904.

THE flour is fed into a closed chest and is distributed by grooved rollers so that it falls in the form of a fine down the sides of the chest. It is exposed during it to the action of the rays of a number of electric lamps situated in a closed chamber with glass walls, occupying the centre of the chest. The flour is withdrawn from bottom and returned to the inlet at the top of the chest by means of a pneumatic elevator; another fan introduces air to the flour circulating through the chest in order to assist the bleaching.—J. F. B.

#### (B.)—SANITATION; WATER PURIFICATION.

*Water; A Case of Bacterial Deposition of Iron in —.* A. Beythien. Z. Unters. Nahr. Genussm. 1904. 529—531.

THE water in question was delivered through iron pipes to a small town in Saxony. As it came from the source the water was found to contain no iron, but a considerable quantity of free carbon dioxide in solution. After passing through 2 kiloms. of main the water coming from taps, hydrants, &c., showed a large amount of ferruginous suspended matter, which was found to consist of organic matter and iron oxide. Under the microscope the deposit was seen to be composed of a mass of threads similar to *Crenothrix*, incrustated with iron oxide, and in all probability *Gallionella ferruginea*. The contamination of the water was, therefore, due to the presence of this vegetation, the presence of the free carbon dioxide also being an important factor.—W. P. S.

*Nitric Acid in Water; Determination of — [by means of "Nitron"].* M. Busch. XXIII., page 638.

#### ENGLISH PATENT.

*Filtering Materials [Sand]; Apparatus for Cleaning —.* F. W. Dobson, Tamworth. Eng. Pat. 10,701, March 31, 1904.

THE apparatus is designed for the removal of sew or other material from sand, so that the latter may be used over again. It consists of a large cylindrical vessel capable of holding a few tons of sand, and is mounted horizontally on bearings so that it can be rotated. The sand is filled into the vessel through one or more man-holes. The vessel is then set rotating, and a stream of water is run through it, entering by a pipe passing through a bearing at one end, and leaving at the other by another. When the water leaving the vessel becomes clear the rotating motion is stopped, leaving the man-holes open most. The water remaining in the vessel is run off by means of a small pipe, after which the vessel is given a half-rotation to bring the man-holes to the under position and the sand then allowed to fall into sacks and back to the filter-bed.—W. P. S.

#### (C.)—DISINFECTANTS.

*Mildew on Vines; Comparison between Normal and Abnormal —.* Acetate and Alkaline Copper Washes, as Prepared by —.



— E. Chuard and E. Porchet. *Comptes rend.*, 1905, 140, 1354—1356.

cupric acetate in 0.5 to 1.5 per cent. solution, and as a wash to the leaves and stems of vines, is partly changed into basic acetate, and adheres strongly to them. Not only laboratory experiments, in which are treated with different washes were syringed with after the lapse of certain intervals of time after application, but also actual exposure for a season on have shown that the amount of copper compound remaining adherent to the plant is greater with cupric than with the washes made with copper salts and soda. These latter are, moreover, more difficult to apply and to apply than is the solution of the acetate. —J. T. D.

#### ENGLISH PATENTS.

*Insectant.* A. Stephan. Gross-Lichterfelde, Germany. Eng. Pat., 17,320, Aug. 8, 1904.

Eng. Pat. 345,398 of 1904; this J., 1904, 1233.—T. F. B.

*Fire Compound for Firemen's Use.* W. M. Mitchell, Louisville, U.S.A. Eng. Pat. 5932, March 21, 1905.

U.S. Pat. 786,543 of 1905; this J., 1905, 511.—T. F. B.

#### UNITED STATES PATENT.

*Acids, and Method of Dehydrating Moist Materials.* J. Smith, Elizabeth, N.J., Assignor to American Agricultural Chemical Co., New York. U.S. Pat. 176, May 9, 1905.

is made for the process of dehydrating a paste containing water and a material insoluble therein, by mixing with the paste, in quantity sufficient to dehydrate anhydrous salt capable of uniting with water, and towards the insoluble material. During the mixing, the mass is maintained at a temperature above the melting point of the hydrated salt. Claim is also made for application of the process to the manufacture of an acid, by mixing a paste of lead arsenate and water with anhydrous sodium sulphate, at a temperature above the melting point of hydrated sodium sulphate a pulverulent mixture of lead arsenate and hydrated sodium sulphate being produced.—A. S.

### XIX.—PAPER, PASTEBOARD, Etc.

*Pulp in Paper Making; Use of* — S. C. Phillips. J. Soc. Arts, 1905, 53, 700—717.

Chief points of this lecture fall under the headings of: (I.) Countries and sources of supply, species of wood, and methods of collection. (II.) Mechanical pulp: its properties, plain ground pulp, steamed and sulphite pulp, pulp treated with alkaline or acid solutions and grinding; Voelter's machine for grinding wood, and its use in manufacture, sorting and preparing the pulp for the crushing or stamping process for disintegrating cost of manufacture. (III.) Chemical pulp: Early makers and pioneers of the industry, Ekman, Mitscherlich, Kellner; processes of manufacture, sulphite process, soda process, sulphate process, properties of wood-products, digester linings, statistics of production. (IV.) Appendices: (1) Patents. (2) Statistics of wood pulp into Great Britain.—J. F. B.

*Yarn and its Uses.* C. Beadle. Paper and Pulp, 1905, 10, 297—301.

are two processes by which paper yarn is manufactured: (1) Paper is made in separate strips on the paper-making machine, the strips being collected in a reel and twisted from these into yarn on the spinning machine; (2) the "Silvalin" process, by which the paper is made on a Fourdrinier machine and divided in the wet into a number of narrow strips, which, however, are not completely separated, but half-dried on a single reel and reeled damp in the form of a coherent web, which is subsequently placed in front of a spinning frame

and the single strips are easily separated in the damp state and spun. The latter is the more economical and efficient process. The raw material may consist of any fibre capable of being made into paper; most frequently a mixture of sulphite and soda wood pulps is employed, to which a proportion (up to 75 per cent.) of mechanical pulp may be added for the rougher yarns. Silvalin is made in counts ranging from 1,000 yards per lb. for the coarsest to 15,000 yards per lb. for the finest. Used either alone or mixed with textile yarns, it is capable of application in almost all classes of fabrics and ropes; the rougher qualities woven alone make an excellent substitute for jute sacking. It resists washing very satisfactorily. A unit plant for preparing the Silvalin paper costs about £3000, and has a capacity of 3½ tons for rough yarns or one ton for finest yarns per 24 hours. The machinery necessary for spinning the product of the above unit plant in 12 hours would contain 1300 spindles for the rough, and 2300 spindles for the fine yarns. The cost of production of Silvalin yarn, when undertaken as an addition to an existing organisation, is estimated at 1½d. per lb. for rough, 1½d. per lb. for medium, and 2½d. per lb. for the finest yarns.—J. F. B.

#### UNITED STATES PATENTS.

*Pulp, Wood; Process for Making* — G. S. Cushing, St. John, Canada. U.S. Pat. 788,633, May 2, 1905.

Wood, reduced to the condition of small chips or blocks, is subjected to the action of steam under pressure, in order to heat and expand it. While hot, it is removed to a grinding machine and ground without pressure, some water being added to it during the operation. A highly fibrous, soft pulp is, it is stated, thus obtained.—E. B.

*Cornstalks, Sugar-cane, Sorghum, &c.; Manufacture of Products and Paper from* — V. Drewsen, New York. U.S. Pat. 789,416, May 9, 1905.

PITHY stalks of any kind, such as maize, sugar-cane or sorghum, are chopped into pieces and boiled with a lye containing 15-30 per cent. of caustic soda, calculated on the dry weight of the material, for four to 10 hours, according to the strength of liquor, under a steam pressure of 60—100 lb., until the pith cells have been converted into soft absorbent pulp, instead of hard parchment-like pulp. The boiled pulp is run directly, without beating, upon the paper machine and converted into opaque, soft paper free from filling material.—J. F. B.

*Cornstalks, Sugar-cane, Sorghum, &c.; Manufacture of Products and Paper from* — V. Drewsen, New York. U.S. Pat. 789,417, May 9, 1905.

THE pulp obtained according to U.S. Pat. 789,416 (see preceding abstract) is mixed with a filling material, and is converted, without beating, into opaque, soft, "imitation coated" paper.—J. F. B.

*Cornstalks, Sugar-cane, Sorghum, &c.; Manufacture of Products and Paper from* — V. Drewsen, New York. U.S. Pat. 789,418, May 9, 1905.

PULP prepared according to U.S. Pat. 789,416 (see above) is converted into translucent, non-brittle writing and imitation parchment paper, by beating the boiled pulp in a beating engine, until the pith-cells have been broken up and opened, and then running the pulp on the paper-machine.—J. F. B.

*Paper Pulp Straining Apparatus.* F. G. Busbridge, West Malling, England. U.S. Pat. 789,792, May 16, 1904.

SEE Eng. Pat. 25,075 of 1903; this J., 1904, 677.—T. F. B.

#### GERMAN PATENT.

*Pulp, Paper; [Electrolytic] Process for the Removal of Chlorine from and Purification of* — J. F. Colby. Ger. Pat. 157,763, Dec. 28, 1902.

THE bleached paper pulp after treatment with acid, is subjected to the action of an electric current, whereby organic and inorganic impurities and particles of metal are

stated to be removed or rendered soluble, whilst the chlorine is oxidised to chloric acid, which, by the subsequent treatment with alkali, is converted into soluble chlorates. —A. S.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Rare Metals: Anhydrous Chlorides of the —.* C. Matignon. *Comptes rend.*, 1905, 140, 1181–1183.

THE solution in hydrochloric acid of the oxide of the metal is evaporated to dryness on a sand-bath at 130–140° C., and the solid residue is heated in a stream of chlorine and hydrochloric acid gases charged with the vapour of sulphur dichloride. The chlorides so formed are fused, and, on cooling in the current of gases, yield a mass of minute crystals. The pure anhydrous chlorides (lanthanum, neo- and praseodymium, samarium, yttrium) are thus prepared with great ease, and either large or small quantities can be treated.—J. T. D.

*Oxidic Acid: New Synthesis of —.* H. Moissan. *Comptes rend.*, 1905, 140, 1209–1211.

CONTINUING the study of the reaction between dry carbon dioxide and potassium hydride (this J., 1903, 494), the author has found that when the reaction is started at a temperature of 54° C., potassium formate is the only product. Similarly, in the presence of a trace of water, when the reaction is started at the ordinary temperature, no oxalate is produced. But when the dried substances are allowed to react at initial temperatures of 80–200° C., the product consists of a mixture of formate and oxalate. The latter is formed in accordance with the equation:



the volume of hydrogen evolved being strictly equivalent to the quantity of oxalate produced.—J. F. B.

*Acids; Electrolytic Reduction of Aromatic Carboxylic — to the corresponding Alcohols.* C. Mettler. *Ber.*, 1905, 38, 1745–1753.

THE author has previously (this J., 1904, 1096) described the electrolytic reduction of aromatic esters. He now finds that under suitable conditions, the free aromatic acids can also be reduced electrolytically to the corresponding alcohols. One of the advantages of the electrolytic method is that the products can be more easily obtained in a pure condition than by the usual methods of preparation. Descriptions are given of the preparation of benzyl alcohol from benzoic acid, *m*-bromobenzyl alcohol from *m*-bromobenzoic acid, *m*-, *o*-, and *p*-chlorobenzyl alcohol from *m*-, *o*- and *p*-chlorobenzoic acid, *o*-aminobenzyl alcohol from anthranilic acid and from *o*-nitrobenzoic acid, *m*-aminobenzyl alcohol from *m*-nitrobenzoic acid, *m*-hydroxybenzyl alcohol from *m*-hydroxybenzoic acid, benzyl-phenyl ether from phenyl benzoate, and dibenzyl ether from benzyl benzoate. Yields of from 70 to 90 per cent. were obtained. The following is an example of the process adopted:—The electrolysis was carried out in a glass beaker containing a porous cell, a lead anode and a sheet lead cathode having a surface of 100 sq. cm. A mixture of 30 grms. of concentrated sulphuric acid, 70 grms. of alcohol and 20 grms. of benzoic acid was placed in the cathode compartment and 30 per cent. sulphuric acid in the anode chamber. The temperature was maintained at 20°–30° C. by water-cooling, and a current-strength of 10 amperes was used. During the electrolysis a further quantity of 20 grms. of benzoic acid was added. When benzoic acid could no longer be detected in the electrolyte, which happened after about 80 ampère-hours, the current was cut off, the benzyl alcohol separated from the electrolyte by diluting with water, and also by extraction with ether, dried by means of ignited sodium sulphate, and distilled.—A. S.

*Alcohols; Reaction of Metal-Ammoniums on — [Alcoholates].* E. Chablay. *Comptes rend.*, 1905, 140, 1343–1344.

THE alkali-metal and the alcohol are separately dissolved in liquid ammonia, and the two solutions are then mixed.

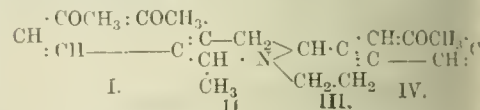
In the case of the primary alcohols the reaction is and the cessation of decolorisation of the methanum, as it is added to the alcohol solution, affords indication of the completion of the reaction. In the case of secondary and tertiary alcohols, it is much slower, and the reaction must be added to the ammonium.—J. T. D.

*Cuminoin and Cuminil; Note on the Preparation of —.* H. Biltz and C. Stellbaum. *Annalen*, 1905, 338, 204–206.

THE authors find that good yields of cuminoin obtained from ordinary cuminaldehyde, if this is purified. The cuminaldehyde is precipitated with potassium bisulphite, and after 24 hours the crystalline mass is washed with bisulphite solution, alcohol and water. The product is decomposed with sodium carbonate, distilled, and the oil fractionated in a vacuum. An alcoholic solution of this aldehyde is boiled in a vacuum with potassium cyanide, and allowed to crystallise. After recrystallising from alcohol, a 30–35 per cent. yield of pure cuminoin is obtained, melting at 100° C. On oxidation with chromic anhydride and glacial acetic acid, there is a yield of 80–85 per cent. of pure corydalin.

*Corydalis Alkaloids.* J. Gadamer and O. Haars. *Pharm.*, 1905, 243, 147–160; 161–197.

THOSE portions of the plant *Corydalis cava* which grow above the ground were found to contain besides the corydalis alkaloids, also bulbocapnine,  $C_{15}H_{15}NO_4$ , and two new bases,  $C_{21}H_{21}NO_8$  and  $C_{21}H_{23}NO_7$ . With regard to the constitution of corydalin, it was found that the drcorydalin,  $C_{22}H_{23}NO_5$ , formed by careful oxidation of corydalin, is a quaternary base, the pseudo base which behaves as a ketone base. By reduction of drcorydalin, two isomeric inactive corydalins are formed, the one melting at 135° C. being of the *racemic* acid type, and the other melting at 158° C. being an *asymmetric* mesotartaric acid. The results of oxidation experiments exactly confirmed those of Dobbie and (this J., 1902, 137), and the constitution of corydalin as indicated by those chemists



may be regarded as proved except with regard to the position of the methoxyl groups in the first carbon atom. (See also this J., 1902, 423, 496).—A. S.

*Papaverinium Bases. III.* H. Decker and O. F. Ber. 1905, 38, 1739–1741.

DIMETHOXY-N-METHYL-ISO-QUINOLONE and N-dimethoxy-iso-quinolone prepared from dimethoxyquinoline proved to be identical with the corresponding compounds from iso-papaverine bases. (See this J., 1905, 336, 1160).—A. S.

*Birch Buds; Essential Oil of —.* H. von Soden and F. Elze. *Ber.*, 1905, 38, 1636–1638.

THE essential oil obtained to the amount of 4.3 per cent. by distilling birch buds is generally viscous, and of a yellowish colour. The specimen examined had a density (15° C.) of 0.975; optical rotation,  $-2^\circ$ ; b. pt., 295° C. with partial decomposition and resinification, acid being evolved; acid value, 2.1; ester value, 177.8. On dilution with alcohol and cooling the oil to about 10° C., a small quantity of less, tasteless crystals was obtained; the pure substance melted at 50° C., and is thought to be a pure compound. The oil contains a large proportion (41 per cent.) of a sesquiterpene alcohol *betulol*, and of its ester (31.4 per cent.). The alcohol is easily isolated from the oil by means of phthalic anhydride, and shows the following properties:—Sp. gr. (15° C.), 0.975; [α]<sub>D</sub>,  $-2^\circ$ ; b. pt. (4 mm.), 138°–140° C.; (743 mm.), 284° C. (with partial decomposition); it is soluble in three p



cent. alcohol, and has an odour resembling that of sandal-wood oil, but differs in odour. Its composition is represented by the formula  $C_{15}H_{12}O$ , and it is probably a primary sesquiterpene alcohol.—T. F. B.

*Am.*; New Compound [Iodosmous Acid] of, Reaction for — [also, for Detection of Iodides]. Alvarez. XXIII., page 637.

*Am.*; Qualitative Reactions of —, P. Melikow and E. Jeltschaniow. XXIII., page 637.

*Am.*; Determination of — in presence of Iodine. J. Milbauer and R. Ilac. XXIII., page 640.

*Am.*; zones derived from p-, m-, and o-Nitrophenylamine [Detection and Determination of Aldehydes and Ketones]. W. A. Van Ekenstein and J. J. Kikina. XXIII., page 639.

*Am.*; Use of — with Hydrochloric Acid as a Reagent. L. Rosenthaler. XXIII., page 639.

*Am.*; in Dimethylaminoantipyrine [Pyramidone or dopyrine]; Detection of —, P. Boureot. XXI., page 639.

#### ENGLISH PATENTS.

*Am.*; Bitartrate and Tartaric and Citric Acids; Process for the Manufacture of —, in which Tormentum is Employed. A. J. Boissière, Tauville, and L. Cheux, Alençon, France. Eng. Pat. 11,991, May 26, 1904.

Pat. 338,735 of 1903: this J., 1904, 680.—T. F. B.

*Am.*; dine Derivatives; Manufacture of —, H. E. Ton, London. From Farbenfabr. vorm. F. Bayer Co., Elberfeld, Germany. Eng. Pat. 17,003, 3, 1904.

condensing the dinitrile of malonic acid or its alkyl esters with thiourea in presence of alkaline condensing agents 2-thio-4,6-di-iminopyrimidines are obtained. These are converted (1) into 2-thio-4,6-dioxypyrimidines by treatment with hydrolysing agents, and the latter into corresponding barbituric acids by oxidising the thionyl to a carbonyl group, or (2) into 2-oxo-4,6-di-imino-pyrimidines by oxidation, barbituric acids obtained from the latter by hydrolysis.—T. F. B.

#### UNITED STATES PATENT.

*Am.*; c Acid and its Salts; [Electrolytic] Process for producing —, C. Ellis, Boston, Mass. U.S. Pat. 769, May 9, 1905.

malonic acid and its salts are produced electrolytically in the presence of saccharine solutions, in the presence of which the oxidation of malonic acid to pyruvic acid, these compounds being removed after separation from the field of oxidation.—R. L.

### XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*Am.*; Photography] "Bleaching-out" Process. R. A. Weiss, Phot. Rundt. 1905, 19, 85. Chem.-Zeit. 1905, 29, Rep. 144.

author has continued his research on the preparation of photographic materials in natural colours, and finds that the best results are obtained by using the following solution:—10 g. of gelatin, 100 c.c. of water, 4 c.c. of Methylene Blue (in 500 of water), 2 cc. of Anramine (1 in 500 of water), and about 1.5 c.c. of Erythrosin (1 in 200 of water). These coloured solutions are added to the gelatin solution, the Erythrosin being added last; and the mixture is allowed to stand at 35°–40° C. for three to four hours. The addition of the Erythrosin or too high a tempera-

ture causes the separation of a microscopic precipitate which impairs the solution. The author also succeeded in transferring the colour pictures to paper. A glass plate is coated with rubber and then with the colour mixture. When dry the picture film can easily be removed, and after dissolving out the rubber with benzene, can be pressed on to gelatinised baryta paper. B. J. S.

*Am.*; Cobaltamine Compounds [and other Cobalt Salts]; Use of — for Reducing the Silver Image. H. E. Smith. Phot. J., 1905, 55, 185–190.

Cobaltamine salts are found to constitute, in acid solutions, satisfactory, if rather slow reducing agents for decreasing the gradation of photographic negatives or positives. The most satisfactory salt was found to be Erdmann's salt,  $Co_2(NH_3)_4(NO_2)_6 \cdot 2KNO_3$ . The solution is prepared by adding 50 c.c. of 15 per cent. sulphuric acid to 50 c.c. of a 0.5 per cent. solution of the salt. The sulphuric acid may be replaced by other mineral acids. When reduction has proceeded to the desired degree, the plate or paper is washed, immersed in a 10 per cent. ammonium solution, and again washed. The following other cobaltamines also act satisfactorily:—Erdmann's salt in which the potassium nitrite is replaced by other metallic nitrites, ceric, xantho-, and flavo-cobaltic chlorides,  $Co_2Cl_2(NO_2)_4(NH_3)_3$ ,  $Co_2Cl_2(NO_2)_2(NH_3)_3$ ,  $Co_2Cl_2(NO_2)_4(NH_3)_3$ . Double salts of cobalt nitrite with the alkali nitrites also have a similar reducing action on the photographic image.—T. F. B.

#### ENGLISH PATENT.

*Am.*; Pigment Paper; Photographic —, A. Hühneimer, Feldkirchen-München, Germany. Eng. Pat. 23,766, Nov. 3, 1904.

SEE Fr. Pat. 347,510 of 1904; this J., 1905, 346.—T. F. B.

#### FRENCH PATENTS.

*Am.*; Photographic Images or Prints; Preparation of Coloured —, and Sensitive Surfaces for their Production. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 349,060, March 7, 1904.

SEE Eng. Pat. 4994 of 1904; this J., 1905, 151.—T. F. B.

*Am.*; Pigment [Photographic] Process. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 349,120, Dec. 2, 1904. Under Int. Conv., June 11, 1904.

This process is based on the fact that neutral chromates which are insoluble in water have the power of rendering pigmented gelatin, in acid solutions, insoluble in water. A suitable support, e.g., paper coated with gelatin, is impregnated with a solution of a ferric salt which can be reduced by light (e.g., ferric citrate), and with a metallic salt which gives a precipitate with neutral chromates, but none with bichromates (e.g., copper or nickel sulphate, or mercuric chloride). On exposure to light, the ferric salt is reduced, and the support is immersed in a solution of a bichromate; at the portions of the paper which contain ferrous salt, reduction of the bichromate to chromate at once takes place, with simultaneous precipitation of the metallic chromate on the paper. The support is then washed, and pressed against a pigmented gelatin paper, in a bath of very dilute acid, when the gelatin in contact with the metallic chromate is rendered insoluble; after allowing the papers to remain in contact for several (three to six) hours, the print is developed in hot water in the usual manner.—T. F. B.

### XXII.—EXPLOSIVES, MATCHES, Etc.

*Am.*; Nitric and Sulphuric Acids; Behaviour of Mixtures of —, A. Saposchnikow. Z. physik. Chem., 1905, 51, 609–626. (See this J., 1904, 865, 935; 1905, 87).

Vapour Pressure of Mixtures of Nitric Acid of sp. gr. 1.48 and Concentrated Sulphuric Acid. The acids used were pure 100 per cent. sulphuric acid monohydrate ( $H_2SO_4$ ) and nitric acid of sp. gr. 1.467 at

15°/15° C., and containing 0.402 per cent. of higher oxides of nitrogen, so that it had the composition: nitric acid, 82.8; water, 17.2 per cent. The results obtained are shown in the following table:—

No.	Percentage by Weight.		Composition, per cent. by Weight.			Vapour Pressure.		Percent of Nitrogen in Vapour.
	Nitric Acid of sp. gr. 1.48.	Sulphuric Acid.	Nitric Acid.	Sulphuric Acid.	Water.	Min. of Mercury.		
	100.0	—	85.2	0.0	14.8	16.64		22.6
1	97.27	2.73	82.87	2.73	14.4	19.56		22.4
2	94.86	5.14	81.0	5.14	13.86	21.50		22.1
3	90.0	10.0	76.07	10.0	13.33	26.8		22.2
4	79.68	20.32	67.87	20.32	11.81	31.30		22.5
5	69.81	30.19	59.48	30.19	10.33	33.60		22.8
6	59.91	40.09	51.04	40.09	8.87	34.12		22.3
7	50.0	50.0	42.60	50.0	7.40	31.16		22.7
8	39.25	60.75	33.44	60.75	5.81	24.88		22.1
9	30.23	69.77	25.75	69.77	4.48	18.20		23.0
10	20.07	79.93	17.10	79.93	2.97	8.40		24.2
11	10.05	89.95	8.56	89.95	1.49	—		29.9
12	5.29	94.71	4.51	94.71	0.78	—		—

It will be seen that the vapour pressure of nitric acid of sp. gr. 1.48 (16.64 m.m.), is nearly three times as small as that of pure nitric acid (sp. gr. 1.52 (16.2 mm.; see this J., 1905, 87), probably owing to the nitric acid forming relatively stable hydrates with the water, 1 mol. of water combining with several molecules of acid, and thereby considerably diminishing the concentration by volume of the latter. This also affords an explanation of why nitric acid alone, even when of the highest strength (sp. gr. 1.5—1.52), is not suitable for the nitration of cellulose, giving low-nitrated products; the water formed in the first stage of the nitration combines with the nitric acid to form hydrates, and in this way reduces the number of available molecules of nitric acid. The maximum vapour pressure is attained with a mixture containing 65 per cent. of nitric acid (sp. gr. 1.48) and 35 per cent. of sulphuric acid, or almost exactly  $5\text{HNO}_3 + 2\text{H}_2\text{SO}_4 + 3\text{H}_2\text{O}$ .

**Action of Water on Mixtures of Nitric and Sulphuric Acids.** The addition of water to mixtures containing less than about 60 per cent. of sulphuric acid, causes a diminution in the vapour pressure, the effect being less as the percentage of sulphuric acid is increased. With mixtures containing more than 60 per cent. of sulphuric acid, however, addition of water causes an increase of vapour pressure. This is due to the fact that with high percentages of sulphuric acid, some of the nitric acid is dehydrated to nitric anhydride, which, on the addition of water, is again converted into nitric acid.

**Use of Mixtures of Nitric and Sulphuric Acids in the Nitration of Cellulose.** A satisfactory acid mixture for nitration purposes must fulfil two requirements. It must contain sufficient nitric acid to give the desired reaction-velocity and degree of nitration; and its properties must not be appreciably altered by the water separated during the nitration. Mixtures which best answer the first condition, have, however, the disadvantage, that the volume-concentration of the nitric acid is strongly diminished by addition of water. A mixture must therefore be chosen which has a vapour pressure less than the maximum, but which will bear an addition of water without notable alteration. In the case of mixtures containing a relatively high percentage of sulphuric acid, an addition of water must be made in order to prevent dehydration of the nitric acid, with formation of nitric anhydride. The composition of acid mixtures for nitrating purposes may be varied within wide limits, but the author considers that for the preparation of high-nitrated gun-cotton, the best results will, in general, be obtained with mixtures of nitric acid of sp. gr. 1.48 with from 65 to 75 per cent. of sulphuric acid. Probably the most suitable mixture is No. 9 in the table (see above) with the addition of 5 per cent. of water, giving a mixture containing: nitric acid, 24.29; sulphuric acid, 65.80; and water, 9.91 per cent.—A. S.

#### UNITED STATES PATENT.

**Blasting Composition.** M. Bielefeldt, Berlin. U.S. Pat. 789,252, May 9, 1905.

SEE Eng. Pat. 25,884 of 1901; this J., 1902, 1471.—T. F. B.

#### FRENCH PATENTS.

**Nitroglycerin: Manufacture of —.** A. Mikol. Fr. Pat. 349,078, Dec. 17, 1904. Under Int. Dec. 18, 1903.

The tendency of trinitroglycerin to congeal diminishes the rise in the amount of dinitroglycerin contained in the object of this patent is to obtain a product containing a large proportion of the latter. For this purpose, the product is separated as completely as possible by water, partially neutralising the acid solution (after nitrating some alkaline substance). The formation of dinitroglycerin is promoted by decreasing the proportion of sulphuric acid in the nitration mixture, and using more glycerin than usually done.—C. A. M.

**Caps; Charges for —.** Westfälisch-Anh. Sprengstoff Act.-Ges. Fr. Pat. 318,721, Dec. 9, 1904.

The following cap compositions are claimed, which are intended to form a protective coating on the gun barrel:—(1) 36 parts of fulminate of mercury, 40 parts of (or mercury) chromate, 20 parts of antimony sulphide, and four parts of powdered glass. (2) 40 parts of fulminate of mercury, 10 parts of potassium chlorate, 26 parts of lead chromate, and six parts of powdered glass. (3) 20 parts of fulminate of mercury, 16 parts of lead peroxide, and six parts of lead chromate, and six parts of powdered glass.—L. F. G.

## XXIII.—ANALYTICAL CHEMISTRY

### INORGANIC QUALITATIVE.

**Sodium; Detection of Salts of —.** Modification of Fremy's Reagent. J. Bougault. J. Pharm. Med. 1905, 21, 437—442.

The best results are stated to be obtained when the reagent prepared in the following manner. One gram of antimony trichloride is added to a mixture of 10 c.c. of a 33.3 per cent. solution of potassium carbonate and 45 c.c. of 10-volume hydrogen peroxide, and the whole gently warmed. The precipitate formed at first gradually redissolves, and there is an evolution of oxygen. After heating for 5 to 10 minutes the solution is cooled and separated by filtration and decantation, from any small quantity of precipitate which has not redissolved. In using the reagent, the following precautions should be observed. The solution of the sodium salt should be neutral or alkaline, free from salts of the heavy metals, and should occupy as small a volume as possible. After adding the reagent (not more than 0.1 cc.), the mixture should be heated to boiling for a few moments, and then allowed to cool. It is then to detect 0.4 mgrm. of sodium chloride. In the case of potassium salts, the reagent is much less sensitive, it is recommended that in these cases, the salts be converted into acetates and then the potassium separated as far as possible, as tartrate. Lithium also is sparingly soluble antimoniate, but this can be distinguished from the sodium salt under the microscope.—



16, 1905.]

*New Reagent for —*, E. P. Alvarez. Comptes rend., 1905, 140, 1186—1187.

A 1 per cent. solution of *eikonogen*, or sodium amino-sulphonate, ( $\text{NH}_2 : \text{OH} : \text{SO}_3\text{Na} = 1 : 2 : 6$ ), is a delicate reagent for potassium in neutral solutions, giving more precipitate than is platinum chloride. The reaction requires time; the deposition of the potassium aurochloride is favoured by shaking, but in a 1 per cent. solution of potassium chloride is only visible after some hours. The precipitate is white and lustrous, and brilliant, the crystals appearing under the microscope as pearly orthorhombic laminae. It is almost insoluble in water, quite insoluble in alcohol. Salts of sodium or magnesium are not precipitated by the reagent, and do not interfere with the precipitation of potassium. Many of the heavy metals behave like potassium, but others are precipitated by the reagent. —J. T. D.

*Monoxide and Silver Oxide; Reaction between — and its application for the Detection of Carbon Monoxide in Atmosphere*, H. Dejust. Comptes rend., 1905, 140, 1250—1252.

Carbon monoxide is passed over silver oxide in the test at the ordinary temperature, the latter is reduced to metallic silver with a very considerable rise of temperature:  $\text{CO} + \text{Ag}_2\text{O} = \text{Ag} + \text{CO}_2$ . It is preferable to use silver oxide to  $40^\circ\text{--}50^\circ\text{C}$ ., in order to start the reaction. In the presence of water there is also a reduction, but extremely slow. The reduction of an ammoniacal solution of silver oxide may be utilised for the detection of small quantities of carbon monoxide in air. For this purpose, the ammoniacal silver solution is allowed to drop through a funnel into a beaker at the rate of about 20 cc. per hour, the same liquid being passed three times in succession. By comparing the colour of the reduced silver with standardised tints, an approximate measure of the proportion of carbon monoxide may be obtained, being taken that neither acetylene, sulphuretted hydrogen nor other reducing gases are present. —J. F. B.

*Colloidal; A Red Solution of — obtained by means of Carbon Monoxide [Detection of Carbon Monoxide]*, J. Monatsh. f. Chem., 1905, 26, 525—530.

Gold obtained by precipitation with oxalic acid dissolved in hydrochloric acid and a few drops of hydrochloric acid, the solution evaporated to dryness, and the residue dissolved in "conductivity water." On passing carbon monoxide through the solution, a faint red or violet coloration appeared after two to three hours, changing after some time to purple. The solution is identical in properties with the colloidal gold obtained by Zsigmondy (this J., 1902, 192, 1250). The reaction may be used as a delicate test for carbon monoxide. A few drops of water saturated with carbon monoxide will give a distinct coloration, and even 1 c.c. of such water has been diluted to five times its volume will give a distinct coloration with the gold chloride solution after some time. —A. S.

*Presence of Ammonia in — as Evidence of Spoilage*, A. Trillat and Sauton. Comptes rend., 1905, 140, 1266—1268.

Authors apply the nitrogen iodide test (see this J., 1905, 548 and 549) for the detection of ammonia in milk, in the following manner: 10 c.c. of milk are treated with a 10 per cent. solution of iodine trichloride, the mixture is filtered and pure milk of lime (1 per cent.) is gradually added to the filtrate until a precipitate of nitrogen iodide, indicating the presence of ammonia, is obtained.

Milk of healthy cows obtained under proper conditions of cleanliness in a well-ventilated house, should contain only ammonia. Ammonia is produced by the action of micro-organisms in the milk, but the absence of ammonia is no proof that the milk is not contaminated. Certain species of bacteria do not form ammonia. The presence of ammonia, especially if the quantity is small, is a presumption, but not a certain proof, of pollution or watering. —J. F. B.

*Rhodium; Reaction of —*, P. Alvarez. Comptes rend., 1905, 140, 1341—1343.

To an aqueous solution of a rhodium salt, such as sodium chlororhodate, excess of sodium hydroxide is added, and through the solution is passed the gaseous mixture evolved by the reaction of hydrochloric acid on potassium chlorate. The colourless liquid becomes yellow and afterwards red; a green precipitate is then formed, which dissolves later to a deep-blue solution. The blue solution is decolorised by sulphurous acid, or by sodium peroxide or persulphate. This reaction is very sensitive, and quite distinctive of rhodium. —J. T. D.

*Osmium; New Compound [Iodo-osmious Acid] of and Reaction for — [also for Detection of Iodides]*, P. Alvarez. Comptes rend., 1905, 140, 1254—1256.

The author has found that nascent hydriodic acid is a good qualitative and quantitative [colorimetric] reagent for osmium compounds and that the latter, particularly osmic acid, are conversely available as reagents for the presence of iodides even when mixed with chlorides and bromides.

The new compound, on the formation of which this test depends, is iodo-osmious acid  $\text{I}_2\text{Os} \cdot 2\text{HI}$ ; its solutions possess a fine emerald green colour, but the free acid is somewhat unstable and very easily oxidised, the green colour changing to red on exposure to the air. The reaction is carried out by mixing 2 c.c. of a one per cent. solution of potassium iodide with 1 c.c. of syrupy phosphoric acid, and adding to the mixture a few drops of a dilute solution of the osmium compound. The green colour is developed after stirring for one or two minutes. The reaction may be expressed by the equation  $\text{OsO}_4 + 10\text{HI} = \text{I}_2\text{Os} \cdot 2\text{HI} + 4\text{H}_2\text{O} + 3\text{I}_2$ . Since the green compound is extracted from its aqueous solution by ether, the delicacy of the test may be very much increased by performing it in presence of ether. The salts of iodo-osmious acid are relatively stable, and permanent green solutions are produced by forming the compound in presence of a strong solution of calcium chloride. —J. F. B.

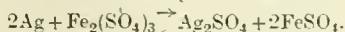
*Niobium; Qualitative Reactions of —*, P. Melikow and E. Jeltchaninow. J. russ. phys.-chem. Ges., 1905, 37, 99—103.

POTASSIUM fluoperniobate is coloured yellow by sulphuric acid in presence of small quantities of hydrogen peroxide. Also, concentrated solutions of potassium perniobate are coloured yellow by concentrated sulphuric acid. The reactions are stated to be so delicate that the presence of 0.1 per cent. of niobium in tantalum preparations can be detected with certainty. —A. S.

#### INORGANIC QUANTITATIVE.

*Potassium Permanganate Solution; Standardisation of — by means of Silver*, K. Hopfgartner. Monatsh. f. Chem., 1905, 26, 469—482.

THE method is based upon the reaction:



A weighed quantity of pure silver is dissolved in a solution of ferric-ammonium sulphate rendered acid with sulphuric acid, and the ferrous sulphate produced in quantity equivalent to the weight of silver dissolved, is titrated with the permanganate solution the strength of which is to be determined. —A. S.

*Chlorates, Bromates, and Iodates; Reduction of —, for the Quantitative Determination of their Halogen Content*, P. Jannasch and A. Jahn. Ber., 1905, 38, 1576—1589.

THE authors have investigated the action on these salts of various reducing agents: their results are as follows:—*Nitric Acid*.—The ordinary strong acid is without action on chlorates and iodates; it reduces bromates, but as free bromine is formed, the reaction is useless quantitatively. Fuming nitric acid reduces chlorates and bromates completely, but not iodates. *Hydrogen peroxide* in alkaline solution has no action: in nitric acid solution, with certain precautions, it reduces chlorates completely;

the same occurs with bromates, but is then perhaps accomplished by the nitric acid alone. There is no reaction with iodates. *Hydrazine sulphate* in alkaline solution reduces iodates and bromates completely, but not chlorates. *Formic acid* behaves towards all three like hydrazine sulphate, save that there is a tendency for free iodine to separate. *Aldehydes* (acetaldehyde and grape sugar were tried) give no reduction: though chlorates are reduced when heated under pressure with dextrose and acetic acid. *Hydroxylamine sulphate* gave the best results of any reagent tried. In acid solution the reaction is stronger than in ammoniacal solution; the former is better for chlorates and bromates, the latter for iodates. About 0.25 gm. of the salt is dissolved in 50 c.c. of water, 5 grms. of solid hydroxylamine sulphate are added, excess of nitric acid added, and the solution warmed and afterwards precipitated with silver nitrate. In the alkaline method, excess of ammonia is added before the hydroxylamine salt, instead of excess of acid after it.—J. T. D.

*Ore-Sampling; Some Experiments on* —. A. T. French, Inst. of Min. and Met. Bulletin, No. 8, May 11, 1905, 9—11.

In the "canvas" method, a sheet of stout canvas about 6 ft. square is employed. If the ore has not been previously crushed, the canvas is laid upon the usual iron plate, and a block of iron is placed on the canvas, upon which the ore is broken with hammers. When sufficiently small the iron block is removed and the sample is mixed by rolling from end to end. Finally it is brought to the centre by taking up the four corners and shaking to detach any fine dust. The sample is then divided into four, and two opposite quarters taken as usual. The rolling and dividing are repeated as may be considered necessary. Comparative experiments with this, the "alternative shovel," and "coning and quartering" methods are also briefly described by the author. He concludes that the canvas method is more accurate than the alternate shovel method, and equal to the coning and quartering method, but much quicker.—J. H. C.

*Copper; Determination of Oxygen in* —. S. Dickson. Analyst, 1905, 30, 145—149.

BLOUNT's method for the determination of oxygen in copper consists in fusing the metal in a current of dry hydrogen and collecting and weighing the water produced. The author proposes a modification of this method by lowering the melting point of the copper by the admixture of about twice its weight of tin, previously fused in a current of hydrogen. By this means the determination can be carried out in an ordinary tube furnace without a blast. The apparatus consists of a hydrogen generator, a drying-tube, a tube containing platinised asbestos for elimination of oxygen, a second drying-tube, a porcelain heating tube  $1\frac{1}{2}$  in. external diameter, a porcelain boat for containing the copper and tin, a tube-furnace, an absorption tube and a guard tube filled with pumice and sulphuric acid. The results obtained are slightly higher than by Blount's method. The author shows that Archbutt's method of heating the copper without fusion only yields the whole of the oxygen when the metal is very finely divided.—J. F. B.

*Nitric Acid in Water; Determination of* — [by means of "Nitron"]. M. Busch. Z. Unters. Nabr. u. Genuss., 1905, 9, 464—468.

*Detection of Nitric Acid in Water.*—From 5 to 6 c.c. of the water under examination are acidulated with one drop of dilute sulphuric acid and six to eight drops of a 10 per cent. solution of "nitron" (see this J., 1905, 289, 291, 458) in 5 per cent. acetic acid are added. If a white precipitate of "nitron" nitrate forms immediately, or if the salt crystallises out in needles within one to two minutes, the water contains more than 100 mgrms. of nitric acid per litre. If, on the other hand, no separation occurs in an hour, less than 25 mgrms. of nitric acid per litre are present.

*Determination of Nitric Acid in Water.*—This is carried out in the manner previously described (this J., 1905, 291), but instead of the costly Neubauer crucible, a small filter-tube may be used for collecting the precipitate. The

filter-tube shown consists of a piece of glass tubing at its upper end in the form of a thistle funnel; the filtering-material consists of a layer of very fine asbestos placed on a small perforated filter-plate.—A. S.

## ORGANIC QUALITATIVE.

*Asphaltum; Detection of Adulterants in Natural Asphaltum*. B. Malenkovic. Oesterr. Chem.-Zeit., 1905, 8, 1—12. Chem. Centr., 1905, 1, 1283.

THE author's experiments were made with the asphaltum extracted in the Soxhlet apparatus with carbon bisulphide and dried for half an hour at 105° C. One gram. of the natural asphaltum when boiled for about 15 minutes with 100 c.c. of N/10 sodium hydroxide solution gives a light brown liquid in which the coloured particles do not appear to be uniformly suspended, but not dissolving bitumen from petroleum pitches when subjected to treatment gives a colourless solution; that from coal-tar pitches, a lemon-yellow solution; and that from natural asphaltum, a reddish-brown liquid having an acrolein-like odour. On boiling 1 gm. for a quarter of an hour with 100 c.c. of 40 per cent. formaldehyde, the bitumen from natural asphaltum does not colour the liquid, but adulterants do so. If 1 gm. of bitumen be dissolved in as far as possible in 10 c.c. of carbon bisulphide, the solution filtered, treated with 90 c.c. of petroleum ether, and the filtrate filtered, the filtrate is red in the case of natural asphaltum, red to brown in the case of petroleum pitch, and yellow in the case of coal-tar products. On adding 100 c.c. of 85 per cent. (by vol.) alcohol, and shaking, the alcoholic layer remains colourless in the case of natural asphaltum, but is coloured yellow with adulterants. It is stated that the presence of 2—5 per cent. of petroleum pitch in natural asphaltum can be detected by this test. For the detection of larger quantities of adulterants, paraffin, ceresin, mineral wax, &c., the bitumen is dissolved in petroleum ether, the extract evaporated to dryness, one gm. of the residue dissolved in 10 c.c. of petroleum spirit, and 90 c.c. of acetone added. In the case of natural asphaltum, the solution generally remains clear, but in the case of petroleum pitch it becomes turbid, whilst with paraffin and paraffin, &c., a flocculent precipitate is formed.

The author also makes use of the maximum bromine value in the examination of asphaltums. About 0.5 gm. of bitumen dried for exactly half an hour at 105° C. in a Soxhlet apparatus with carbon tetrachloride and anhydrous bromine for 25 hours or until no more bromine is evolved. The mixture is poured into a porcelain dish, the excess of bromine is removed by carbon tetrachloride expelled on the water-bath, the residue dissolved in carbon tetrachloride, the solution in a weighing bottle, evaporated to dryness for a quarter of an hour at 105° C. and weighed. The percentage of bromine taken up is called the maximum bromine value; it is 89—93 for natural asphaltum, 67 for petroleum pitches, and 173—191 for coal-tar products.—A. S.

*Dyestuffs; Differentiation of Blue Sulphur Dyes*. Lüttringhaus. Z. Farben- u. Textil-Ind., 1905, 214—215.

AS the sulphur dyestuffs of similar shades give very similar reactions with the usual reagents, and also show a difference in dyeing properties, it is very difficult to identify the different dyestuffs. The dyestuffs dimethylamino-*p*-oxydiphenylamine (Fr. Pat. 305,800) and from dimethylaminothiazine (Fr. Pat. 305,801) can be distinguished as follows: 10 grms. of the dyestuff dissolved in 75 c.c. of warm water with 10 grms. of carbon disulphide crystals, the solution is treated with 25 c.c. of 40 per cent. caustic soda solution, and heated for 15 minutes in an open vessel to 50—75° C. with constant stirring. A strong stream of air being passed through. 200 c.c. of water and 50 grms. of salt are then added, and the mixture filtered off and dried in the air.

The first dyestuff (from *p*-dimethylaminodiphenylamine) gives a dark violet blue powder, which dyes unmordanted cotton a weak violet or pink, whereas, the original dyestuff gives a bright blue.



dyestuff (from dimethylaminothiazone) gives a color which dyes unmordanted cotton in pure blue like the original dyestuff, but a little weaker; however, four to five times stronger than those with the product from the diphenylamine dyestuffs. Some other dyestuffs showed similar differences.

—A. B. S.

*Oil in Walnut Oil; Detection of* — G. Halphen. Bull. Soc. Chim., 1905, 33, 571—572.

Method given by the author, which is capable of detecting in a few minutes, the presence of less than 5% of linseed oil in walnut oil, makes use of a solution prepared by adding sufficient bromine to carbon tetrachloride to increase the volume of the latter by one-fifth c.c. of the oil is dissolved in a test-tube in 10 c.c. (66°), and 1 c.c. of the freshly prepared bromine solution is run in from a burette. The test-tube is stoppered, and the contents are mixed, and placed in a water-bath at 25° C. If linseed oil be present, the liquid becomes turbid in less than two minutes. The reaction is not affected by the presence of poppyseed oil.—T. H. P.

*Method: Quick and Simple Method of Detecting Hide in* — F. Kopecky. Collegium, 1905, 50.

Hide can be detected in hide powder used for tanning by moistening 0.2—0.3 gm. of the powder with a solution made by adding six parts of potassium iodide to one part of zinc chloride solution (sp. gr. 1.8) and saturating with iodine. After allowing the mixture to stand for 2—3 minutes, 25 c.c. of water are added, and the mixture is mass well stirred. The cellulose particles are stained a deep violet by the treatment, and can easily be separated from the particles of hide, which become colorless.

For comparison with a standard sample, it is possible to estimate the amount of cellulose present in any sample of hide powder.—M. C. L.

*Use of* — with Hydrochloric Acid as a Reagent. L. Rosenthaler. Z. anal. Chem., 1905, 44, 101.

Reactions of vanillin in hydrochloric acid give characteristic color reactions with phenols, ketones and other substances. The reaction takes place on adding a few drops of a small crystal of the substance to be tested to a solution of vanillin in hydrochloric acid; the mixture is allowed to stand for 15 minutes, and the change noted; it is then heated to boiling, when a new color change is usually observed. Acetone and its derivatives give, as a rule, a light rose color at first. On heating, a green color is obtained. All aliphatic ketones give some color change. Benzalacetone and acetone give a red coloration on heating. Morphine and the same way give a violet-red coloration. Essential oils, which contain certain phenols and ketones, give reactions which may be classified as follows:—Green coloration on heating is given by oils containing pinene or limonene, by oil of turpentine and generally by oils which come from trees of the coniferae; the others give no reaction.

Violet coloration after heating is obtained from oils of linalool and geraniol, e.g., the oils of linaloe, rose, lavender, rose and palmarosa.

Green coloration on heating is given by oils containing such as cedar oil.

Bluish-green coloration on heating is given by oils, as it contains substances giving both the green and violet colors.

Oils which do not themselves give any color reaction, such as cloves, give a coloration if they have been mixed with oils like oil of turpentine and copaiba. The author states that further research into the classification of these colors is necessary before the method can be conducted with any degree of certainty.

—C. E. F.

*Use in Dimethylaminoantipyrine [Pyramidone or Antipyrine]; Detection of* — P. Bourelet. Bull. Soc. Chim., 1905, 33, 572—573.

Antipyrine is much cheaper than dimethylaminoanti-

pyrine, and has very similar general properties, so that the latter product sometimes contains one-third of its weight of antipyrine as an adulterant. The presence of as little as 2 per cent. of antipyrine can be detected as follows:—0.01 or 0.02 gm. of the dimethylaminoantipyrine is dissolved in a test tube in 4 or 5 c.c. of cold water and to the solution are added two drops of 66 per cent. sulphuric acid, and either two drops of a saturated solution of sodium nitrite or a few fragments of the crystallized salt, and the mixture shaken. If the dimethylaminoantipyrine be pure, an intense, bluish-violet coloration is immediately obtained, which, especially in presence of excess of the nitrite, rapidly disappears, leaving a colorless solution. If antipyrine is present, the violet coloration disappears gradually on shaking, especially if fresh nitrite is added, its place being taken by a persistent bluish-green coloration, the intensity of which increases with the content of antipyrine. If the latter is small, the bluish-green coloration may be observed by holding the tube vertically over white paper and looking at the surface of the liquid at an angle.—T. H. P.

### ORGANIC QUANTITATIVE.

*Oxalic Acid; Determination of* —, by Permanganate in the presence of Hydrochloric Acid. G. P. Baxter and J. E. Zanetti. Amer. Chem. J., 1905, 33, 500—506.

The authors find that oxalic acid may be very accurately determined by titration with potassium permanganate solution, in the presence of hydrochloric acid if the temperature of the solution at the beginning of the titration be not lower than 70° C. The concentration of the hydrochloric acid must not be greater than 20 c.c. of dilute acid (sp. gr. 1.04) to 150 c.c. of oxalic acid solution, and the latter volume should not contain more than 0.3 gm. of crystallized oxalic acid. It is also important to add the permanganate solution slowly, and constant stirring is advisable. Loss of chlorine and consequent use of too much permanganate when the titration is performed at low temperatures may be due to the formation of hypochlorous acid which is readily volatile. Further experiments are described, which show that oxalic acid does not appreciably volatilize or decompose, in dilute solution, at temperatures as high as 90° C.—W. P. S.

*Hydrazones derived from p-, m-, and o-Nitrophenylhydrazine [Detection and Determination of Aldehydes, Ketones and Sugars].* W. A. Van Ekenstein and J. J. Blanksma. Rec. trav. chim. Pays-Bas, 1905, 24, 33—39; Chem. Centr., 1905, 1, 1277—1278.

*p*-NITROPHENYLHYDRAZINE can be used for the quantitative determination of aldehydes and ketones. For example, from 50 c.c. of a solution of 82 mgrms. of acetone in 10 per cent. alcohol, a solution of 400 mgrms. of *p*-nitrophenylhydrazine in 15 c.c. of 30 per cent. acetic acid, precipitated 81 mgrms. of acetone in the form of its hydrazone. In a similar manner, 44 mgrms. of diethylketone were obtained from 45 mgrms., 46 mgrms. of acetaldehyde from 46.4 mgrms., and 66.7 mgrms. of benzaldehyde from 66.7 mgrms. *p*-Nitrophenylhydrazine can also be used for the separation of sucrose from dextrose, levulose and mannose. The hexoses readily form hydrazones which are almost insoluble in water, whereas sucrose does not react in alcoholic solution.

*m*-NITROPHENYLHYDRAZINE when warmed for a few minutes with aldehydes and ketones in alcoholic solution forms characteristic hydrazones, in most cases red crystalline compounds. *o*-Nitrophenylhydrazine also readily forms hydrazones with aldehydes and ketones. The levulose derivative, m. pt. 162° C.,  $\alpha_D^{20} = +31^\circ$ , separates from alcoholic solution more readily than the corresponding dextrose derivative, m. pt. 158° C.,  $\alpha_D^{20} = +27.8^\circ$ ; and thus a separation of the two sugars is possible.—A. S.

*Betaine in Sugar Factory Products; Determination of* — V. Stanek. Z. Zuckerind. in Böhmen, 1905, 29, 410—417.

In applying the author's method for the determination of betaine (see this J., 1904, 844) to the case of impure industrial products, certain modifications are necessary to ensure good results. In the case of undefecated juices the

albumins must first be precipitated either by ether-alcohol or by cupric hydroxide. The juice, syrup, massecuite or molasses at a suitable degree of concentration, is dissolved in 50 c.c. of sulphuric acid of 10 per cent. strength, saturated with salt. The solution of potassium tri-iodide is added drop by drop so long as a precipitate is formed, and then a few grains of iodine powder (precipitated) are introduced in order to facilitate the filtration. After standing for six hours the precipitate is collected in a Gooch crucible and washed five times with 5 c.c. of saturated brine. The washed precipitate is returned to the beaker with 25 c.c. of water, the liquid is heated and copper dust (precipitated by zinc) is stirred in until the colour and smell of the iodine are discharged. The liquid is boiled and sufficient cupric hydroxide (Stutzer's reagent) is added to convert the yellow precipitate into a green one. The liquid is cooled, filtered on the pump, and the precipitate is washed 10 times with 5 c.c. of cold water. The betaine passes into the filtrate and is determined by Kjeldahl's method. The following determinations indicate the average percentages of betaine found by the author in various saccharine products: sugar, 1st product, 0.69; massecuite, 1st product, 1.70; massecuite, 2nd product, 4.43; molasses, 6.70; strontia-molasses, 4.47; strontia waste lyes, 17.41; thick juice from unripe beets, 2.65.—J. F. B.

*Malt; Determination of Extract in* — C. Bleisch and P. Regensburger. *Z. ges. Branw.*, 1905, 28, 313—316.

In the process of determining the yield of extract from malt in the laboratory, even when the prescribed "fine-grist" is mashed, a certain proportion of available extractive matter remains behind in the unsaccharified condition in the grains. The quantity of this residual extractive is greater in the case of dark malts than in that of pale malts. The authors have investigated three methods with a view to determining the quantity of extract thus lost:—(1) The residues from the laboratory mash were thoroughly washed, dried and mashed again with extract of green malt. (2) The laboratory mash after saccharification was boiled and re-saccharified with extract of green malt. (3) A portion of clear wort was withdrawn from the laboratory mash, the latter was boiled and re-saccharified with the clear portion of the wort. The first method gave rather higher results than the second, whilst the results from the third were very much lower than from the other two. But none of these methods gave the absolute quantity of extractive matter contained in the malt, since further small proportions of extract were obtainable on repeating the treatments.

The influence of the decoction in the brewery mashing would tend to make the practical yield of extract higher than the laboratory yield, were it not that a certain quantity of extract is lost in practice by incomplete sparging. Owing, however, to the possibility of losses by sparging being very much reduced, the authors consider that the decoction principle should be introduced in the laboratory determination of the extract. They recommend the second method above as being most convenient, viz., after the complete saccharification of the laboratory mash, as at present conducted, the whole mash is boiled over a flame for 20 mins.; it is then cooled to 65° C., 10 grms. of an extract of green malt are added, and the mash is maintained at 65°–70° C. for 10 mins. after the second saccharification is complete. The extract of the wort is then determined in the usual way and corrected for the extract of the green malt employed.

—J. F. B.

*Cyanogen Iodide; Determination of* — in presence of Iodine. J. Milbauer and R. Hac. *Z. anal. Chem.*, 1905, 44, 286—292.

THE qualitative and quantitative determination of cyanogen iodide in presence of iodine is very important in pharmacology on account of its poisonous character.

Meineke (*Z. anorg. Chem.*, 2, 157—174; also this J., 1893, 371) has suggested methods for the determination of the substance which the authors of this paper state are inexact.

The new method devised for the determination of cyanogen iodide depends on the principle that all its iodine is converted into ammonia by the Kjeldahl method. The purity of ordinary commercial iodine was tested and a trace of cyanogen obtained. Statements which have been made from time to time regarding the occurrence of cyanogen iodide in iodine cannot, therefore, be considered as valid.—C. E. F.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Thorium; Radioactivity of* — O. Sackur. *Ber. d. Chem. Ges.*, 1905, 38, 1756—1761.

THE more soluble portions in a fractionation of radium bromide mixture from thorianite gave, precipitating with ammonia a substance having the active properties of thorium, but, in a very small degree. The author has attempted by fractional distillation of the chlorides, by adsorption by barium chloride, and by electrolytic methods, to separate this substance from thorianite, and from thorium preparation of known origin, and thus to answer the question whether thorium and the new substance independently give the same products of atomic disintegration, or whether the substance, associated in minute quantity with thorium, is the only source of the radio-active properties ascribed to the latter. His results do not decide the question, but, as far as they go, lend support to the latter view, according to which thorium itself is not radioactive.—J. F. B.

*Triboluminescence of Arsenious Oxide* [and Class of Triboluminescent Reactions.] M. G. Comptes rend., 1905, 140, 1170—1171.

THE luminescence of arsenious oxide is due to the and transformation of crystals after their formation. Gernez, this J., 1905, 564. The light produced is a continuous spectrum, in the visible part of which the red and green predominate, though it also contains violet. The radiation has a strong photographic action; at a distance its effect is comparable to that of the light of a Bunsen burner at 100 cm. It has no effect on an electro-scope, but seems to be in all respects similar to light emitted by an incandescent solid.

Light is also emitted during the reaction of alkali chlorides or hypobromites, or of solution of these in water, under certain conditions of concentration of nitrogen compounds, such as urea, oxamide, ammonium, ammonium thiocyanate, or asparagus. The radiation has no special properties, but produces feeble photographic effects. The cause, according to the author, is the production, and immediate decomposition of an alkaline liquid, of nitrogen chloride. Sodium chloride when thrown into hypobromite solution also gives luminescence.—J. T. D.

*Hydrogen; Evolution of* — by the Action of Calcium on Mercury. L. Kahlenberg and H. J. *J. of Phys. Chem.*, 1905, 9, 257—259. *Chem. News*, 1905, 1, 1365.

METALLIC sodium and mercury react with one another, producing of light and flame, and simultaneous evolution of hydrogen. From 1 gm. of sodium, on the addition of 3.24 c.c. of hydrogen are produced, probably owing to the presence of sodium hydride in the metal. Lohmann, 1879, found that "pure" distilled sodium gave 0.18 times its volume of hydrogen when heated in vacuum.

*Aqueous Solutions; Coefficient of Magnetisation* — G. Meslin. *Comptes rend.*, 1905, 140, 1329—1330.

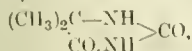
THE coefficient of magnetisation of the solid salt separated from the difference between the coefficient of the solution and of water, is not a constant, but decreases towards a limit as the solution becomes more dilute. The author's own figures, and also those of other authors, have shown this in the cases of copper sulphate, ferrocyanide, and ferrous sulphate. This is probably due to the ionisation of the dissolved salt. A somewhat more complex phenomenon is exhibited by



tures of alcohol and water, the coefficient of which was a maximum value at 96 per cent. of alcohol, while value is the same for absolute alcohol and for a mixture containing 92 per cent. of alcohol. This maximum coefficient is similar to the minimum b. pt. noticed by using for 96 per cent. alcohol.—J. T. D.

*Chemical Action of* — IX. G. Ciamician and Silber. Ber., 1905, 38, 1671—1675. (See also this, 1901, 844 and 943; 1902, 876 and 1477; 1903, 50 and 14; 1904, 138 and 341.)

the action of light for 5—7 months on a mixture of one and dilute hydrocyanic acid c. 3.3 per cent. length, a product was obtained containing a number of bases, of which the following were isolated:—monium cyanide, ammonium oxalate, acetonyleurea,



oxyisobutyramide  $(\text{CH}_3)_2\text{C}(\text{OH})\text{CONH}_2$ , and isobutyric acid. The only compound isolated as the product of the action of light on a mixture of hydro-ammonia and hydrocyanic acid was a compound of the formula,  $\text{C}_6\text{H}_{12}\text{N}_2\text{O}_3$ , probably of the constitution  $\text{CH}_3\text{CH}(\text{COOH})\text{NH}.\text{CH}(\text{CH}_3)\text{CONH}_2$ . No reaction was observed on exposing a mixture of benzaldehyde and hydrocyanic acid to light, whilst, under the same conditions, acetaldehyde only yielded a small quantity of inous compound.—T. F. B.

## New Books.

**NATURE OF EXPLOSIONS IN GASES.** Being the Tenth Lecture by Boyle Lecture, delivered before the Oxford University Junior Scientific Club on June 17, 1903. By ROYAL B. DIXON, M.A., F.R.S. Henry Frowde, Amen Corner, London, E.C.; 12, Frederick Street, Edinburgh; 104, West George Street, Glasgow; 116, High Street, Oxford; 91 and 93, Fifth Avenue, New York; 27, Richmond Street West, Toronto. 1905. Price 3d. nett.

**PHLET**, small 8vo. size, containing 33 pages of subject matter, and five plates of engravings.

**ANALYSE CHIMIQUE QUANTITATIVE.** Par E. TRAUL, Professor Agrégé à la Faculté de Médecine et de Pharm. de Lyon. J. B. Baillière et fils, 19, rue de la Harpe, Paris. Price 12 fr.

Two volume, containing Preface, 843 pages of subject matter, and an alphabetical index of subjects. The text is illustrated with 310 engravings. This work is divided into four parts. In PART I., the special processes of quantitative analysis are described, and they are largely treated. PART II. is devoted to the subject of the methods specially employed in quantitative analysis. PART III.—In this, considerable space is devoted to the various Methods of Analysis. (A.) Gravimetric Methods. (B.) Volumetric Methods, and (C.) Physical Methods. PART IV. is devoted to Titrations and Separations of the various Groups, the group of Metalloids, and the determination of the Carbon Group or Organic Compounds.

## Trade Report.

### I.—GENERAL.

**LOCOMOTIVES AND WAGGONS; USE OF — ON LINES OF RAILWAYS IN OR USED IN CONNECTION WITH PREMISES UNDER THE FACTORY AND WORKSHOP ACT, 1901.**

Home Office Circular, May 12, 1905.

The Secretary of State proposes to make regulations, with the use of locomotives and waggons on lines

or sidings in or in connection with premises under the Factory and Workshop Act, draft copies of which may be obtained on application to the Factory Department, Home Office, London, or at the local offices of the Inspectors of Factories; any objection with respect to the draft Regulations by or on behalf of any person affected thereby must be sent to the Secretary of State within 40 days from May 12th, 1905. Every such objection must be in writing, and must state (a) the draft Regulations or portions of draft Regulations objected to; (b) the specific grounds of objection; and (c) the omissions, additions, or modifications asked for.

### III.—TAR PRODUCTS, PETROLEUM, Etc.

#### PETROLEUM PRODUCTION OF BATOUM IN 1904.

For. Off. Ann. Series, No. 3366.

The production of crude petroleum at Baku during 1904 was in excess of the production for 1903. In view of the disturbed condition of affairs, however, prevalent during the year in the localities where the wells are situated, and the frequent fires that occurred during the same period, by which large quantities of oil were destroyed, and the subsequent somewhat prolonged strikes, during which the output of oil, except from flowing wells, entirely ceased, the production was brought down to only a little over 2,000,000 barrels in excess of the production of 1903, viz., 73,705,852 barrels, against 71,625,611 barrels. In the early part of 1904, i.e., from January to about the beginning of May, prices of kerosene were fairly high. Later in the year, however, the demand decreased, and a considerable fall in prices followed, with but small shipments from Batoum. Meanwhile Baku continued forwarding kerosene to Batoum, so that towards the autumn the tank storage accommodation at this port was becoming scarce, and at the end of the year the stocks of oil became so enormous that all available reservoirs were full up. Tank storage accommodation at Batoum is estimated at 15,500,000 poods, and the stocks reached nearly 15,000,000 poods.

The total quantity of petroleum products shipped at Batoum in 1904 was:—

To.	1904.	1903.
	Barrels.	Barrels.
Foreign countries .....	9,261,718	9,415,256
Russia .....	427,690	502,750

Showing a decrease of 153,538 barrels on exports abroad and of 75,069 barrels on shipments to Russia.

The total number of wells in the Baku oil fields on December 31, last, according to the official statistical information furnished by the Committee of Petroleum Producers, was:—

	1904.	1903.
Producing wells .....	1,555	1,420
Trial pumping .....	31	27
Drilling .....	279	358
Deepening .....	66	96
Cleaning out and under repair .....	327	257
Standing idle .....	1,443	1,276
Total .....	3,701	3,434

### VII.—ACIDS, ALKALIS AND SALTS.

#### ALKALI, &C., WORKS BILL [No. 227].

Ordered by the House of Commons to be Printed, May 22, 1905.

A Bill to consolidate and amend the Alkali, &c., Works Regulation Acts, 1881 and 1892. Presented by Mr. Gerald Balfour, supported by Mr. Grant Lawson.

The Bill is identical with that presented in May, 1904, and reprinted in this Journal, June 15, 1904, pp. 630—635.

## X.—METALLURGY.

## MINERALS (OTHER THAN GOLD); OUTPUT OF —, IN WESTERN AUSTRALIA.

*Ed. of Trade J., May 25, 1905.*

A supplement to the "Government Gazette" of Western Australia contains statistics of the output of minerals (other than gold) in that State during the year 1904 and previous years, from which the following table has been compiled:—

Minerals.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
	Tons.	£	Tons.	£
Black tin .....	817	55,800	855	58,817
Copper ore .....	20,526	56,541	3,969	25,180
Ironstone .....	220	88	1,442	577
Coal .....	133,427	69,128	138,550	67,174
Limestone .....	1,280	178	13,397	1,699

## IRON CONSUMPTION; GERMAN —.

*Eng. and Mining J., May 4, 1905.*

The consumption of iron in Germany is estimated by the German Iron and Steel Union on a pig-iron basis. That is, in finding the totals, iron and steel finished products are reduced to the equivalent in pig iron, or to the pig iron consumed in making such products. The statement is as follows, for two years past:

	1903.	1904.
	Tons.	Tons.
Pig iron production .....	10,085,634	10,103,941
Pig iron imports .....	265,422	288,726
Pig iron equivalent of other imports .....	208,891	252,903
Total supplies .....	10,559,947	10,645,570
Pig iron exports .....	527,814	316,255
Pig iron equivalents of other exports .....	4,269,464	3,628,056
Total exports .....	4,797,278	3,944,311
Consumption .....	5,762,669	6,701,259

The average production per head was 171·4 kilos. of pig iron in 1903, and 169·2 kilos. in 1904, a decrease of 2·2 kilos. The average consumption was 97·9 kilos. per head in 1903, and 112·2 kilos. in 1904, an increase of 14·3 kilos. In ten years the average production has increased from 105·1 to 169·2 kilos., and the consumption from 71·9 to 112·2 kilos. of pig iron per inhabitant.

## XX.—FINE CHEMICALS. ETC.

## CINNAMON CHIPS.

*Schimmel's Report, May, 1905, 22.*

The total quantity of cinnamon chips exported during the year amounted to 2,135,226 lb., an amount which exceeds any previous return. Of this total, Germany took 692,089 lb.; Great Britain 400,264 lb.; Holland, 268,754 lb.; Belgium, 226,366 lb.; Russia, 130,910 lb.; America, 82,507 lb.; Austria, 79,496 lb.; Australia, 73,608 lb.; France, 18,960 lb., with small amounts to Africa and India.—J. O. B.

## CITRONELLA OIL. MARKET POSITION.

*Schimmel's Report, May, 1905, 22.*

Since last October there has been a great scarcity of citronella oil in the London market, and prices in consequence have risen to 1s. 6d. per lb. In Ceylon, the principal exporters were prevented by heavy contracts in the United States from supplying urgent European demands, and it is only during the past few weeks that large consignments have been advised. The total shipments from Ceylon during 1904 amounted to 1,132,068 lb., as compared

with 1,062,594 lb. in 1903. Of this quantity, the Kingdom received 514,007 lb.; America, 459,211 lb.; Germany, 72,376 lb.; Austria, 47,377 lb.; and France, 9,944 lb. Under the prevailing conditions, there is no immediate prospect of prices attaining the low figures of the last few years, since the growing manufacture of citronella and other products absorbs considerable quantities of the oil.—J. O. B.

## GERANIUM; ESSENTIAL OIL OF —. MARKET POSITION.

*Schimmel's Report, May, 1905, 39—41.*

In Algeria, an attempt has been made to advance the rate in consequence of the backward state of the market. In Réunion, the prospect has again improved, and shipments point to a heavy production. A wide tendency to adulterate the oil with palma (East Indian geranium) oil is prevalent, so that exceptionally low quotations should be regarded with suspicion. During 1904, 2034 cases of geranium oil, equivalent to 25,425 kilos., were shipped to Marseilles.

The production of East Indian geranium oil, or rosa oil has enormously increased, the large supply being able to tend to still further depreciate the present market rate. At present prices, palma rosa oil is available as a perfume for many technical purposes.—J. O. B.

## LEMON OIL. MARKET POSITION.

*Schimmel's Report, May, 1905, 32—34.*

The present stock of lemon oil is very low at Marseilles in consequence of the heavy exports during the past season. The condition of the coming crop indicates a deficit of 15 per cent. below a normal fruit harvest. The price for oil during the coming season are, therefore, likely to be higher. The lowest quotation during the past season has been 4·40 marks; from which it has risen to 5·75 marks, and will probably advance still further. The market is now influenced not only by the scarcity of supply of material, but by the fact that a successful syndicate, originally formed to control the concentration of lemon juice and calcium citrate industry, is now including producers of lemon oil in its membership.—J. O. B.

## LEMON GRASS OIL. MARKET POSITION.

*Schimmel's Report, May, 1905, 54.*

The high prices which are prevalent are likely to be diminished production being met with an increasing demand. The stock in Cochin is stated to have fallen to 25 cases; the distilling season being September and October, it is doubtful if the stock now in Europe will last until then. The total shipments from Cochin from July 1st to December 31st, 1904, amounted to 130,416 against 163,661 in the same period in 1903, and 147,000 in 1902. A large proportion of the lemon grass used is absorbed in the production of citral and ionone.—J. O. B.

## XXII.—EXPLOSIVES, MATCHES, ETC.

## EXPLOSIVES IN COAL MINES. STATUTORY REGULATIONS, 1905, No. 78.

*Home Office, Feb. 11, 1905.*

The Secretary of State has issued an order on February 11, 1905, permitting the use of the explosives "abbcite," "minite," "monobel powder," and "lite," in addition to those already in use under the provisions of the order of December 20, 1902; April 24, 1903; September 5, 1903; December 10, 1903; and September 6, 1904. The following are the provisions of the schedule:—

## Abbcite.

Ingredients.	Parts by Weight.	
	Not more than—	Not less than—
Nitrate of ammonium .....	82·0	75·0
Nitroglycerin .....	11·0	9·0
Woodmeal (dried at 100° C.) .....	10·0	8·0
Moisture .....	2·5	1·0



provisions for its use are as follows:

The explosives shall be used only when contained in a case of stout brown paper thoroughly waterproofed with paraffin wax.

The explosives shall be used only with a detonator electric detonator of not less strength than that known as No. 6, i.e., that the detonator or electric detonator used shall possess an effective detonative strength as great as or greater than that of one containing 15 gms. of composition consisting in every 100 parts by weight of fulminate of mercury and 20 parts of chlorate of potassium.

The explosive shall have been made at the works of the Compagnie (Limited), near Stanford-le-Moape, Essex, or at the works of the Compagnie, near Ferrybank, Arklow, Wicklow.

The explosive shall be in all respects similar to the sample submitted to test on December 30, 1904.

The outer package shall bear the words, "As defined in the list of permitted explosives," and the inner package shall be marked with the words, "Permitted explosives used only with not less than No. 6 detonator," and also the name of the explosive, the name of the manufacturer, the date and place of manufacture, and the nature and proportion of the ingredients.

#### Minute.

Ingredients.	Parts by Weight.	
	Not more than—	Not less than—
of ammonium ....	92.0	87.0
of nitro-cotton .....	11.0	9.0
of potassium .....	2.0	0.5
of woodmeal (dried at 100° C.)	0.5	—

Provisions 2, 3, and 5 for its use are precisely the same as for the sample submitted to test on September 23, 1904.

#### Monobel Powder.

Ingredients.	Parts by Weight.	
	Not more than—	Not less than—
of ammonium ....	82.0	78.0
of glycerin .....	11.0	9.0
of potassium (dried at 100° C.)	10.0	8.0
of woodmeal (dried at 100° C.)	2.5	0.5

The explosive shall be used only when contained in a case of paper thoroughly waterproofed with ceresin.

The explosive, if compressed into a pellet, shall not have a density exceeding 1.3, and each cartridge shall be provided with an axial perforation or cavity of sufficient dimensions to admit of the ready insertion of the detonator. The ends or end of the paper case of each cartridge shall be clearly marked to indicate the position of the said perforation or cavity.

The explosive shall be used only with a detonator electric detonator of not less strength than that known as No. 6 (See 2, abbeite).

The explosive shall have been made at the works of the Explosives Company (Limited), at Ardeer, in county of Ayr.

The explosive shall be in all respects similar to the sample submitted to test on October 6, 1903, and other

The outer package shall bear the words "As defined in the list of permitted explosives," and the inner package shall be marked with the words "Permitted explosive used only with not less than No. 6 detonator," and also the name of the explosive, the name of the

manufacturer, the date and place of manufacture, and the nature and proportion of the ingredients.

#### Russelite.

Ingredients.	Parts by Weight.	
	Not more than —	Not less than—
Nitroglycerin .....	42.0	40.0
Nitrocotton .....	2.75	1.75
Nitrate of potassium .....	26.0	24.0
Woodmeal (dried at 100° C.)	5.0	3.0
Moisture .....	1.0	0.0
Carbonate of calcium ....	0.5	0.0
Oxalate of ammonium ....	24.0	22.0
Trinitrotoluol .....	0.5	4.5

1. The explosive shall be used only when contained in a nonwaterproofed wrapper of parchment paper.

2. The explosive shall be used only with a detonator or electric detonator of not less strength than that known as No. 6. (See 2, Abbeite.)

3. The explosive shall have been made at the works of the Compagnie de la Forceite, Baclen Wezel, Belgium.

4. The explosive shall be in all respects similar to the sample submitted to test on September 16, 1904.

5. The outer package shall bear the words "As defined in the list of permitted explosives," and the inner package shall be marked with the words, "Permitted explosive to be used only with not less than No. 6 detonator," and also the name of the explosive, the name of the manufacturer, the date and place of manufacture, and the nature and proportion of the ingredients.

6. The explosive, if in a frozen condition, shall be thoroughly thawed in a safe and suitable manner before use.

#### EXPLOSIVES; REGULATIONS RESPECTING THE IMPORTATION OF — INTO EGYPT.

*Bd. of Trade J., May 18, 1905.*

The Egyptian "Journal Officiel" for April 29 contains the text of a Khedivial Decree respecting the importation of, and trade in explosives. The Decree authorises the importation of ammunition for sporting arms, and certain arms for trading purposes, as specified in a list appended to the Decree. The importation of all other explosives (including powder of all kinds, saltpetre, potassium chlorate, dynamite, gun-cotton, nitro-glycerin, fulminates &c.) is prohibited. The prohibition against the importation of explosives does not apply to articles which, in virtue of their composition, are explosive under certain conditions, or which may possibly be used in the manufacture of explosives, as, for example, sulphur, ether, sodium nitrate; it covers only those materials which are intended to be exclusively, or, at least, principally used as quarrying powder or for similar purposes.

The full text of the Decree may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

#### Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of said date.

#### I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 10,277. Bonnicart (Chapelle). Apparatus for filtering liquids. May 16.

„ 10,395. Lake (Sarghel and Koepp). Distilling, concentrating, evaporating and condensing liquors. May 17.

- [A.] 10,538. Seitz. Filters.\* May 19.  
 .. 10,560. Hargreaves. Concentrating solutions and obtaining salts. May 20.  
 .. 10,617. Rudge-Whitworth, Ltd., Pugh and Heathcote. Method for and appliances for ascertaining the temperature of heated articles and of furnaces, crucibles, and the like. May 20.  
 .. 10,817. Morison. Apparatus for heating and evaporating liquids. May 24.  
 .. 10,847. Bower and Phillips. *See under XVIII. A.*  
 .. 10,862. Aktiebolaget Separator. Centrifugal separating apparatus. [Appl. in Sweden. May 27, 1904.]\* May 24.  
 .. 10,873. Aktiebolaget Separator. Centrifugal separating apparatus. [Appl. in Sweden. May 27, 1904.]\* May 24.  
 .. 10,874. Aktiebolaget Separator. Centrifugal separating apparatus. [Appl. in Sweden. May 27, 1904.]\* May 24.  
 .. 10,875. Aktiebolaget Separator. Centrifugal separating apparatus. [Appl. in Sweden. May 27, 1904.]\* May 24.  
 .. 10,934. Eastman and Camacho. Apparatus for separating crystalline or organic matter from solutions thereof by freezing. May 25.  
 .. 10,947. Sauerbrey. Vacuum evaporators with heating and evaporation in separate chambers or compartments.\* May 25.  
 [C.S.] 6128 (1904). Burdth. Apparatus for cooling, heating, &c. May 24.  
 .. 11,452 (1904). Armstrong, Whitworth and Co., Ltd., and Sodeau. Regulation of the pressure of pumped or compressed fluids. May 24.  
 .. 11,756 (1904). Christiansen, and Aktieselskabet P. J. Buus' Fabrikker. Apparatus for effecting exchange of temperature of liquids and gases. May 31.  
 .. 16,644 (1904). Wakefield. Filters. May 31.  
 .. 29,136 (1904). Ohlsson. Liners for centrifugal separators. May 31.  
 .. 915 (1905). Beemer. Dashers or beaters for mixing or agitating liquids. May 24.  
 .. 5988 (1905). Schneisser. Distilling apparatus. May 24.  
 .. 6363 (1905). Benson. Jacketed vessels. May 24.  
 .. 7101 (1905). De Hemptinne. *See under XI.*  
 .. 7522 (1905). Mclotte. Centrifugal separators. May 31.

## II.—FUEL, GAS, AND LIGHT.

- [A.] 10,216. Carolan (Gen. Electric Co.). Liquid fuel. May 15.  
 .. 10,440. Pease. Manufacture of coke. May 18.  
 .. 10,496. Lane. Gas producers. May 19.  
 .. 10,616. Fleming. Method and means for generating and utilising hydrocarbon vapours for lighting and heating purposes. [Belg. Appl., May 20, 1904.]\* May 20.  
 .. 10,632. Lane. Gas producers. May 22.  
 .. 10,699. Collin. Coke ovens with regenerator action. May 22.  
 .. 10,733. Hooton and Noble. Method of and means for the production and enriching of gas. May 23.  
 .. 10,866. Grayson. Artificial fuel. May 24.  
 .. 10,889. Vivian. Manufacture of artificial fuel. May 24.  
 .. 10,906. Cundy, Curtis and Venning. Coal-saving preparation. May 25.  
 .. 10,954. Woodall and Duckham. Carbonisation of coal in vertical or inclined retorts and apparatus therefor.\* May 25.  
 .. 10,993. Towns. Purifiers for gases.\* May 26.

- [A.] 11,010. Norris and Bentley. Gas-cleaning plant. May 26.  
 .. 11,011. Norris and Bentley. Gas producer plant. May 26.  
 [C.S.] 6959A (1904). Lewis (Gen. Electric Co.). Incandescent lamps and the manufacture thereof. May 31.  
 .. 13,377 (1904). Roux, Gonin and Thompson. Production of coal gas, and the resulting by-products. May 24.  
 .. 13,877 (1904). Hatton. Gas producers. May 24.  
 .. 14,219 (1904). Höpfner. Manufacture of fuel and apparatus therefor. May 24.  
 .. 15,270 (1904). Kermode. Apparatus for liquid fuel. May 31.  
 .. 15,271 (1904). Kermode. Apparatus for liquid fuel. May 31.

## III.—DESTRUCTIVE DISTILLATION, TARS, PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [C.S.] 6056 (1905). Gautsch. Method for preventing extinguishing fires at petroleum and mineral springs and the like. May 31.

## IV.—COLOURING MATTERS AND DYES.

- [A.] 7910A. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of azo dyestuffs from 5-nitro-2-phenol. May 18.  
 .. 10,677. Johnson (Badische Anilin und Soda Werke). Manufacture of colouring matters of the azo series and the treatment and employment thereof for dyeing and printing. May 24.  
 .. 11,066. Meyenberg, Allpass and Tieck. Aniline Co., Ltd. Manufacture of colouring matters. May 26.  
 [C.S.] 15,935 (1904). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of indophenols. May 24.  
 .. 15,982 (1904). Shillito (Aniline Colour and Works, formerly J. R. Geigy). Manufacture of nitro-o-oxyazo colouring matters. May 24.  
 .. 16,119 (1904). Johnson (Kalle and Co.). Manufacture of new dyes. May 24.  
 .. 16,120 (1904). Johnson (Kalle and Co.). Manufacture of new dyes. May 24.  
 .. 16,269 (1904). Imray (Meister, Lucius and Brünning). Manufacture of violet sulphur dyestuffs. May 31.  
 .. 16,566 (1904). Shillito (Aniline Colour and Works, formerly J. R. Geigy). Manufacture of o-oxyazo colouring matters from 2-naphthol sulphonic acids. May 31.  
 .. 17,589 (1904). Newton (Bayer and Co.). Manufacture of new anthraquinone derivatives. May 24.  
 .. 3983 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of sulphur colouring matters. May 31.  
 .. 9547 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the naphthalene series. May 31.

## V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 10,195. Imray (Meister, Lucius und Brünning). Method of and apparatus for producing effects on fabrics or the like by padding.



10,196. Imray (Meister, Lucius und Brüning). Method of producing shaded effects on fabrics or the like by printing. May 15.

10,437. Brewer and Hardy. *See under XIV.*

10,465. Radclyffe. Process, appliances, and machinery to decorticate, scutch, and de-gum fibres, more especially ramie, rhea and the like. May 18.

10,677. Johnson (Badische Anilin und Soda Fabrik). *See under IV.*

10,691. Bart, Jackson and Finch. Extraction of grease from wool and apparatus therefor.\* May 22.

11,913. Mycock and Mycock. Protection in a dyeing process of "tied-up" designs upon cloth. May 26.

11,323 (1904). Girdwood. Preparing flax, tow, and similar fibres and means therefor. May 24.

18,720 (1904). Wilhehn. *See under XII.*

1156 (1905). Kunz. Dyeing machines. May 31.

#### COLOURING WOOD, PAPER, LEATHER, Etc.

11,049. Lamb and Rennie. Printing on leather. May 26.

#### VII.—ACIDS, ALKALIS, AND SALTS.

10,471. Morel and Héritte. Manufacture of borax. May 18.

10,560. Hargreaves. *See under I.*

10,722. Bale. Treatment of the pan scale of salt pans and of its products and apparatus used. May 23.

11,006. Petersson. Production of zinc oxide and metallic tin from scrap or other materials containing these metals. May 26.

12,639 (1904). Robson. Apparatus for vaporising ammonia and reabsorbing ammoniacal and other gases soluble in water. May 24.

13,955 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture and application of reducing agents. May 31.

15,792 (1904). Wrinkle and Wrinkle. Furnaces for use in the manufacture of soda, for the smelting of metals and for like purposes. May 31.

#### VIII.—GLASS, POTTERY, AND ENAMELS.

10,833. Heller, Baumgarst, and Porzellanfabrik Ph. Rosenthal und Co., Akt.-Ges. Filiale Kronach. Ceramic ware. May 24.

8477 (1905). Handel. Method of ornamenting glass, porcelain, and like articles. May 31.

#### —BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

10,547. Hoffmann. Manufacture of magnesia cement. May 19.

10,902. Smith and Atherton. Asphalt. May 25.

11,830 (1904). Von Kauffmann and Medberg. Manufacture of artificial stone. May 24.

12,940 (1904). Vokes. Artificial granite and process for the manufacture of the same. May 24.

24,199 (1904). Frugier. Process and apparatus for disintegrating kaolinic stone and the like, and for separating the constituents thereof. May 31.

28,368 (1904). Trapnell and Wood. Manufacture of bricks, tiles, and the like. May 24.

#### X.—METALLURGY.

[A.] 10,312. Baillot. Cupolas. [Fr. Appl., Dec. 5, 1904.]\* May 16.

" 10,469. Ridley. Treatment of slag and apparatus therefor. May 18.

" 10,475. Morgan Crucible Co., Ltd., and McCourt. Treatment of ores or the like for the separation of their constituents. May 18.

" 13,481. Head. Manufacture of steel or ingot iron. May 18.

" 10,594. Claremont and Stratton. Manufacture of sheet lead. May 20.

" 10,869. MacIvor and Fradd. Process for treating nickel ores or oxidised nickel mattes. May 24.

" 10,881. Vautin and Burt. Production of fused metals from oxides and other compounds. May 24.

" 10,943. MacIvor and Fradd. Process for extracting tin from ore. May 24.

" 10,999. Anchinachie. Extracting gold from sea water. May 26.

" 11,006. Petersson. *See under VII.*

" 11,073. Casman. Process of extracting and refining the copper and alloys of copper contained in ashes, sand, and waste from foundries and other works where copper is dealt with. May 26.

[C.S.] 11,437 (1904). Clark (Goldschmid). Process of and apparatus for refining ores. May 24.

" 14,980 (1904). Lébédoff. Process for smelting sulphuretted copper ores and the simultaneous concentration of the matte. May 24.

" 15,220 (1904). Hadfield. Manufacture or treatment of armour plates or other articles of steel. May 31.

" 15,792 (1904). Wrinkle and Wrinkle. *See under VII.*

" 16,754 (1904). Tyars. Apparatus for treating and amalgamating metals. May 31.

#### XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 10,888. White and Cowley. Primary batteries. May 24.

" 11,040. Fuller. Electric batteries. May 26.

" 11,056. Fairbrother. Electric accumulator plates. May 26.

[C.S.] 17,011 (1904). Delafon. Voltaic cell. May 24.

" 7101 (1905). De Hemptinne. Apparatus for absorbing gases by a liquid under the action of the silent electric discharge. May 24.

#### XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 10,326. Buchanan. Apparatus for heating linseed oil. May 16.

" 10,384. Imbert. Soap. May 17.

" 10,387. Fresenius. Purification of fats, fat resins, &c.\* May 17.

" 10,437. Brewer and Hardy. *See under XIV.*

[C.S.] 18,720 (1904). Wilhelm. Method of cleaning oil waste and the like. May 31.

#### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

##### (A.)—PIGMENTS, PAINTS.

[A.] 10,876. Griffiths. Pigments. May 24.

##### (B.)—RESINS, VARNISHES.

[A.] 10,387. Fresenius. *See under XII.*

" 11,063. Menge. Driers for oils, paints, lacquer and the like.\* May 26.

## (C.)—INDIA-RUBBER.

- [A.] 10,713. Parkin and Williams. Manufacture of substitutes for india-rubber. May 23.

## XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

- [A.] 10,227. Calico Printers' Association, Ltd., and Warr. Treatment of serum for blood albumen for commercial purposes. May 16.  
 „ 10,437. Brewer and Thomas. Process and apparatus for extracting the grease and oil from skins, hides, wool, cotton waste, and other material. May 18.

## XVI.—SUGAR, STARCH, GUM, Etc.

- [A.] 10,273. Roy. Treatment of massecuite and apparatus therefor. [Fr. Appl., May 16, 1904.]\* May 16.  
 „ 10,822. Castle. Manufacture of gum tragacanth from locust bean kernels. May 24.  
 [C.S.] 15,934 (1904). Stiepel. Manufacture of betaine and its salts from molasses and waste products of beet-root sugar manufacture. May 21.

## XVII.—BREWING, WINES, SPIRITS, Etc.

- [A.] 10,198. Worssam. Apparatus for heating or boiling brewers' wort or the like.\* May 15.  
 „ 10,435. Mislin and Lewin. Manufacture of fusel oils. May 18.  
 „ 10,783. Hyde. Process of brewing and appliances employed therewith. May 23.  
 [C.S.] 4271 (1904). Oppenheimer and Kent. Spirituous fluid or compound and process for obtaining the same. May 31.

## XVIII.—FOODS; SANITATION, WATER PURIFICATION; &amp; DISINFECTANTS.

## (A.)—FOODS.

- [A.] 10,303. McDonnell. Process for preserving milk. May 16.  
 „ 10,847. Bower and Phillips. Apparatus for desiccating milk and similar liquids. May 24.  
 „ 11,131. Bonnicart (Evangelidi). Process of preserving eatables.\* May 27.  
 [C.S.] 6278 (1904). Poumay. Alimentary product and process for the manufacture thereof. May 31.

## (B.)—SANITATION; WATER PURIFICATION.

- [A.] 10,382. Commin. Installation for the septic tank treatment of sewage.\* May 17.  
 „ 10,670. Ridley. Preparation of slag suitable for use in bacteria beds. May 22.  
 [C.S.] 15,829 (1904). Middleton. Filter and contact beds for the bacterial treatment of sewage. May 24.  
 „ 5274 (1905). Smith. Compounds for removing incrustation from boilers and the like. May 24.

## (C.)—DISINFECTANTS.

- [A.] 10,824. Gyr. Sheep dipping compounds. May 16.  
 „ 10,825. Gyr. Insecticide and fungicide. May 16.

## XIX.—PAPER, PASTEBOARD, Etc.

- [A.] 10,319. Garbin, Gérard and Gérard. Process and apparatus for utilising the waste of cellulose and similar substances.\* May 16.  
 „ 10,880. Boulton (Moritz and Moritz). Paper making apparatus.\* May 24.  
 [C.S.] 15,435 (1904). Gardner (Chem. Fabr. v. Weiler-ter-Meer). Process for producing substances resembling celluloid. May 24.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 10,201. Chem. Fabr. von Heyden Act.-Ges. Manufacture of guanyl dialkylbarbituric acids. [Ger. Appl., July 14, 1904.]\* May 15.  
 „ 10,436. Mislin and Lewin. Method for manufacturing lactic acid for technical purposes. May 18.  
 „ 10,758. Behal. Manufacture of camphor, borneols and camphors.\* May 23.  
 „ 10,927. Angier. Process for the production of bisulphide of carbon. [Ger. Appl., May 1, 1904.]\* May 25.  
 „ 10,976. Merck, Merck and Merck. Manufacture of guanines from cyanamido-4,5-diaminobenzoxypyrimidine and its homologues. [Ger. Appl., July 19, 1904.]\* May 25.  
 „ 11,058. Sommer. Production of anhydrides of organic acids. May 26.  
 [C.S.] 14,014 (1904). Boehm (Merck). Manufacture of barbituric acids and intermediate products. May 31.  
 „ 15,934 (1904). Stiepel. See under XVI.  
 „ 22,129 (1904). Merck, Merck and Merck. Separation of pyrimidines. May 24.  
 „ 2787 (1905). Mayer. Method of preparing diet malonylurea. May 24.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 10,372. Smith. Manufacture of films for photographic and other purposes. [Ger. Appl., May 18, 1904.]\* May 17.  
 „ 10,900. Grün and Smith. Producing photographic prints in natural colours from negatives obtained by the ordinary trichromatic system of photography. May 25.  
 „ 11,077. Pflanz. Preparation of photographic printing papers or surfaces.\* May 26.  
 [C.S.] 6276 (1905). Smith. Reducing agents or compositions for use in photography. May 24.

## XXII.—EXPLOSIVES, MATCHES, Etc.

- [A.] 10,901. Le Sueur. Explosive. May 25.

## XXIII.—GENERAL ANALYTICAL CHEMISTRY.

- [A.] 11,067. Martin. Estimation of the quantity of oil contained in feed water.\* May 26.



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Thomas Tyrer ....	1895—1896.
Edward Schunck, Ph.D., F.R.S. ....	1896—1897.
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George Bellby ....	1898—1899.
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Ivan Levinstein ....	1900—1901.
Wm. Ramsay, K.C.B., D.Sc., LL.D., F.R.S. ....	1901—1903.
Wm. Ramsay, K.C.B., D.Sc., LL.D., F.R.S. ....	1903—1904.

† Deceased.

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Vice-Chairman: J. S. Macarthur.

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Committee:

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L. Meggitt.	J. A. Schofield.	T. Steel.

Hon. Local Secretary:

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The following take office in July next:—Committee: V. G. C. Joplin and J. M. Petrie.

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Vice-Chairman: G. W. Slatter.

Committee:

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The following take office in July next:—Vice-Chairman: Whitaker. Committee: Saml. H. Davies, H. R. Hirst, W. Mackey and G. E. Scott-Smith.



## Official Notices.

### COMMUNICATIONS.

Authors of communications read before the Society, or of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of property of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be retracted by the Publication Committee, or ordered to be retracted for the Journal, in which case no reprints can be furnished to the author.

### ANNUAL GENERAL MEETING, 1905.

The Annual General Meeting will be held in London on July 10th next, and the proceedings will commence on that day, July 10th.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council retire from their respective offices at the forthcoming Annual Meeting.

Mr. Edward Divers, F.R.S., has been nominated to the office of President under Rule 8; Dr. L. Baekeland, J. Carter Bell, Dr. J. Lewkowitzsch, and Mr. N. H. Martin have been nominated Vice-Presidents under Rule 8; and Mr. Wm. H. Nichols has been nominated a Vice-President under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices. Mr. J. Bingham Allott, Dr. J. T. Dunn, Mr. A. R. Ling, J. S. McArthur, Dr. K. E. Markel, and Mr. Charles Taylor have been nominated under Rule 18 to fill vacancies among the Ordinary Members of Council. Ballot List, Member's Ticket, Supplementary Programme, and Request were issued with the June 15th number.

The Hon. Treasurer's Annual Statement and audited Balance-sheet are contained in this number.

### BIRMINGHAM SECTION.

The Birmingham Section of the Society, after an interval of some years, has resumed active work. Meetings will be held at the University, and Prof. W. Frankland, F.R.S., has accepted the chairmanship. With Mr. F. R. O'Shaughnessy as Hon. Local Secretary and Treasurer.

### NEW ENGLAND SECTION.

The New England Section held its inaugural meeting in Boston, Mass., on May 12th. Between 80 and 90 members were present, including the President of the Society, with Dr. H. Schweitzer, Mr. T. J. Parker, and other representatives of the New York Section.

### CONGRESS OF CHEMISTRY AT LIÈGE.

In connection with the Liège Exhibition, a Congress of Chemistry and Pharmacy will be held from the 27th to the 30th July next. By a subscription of 10 francs, members may take part in the Congress, and will receive copies of the transactions. Application for Adhesion forms and programmes should be made at once to M. J. Mond, Pharmacien, Liège, or M. J. Wauters, Chimiste en chef de la Ville de Bruxelles.

### THE INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

The Sixth International Congress of Applied Chemistry will be held in Rome in April, 1906, during Easter week. Communications should be addressed to the President, Prof. E. Paternò, Via Panisperna, 89 Rome.

## List of Members Elected.

June 23rd, 1905.

- Amory, L. H., c/o Messrs. J. Heatcoat and Co., Tiverton, Devon, Lace Manufacturer.
- Andreac, Dr. E. P., Crestalba, Champion Hill, London, S.E., Chemist.
- Baker, Henry, 18, Booth Street, Manchester, Secretary.
- Barker, Perry, c/o F. W. Matthiessen, jun., La Salle, Ill., U.S.A., Chemist.
- Broemmel, Geo. M., 2501, California Street, San Francisco, Cal., U.S.A., Chemist.
- Brown, Nicol, 4, The Grove, Highgate, N., Mining Director.
- Clayton, W. E., Royal Victoria Yard, Deptford, S.E., Superintendent.
- Davidson, Frank A., 182, Mount Vernon Street, West Roxbury, Mass., U.S.A., Pharmaceutical Chemist.
- Derby, Wallace G., Laurel Hill, Queens Boro', New York City, U.S.A., Assayer.
- Duckworth, Harry S., Dover, N.H., U.S.A., Print Works Chemist.
- Fenner, R. Lennox, Abbot's Road, Poplar, E., Assistant Chemical Manager.
- Field, Charles, 3rd., 57, Waban Hill Road, Chestnut Hill, Mass., U.S.A., Research Chemist.
- Harrison, E. F., Langholm, Purley Oaks Road, South Croydon, Analytical Chemist.
- Hart, George Adam, Sewage Engineer's Office, Municipal Buildings, Leeds, Civil Engineer.
- Hazard, Fred. R., P.O. Box 2, Syracuse, N.Y., U.S.A., President, Solvay Process Co.
- Heilborn, Jacob, 503, Washington Street, Brookline, Mass., U.S.A., Traveller.
- Hook, Arthur Henry, Victoria Road P.O., Ont., Canada, Chemist.
- Howe, Roland E., 196, Commonwealth Avenue, Concord Junction, Mass., U.S.A., Explosives Chemist.
- Hulme, John, 5, Duke Street, Macclesfield, Journalist.
- Johnson, Charles F., Avery Chemical Co., Littleton, Mass., U.S.A., Superintendent of Chemical Works.
- Jones, Harold, Morro Velho, Villa Nova de Lima, Minas Geraes, Brazil, Analyst and Assayer.
- Kimball, Herbert S., 101, Tremont Street, Boston, Mass., U.S.A., Mill Engineer.
- Koch, Geo. W., Ocean View Avenue, Woodhaven, Long Is., N.Y., U.S.A., Chemist.
- Loring, Lindley, 55, Kilby Street, Boston, Mass., U.S.A., Vice-President (Cochrane Chemical Co.).
- Martin, Gustav, 38, Pearl Street, Boston, Mass., U.S.A., Merchant.
- Menell, Ambrose, 43, Exchange Place, New York City, U.S.A., President, Int. Nickel Co.
- Oburg, W. F., 77, Broad Street, Boston, Mass., U.S.A., Assistant Treasurer, Merrimac Chemical Co.
- Phelan, Joseph W., Mass. Institute of Technology, Boston, Mass., U.S.A., Instructor.
- Pinnock, H. T., c/o Mond Gas Power Co., Dudley Port, Chemist.
- Preston, James F., Lowell, Mass., U.S.A., Manufacturing Chemist.
- Pyzel, E., 32, India Street, Boston, Mass., U.S.A., Works Manager.
- Robertson, Robert, 135, Pearl Street, Boston, Mass., U.S.A., Dyestuff Salesman.
- Rodger, R. L., Suffolk House, Cannon Street, London, E.C., Manager, Pena Copper Mines.
- Schneider, Dr. Felix G., Farbenfabriken of Elberfeld Co., 32, India Street, Boston, Mass., U.S.A., Technical Chemist.

## STATEMENT OF REVENUE AND EXPENDITURE FOR THE YEAR 1904.

(Made up to the 18th May, 1905.)

REVENUE.		£	s.	d.	£	s.	d.
Annual Subscriptions:—							
3 Subscriptions for 1904 received in 1902 .....		3	15	0			
121 Subscriptions for 1904 received in 1903 .....		151	5	0			
3665 Subscriptions for 1904 received in 1904 .....		4581	5	0			
55 Subscriptions for 1904 received in 1905 .....		68	15	0			
(Sundry excess Payments and Balances of Subscriptions) .....		9	4	5			
					4814	4	5
3844							
Entrance Fees (373 at 17. 1s) .....		391	13	0			
Life Composition Fees (4 at 20s.) .....		80	0	0			
"Collective Index" Subscriptions .....					9	10	0
Investments—Interest from—							
	£ s. d.						
Gas Light and Coke Company's 3 per cent. Consolidated Stock .....	600 0 0	17	3	2			
Great Eastern Railway 4 per cent. Irredeemable Guaranteed Stock .....	1509 0 0	41	4	3			
Great Northern Railway 3 per cent. Debenture Stock .....	800 0 0	22	17	0			
Great Western Railway 5 per cent. Guaranteed Preference Stock .....	600 0 0	28	11	11			
Metropolitan 3 per cent. Consolidated Stock .....	4476 0 2	127	14	5			
Midland Railway 2½ per cent. Perpetual Preference Stock .....	1690 0 0	40	8	3			
North British Railway 3 per cent. Consolidated Lien Stock .....	1084 13 4	31	0	2			
New South Wales 3 per cent. 1935 Stock .....	485 4 8	13	17	1			
New Zealand 3 per cent. 1945 Stock .....	1000 0 0	28	11	3			
Nottingham Joint Station 3 per cent. Stock .....	200 0 0	5	14	4			
South Eastern Railway 4½ per cent. Preference Stock .....	673 0 0	28	17	5			
Southwark and Vauxhall Water Company's 3 per cent. Debenture Stock .....	1000 0 0	28	11	3			
Deposit Account at Bank .....		28	10	2			
	£14124 7 2				443	1	2
Journal:—							
Sales .....		509	3	11			
					£5775	19	6
EXPENDITURE.		£	s.	d.	£	s.	d.
Journal Expenses:—							
Publishing .....		1064	9	6			
Editorial:—	£ s. d.						
Editor's Salary .....	600 0 0						
Editor's Expenses .....	57 4 0						
Abstractors .....	503 18 11						
Sub-Editor's Salary .....	150 0 0						
Indexing Journal .....	135 19 0						
Foreign Journals .....	14 4 0						
Sundry Journals .....	8 14 7						
	1470 0 6						
Insurance of Stock .....	6 17 6						
French Patents and Specifications .....	56 0 0						
	2597						
Sectional Expenses .....	587 12 0						
Annual Meeting Expenses .....	206 5 5						
	883 1						
Secretary's Salary .....	300 0 0						
Assistant .....	150 0 0						
	450						
Printing Sundries .....	88 11 9						
Stationery .....	34 5 0						
Library (Binding Books) .....	8 17 11						
Clerical Assistance .....	13 2 0						
Honorarium to Treasurer's Assistant .....	52 10 0						
	197						
Office Expenses (including Rent, Lighting, &c.) .....	208 16 9						
Auditors' Fee .....	10 11 6						
Solicitors' Charges .....	6 6 0						
Bank Charges .....	4 18 2						
	230 1						
Treasurer's Petty Cash, Postage and writing up Subscriptions .....	35 3 3						
Secretary's Petty Cash and Postage .....	69 5 7						
	104						
National Physical Laboratory (Third Donation) .....							
Decennial Index (1896—1905) and Insurance of Manuscript .....							
Investment:—							
Great Eastern Railway 4 per cent. Guaranteed Stock, 855s. .....	999 9 0						
Balance of Revenue over Expenditure .....	1117						

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Smith, H. Melville, Ammunition Works, Abbey Wood, Kent, Engineer and Superintendent.

Tanssig, Dr. Hugo, 237, East 72nd Street, New York City, U.S.A., Chemist.

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Travelli, Charles Innis, United Printing Machinery Co., 246, Summer Street, Boston, Mass., U.S.A., Mechanical Engineer.

Umney, John C., 48, Southwark Street, London, S.E., Wholesale Druggist.

Varshnei, Ishmar Das, Bara Bazar, Aligarh, U.P., India, Chemical Engineer.

Woore, N. L., Post Office, Mt. Morgan, Queensland, Assayer.

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Bowman, R., 1/o North Wales; c/o Bowmans, 1, Lythgoe's Lane, Warrington.

Danziger, J. L., 1/o West 114th Street; 259 West 114th Street, New York City, U.S.A.

Davis, Bernard F., 1/o Bodok; c/o Borneo Co., 1, Sarawak.



THE TREASURER—IN ACCOUNT WITH THE SOCIETY OF CHEMICAL INDUSTRY  
FOR THE YEAR 1904.

Dr.

Cr.

	£	s.	d.	£	s.	d.
Balance at Bank (1st January, 1904)	407	8	2			
Cash in Secretary's hands (1st January, 1904)	19	8	7			
				426	10	9
Annual Subscriptions:—						
1 Subscription for the year 1901	1	5	0			
5 Subscriptions for the year 1902	6	5	0			
54 Subscriptions for the year 1903	67	10	0			
3665 Subscriptions for the year 1904	4581	5	0			
124 Subscriptions for the year 1905 (less 8s. short paid).....	154	12	0			
Sundry amounts received on account of Subscriptions, Excess Payments, &c. ....	9	4	5			
				4820	1	5
3s. 4d. Entrance Fees (373 at 1l. 1s.) .....				391	13	0
Life Composition Fees (4 at 20l.).....				80	0	0
"Effective Index" Subscriptions .....				4	10	0
Interest from Investments:—	£	s.	d.			
Gas Light and Coke Com- pany's 3 per cent. Con- solidated Stock .....	000	0	0	17	3	2
Great Eastern Railway 4 per cent. Irredeemable Guaranteed Stock .....	654	0	0	41	4	3
Great Northern Railway 3 per cent. Debenture Stock .....	800	0	0	22	17	6
Great Western Railway 5 per cent. Guaranteed Preference Stock .....	600	0	0	28	11	11
Metropolitan 3 per cent. Consolidated Stock ..	4476	9	2	127	14	5
Midland Railway 2½ per cent. Perpetual Pre- ference Stock .....	1696	0	0	40	8	3
North British Railway 3 per cent. Consolidated Loan Stock .....	1084	13	4	31	0	2
New South Wales 3 per cent. 1935 Stock .....	485	4	8	13	17	1
New Zealand 3 per cent. 1945 Stock .....	1000	0	0	28	11	3
Nottingham Joint Station 3 per cent. Stock .....	200	0	0	5	14	4
South Eastern Railway 4½ per cent. Preference Stock .....	673	0	0	28	17	5
Southwest and Vauxhall Water Company's 3 per cent. Debenture Stock ..	1000	0	0	28	11	3
Deposit Account at Bank ..				28	10	2
	£114124	7	2	443	1	2

Journal:—						
Sales .....				523	7	11

## By Journal Expenses:—

	£	s.	d.	£	s.	d.
Publishing .....	1064	0	0			
Insurance of Stock .....	6	17	0			
Editorial:—						
Editor's Salary ...	600	0	0			
Editor's Expenses .....	82	2	4			
Abstractors .....	536	14	0			
Sub-Editor's Salary .....	150	0	0			
Indexing Journal .....	129	17	0			
Foreign Journals .....	14	4	0			
Sundry Journals ..	8	14	7			
	1501	11	11			
French Patents and Specifications	51	13	0			
				2024	11	11
Sectional Expenses:—						
Canadian Section .....	32	0	0			
Liverpool Section .....	34	19	9			
London Section .....	117	17	7			
Manchester Section .....	69	19	4			
Newcastle-on-Tyne Section .....	27	10	0			
New York (U.S.A.) Section .....	190	0	0			
Nottingham Section .....	34	6	11			
Scottish Section .....	34	2	1			
Yorkshire Section .....	37	14	2			
Sydney, New South Wales, Section	9	1	8			
				587	12	0
Expenses connected with Secretary's attending Annual Meeting at New York (U.S.A.) .....				141	6	3
Secretary's Salary (see also Sub-Editor)	300	0	0			
Assistant .....	150	0	0			
				450	0	0
Printing Sundries .....	86	4	1			
Stationery .....	40	11	6			
Library (Binding Books) .....	8	17	11			
Clerical Assistance .....	27	9	0			
Honorarium to Treasurer's Assistant	52	10	0			
				215	12	6
Office Expenses, &c.:—						
Rent, &c. ....	153	15	0			
Gas and Electric Light .....	11	13	2			
Cleaning, Attendance, &c. ....	18	0	4			
Furniture, Repairs, &c. ....	11	2	6			
Sundries .....	12	9	0			
Fire Insurance .....	0	8	0			
Sundry Requisites .....	1	8	9			
				203	16	9
Auditors' Fee .....	10	11	6			
Solicitors' Charges .....	6	6	0			
Bank Charges .....	4	18	2			
				21	15	8
National Physical Laboratory (Third Donation) .....				100	0	0
Investment:—						
855l. Great Eastern Railway 4 per cent. Guaranteed Stock .....				999	9	0
Decennial Index (1896—1905), paid on account .....	90	0	0			
Decennial Index—Insurance of Manu- script .....	5	1	0			
				95	1	0
Treasurer's Petty Cash and Postage	20	16	3			
Secretary's Petty Cash and Postage	69	5	7			
				90	1	10
Cash on Deposit (31st December, 1904)	1000	0	0			
Balance at Bank (31st December, 1904)	158	13	7			
	1158	13	7			
Less Cash due to Secretary (31st December, 1904) .....	3	10	3			
				1155	3	4
				£6689	10	3

£6689 10 3

£6689 10 3

We have compared the above statement with the vouchers, counterfoils of the receipts issued and other records, and are of opinion it correctly exhibits the cash transactions of the Society for the year 1904. The amounts of the Metropolitan 3 per cent consolidated, 3 per cent. New Zealand and 3 per cent. New South Wales Stocks have been confirmed by the Chief Accountant to the Bank of England. Certificates for the remaining investments have been inspected and the Bank Balances have been certified by the Bankers.

23, St. Swithin's Lane, London, E.C.  
19th April, 1905.

(Signed) MIALl, WILKINS, RANDALL & Co.,  
Chartered Accountants.

ray, Jas., l/o Box 98; c/o Henry Nourse G. M. Co.,  
P.O. Box 1140, Johannesburg, South Africa.

Greenwood, Conrad V., l/o Green Hill; Horsfield, Colne,  
Lancashire.

Lawkins, H., l/o Concord Junction; c/o Edw. P. Brook  
and Co., 164, High Street, Boston, Mass., U.S.A.

Lowlay, John; Journals to c/o Wm. Galbraith, 97,  
William Street, Sheffield.

Ingalls, Walter R., l/o Broadway; Jnl. to Bement  
Avenue, West New Brighton, Staten Is., N.Y., U.S.A.,  
and communications to 505, Pearl Street, New York  
City, U.S.A.

Lang, Jas. G., l/o Greenwood: P.O. Box 475, Victoria,  
B.C., Canada.

McArthur, J. S., l/o Renfield Street; 74, York Street,  
Glasgow.

Mannhardt, Hans, 1/o Melrose Street; c/o Heath and Milligan Manufacturing Co., 96, Seward Street, Chicago, Ill., U.S.A.

Marshall, Jos. Wm.; all communications to 143, De la Pole Avenue, Hull.

Mercer, J. B., 1/o Manchester; 4, Tabley Road, Knutsford, Cheshire.

Pidduck, E. W., 1/o Hull; 73, Lord Street, Southport.

Shepherd, E. Sanger; Journals to 12, Heath Hurst Road, Hampstead, N.W.

Sims, W. Edgar, 1/o Higher Crumpsall; 344, Rochdale Road, Blackley, Manchester.

Sperry, Elmer A., 1/o Cleveland; 1114 Ocean Avenue, Brooklyn, N.Y., U.S.A.

Taylor, Jas., 1/o Sydney; Nymagee, New South Wales, Australia.

Whalley, L. J. de, 1/o Erlanger Road; 148, Jerningham Road, New Cross, S.E.

### Change of Address required.

Warden, J. B.; 1/o Sevier Mine, Kimberley, Utah, U.S.A.

### Death.

Clarke, J. F. Wyllie, Wellpark Brewery, Glasgow.

### London Section.

Meeting held at Burlington House, on Monday, June 5th, 1905.

MR. A. GORDON SALAMON IN THE CHAIR.

#### AZO-COLOURING MATTERS DERIVED FROM AR-TETRAHYDRO- $\alpha$ -NAPHTHYLAMINE.\*

BY GILBERT T. MORGAN, D.Sc., AND F. E. RICHARDS.

Although naphthalene was long ago shown to consist of two conjugated benzene rings, yet it was almost as soon recognised that the behaviour of this hydrocarbon was usually by no means strictly comparable with that of benzene and its homologues (toluene, xylene, &c.), the bicyclic hydrocarbon being generally found to be chemically more reactive than its unicyclic prototype.

Bamberger's classical researches on the hydrogenation of the naphthylamines and the naphthols showed that

the characteristic properties of the naphthalene compounds are due to the mutual influence of the two unsaturated rings and that the hydrogenation of one of these systems brings about a reversion to the benzenoid (Ber. 1888, 21, 847, 1112, 1786, 1892; 1889, 22, 1295; Ber. 1890, 23, 197, 876).

Recently this interesting case of chemical atavism formed the subject of a series of investigations emanating from the chemical laboratory of the Royal College of Science, and, in the course of this work, Dr. C. S. showed (Journ. Chem. Soc. 1902, 81, 900, and 1904, 728, 732) that contrary to the experimental evidence adduced by Bamberger and Bordt (Ber. 1890, 23, *ar*-tetrahydro- $\beta$ -naphthylamine does not yield derivatives by the direct action of diazonium salts, resembles aniline, *p*-toluidine and their homologues forming intermediate diazoamines and also behaves in other respects just like a benzenoid amine. In this, therefore, the disappearance of naphthalenoid properties is complete.

On the other hand one of the authors in conjunction with Miss Micklethwait and Mr. Winfield (Journ. Chem. Soc. 1904, 85, 736) substantiated Bamberger and Althausse's statement (Ber. 1888, 21, 1786) that tetrahydro- $\alpha$ -naphthylamine at once yields azo-compounds and does not, under the conditions usually employed these condensations, give rise to intermediate diazoamines. Hence, in this respect, the base retains its naphthalenoid character, although towards other reagents it exhibits the behaviour of aniline and its homologues (Bamberger *cit.*). The tinctorial properties of *ar*-tetrahydro- $\alpha$ -naphthylamineazobenzenesulphonic acid and other azo-compounds have been found to differ considerably from those of the corresponding derivatives of  $\alpha$ -naphthylamine and the above mentioned authors proved that dissimilarity must be ascribed to the hydrogenation of the unsubstituted ring and not to a difference in the orientation of the azo-groups (Journ. Chem. Soc., 1904, 85, 754). The foregoing sulphonated azo-derivative of *ar*-tetrahydro- $\alpha$ -naphthylamine was shown (Morgan, Micklethwait and Winfield *loc. cit.* p. 754) to be a para compound just like its analogue obtained from  $\alpha$ -naphthylamine.

This fact brings *ar*-tetrahydro- $\alpha$ -naphthylamine into the category of aromatic bases which yield directly *p*-azo-azo-compounds capable of being diazotised and combined with various phenols and amines to form direct-colouring matters.

Although at present the cost of the materials (ethyl alcohol and sodium) required in preparing *ar*-tetrahydro- $\alpha$ -naphthylamine from  $\alpha$ -naphthylamine precludes the possibility of employing the base in the manufacture of azo-dyes, yet it seems desirable to place on record the fact that such colouring matters may readily be obtained, and accordingly some representative examples of these substances have been prepared and compared with their analogues in the benzene and naphthalene series.

In connection with this question of the cost of production, the remarkable results obtained by Sabatier and Senderens in hydrogenating aromatic substances with hydrogen in the presence of nickel should be noted, for these authors have announced the production of tetrahydronaphthalene from naphthalene by this process (Comptes rend., 1901, 132, 1254). Should it be found possible to extend this reaction to the preparation of azoamines and phenols of the tetrahydronaphthalene series, then the employment of these substances in the manufacture of artificial colouring matters might become practicable.

#### I.—Azo- and Disazo-derivatives of *ar*-Tetrahydro- $\alpha$ -naphthylamine.

1.—*ar*-Tetrahydro- $\alpha$ -Naphthylamineazobenzenesulphonic acid ( $\text{NH}_2\cdot\text{C}_{10}\text{H}_{10}\cdot\text{N}_2\cdot\text{C}_6\text{H}_4\cdot\text{SO}_3\text{H}$ ) (Ber. 1889, 22, 1295; Journ. Chem. Soc. 1905, 85, 743), is a well-defined compound, the sodium salt of which crystallises in brown orange scales. It dyes wool in an orange shade from an acid bath, thus differing considerably from the corresponding  $\alpha$ -naphthylamine derivative  $\text{NH}_2\cdot\text{C}_{10}\text{H}_9\cdot\text{N}_2\cdot\text{C}_6\text{H}_4\cdot\text{SO}_3\text{Na}$  which gives a chocolate brown colour.

\* Taken as read.



Disazo-colouring matter with Chromotrope acid. The foregoing azo-sulphonic acid when suspended in hydrochloric acid and treated with sodium nitrite yields disazo-derivative the aqueous suspension of which, when poured into a sodium carbonate solution of 2-dihydroxynaphthalene-3:6-disulphonic acid gives to the disazo-compound  $\text{SO}_3\text{Na} \cdot \text{C}_6\text{H}_4 \cdot \text{N}_2 \cdot \text{C}_{10}\text{H}_{10} \cdot \text{C}_{10}\text{H}_7(\text{OH})_2(\text{SO}_3\text{Na})_2$  which being only moderately soluble in cold water is readily salted out.

When dyed on wool from an acid bath this disazo-derivative gave reddish-violet to violet blue shades thus differing from the corresponding naphthalene derivative  $\text{SO}_3\text{Na} \cdot \text{C}_6\text{H}_4 \cdot \text{N}_2 \cdot \text{C}_{10}\text{H}_6 \cdot \text{N}_2 \cdot \text{C}_{10}\text{H}_7(\text{OH})_2(\text{SO}_3\text{Na})_2$  which gave a much more intense black shade.

Disazo-colouring matters with "R salt" and with naphthol-4-sulphonic acid.—The disazo-compound

$\text{SO}_3\text{Na} \cdot \text{C}_6\text{H}_4 \cdot \text{N}_2 \cdot \text{C}_{10}\text{H}_{10} \cdot \text{N}_2 \cdot \text{C}_{10}\text{H}_7(\text{OH})(\text{NaSO}_3)_2$  obtained by a process similar to that employed in production of the preceding compound; it dyes wool dark reddish brown shades.

The disazo-compound similarly produced from  $\alpha$ -naphthol-4-sulphonic acid, gives a dark red shade on wool in an acid bath. In each case the colour produced in the tetrahydronaphthalene derivative was found to be redder and brighter than that obtained with the corresponding naphthalene derivative.

The foregoing three disazo-colouring matters resemble their tinctorial properties, the analogous disazo-compounds of aminoazobenzene and its toluene and xylene homologues, and thus furnish additional evidence of the teneid character of *ar*-tetrahydro-*a*-naphthylamine.

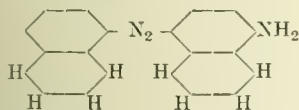
Naphthaleneazo-*ar*-tetrahydro-*a*-naphthylamine. —  $\text{C}_{17}\text{H}_{16}\text{N}_2\text{O}_2$  is isomeric with tetrahydronaphthaleneazo-*a*-naphthylamine (Bambeyer and Bordt, Ber. 1, 22, 625) was prepared by diazotising  $\alpha$ -naphthylamine and combining the diazo-salt with the tetrahydro-; it separated from methyl alcohol in reddish black crystals. 0.1986 gave 23.7 c.c. nitrogen at 22° 765 mm.; N=13.93 per cent.

$\text{C}_{20}\text{H}_{19}\text{N}_3$  requires N=13.95 per cent. This compound dissolves in concentrated sulphuric acid yielding a violet coloration, whereas its isomeride gives a dull violet solution.

*p*-Nitrobenzeneazo-*ar*-tetrahydro-*a*-naphthylamine,  $\text{C}_{16}\text{H}_{14}\text{N}_2\text{O}_2$  is a well defined azo-base, formed by adding an acetic acid solution of *p*-nitrobenzediazonium chloride to an alcoholic or acetic acid solution of *ar*-tetrahydro-*a*-naphthylamine; the hydrochloride at once separates as a dark red microcrystalline precipitate, from which the base is liberated by ammonia. The azoamine when crystallised from ethyl acetate separates in dark brown flakes. 0.1439 gave 23 c.c. nitrogen at 21.5° and 771 mm.; N=18.84.

$\text{C}_{16}\text{H}_{16}\text{O}_2\text{N}_4$  requires N=19.03 per cent.

Tetrahydro-*a*-naphthaleneazo-*ar*-tetrahydro-*a*-naphthylamine



Prepared by diazotising the tetrahydro-base and combining the diazo-compound with another molecular portion of the base in acetic acid solution, separates on the addition of aqueous sodium acetate and crystallises from ethyl acetate in brownish orange needles melting at 35–140°. 0.2602 gave 30.6 c.c. nitrogen at 19° and 771 mm.; N=13.63.

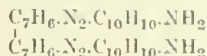
$\text{C}_{20}\text{H}_{23}\text{N}_3$  requires N=13.77 per cent.

Substantive Polyazo-colouring matters derived from *ar*-tetrahydro-*a*-naphthylamine.

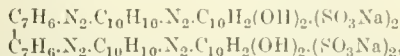
These substances result from the combination of the azotised para-diamines (benzidine, tolidine, dianisidine) with one or two molecules of *ar*-tetrahydro-*a*-naphthyl-

amine; the intermediate aminoazo-compounds being subsequently diazotised and then condensed with the sulphonic acids of various amines and phenols.

1. Ditolyldisazo-*ar*-tetrahydro-*a*-naphthylamine. — When a hydrochloric acid solution of *ar*-tetrahydro-*a*-naphthylamine (2 mols.) and the diazonium chloride from tolidine is treated with aqueous sodium acetate, the aminoazo-derivative



is obtained as a dark brown insoluble product; it dissolves in alcohol to an orange-brown solution; its hydrochloride is a black powder sparingly soluble in water and dissolving in alcohol to a purple solution. The polyazo-colouring matter,



obtained by diazotising the preceding hydrochloride and combining it with chromotrope acid, and the allied azo-compound from  $\alpha$ -naphthol-4-sulphonic acid are black powders with a metallic lustre, sparingly soluble in cold water to a reddish-violet solution and developing intense blue colorations with concentrated sulphuric acid. The former gives greyish-blue shades on unmodified cotton, whilst heliotrope tints are obtained with the latter.

2. The intermediate diazo-compound obtained by combining tetrazotised tolidine with one molecular proportion of *ar*-tetrahydro-*a*-naphthylamine, when again diazotised and coupled with chromotrope acid, yields a more soluble polyazo-compound, which dyes unmodified cotton in a dark blue shade.

If the preceding diazo-derivative is coupled with  $\alpha$ -naphthol-4-sulphonic acid, it yields a polyazo-compound which dyes unmodified cotton in a reddish heliotrope shade.

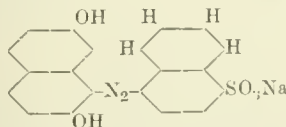
III.—Azo-derivatives of *ar*-Tetrahydro-*a*-naphthylamine-4-sulphonic acid.

1. As recently shown (Journ. Chem. Soc., 1904, 85, 755), *ar*-tetrahydro-*a*-naphthylamine on sulphonation yields tetrahydro-*a*-naphthylamine-4-sulphonic acid  $\text{NH}_2 \cdot \text{C}_{10}\text{H}_{10} \cdot \text{SO}_3\text{H} \cdot \text{H}_2\text{O}$ , a substance closely resembling sulphanilic acid and which, when diazotised and combined with  $\beta$ -naphthol yields sodium  $\beta$ -naphtholazotetrahydronaphthalenesulphonate,  $\text{HO} \cdot \text{C}_{10}\text{H}_6 \cdot \text{N}_2 \cdot \text{C}_{10} \cdot \text{SO}_3\text{Na}$ , this azo-derivative readily separating as a bright red precipitate on adding to its solution a small amount of salt.

Comparative dye tests with Naphthol Orange,  $\text{HO} \cdot \text{C}_{10}\text{H}_6 \cdot \text{N}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{SO}_3\text{Na}$  and Fast Red,  $\text{HO} \cdot \text{C}_{10}\text{H}_6 \cdot \text{N}_2 \cdot \text{C}_{10}\text{H}_6 \cdot \text{SO}_3\text{Na}$  showed that the tetrahydronaphthalene derivative resembles the former dye in tinctorial properties. It dyes wool from an acid bath in bright orange shades which are distinctly redder than those from Naphthol Orange, but differ entirely from the shades of colour obtained with Fast Red.

3. Sodium dimethylanilineazotetrahydronaphthalene-4-sulphonic acid is prepared by the interaction of diazo-tetrahydronaphthalene-4-sulphonic acid with dimethylaniline, and is a brown-orange powder having tinctorial properties resembling those of its benzene analogue, Methyl Orange.

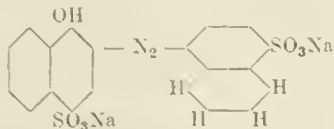
3. Sodium 2:7-Dihydroxynaphthaleneazotetrahydronaphthalene-4-sulphonate.—



is prepared by the interaction of diazotetrahydro-*a*-naphthalene-4-sulphonic acid with 2:7-dihydroxynaphthalene, and separates from solution on the addition of a small quantity of sodium chloride; it dyes wool in a reddish-brown shade from acid bath, the colour produced differing considerably from that of Roxamine, its naphthalenoid analogue.

4. Sodium 3:6 disulpho-1:8-dihydroxynaphthaleneazotetrahydronaphthalene-4-sulphonate, prepared by the interaction of diazotetrahydro- $\alpha$ -naphthalenesulphonic acid with chromotropic acid, separates out on the addition of potassium chloride. In this case the fractional precipitation of the dye with potassium chloride leads to the separation of two substances, one dyeing wool in brownish-red, and the other producing a dark reddish-purple shade.

5. 4-sulpho-1-hydroxynaphthaleneazotetrahydronaphthalene-4-sulphonic acid.



is prepared by the interaction of diazotetrahydronaphthalene-4-sulphonic acid and Nevil and Winther's acid, and separates best in the form of its calcium salt; it dyes wool from an acid bath in brown shades, thus differing from the colour obtained with Fast Red C, its naphthalenoid analogue.

#### IV. Azo-Derivatives of Dimethyl- $\alpha$ -tetrahydro- $\alpha$ -naphthylamine.

The dimethyl- $\alpha$ -tetrahydro- $\alpha$ -naphthylamine required in these experiments was prepared by heating  $\alpha$ -tetrahydro- $\alpha$ -naphthylamine hydrochloride with methyl alcohol under pressure at  $170-180^\circ$ . This tertiary base, unlike dimethylaniline, does not show any tendency to condense with formaldehyde or benzaldehyde, but nevertheless retains the property of coupling with diazonium salts.

1. *p*-Nitrobenzenediazodimethyl- $\alpha$ -tetrahydro- $\alpha$ -naphthylamine  $\text{NO}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{N}_2 \cdot \text{C}_{10}\text{H}_{10} \cdot \text{N}(\text{CH}_3)_2$  produced by coupling the base with *p*-nitrobenzenediazonium chloride in the presence of excess of aqueous sodium acetate crystallises from alcohol or ethyl acetate in well-defined, deep red acicular prisms melting at  $150^\circ-152^\circ$ . 0.1497 gm. gave 21.4 c.c. nitrogen at  $21^\circ$  and 766 mm.  $\text{N} = 16.78$ .  $\text{C}_{18}\text{H}_{20}\text{O}_2\text{N}_4$  required  $\text{N} = 17.28$  per cent.

2. Sodium Dimethyl- $\alpha$ -tetrahydro- $\alpha$ -naphthylamineazobenzenesulphonate  $\text{N}(\text{CH}_3)_2 \cdot \text{C}_{10}\text{H}_{10} \cdot \text{N}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{SO}_3\text{Na}$  prepared by coupling the tertiary base with diazobenzenesulphonic acid, separates from its aqueous solution on the addition of alcohol in yellow-brown flakes.

For purposes of comparison the naphthalenoid analogue of the foregoing compound was prepared from dimethyl- $\alpha$ -naphthylamine and diazobenzenesulphonic acid.

Sodium dimethyl- $\alpha$ -naphthylamineazobenzenesulphonic acid separates from its concentrated aqueous solution in brown flakes on the addition of sodium chloride.

The tinctorial properties of these two azo-compounds were compared. The colours obtained on wool showed that the isomeric tetrahydronaphthalene compounds  $\text{N}(\text{CH}_3)_2 \cdot \text{C}_6\text{H}_4 \cdot \text{H}_2 \cdot \text{C}_{10}\text{H}_{10} \cdot \text{SO}_3\text{Na}$  (see page 653) and  $\text{N}(\text{CH}_3)_2 \cdot \text{C}_{10}\text{H}_{10} \cdot \text{N}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{SO}_3\text{Na}$  give reddish-orange shades on wool from an acid bath, whereas the naphthalene derivative  $\text{N}(\text{CH}_3)_2 \cdot \text{C}_{10}\text{H}_8 \cdot \text{N}_2 \cdot \text{C}_6\text{H}_5 \cdot \text{SO}_3\text{Na}$  furnishes a brown colour.\*

#### CONCLUSIONS.

1.  $\alpha$ -Tetrahydro- $\alpha$ -naphthylamine retains its naphthalenoid character and resembles  $\alpha$ -naphthylamine in yielding directly aminoazo-compounds which can be readily diazotised and coupled with suitable sulphonated amines or phenols to form polyazo-colouring matters.

2. The azo- and disazo-colouring matters derived from  $\alpha$ -tetrahydro- $\alpha$ -naphthylamine and its sulphonate and dimethyl derivative have tinctorial properties very similar to those of their analogues of the benzene series, and differ markedly in this respect from the corresponding compounds in which the naphthalene residue is substituted for the tetrahydronaphthalene complex.

\* The authors' thanks are due to Miss F. M. G. Mickethwait for assistance in preparing the tetrahydronaphthalene derivatives employed in this investigation.

#### ANALYSIS OF SILICON (GRAPHITIC) AND SILOXICON.\*

(From the Acheson Carborundum Works, Niagara, U.S.A.)

BY PERCY E. SIELMANN, A.R.C.Sc., A.I.C.

##### *Analysis of a Sample of Silicon.*

The sample contained silicon, silica, iron, alumina, and alumina. An occasional crystal of carborundum was found, and not included in the analysis.

The substance was heated in a porcelain boat in a stream of chlorine, whereby the silicon, iron, and alumina were volatilised as chlorides. They were absorbed being passed over the surface of water in a flask, and through a U-tube loosely packed with wet cotton wool the silicon tetra-chloride being decomposed to the hydroxide. In this way there was no loss of gases, as was the case when pure water was employed in the place of wet cotton wool. After the ferric chloride was volatilised the combustion tube was blow-piped as strongly as possible to do; the reaction was known to be at an end when the contents of the boat ceased to glow. Only silicon chloride and a negligible amount of ferric chloride absorbed by the cotton wool, which was burned off the oxides.

The separation of the silicon, iron, and aluminium was carried out as usual. The residue of silica and alumina left in the boat was fused with acid potassium sulphate and their amounts estimated.

This analysis gave:—

Si	..	..	..	..	93.91	per cent.
Fe	..	..	..	..	2.57	..
Al	..	..	..	..	0.41	..
SiO <sub>2</sub>	..	..	..	..	2.65	..
Al <sub>2</sub> O <sub>3</sub> (by diff.)	..	..	..	..	0.46	..
					100.00	..

Other attempts at analysis brought out the following facts:—Hydrofluoric acid with sulphuric acid has no effect, nor has boiling bromine, nor fused potassium nitrate. Fusion mixture acts well on the substance, but a suitable crucible is not obtainable, because the fusion mixture attacks porcelain and the silicon attacks metals, including platinum.

The specific gravity of the substance was found to be 1.90.

##### *Analysis of a sample of Siloxicon.*

Siloxicon is a greenish-grey substance, easily reduced to a coarse powder in the fingers, and contains shining particles distributed throughout its mass. It can be separated, though not quantitatively, and is able to scratch glass; they consist of carborundum and with graphite.

The specific gravity is 2.52.

In 1881 Colson and Schutzenberger described before the Paris Academie des Sciences, a green coloured powder having the formula  $\text{SiCO}$ , which they prepared by passing a stream of carbon dioxide over silicon which was slowly heated in a porcelain tube. This was the first silicon-carbon-oxygen compound of its kind.

Acheson, in 1903, patented a process for the manufacture of a highly refractory substance of a composition varying between  $\text{Si}_2\text{C}_2\text{O}$  and  $\text{Si}_2\text{C}_3\text{O}$ . It has been described more than once; and Mr. Bertram Blount reported in the "Analyst" for February of this year that he had estimated directly the total carbon in siloxicon by heating it with lead chromate, the silica directly, and the oxygen by difference. No figures were given and I have found anywhere an account of a detailed analysis of this substance. I have attempted such an analysis in the following manner.

The percentage of total silicon was determined by fusion with sodium peroxide in a nickel crucible. Vigorous action occurred, and the resulting silicate was decomposed with hydrochloric acid, and the silica estimated in the usual way, after separation of the iron and of some of the other elements derived from the crucible.

\* Taken as read.



total carbon was estimated as follows:—A sample fused in an iron boat in a combustion tube with an excess of sodium peroxide. Potash absorption was fitted to one end to retain any carbon dioxide which might escape the peroxide; as a matter of fact, it did escape. To the opposite end was attached an earthen bottle to remedy any back pressure caused by a sudden action within the tube, and to wash out the gases at the end of the reaction. The ordinary carbon dioxide was absorbed on the fused mass, and the gas passed into a mixture of calcium chloride and ammonia. The mixture was boiled, and the calcium carbonate precipitated, filtered, and weighed as lime. It was found that dilute hydrochloric acid acts well in liberating the carbon dioxide, and that chlorine is evolved if hydrochloric acid is employed, owing to its action on the sodium peroxide.

In the above-mentioned estimation of carbon, none of the gas escaped combination with the sodium peroxide, an analysis, sufficiently accurate for all purposes, can be effected by tipping small quantities of a mixture of siloxicon with an excess of sodium peroxide into some peroxide fused in a nickel crucible; the carbonate of sodium is formed, and each can be estimated in the way already indicated.

A portion of the siloxicon was heated in chlorine, some silicon was volatilised as tetrachloride together with ferric chloride and a very small amount of aluminium chloride. The vapours were collected, as already explained, passing them over the surface of water and then through cotton wool. The separation and estimation of the iron, and aluminium were carried out in the usual manner.

The weight of silicon, iron, and aluminium collected was less than the loss of weight of the siloxicon, but this was due up by the presence of a substance having the formula  $\text{Si}_2\text{C}_2\text{O}_3$ , which will be accounted for later.

The residue was then heated in oxygen and the carbon dioxide formed was estimated as before. The residue was  $\text{Si}_2\text{C}_2\text{O}_3$ .

The other portion was heated to determine the moisture. A third portion was boiled for some time with hydrofluoric acid: the filtrate was found to contain ammonium ammonium silico fluoride; this proves the presence of silicon nitride; the amount was, however, too small to be estimated.

The results of these estimations are as follows:—

By fusion with sodium peroxide:	
Total Si .. .. .	50.31 per cent.
By fusion with sodium peroxide:	
Total C .. .. .	31.39 "
By heating in chlorine:	
Si .. .. .	7.54 "
Fe .. .. .	1.07 "
Al .. .. .	trace.
By heating in oxygen:	
C .. .. .	11.79 "
By heat:	
Moisture .. .. .	0.19 "
By treatment with hydrofluoric:	
N .. .. .	trace.
Residue in the boat:	
$\text{Si}_2\text{C}_2\text{O}_3$ .. .. .	71.39 "
These give:	
Total Si .. .. .	50.31 "
Total C .. .. .	31.39 "
Fe .. .. .	1.07 "
Moisture .. .. .	0.19 "
$\text{Al}_2\text{O}_3$ and N .. .. .	traces.
O (by diff.) .. .. .	17.04 "
	100.00 "

At the residue left in the boat was  $\text{Si}_2\text{C}_2\text{O}_3$  was substituted by a further quantity being prepared and fused, as well as by the close agreement with the Si calculated for  $\text{Si}_2\text{C}_2\text{O}_3$ , and the difference between the amount of total silicon and that volatilised in chlorine.

The carbon burned off in oxygen occurred in the siloxicon as carborundum (which was decomposed by hydrofluoric acid) and partly as graphite. This quantity with the amount calculated to be in the  $\text{Si}_2\text{C}_2\text{O}_3$  subtracted from

the total carbon found by the peroxide fusion left 1.47 per cent.

The amount of oxygen in  $\text{Si}_2\text{C}_2\text{O}_3$  subtracted from the total oxygen left 5.24 per cent. This, with the 1.47 per cent. of carbon just mentioned, is almost exactly that required for 10.81 per cent. of  $\text{SiCO}_3$ , which contains 3.48 per cent. of silicon. This amount of silicon subtracted from the amount volatilised in chlorine gives the amount of silicon present as carborundum, i.e., 4.08 per cent. The amount of carbon thus combined equals 1.73 per cent., which, if subtracted from the weight of carbon burned off in oxygen, leaves the amount of carbon present as graphite.

Thus, commercial siloxicon is resolved into:—

$\text{Si}_2\text{C}_2\text{O}_3$ .. .. .	71.39 per cent.
$\text{SiCO}_3$ .. .. .	10.81 "
SiC .. .. .	5.81 "
Graphite .. .. .	10.06 "
Fe .. .. .	1.07 "
Volatile matter .. .. .	0.19 "
$\text{Al}_2\text{O}_3$ , $\text{Si}_3\text{N}_4$ (by diff.) .. .. .	0.67 "
	100.00 "

Considering that siloxicon is obtained as a by-product from the carborundum furnace, it is to be expected that some free silicon will be present. This accounts for the silicon nitride being found in the substance as it would be formed by the action of atmospheric nitrogen in the furnace; the atmospheric oxygen together with free carbon may well be responsible for the  $\text{SiCO}_3$ . The actual existence of this substance in siloxicon is open to question, since, although it fits in well by calculation, it should not, according to Dammer's *Anorganischen Chemie*, be decomposed by chlorine.

In the course of the search for a method of analysis the following properties and reactions were observed:—

Fusion mixture and fused potassium nitrate acted vigorously but not completely.

Hydrofluoric acid and sulphuric acid caused slight decomposition. Fused ammonium fluoride was without action.

Heated lead peroxide acted vigorously, but attacked also the containing crucible.

Concentrated potassium permanganate solution was allowed to act on some siloxicon for a week on a water-bath. Colourless soluble and insoluble compounds, as well as some tarry matter, were formed; and instead of getting rid of the free carbon quantitatively, there was an increase of weight amounting to about 14 per cent.

## Manchester Section.

Meeting held at Manchester, on Friday,  
May 5th, 1905.

MR. J. CARTER BELL IN THE CHAIR.

### THE RECOVERY OF PRODUCTS OF COMMERCIAL VALUE FROM SEWAGE SLUDGE.

BY J. GROSSMANN, PH.D., F.I.C.

In the year 1898 (this J., 17, 421—424) I read a paper before this section dealing with the problem of obtaining products of value from sewage sludge by distillation at such a temperature as to produce gas suitable for technical purposes, and to drive off ammonia, whilst leaving a residue which should be available for use as a manure. I was fully aware at the time that there were serious objections to such a scheme. One, which is always a great and in many cases a fatal one was that it had been tried before and found impracticable. It could also be urged that the gas produced could only in very rare cases be utilised on the sewage works, and would, therefore, have no value, and in the discussion which followed my paper it

was maintained that the residue from the distillation would be worthless. The principles which I wished to establish were that the mechanical difficulties which had in the past been in the way of solving the problem could, in the present advanced state of engineering, be overcome and that it might pay to use precipitants more or less in excess, and produce more sludge so long as the products obtained more than covered the expenses of working.

Since that time I have had ample opportunity of proving the correctness of my ideas on the construction of furnaces, on distillation, and on other matters relating to chemical engineering on a large scale in connection with other processes, and the Corporation of Bradford consulted me, towards the end of 1903, on the feasibility of subjecting their sewage sludge to distillation, and subsequently requested me to prepare the necessary plans and specifications for an installation dealing with 16 tons of sludge per day, *viz.*, one-third to one-fourth of their total production.

It is well known that Bradford is the centre of the woollen industry in Yorkshire, and that from industrial processes incidental to that source its sewage is exceptionally rich in fatty matter. It was found that by adding a small quantity of sulphuric acid to the sewage, insoluble matter settled out well, and that the sludge thus obtained held the greater part of the fatty matter originally contained in the sewage. It was also found that if this sludge, which is charged with about 80 per cent. of water, was heated with a suitable quantity of sulphuric acid, and whilst hot passed through a filter press, a considerable quantity of grease could be removed from the liquor running from the presses. But it was found impossible to thus recover all fatty matter and I was informed that the sludge cake coming from the filter presses contained 24 per cent. of grease, equal to about 40 per cent. of matter, which could be extracted by ether, after the cake had been dried at 100° C. I have subsequently found that, according to the state of the woollen trade, which fluctuates with the seasons and to numerous other contingencies, the amount of fat in the sewage cake varies considerably, and may be as low as 7 per cent. and even less.

Apart from the question of expense, the sludge thus obtained became a serious nuisance, and various processes of recovering the fat in it by extraction with volatile solvents, and at the same time obtaining a residue which should be innocuous, and of some value as manure, were tried on a large scale, but without success. Experiments carried on by the Bradford Corporation at the Frizinghall Sewage Works, in which the sludge cake was heated in a large pot-shaped still, particularly in the presence of superheated steam, and under a vacuum, gave more encouraging results, and although it was found impracticable in the experimental plant to determine the best conditions under which the distillation could be carried out, and although a large amount of the fat was decomposed and lost in the form of hydrocarbons, yet the fact was established that it was possible to distil over a certain amount of fat and to obtain a dry residue containing only a small quantity of fat and sufficient nitrogenous matter to be of manurial value.

With these data, and a sample of sludge cake to go upon, it occurred to me that the principal conditions under which a plant should be constructed, were as follows:—

1. That the sludge should be heated in comparatively thin layers. A simple mathematical calculation shows that in the case of bad conductors the heat as transmitted from the outside to the centre of the cake will decrease in a geometrical progression, whilst the thickness of the cake is made to increase in an arithmetical progression, so that a comparatively slight alteration in the thickness of the sludge cake will make a considerable difference in the results.

2. That the furnaces should be capable of maintaining an even heat at temperatures varying from 200 to 500° C., or even more.

3. That manual labour should be dispensed with as far as possible by the substitution of mechanical appliances by which the process could be made continuous, and almost automatic.

4. That under these circumstances it would be practicable to maintain a high vacuum, but that minus pressure in conjunction with superheated steam would be most likely to give satisfactory results.

Generally speaking, it could be assumed that the efficiency of the apparatus would be a function of three variables, *viz.*, the temperature, the thickness of the cake, and the time of the operation, *i.e.*, in a continuous apparatus the speed with which the mass was moved from one retort to end. As these were unknown quantities, the parts of the apparatus had to be constructed with a view to subsequent adjustment and alteration. Particular care had to be made, moreover, to prevent access of air to the system during charging and discharging, and to guard against explosions if hydrocarbons should be evolved in sufficiently large quantities.

It is on these lines that the plant which I have now constructed, and it consists briefly of the following arrangements.

The distillation takes place in eight D-shaped retorts which are placed side by side at convenient distances in a furnace bed in such a manner that the space between the fourth and fifth retort is greater than that between the others to allow for the exit flue to pass between them. This arrangement really represents two sets of four retorts built back to back. The fire gases run in flues between the retorts at angles to the length of the retorts under and above them in such a manner that the whole system is similar to a regenerating furnace or baker's oven, where the heat is mostly given off by reflection from the heated bricks or tiles, and are finally taken through the central flue referred to before into the main flue and chimney. In that way it is possible to maintain an even temperature and yet vary the heat from 200° to 900° C. The retorts are heated separately and independently from each other so that more heat may be used on certain portions of the retorts than on others. This is an important feature in the construction as the process of distillation consists of two separate parts, firstly the expulsion of the water from the cake and, secondly, the distillation of the fatty matter or less, both processes take place simultaneously. At the beginning of the operation, still the chief quantity of heat will be required for the evaporation of the water of the water which takes place first, and, therefore, a greater amount of fuel will be necessary in that part of the furnaces nearest to the charging apparatus. As the retorts are closed at both ends, and a scraper arrangement travels very slowly on the flat base of the D-shaped retorts, the bottom of the retorts, in such a manner that the sludge, which is fed in at the top, is slowly moved along at a proper rate, and is practically free from fatty matter when it is discharged at the other end. Perforated pipes are fitted inside the retorts for the supply of steam or heated steam. The feeding is arranged in such a manner that two closed hoppers, one above the other, are connected with an opening at one end of the retorts; the top hopper is being charged, the bottom one is discharging from it by means of a funnel plug, so that no air enters the retorts during the feeding from that part. The discharging part is arranged in a similar manner in emptying the discharging box it is disconnected from the retorts. This is effected by feeding the dry residue from the retorts alternately into two different boxes, each of which is disconnected from the rest of the retorts whilst it is being opened and emptied, thus preventing access of air to the retorts. An arrangement for the waste material is interposed between the retorts and the discharging tanks, and acts at the same time as a safeguard against explosions. The gases leave the retorts at the top nearest to the end from which the waste material is discharged; they are taken through suitable collection pipes and scrubbers in which the fatty acids are condensed and other organic compounds and ammonia are separated, and finally pass through an exhauster into the chimney. There is no nauseating smell arising during the course of distillation.

The cost of the installation is about £4,000; the fuel burnt per 24 hours amounts to two tons of coal, and the labour at 6d. per hour to 36s.; so that the depreciation and interest into account, the total cost comes to £4 per day for the distillation of 16 tons of



containing from 40 to 50 per cent. of water. As installations could be erected at less expense, and as economies could be effected in labour and fuel, they may be taken as the maximum cost of production. Products obtained per 24 hours are 7 tons of residue, consisting besides free carbon about 2 per cent. of nitrogen, yielding to 8 per cent. of ammonia sulphate and 1 per cent. of phosphoric acid, equal to a little over 2 per cent. of calcium phosphate, and a quantity of grease which is on the original quantity contained in the sludge. But, however, from these two products, I have found, as anticipated in my paper of 1898, that other valuable compounds are produced in the process of distillation. So far, I have been able to determine and to separate butyric and similar acids, and there is evidence of aniline bases and other compounds in the distillate. A small quantity of organic acids obtained when working at a higher temperature than necessary to obtain the best results as far as the yield of grease is concerned, yielded in 24 hours to 50 lb., of which 25 lb. was butyric. These acids can be easily recovered, and should be a considerable source of revenue. In the case of a sludge containing small quantities only of fat, it might be advantageous to regulate the distillation with a view to maximum production.

The total amount of nitrogen recovered, including that lying in the manurial residue, and calculated as ammonia is a little over 1 per cent.; that of phosphoric acid is about 1 per cent. reckoned on wet sludge. Possibly the yield of these products might be obtained by using the sludge, or in conjunction with acid, a suitable product in the preliminary treatment of the sewage. The economy might also be effected in the final boiling by the use of sulphuric acid to which the sludge is subjected; the process part of the phosphates which have settled in the sludge will become decomposed; the liberated phosphoric acid will run to waste with the effluent from the presses, and probably carry with it some colloidal and other nitrogenous compounds. By preventing the effluent from the presses it should be therewith possible to recover a further amount of valuable products. The use of phosphoric acid or acid phosphates in either of these operations may some day be of great advantage.

As stated before that, under normal conditions, the sludge as it comes from the filter presses should contain about 24 per cent. of grease, and with such sludge, for all possible losses, the amount of grease recovered should pay all working expenses and show a profit. But as there are only few towns which could produce sludge rich in fatty matter, the results obtained in Bradford would, under ordinary circumstances, be of general interest. It was a fortunate accident, however, that the sludge placed at my disposal was from a storm-water tank, and contained only 7 per cent. of fat, a percentage which is abnormal for Bradford sludge, which resembles normal sludge as obtained from ordinary domestic sewage. It was found that even with such a low percentage of fat the manurial residue and the grease recovered products recovered will pay the working expenses.

I am thus enabled to consider the question whether the results which I have obtained in Bradford influence the general treatment of sewage in other towns.

Up to the present, the sludge produced at sewage works has, in most cases, been a source of nuisance and expense. Loaded with a large amount of water it has been difficult to remove, and the aim has therefore been to reduce the quantity produced to a minimum. For this reason, even where chemicals were used for precipitation, they were brought down to the smallest quantity, just sufficient to produce an effluent which could afterwards be cleared by filtration, with the result that the valuable elements contained in the colloidal matter were wasted. Considering that for every tenth of a per cent. of ammonia present in the sludge a further gain of 10d. per ton could be realised, it is possible that where chemicals are used to present an increase in their quantity might be more than compensated for by the additional yield on ammonia and phosphoric acid. In whichever way produced the sludge will require treatment with sulphuric

hydrochloric or phosphoric acid, and filter-pressing, and any valuable ingredients in the press-effluents could be recovered as previously indicated. The temperature at which the sludge cake should be distilled will vary in different localities; it will be ascertained by conducting the operation at gradually rising temperatures, and noting the quantity, nature, and value of the products obtained, and accepting that temperature as most suitable at which the total value of the products is highest.

There are certain ingredients in sewage which are removed from it partly by dredging, partly by means of screens, and which up to the present have been dealt with separately. It may be found that in some cases it will be advisable to mix these matters after suitable mechanical treatment, that is, disintegration or otherwise, with the sludge; and possibly part of the refuse obtained from ashbins, and dealt with at present in the destructors, might be utilised in the same way. The question which will in each case have to be determined, will depend upon the fact under what conditions the manure and the products of distillations obtained will produce the best commercial results. In many cases it may be possible to enrich the sludge by conducting the settling on a system of differentiation, with the object of obtaining a sludge in the first tanks which contains more fatty and nitrogenous matter than the average sludge which would be obtained by settling without differentiation.

It may be possible by judicious manipulation to greatly enhance the value of the products obtained; that of the residue by mixing it with materials which would improve its manurial value; that of the grease by refining; and that of the organic acids by converting them into fruit essences, or other more complex compounds. But this is a matter which, as it affects the principle of municipal trading, will have to be settled by the respective authorities who control the disposal of sewage. In my calculations, I have only dealt with the products as they leave the apparatus.

#### DISCUSSION.

The CHAIRMAN said, considering that Dr. Grossmann had worked upon a sludge containing 5 or 6 per cent. of fat, it was marvellous how it could be made to pay expenses. If the Salford Corporation could make something out of the 200,000 tons of sludge which contained about 40 per cent. of total solid matter, it would be a very great advantage.

Dr. C. DREYFUS thought the first question was—Why should they wish to extract the grease from the sewage? The reason why grease was so objectionable in the treatment of sewage by biological methods was the fact that if it were allowed to get on to the bacteria beds it clogged up the pores of the beds, and prevented to a certain extent the sewage from penetrating and becoming purified. This was one of the great difficulties, and it was, therefore, quite a problem for chemists to get rid of the grease. It had been done on a large scale in several places. In Germany they treated the sludge which they obtained by sedimentation in suitable tanks, by adding a sufficient quantity of sulphuric acid to decompose the lime and other fatty soaps which were formed in the process, by which means and subsequent pressing they were able to concentrate the sludge itself, which previously contained about 10 per cent. of solids, to one of 30—40 per cent. of solids. This was afterwards dried in a suitable apparatus until it contained about 10 per cent. of moisture, when it was treated by petroleum spirit or benzole. By this method they obtained very good grease, but he hardly thought it had been a commercial success. He thought the extraction of grease from sewage could not be made to pay, and it would be quite sufficient if the process could be carried on without entailing serious expenditure. In Bradford they had, at one time, an excellent plant for the purpose; they started with the idea of treating the wet sludge with a solvent, and by an ingenious method they succeeded in extracting almost all the fats contained in the sludge, but the loss of solvents must have been very considerable. He hoped the process described by Dr. Grossmann might be successful. What quantity of sulphuric acid did he use for every million

gallons of sewage? What was the yield obtained out of the sludge which contained 7 per cent. of total fats? How much of that fat was left in the residue after treatment? The treatment of large quantities of sludge would necessitate the fitting up of most expensive and elaborate plant. Dr. Grossmann had said that for treating only 16 tons of sludge he had to spend something like about £4000. Sixteen tons of filtered press sludge was a very small quantity indeed for a large population like Manchester. Even if it could be shown that there was no loss in the working, Manchester was better situated as an inland town, owing to the Ship Canal, and by reason of their being able to send the sludge out to sea by steamer. The cost, although a very heavy one, did not reach a very large figure. The cost of disposal of sludge in inland towns was becoming daily a more difficult problem. The most valuable method would be one whereby the fatty matters could be extracted before they passed into the sludge, and so obtain an effluent free from those elements so injurious to the bacteria beds. It was on these lines both inventors and chemists ought to work.

Dr. G. J. FOWLER said that he was not quite clear as to the percentage of fat in the sludge with which Dr. Grossmann had worked. If the material represented normal Bradford sludge it would be of such a nature as would hardly be met with in any other town except Bradford, which had an industry producing large quantities of fat. The average percentage of fat on the dry material in most towns would range from 15 to 20 rather than 40 per cent.; therefore, they would have at once a very considerable difference on which to calculate the cost. At the same time he would like to emphasise his opinion that a town was not necessarily concerned in making the extraction of grease a financial success in itself as apart from reducing the cost of sludge disposal, and it was on those lines that the economics of the subject should be looked at. He agreed with Dr. Dreyfus entirely that the ultimate solution of the problem would probably be arrived at by a combination of experience of various kinds.

Dr. G. H. BAILEY said he understood Dr. Grossmann in his paper was dealing with 5 per cent. of grease from storm-water tanks, and not, as Dr. Fowler had evidently inferred, with 25 per cent. This was one of the most essential points of the paper since the remarks became applicable to all forms of sewage. Assuming that there was something like 200,000 tons of soap used per annum, the recovery of a small percentage of the fat would be some advantage. Could this process be applied generally to sewage, and would it be possible to construct an experimental plant on a small scale that could be used for the investigation of the sludge from a small population? Dr. Fowler and Dr. Dreyfus had both emphasised the importance of removing the fat and colloidal matters from the sewage before passing it on to the bacteria beds. If this were done the separation would yield an addition to the sludge, as it was inconceivable that any method dealing directly with such large volumes of liquid should effectually destroy the grease. At the previous meeting Dr. Fowler had spoken hopefully of the precipitation of the colloidal matters, and if this were done, even partially, the sludge would become enriched with bodies rich in nitrogen and the value of the process before them would be enhanced.

Dr. K. E. MARKEE supplemented Dr. Bailey's remarks by intimating that the total production of soap in Great Britain was over and not under 400,000 tons per annum. He asked for information with regard to the composition of the recovered sewage fat, especially relating to the proportion of "glycerides" and wool fat or "cholesterine"? He considered this important, because the composition in this respect determined its market value, and, further, because it would indicate whether the sewage yielding this fat was of an exceptional nature. Bradford sewage presented the same difficulty of treatment as other districts where the woollen industry was rife. Such sewage always contained cholesterine in appreciable quantity—a substance, which, owing to its inert character, combined with extraordinary emulsifying power, was probably the most objectionable constituent in sewage. His own

experience with regard to precipitation of ap- chemically inert organic substances led him to believe they were far from understanding even the elementary principles underlying sewage precipitation in all its details. Why did calcium carbonate for example precipitate all the organic substances precipitated by lime? In practice 1.25 tons of calcium carbonate precipitated the same weight as did 1 ton of unslaked "Absorption," a term lately introduced to indicate chemical precipitation of neutral bodies by neutralisation may be convenient, but was by no means satisfactory. In certain sewage works calcium oxide had been introduced with success by calcium carbonate containing 10 per cent. calcium hydrate. This raw material was only cheaper, but its application required less and less plant, produced a denser precipitate, and was more important, produced a non-alkaline, and less putrescent effluent.

Mr. F. SCUDDER asked Dr. GROSSMANN to state the capital cost of a plant to deal with a definite quantity of sewage sludge expressed as money required per ton of sludge treated, and also to state the weight and the bye-products recovered. The whole question simply one of expense, and without this information value or otherwise of the process could not be determined. Before Bradford obtained their Act of Parliament to compel the woolcombers to treat their trade effluent prior to entering the sewers, something like 45 tons of grease passed per day into the town's sewage, subsequently reduced to about 28 tons. Bradford produced about 220 tons of sludge with 50 per cent. grease per day. There was a desire on the part of the town to adopt a recovery process for this grease. Dr. Dreyfus had remarked, the Dellatre process tried amongst others, and in spite of the fact that the Chief Engineer of the Department du Nord had made a statement showing that a profit of 81l. a day was made out of the Roubaix and Tourcoing sewage, with the Dellatre process at Frizinghall had not been so successful as was anticipated. With regard to Grossmann's scheme there was further the question of wear and tear of the retort settings and renewals considered, and, having regard to the fact that there was no commercial value, it was not known the yields of ammonia, acetic acid, and other products which he proposed to recover. It was not a question of quantity of the nitrogen and phosphoric acid, but of the "available" nitrogen and the "available" phosphoric acid.

Dr. GROSSMANN, in reply, said that, although with him he was called in to work on the Bradford sewage through an accident, he was supplied with a sample of tank which was not strictly typical of Bradford sludge, which was of the nature of sludge obtained from domestic sewage. He did not say that his process was applicable to every town, but no doubt there were localities where it might, with advantage, be applied. He also did not say that the preliminary treatment of the sewage would make the effluent what it should be. In some cases, by the preliminary treatment, the effluent might be produced which would pay even at a very low percentage for working up. So far as he could see at the lowest limit of fat at which it will pay for working up would be from 5 to 7 per cent. on the wet cake. Farmers were paying 2s. 6d. per ton for the residue from the tanks, and as much as 3s. 6d. for the oil offered. It had been valued by an authority at about 5s. A weak sludge would yield 100 lb. of grease per day, and this, together with the residue, would produce more than £4 per day. This brought the figure to which there would be a reasonable profit, even with a small amount of fat. As already shown—and in which Dr. Fowler could not but see the differentiation in the settling tanks could be used for this purpose, and the fact that it was not that an apparatus could be made for using it might induce others to give their attention to preliminary sewage treatment which hitherto have had no attention. Dr. Dreyfus was quite right in saying that farmers would not use any measure that



a large amount of fat, but if it could be reduced to from 2 to 3 per cent. in the residue, and from 1 to 1½ per cent. calculated on the fat in the original cake, it would do no harm. Dr. Dreyfus had also stated that it would cost of great expense for Manchester to deal with the sludge in the manner suggested in the paper. (Hossmann) did not think it necessary that Manchester utilise the whole of the sludge. He wished to see the fact, which did not appear clear to Dr. Fowler, that the sludge at his disposal was not typical sludge, but only contained from 5 to 7 per cent. of the wet, and that, with a system of differentiation, it could produce sludge much richer in fat than one he happened to deal with in Bradford. With reference to Dr. Dreyfus' remarks relating to the prevention of soapy matter passing into the effluent, it is to him that after all there were only three ways in which this could be done, viz.:—(1) by dissolving the fat by means of a solvent, which would not be a practically practicable process; (2) by bacterial methods, which could mean that the valuable constituents would be destroyed and lost; (3) by precipitation, which would yield the fat in such a form that it would have to be treated by such a process, as suggested in the paper. Dr. Fowler asked where the butyric acid came from, this was a difficult question to answer, but from this he was inclined to think that it was not a product of decomposition of fat, but that it came from substances in the sludge. In reply to Dr. Bailey, he thought it would be possible to construct an apparatus suitable for small localities. An eighth of the cost could be applied for experimental purposes or for large works at a comparatively low cost, and the apparatus could be reconstructed and again form part of a new installation. It would be quite possible to have an installation consisting of one retort, and to have a small condensing plant. Replying to Dr. Bailey as to the quantity of cholesterol and glycerides, the quantities which had been made so far, had been confined to a chemical valuation of the grease recovered in connection with further purification by distillation, and therefore its saponification value had been determined. Dr. Bailey's statement with regard to the quantity of sludge in Bradford must have been based on a misunderstanding. The quantity obtained there was 20 tons per day, but from 50 to 60 tons.

the coast of Asia may be seen distinctly across Behring Strait, while to the right lies the Arctic Ocean, and to the left the Behring Sea. The climate is severe, but not so bad as it is supposed to be by those who have not been in the Arctic regions. The summers are moderate, and though the winters are stormy and cold, it is only for two or three months that very bad weather lasts, and then one is prepared for it. The country is completely cut off from supplies from the outside world from November to June, both inclusive, so that all necessities must be brought in during the open months. During these open months the ocean is clear of ice, and steamers run between Nome and Seattle, and Nome and San Francisco.

Wm. C. J. Bartels, of the Bartels Tin Mining Co., was the first to find tin, in 1901, on Cape Mountain and in the vicinity. Since that time numerous strikes have been made at other places from 10 to 30 miles distant. Indeed, it would seem that the whole neighbourhood abounds in tin ore, cassiterite, mixed with granite of various kinds, the cassiterite being sometimes in large crystals and at other times intimately mixed with the granite.

#### *Assay of Tin Ore.*

The cyanide assay is the best both for speed and accuracy. This assay depends on three properties of the cassiterite—one physical, the other two chemical: its high specific gravity, seven; its insolubility in aqua regia; and its quick and complete reduction by fusing with potassium cyanide, the equation for the reaction being  $\text{SnO}_2 + 2\text{KCN} = 2\text{KCN} + \text{Sn}$ .

The sample is ground through a 60 or 80 mesh sieve and thoroughly mixed. From 25 to 100 grms. are then concentrated by panning down with water to remove the lighter substances. The concentrates will now consist of cassiterite, mixed with any heavy minerals which may have been contained in the ore, and which in our ores are usually small quantities of iron oxides, with occasionally some wolframite. The concentrates are now boiled with aqua regia for half an hour. This dissolves the iron, changes any tungsten compounds to insoluble yellow tungstic acid, and leaves the cassiterite unattacked. The concentrates are now washed by decantation, and any tungstic acid removed by solution in ammonia. They are then washed again, dried and weighed. If only an approximate assay is needed, which is often the case, the tin may be estimated by calculation, the concentrates from our ore always containing very close to 70 per cent. tin. If more accurate work is desired, the dried concentrates are mixed with about five times their weight of powdered potassium cyanide, and smelted in a clay crucible at a good red heat. The tin is reduced and collects in a button at the bottom of the crucible.

Analyses of buttons obtained in this manner have shown them to be practically pure tin, the impurities in a one grm. sample being too small to be collected and identified.

## New York Section.

*Meeting held at the Chemists' Club, on  
Friday, May 19th, 1905.*

DR. RUSSELL W. MOORE IN THE CHAIR.

### TIN IN ALASKA.

BY MARTIN SCHWITTER.

discovery of tin on the Seward Peninsula, Alaska, is of interest to a region already important since the discovery of rich placer goldfields at Nome, in 1899. The Seward Peninsula is the most westerly portion of the American Continent, and it is within 30 miles of the most westerly point, Cape Prince of Wales, that the most important discoveries have been made. The country, which is practically unknown, is composed of timber and consists of mountains of from 2,000 to 3,000 ft. high, which rise abruptly from the ocean. Cape Mountain is about 3,000 ft. high, and its apex is probably not half a mile from the shore line. From this mountain on a clear day,

### THE EFFECT OF ALKALINE SCOURING AGENTS ON THE STRENGTH OF WOOLLEN YARNS.

BY J. MERRITT MATTHEWS, PH.D.

The experimental work on which this paper is based was undertaken with the view of ascertaining as far as possible the effect of soap and alkaline solutions on the tensile strength, elasticity, lustre, degree of cleansing, &c., of woollen yarns. The yarn I employed was of a medium grade, all woollen yarn, carded and spun with an emulsion containing hard oil and borax; it had been spun about six months. In its unscoured condition it was of a greyish colour, like all yarn of this class, and contained a small amount of iron (about 0.1 per cent.). The amount of grease and miscellaneous dirt was 6 per cent. This figure was determined by extraction of a sample with petroleum ether and then scouring in soap. Nearly all yarn of this character will contain varying

amounts of iron mixed in with the oil and dirt in the fibre. This is derived from the wearing of the metallic parts of the cards and spinning frames through which the wool passes in the course of its manufacture, and I doubt if it is possible to spin this class of yarn without it showing at least a trace of iron. In my tests I employed small skeins weighing about 5 grms., and containing 23 strands. The various scouring tests were made in porcelain beakers with 250 c.c. of the respective solutions, and the small skeins were systematically worked in these solutions as in the usual method of scouring by hand. After scouring the samples in this manner for 20 minutes, they were washed well in fresh warm water, squeezed, and dried. The amount of loss in weight of each skein was determined, and tests were made to determine the tensile strength and elasticity in each case.

First, the effect of hot water alone was determined. The tensile strength of the unscoured yarn was 28.5 lb. to the skein of 23 strands (this determination was a mean of three sets of tests on five different skeins—minimum 28 lb., maximum 30 lb.). The elasticity was 19 per cent., and was determined in the same manner. On treatment with plain water at a temperature of 140° F., the yarn lost 2.2 per cent. in weight, and decreased in strength 37 per cent. to 17.8 lb. (a mean of three tests, as are all the figures to be given). The elasticity appeared to be unaltered. When treated with boiling water, the yarn lost 3.4 per cent. in weight, and suffered about the same diminution in strength. Both samples showed that a considerable amount of the grease and dirt had been removed by emulsification, although they were by no means in a scoured condition, and they still exhibited the presence of iron, though to a much less degree than in the original.

The results of this set of tests are tabulated as follows:—

TABLE I.—Effect of Hot Water.

No. Exp.	Temp. F.	Strength.		Elasticity.		Loss in Weight per cent.	Remarks.
		Lb.	Loss in %.	Per cent.	Loss in %.		
1 (original)		28.5	—	19.0	—	—	contains iron
2	140	17.8	37.0	19.0	0	2.2	do.
3	212	18.2	36.0	19.0	0	3.4	do.

The effect of soap solutions was next taken up. The soap employed was a neutral olive oil soda soap free from resin. Using a solution containing 5 grms. of soap per litre, skeins of the woollen yarn were scoured at different temperatures. Scouring at 65° F., the loss in strength was about 5 per cent. more than with boiling water alone, although the elasticity was not affected. It will be noticed from the table (II.) that increasing the temperature of the soap scouring bath from 65° to 212° F. causes a gradual decrease in the tensile strength of the yarn, though the elasticity is not altered until we reach 140° F., and even up to the boil the elasticity is not very greatly affected. Complete scouring, however, is not obtained until the temperature of 140° F. is reached, and from that point to the boil the amount of matter removed from the yarn is practically the same, so it may be said that the cleansing of the yarn is as complete at 140° F. as at the higher temperatures. Both the tensile strength and elasticity, however, run down considerably beyond 140° F. An important point to be noted, in connection with these tests on soap scouring, is that the wool scoured by this means appeared to have all of the iron removed from the fibre: only in the skein scoured at 65° F. was there a trace of iron still found, whereas all the other tests showed the complete absence of iron. Herein the scouring with soap differs from the scouring with all other alkalis, for it will be shown in the succeeding tests that the iron was not removed from the fibre, but was fixed therein as an insoluble oxide, a condition which we would naturally expect in the use of alkali carbonates and hydroxides.

TABLE II.—Effect of Soap Solutions.

(5 grms. per litre).

No. Exp.	Temp. F.	Strength.		Elasticity.		Loss in Weight per cent.	Remarks.
		Lb.	Loss in %.	Per cent.	Loss in %.		
4	65	16.8	41.0	19.0	0.0	4.2	trace of iron
5	100	15.3	46.0	19.0	0.0	4.5	no iron
6	140	12.6	55.0	18.0	5.0	5.7	do.
7	180	11.4	60.0	17.0	10.0	5.6	do.
8	212	10.8	62.0	16.0	15.0	5.9	do.

The action of solutions of soda ash was next studied. In these tests two series were made; in the first (III.), the temperature of the scouring solution maintained constant at 140° F., while in the second (IV.) the strength of the alkali was maintained constant at 5 grms. per litre, and the temperature was varied. In all cases of the use of soda ash the yarns were perfectly scoured, and there was iron to a greater extent always left in the fibre, giving it a brown colour. The lustre of the fibre was considerably affected especially in the stronger solutions of soda ash, at the higher temperatures. At points where such a strong alkali was employed and at a high enough temperature to remove all of the oil from the yarn, the fibre was in a lifeless condition without the resilience to be met in yarn scoured with soap alone. On reference to the tabulated results, a peculiarity will be observed: the effect of soda ash solutions of different strengths is, the tensile strength apparently increases with increase in the strength of the alkali. This, however, is accounted for by the fact that the stronger solutions cause the fibres of the yarn to shrink to a considerable extent, and a good deal of felting also takes place, which produces a greater coherence among the elements of the yarn. In order to remove all the grease from the yarn at a temperature of 140° F. requires a scouring solution containing at least 15 grms. of soda ash per litre.

TABLE III.—Effect of Soda Ash Solutions.

(at 140° F.).

No. Exp.	Gms. per litre.	Strength.		Elasticity.		Loss in Weight per cent.	Remarks.
		Lb.	Loss in %.	Per cent.	Loss in %.		
9	1	12.5	56.0	19.0	0.0	4.0	contains iron
10	2	13.6	53.0	19.0	0.0	4.3	do.
11	3	15.8	45.0	19.0	0.0	4.4	do.
12	5	14.1	50.0	19.0	0.0	4.8	do.
13	10	17.4	39.0	18.0	5.0	5.3	do.
14	15	18.0	37.0	17.0	10.0	5.6	do.

Scouring with solutions of soda ash at temperatures higher than 140° F. is attended with great deterioration in the quality of the yarn even with a strength of only 5 grms. of soda ash per litre. At a boiling temperature the yarn is practically destroyed as far as any use is concerned.

TABLE IV.—Effect of Soda Ash Solutions.

(5 grms. per litre).

No. Exp.	Temp. F.	Strength.		Elasticity.		Loss in Weight per cent.	Remarks.
		Lb.	Loss in %.	Per cent.	Loss in %.		
15	140	14.1	50.0	16.0	16.0	4.8	contains iron
16	180	13.0	54.0	16.0	16.0	5.1	do.
17	212	11.6	59.0	11.0	44.0	6.0	do.



destructive action of caustic soda on wool is a  
own fact, and yet most of the common soaps  
d for the scouring of wool and woollen materials  
more or less free caustic alkali. In the set of  
ents with respect to the effect of caustic soda  
V.), it will be found that the destructive action  
alkali starts at a strength of 0.1 grm. per litre at  
ature of 140° F. This strength of alkali, however,  
effect a scouring of the yarn to any better extent  
ain water at the same temperature, whereas the  
nce and feel of the fibre is very evidently de-  
ed. In none of the experiments with caustic  
s the scouring complete, even so far as the removal  
grease alone was concerned; and in every test  
present in the unscoured yarn was fixed in the  
At a strength of 0.5 grm. of caustic soda per litre,  
temperature of 140° F., the skein of yarn suffered  
h that it would be useless for manufacturing  
s; it still, however, possesses considerable strength  
o the great felting together of the fibre; it will  
ed, however, that the elasticity of the fibre has  
o a low figure. The loss in weight also shows  
me of the fibre has been dissolved, and the  
nce of the yarn showed that structural disintegra-  
the fibre had proceeded to a considerable degree.

TABLE V.—Effect of Caustic Soda Solutions.  
(at 140° F.).

No. Exp.	Strength.		Elasticity.		Loss in Weight per cent.	Remarks.
	Lb.	Loss in %.	Per cent.	Loss in %.		
1	16.1	43.0	17.0	10.0	2.0	contains iron
2	15.3	46.0	14.0	26.0	2.2	do.
5	12.4	56.0	11.0	44.0	8.7	do.
0	8.9	70.0	10.0	49.0	12.6	do.
0	4.0	85.0	9.0	52.0	18.5	do.

Effect of caustic soda solutions at higher tempera-  
an 140° F. was, of course, much more marked.  
centration of only 0.1 grm. of caustic soda per litre  
was ruined at 180° F., while at the boiling tem-  
it was destroyed, as may be seen by reference to  
I.

TABLE VI.—Effect of Caustic Soda Solutions (0.1 grm.  
per litre).

No. Exp.	Strength.		Elasticity.		Loss in Weight per cent.	Remarks.
	Lb.	Loss in %.	Per cent.	Loss in %.		
140	16.1	43.0	17.0	10.0	2.0	contains iron
180	7.8	72.0	11.0	44.0	13.2	do.
212	—	100.0	—	100.0	100.0	—

ing with solutions of ammonia does not appear  
l the results in practice which are usually  
for this scouring agent in text-books. In Table  
shown the results obtained by scouring with  
solutions of different concentrations at the usual  
temperature of 140° F. It will be seen that a  
e removal of grease and oil is not effected until a  
of 10 grms. of ammonia per litre is reached. The  
ation of the grease and dirt does not appear to be  
s perfect with ammonia as with plain soap solu-  
and the ammonia also fixes the iron compounds in  
s and leaves the wool of a brownish tint instead of  
ost pure white which results from scouring with  
Ammonia, however, does not appear to affect the  
of the yarn to any appreciable extent unless  
temperatures are employed, as may be seen in  
III.

TABLE VII.—Effect of Ammonia Solutions (at 140° F.).

No. Exp.	C.c. per Litre.	Strength.		Elasticity.		Loss in Weight per cent.	Remarks.
		Lb.	Loss in %.	Per cent.	Loss in %.		
26	1	15.8	44.0	10.0	0.0	3.7	contains iron
27	2	15.0	47.0	19.0	0.0	4.1	do.
28	5	16.2	43.0	19.0	0.0	4.6	do.
29	10	16.4	42.0	17.0	10.0	6.1	do.
30	25	15.8	44.0	17.0	10.0	6.4	do.

TABLE VIII.—Effect of Ammonia Solutions (10 c.c. per  
litre).

No. Exp.	Temp. °F.	Strength.		Elasticity.		Loss in Weight per cent.	Remarks.
		Lb.	Loss in %.	Per cent.	Loss in %.		
31	160	14.4	49.0	17.0	10.0	6.1	contains iron
32	180	13.9	51.0	16.0	15.0	6.3	do.

Experiments with the use of borax proved this alkali to  
be a very unsatisfactory scouring compound in this con-  
nection. Its power of emulsification does not appear to  
be very marked, for, even with a strength of 10 grms. per  
litre, the scouring of the wool was very incomplete; and,  
even using a strength of 5 grms. per litre at temperatures  
up to the boiling point, the grease in the fibre was not  
thoroughly removed. These results are summarised in  
Tables IX. and X.

TABLE IX.—Effect of Borax Solutions (at 140° F.).

No. Exp.	Grms. per Litre.	Strength.		Elasticity.		Loss in Weight per cent.	Remarks.
		Lb.	Loss in %.	Per cent.	Loss in %.		
33	1	14.0	51.0	17.0	10.0	4.4	contains iron
34	5	16.6	42.0	17.0	10.0	4.3	do.
35	10	16.2	43.0	18.0	5.0	4.8	do.

As far as the effect on the strength and elasticity of  
woollen yarn by borax solutions, it will be seen that there  
is no weakening action due to the mild alkaline nature of  
the borax.

TABLE X.—Effect of Borax Solutions (5 grms. per litre).

No. Exp.	Temp. °F.	Strength.		Elasticity.		Loss in Weight per cent.	Remarks.
		Lb.	Loss in %.	Per cent.	Loss in %.		
36	160	16.4	43.0	17.0	10.0	4.3	contains iron
37	180	16.0	44.0	17.0	10.0	4.4	do.
38	212	15.0	47.0	13.0	31.0	4.8	do.

The results of these tests have led me to the statement  
that the scouring of the usual grade of woollen yarn is best  
conducted by the use of soap solutions. I know it is the  
customary practice to employ alkali carbonates in con-  
junction with the soap, and on some grades of yarn, to use  
even a large excess of alkali. This appears to me to be  
bad practice for I have found that soap solutions unaided  
by the addition of any alkali give superior results to those  
obtained by the use of the latter. Soap solutions appear  
to cause the complete emulsification and consequent  
removal of the grease, dirt, and iron present in the woollen  
yarn, at concentrations and temperatures much below  
those required with solutions of soda ash and ammonia  
compounds. Soap appears to be the only scouring  
agent among those in common use which eliminates  
all trace of iron from the wool, and this is a most  
important point in proper scouring, though unfor-  
tunately one which is too often passed over.

There is a common statement to the effect that the oil

or the emulsion employed for the oiling of woollen stock for spinning should be one that is easily saponified; for that in scouring, the alkali employed causes a saponification of the oil on the fibre, and hence renders it soluble and easily removable. If this idea were a correct one, solutions of soda ash should prove more efficient scouring agents than solutions of soap, as the former possess the necessary alkali to bring about the saponification of the grease; but we find the contrary to be the case, and soap solutions prove the best scouring agents. A careful study of this subject has led me to the opinion that the saponification theory of wool scouring is entirely erroneous. If we bear in mind the fact that the alkaline liquors employed in scouring are comparatively dilute and are used at rather low temperatures, we can readily understand that there would be a very small amount of actual saponification of the oil, especially when we furthermore consider that not caustic but carbonated alkalies are employed; and in the use of soap solutions it cannot be considered that there is any actual saponification of the oil at all.

It is often said that wool-oils should be as free as possible from unsaponifiable matter, such as mineral oils, &c. But I claim this to be erroneous. Wool fat, which is the natural grease in the wool fibre, consists for the most part of unsaponifiable matter, and yet this grease is easily removable by soap solutions. In the ordinary scouring of raw wool there is practically no saponification of the grease, hence the scouring properties of an oil or grease is evidently not conditioned by its saponifiable nature. The scouring quality of a wool-oil is dependent on the readiness with which it forms an emulsion with water and soap or alkaline solutions and not upon its property of being saponified.

This leads me to the expression of another factor which I shall term the "*emulsification equivalent*" of the oil. Where it is desirable to obtain the emulsification equivalent of a wool-oil or emulsion in practical use on the fibre, I proceed as follows:—A skein of the woollen yarn, spun with the emulsion under examination, is weighed and then scoured for 20 minutes at a temperature of 140° F. in a solution containing 5 grms. of soap per litre; on washing, drying, and reweighing, the total loss on scouring is obtained. A similar weighed skein of yarn is then scoured for 20

minutes in plain water at a temperature of 140° F. which it is dried and reweighed, and the loss determined. The ratio between the first and second values obtained in this manner will give a crude practical idea of the emulsifying property of the oil on the fibre. In the experiments described in the first part of this paper, for example, have the following data:—

Loss with soap solution .. ..	5.7 per cent.
Loss with warm water .. ..	2.2 "
Emulsification equivalent = $2.2 \div 5.7 = 38$	"

Therefore, the emulsification equivalent may be taken to represent the ratio between the total amount removable by complete scouring with soap at 140° F. that removed by emulsification in plain water at the same temperature. If the water completely removed the emulsification equivalent would be 100 per cent.

To give a numerical value to the emulsification equivalent of the oil itself, without special reference to the method is a more difficult task, and I have not as yet decided upon a method which is satisfactory. The best means that I suggest at present is to take a weighed portion of a cloth or skein of woollen yarn free from grease and materials, treat it with the oil or emulsion in question, and reweigh it in order to obtain the amount of oil in the material. This prepared sample is then treated in the same manner as I have already outlined, and the emulsification equivalent of the oil deduced by the method of calculation. In order to render this method accurate and satisfactory, however, there are many conditions to be determined. I am at present engaged upon this question, and expect to be able to furnish a complete description of the method and the results obtainable from it at a later date.

In conclusion, let me say that an oil which is emulsified with soap solutions at temperatures not higher than 140° F., other conditions being proper, may be considered as a good wool-oil, irrespective of the fact whether it contains unsaponifiable matter or not. Mineral oils and wool-fat, both of which are *unsaponifiable*, if properly employed, are easily *emulsifiable*, and may be used advantageously in the preparation of wool-oils.

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## PLANT, APPARATUS, AND MACHINERY.

## ENGLISH PATENTS.

*for Cooling Fluids; An Improved Method of —.*  
I. W. Proctor and W. Morgan, Coventry. Eng. Pat. 12,606, June 3, 1904.

with hollow blades is made to rotate in a vessel. It is to be heated or cooled, may be caused to circulate in the vessel, and the heating or cooling agent through the hollow blades of the fan, or vice versa.—W. H. C.

*Towers for Reducing the Temperature of Cooling Water or other Liquids; Impts. in —.* J. A. Bell, Beckenham. Eng. Pat. 15,010, July 5, 1904.

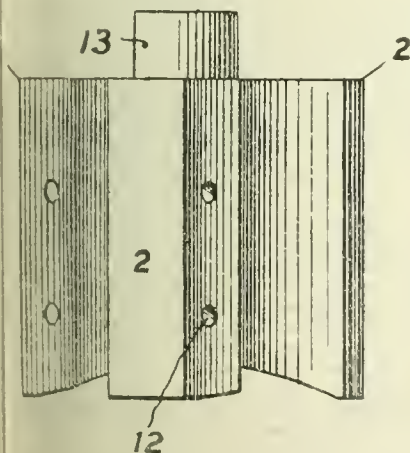
This is for the method of the feeding the liquid to be cooled to the "mats" of the cooling tower down which it flows. A number of troughs or channels are arranged between the "mats" and are made in two parts, bolted together, with the upper edge of the "mat" held between the two pieces are placed between the edges of the trough and the "mat," so as to leave spaces through which the liquid passes on to the "mat." The liquid is conveyed transversely in the main trough and delivered into the pipes by means of pipes.—W. H. C.

*Apparatus; Impts. in —.* O. Schmeisser, Stuttgart, Germany. Eng. Pat. 5988, March 21, 1905.

This is for the introduction of additional annular spaces between the distilling and condensing chambers in the apparatus in which the heating and cooling is surrounded one another concentrically. Each such additional chamber is separated by a vertical partition which does not extend quite to the top of the apparatus, leaving an annular opening between the two partitions. The vapour given off in the inner of the two chambers passes through this opening, and is condensed in the outer one.—W. H. C.

*for Agitating Liquids; Impts. in Dashers or Stirrers for —.* M. W. Beemer, New York. Eng. Pat. 15, Jan. 17, 1905.

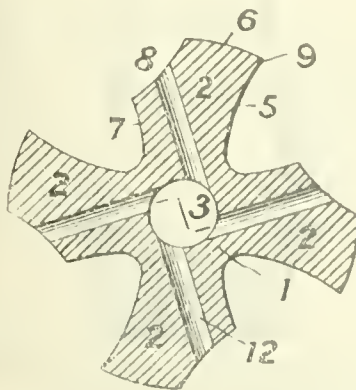
FIG 1.



has a concave under-surface, and is mounted on a shaft 13; it has a central vertical air-duct 3,

and lateral air-ducts 12, extending through the wings 2. The wings are of a special shape, having their faces formed as shown at 5, 6, 8 and 7 and provided with a sharp edge

FIG 2.



at 9, the object being to throw the liquid away from the wings as the beater rotates and to induce a current of air through the air-ducts.—W. H. C.

*Scale from Boilers; Composition for Removing —.*  
A. O. Hamilton, Dundee. Eng. Pat. 2219, Feb. 4, 1905.

The composition consists of from 50 to 200 lb. of sodium hydroxide, 4 to 56 lb. of cutch, and 1 to 20 galls. of glycerin mixed with 40 galls. of water. The mixture is fed into the boiler and the sediment removed in the usual way.—W. P. S.

*Jacketed Vessels; Impts. in —.* W. A. S. Benson, London. Eng. Pat. 6363, March 25, 1905.

The inner and outer lids of jacketed vessels are arranged so as to be entirely independent of one another, the insulating air layer thus enclosed between them preventing conduction of heat from the one to the other. The lids are attached by means of "lugs" and "pins" instead of hinges. By depressing a push-piece, connected to the inner lid and passing through an opening in the outer one, the two lids can be opened simultaneously.—W. H. C.

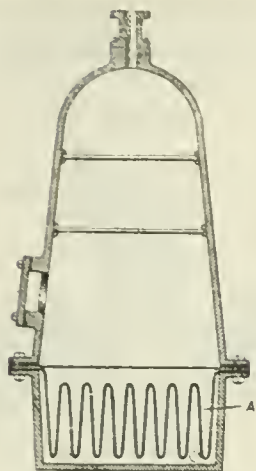
*Gases by a Liquid under the Action of the Silent Electric Discharge; Apparatus for Absorbing —.* A. de Hemptinne, Ghent, Belgium. Eng. Pat. 7101, April 4, 1905.

A SERIES of parallel revolving metal plates, with discs of insulating material between adjacent ones, is arranged within a fixed casing or within a vessel that revolves with the plates on a horizontal axis. Alternate metal plates are connected to one pole, and the remainder to the other pole of a source of electric current, in order to establish a silent electric discharge between the plates. The latter are partially immersed in the absorbing liquid, which is carried round by small troughs attached to the casing and delivered on to the upper portions of the plates, so that a thin layer of liquid is maintained on the plates, and the gas to be treated is thus brought into intimate contact with the liquid. An electro-magnetic device, working automatically, maintains a constant pressure of gas in the apparatus during the absorption.—B. N.

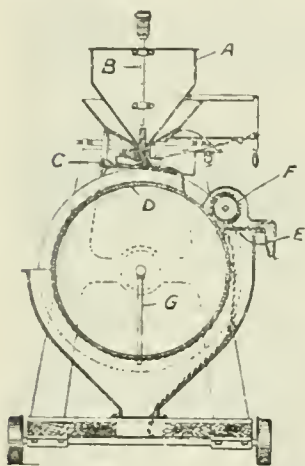
## UNITED STATES PATENTS.

*Vacuum-Pan.* H. W. Buschmeyer, Louisville, Ky. U.S. Pat. 789,793, May 16, 1905.

THE claim is for a metallic hanging basket A with a corrugated bottom, which is fitted steam-tight into



the outer walls of the pan and has a space below for the introduction of the heating agent.—W. H. C.



*Dryer.* W. R. Macklind, Mineralpoint, Mo. U.S. Pat. 789,984, May 16, 1905.

THE sludge to be dried is fed from the hopper A by the reciprocating agitator B on to the vibrating table C, from which it is fed on to the heated rotating cylinder D. The dried material is removed by the scraper E and the brush F, and the condensed water is led off from the interior of the cylinder D by a siphon G, one limb of which passes through a stuffing-box in the end of the cylinder.—W. H. C.

*Dryer and Separator.* J. Waterhouse, New York. U.S. Pat. 790,605, May 23, 1905.

THE separator consists of a pear-shaped casing provided with a charging opening and cover near the top, with two discharge openings of different diameters at the bottom, and with one or more glass-covered sight holes. The separating agent, which may be a current of compressed air, is delivered in a downward direction into the casing by two pipes, one of which is of smaller diameter than the other and enters the casing at a point lower down. The waste air leaves at the top by a pipe which takes a sharp bend downwards and is provided with a sight tube.

—W. H. C.

*Separating Apparatus; Centrifugal* —. E. Seger, Stockholm. U.S. Pat. 790,081, May 16, 1905.

SEE Eng. Pat. 458 of 1904; this J., 1904, 363.—T. F. B.

#### GERMAN PATENTS.

*Centrifugal Machine for the Separation and Washing of Substances Crystallising out from Solutions.* F. Scheibler. Ger. Pat. 158,788, Feb. 28, 1903.

THE drum of the centrifugal machine is double-walled, but only the inner wall is perforated. Around the drum are arranged a number of "protecting rings" or annular division plates, which are movable vertically, and project below into the annular discharge-channels at the bottom

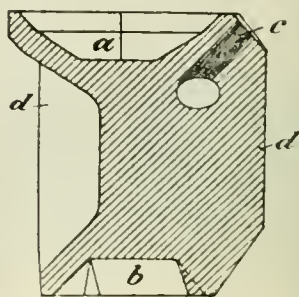
of the drum casing, each of these division-plates, when in its lowest position, closing the discharge-channel in which it projects. The liquid expelled by the centrifugal force through the perforations in the inner wall of the drum, collects in the annular space between the two walls, and is then forced upwards, being finally collected in any one of the discharge-channels by raising the corresponding division-plate.—A. S.

*Centrifugal Machine; Process of and Device for Collecting in Separate Outlet Channels the Liquids Separated in* —. W. Gantenberg. Ger. Pat. 157,926, June 1904.

BETWEEN the inner perforated drum of the centrifugal machine and the outer casing is interposed a second perforated drum. The bottom of this intermediate drum is provided with outlet openings near its outer edge, whilst the centre it has a flange forming a hollow cone, which means of a lever can be brought at will into contact with a corresponding cone on the driving shaft. By this arrangement the two perforated drums can be made to rotate together, in which case the liquid passes through the perforations in the second drum; or the inner drum only is made to rotate, when the liquid flows down the inner wall of the second drum into a separate outlet channel.—A. S.

*Packing Blocks for Absorption Towers and Distillation Columns.* R. Sauerbrey and A. Wünsche. Ger. Pat. 158,715, Nov. 13, 1903.

THE blocks have the form shown in the figure, each



being composed of a head piece (a) with a dish-like depression on its upper surface, and a base piece (b) hollowed out on its lower side, and connecting walls (d), with channels (c) leading from the upper face of the head-piece to the walls (d). Each block can be divided into two or more pieces by cuts through its longitudinal axis, and the blocks are disposed in the tower

or column, that enclosed spaces are left between several head-pieces.—A. S.

## II.—FUEL, GAS, AND LIGHT.

*Iron Sulphides, and the Purification of Coal Gas by means of Ferric Hydroxide.* L. Gedel. J. Gasbel., 1905, 412—417, 428—432.

### I.—IRON SULPHIDES FORMED BY WET METHODS.

*Alkalinity maintained.*—Ferric sulphide was formed by gradually adding ferric chloride solution to freshly prepared ammonium sulphide solution, so as finally to leave an alkaline liquid. The black precipitate was washed as to avoid oxidation, and a portion was dried at about 100° C., and then treated with carbon bisulphide. It was found, however, that no sulphur was extracted, since ferric sulphide is stable at that temperature. If ferric sulphide not been formed, the only other reaction possible would have been the formation of a milky precipitate of ferrous sulphide and free sulphur;  $(2\text{FeS}_4)$ . This possibility is, however, excluded, since ferric sulphide in presence of free sulphur, on but slight rise of temperature, yields some iron disulphide, insoluble in hydrochloric acid, and none was present; moreover, ferrous sulphide itself dissolves with evolution of hydrogen sulphide and no separation of sulphur, whereas the ferric sulphide actually formed, decomposes with liberation of sulphur, as follows:— $\text{Fe}_2\text{S}_3 + 4\text{HCl} = 2\text{FeCl}_2 + 2\text{H}_2\text{S}$ . A more convenient method of preparing ferric sulphide was found in the treatment with ammonium sulphide of an alkaline (ammoniacal) ferric solution, formed by



ion of ammonium tartrate and ammonia to ferric sulphide solution.

It was further found that on submitting ferric sulphide oxidation with moist air, the reaction proceeds in the following:— $\text{Fe}_2\text{S}_3 + 3\text{O}(\text{air}) = \text{Fe}_2\text{O}_3 + 3\text{S}$ . At the time a minute quantity of ferrous sulphate is formed (Wagner, J. Gasbel, 1869, 180). Ferrous sulphide in the presence of free sulphur, collaterally formed, on slight increase of temperature through chemical action, would have reacted with a portion of that sulphur to form some iron sulphide which remains unoxidised by the air. On heating the mixture  $2\text{FeS} + \text{S}$  at about  $100^\circ \text{C}$ ., the complete reaction ( $2\text{FeS} + \text{S} = \text{FeS}_2 + \text{FeS}$ ) takes place, the whole of the free sulphur being absorbed.

*Slight Acidity maintained.*—Ferric chloride was treated with ammonium sulphide, so that slight acidity was maintained. Sulphur separated and a precipitate of  $\text{FeS}$  was formed (see a).

*Slight Acidity and increased Temperature.*—The reaction referred to under (b) recurs, but at the raised temperature, a further reaction takes place  $2\text{FeS} + \text{S}$  converted into  $\text{FeS}_2 + \text{FeS}$ . No sulphur could then be attracted by carbon bisulphide, and on treating with hydrochloric acid, an insoluble residue of iron disulphide remained (see a). It was found that if ferrous sulphide, instead of being treated with ferrous sulphate solution with ammonium sulphide, were treated with ammonium sulphide, it became converted into ferric sulphide.

**FERRIC HYDROXIDE AND HYDROGEN SULPHIDE.**  
*In presence of acid.*—Hydrogen sulphide first rendered acid by passing it through dilute hydrochloric acid was passed over pure ferric hydroxide for several hours. No ferric sulphide was formed, but only the iron  $2\text{FeS} + \text{S}$ , and, from this, in consequence of the nature of the chemical reaction, also some iron disulphide  $\text{FeS}_2$  (see a and b). After drying at  $100^\circ \text{C}$ ., the product consisted entirely of iron disulphide.

*In absence of acid but moisture present.*—Practically the same reaction in (A) repeated.

*Absence of acid but moisture and some air present.*—In the presence of air proved practically without influence, the reaction being substantially that in (A) and (B).

*Method of Determination.*—(1) Estimation of total iron sulphur by direct oxidation with bromine. (2) Determination (i.) of the hydrogen sulphide liberated by the action of hydrochloric acid, and (ii.) of the iron disulphide remaining undissolved; the first representing  $\text{FeS}$ , and the second,  $\text{FeS}_2$  present. (3) The free sulphur, by reaction with carbon bisulphide.

*In presence of ammonia.*—The hydrogen sulphide was first passed through ammonium sulphide and thus rendered alkaline, and then through the ferric hydroxide. The product now consisted solely of ferric sulphide,  $\text{Fe}_2\text{S}_3$ . On exposing some of each of the two products (i.) under acid treatment, and (ii.) under alkaline treatment, to oxidation in the air for several days, it was found that in case (i.) the iron disulphide had remained unchanged, and was also insoluble in dilute hydrochloric acid whilst in (ii.) the product was completely oxidised to ferric oxide with liberation of sulphur. On treating a portion of it (the ferric sulphide) with dilute hydrochloric acid, hydrogen sulphide was evolved, sulphur separated, and all the iron went into solution.

"GAS OXIDE" was now examined fresh from the purifier. The results show that no insoluble iron was present, representing iron disulphide in the product, but in consequence of the presence of ammonia in the gas passed into the purifiers, hydrogen sulphide is removed by the formation of ferric sulphide, this by oxidation with moist air afterwards yielding smoothly, sulphur and ferric hydroxide.

*Sulphur in Coke and its Behaviour in the Blast Furnace.* F. Wuest and F. Wolff. X., page 675.

*Uses as Fuel.* R. Terry, S. Arnold and H. Fisher. XVI., page 683.

*Determination of Dust in Blast-Furnace.* E. Hubendick. XXIII., page 691.

## ENGLISH PATENTS.

*Briquettes for Steel-making, Fuel, &c.* R. F. Strong. Eng. Pat. 10,066, May 2, 1904. X., page 670.

*Coal, Slack, Ores, Minerals or Substances of Different Specific Gravity: Separating.* T. A. Johnson, Northwich, Cheshire. Eng. Pat. 13,765, June 17, 1904.

THE material is made to fall down a vertical or nearly vertical shoot containing water or other liquid, and a current of air or gas is forced into the liquid at the bottom of the shoot. The upward flow thus produced, carries the lighter portions of the material over a spout at the top of the shoot on to a drainer, and then into a suitable receptacle. The heavier portion falls to the bottom of the vessel and is carried away by a conveyor, or it falls into a "shot flask device," from which it is finally discharged.—W. H. C.

*Fuel; Manufacture of Artificial — and Apparatus therefor.* G. Höpfner, Bleekendorf, Germany. Eng. Pat. 14,219, June 23, 1904.

SEE Fr. Pat. 344,926 of 1904; this J., 1904, 1205.—T. F. B.

*Igniting Substances having High Ignition Points: Method of and Means for —, in Apparatus for Heating by the Reaction of such Substances.* A. Lang, Karlsruhe, Germany. Eng. Pat. 14,750, June 30, 1904.

SEE Addition of June 17, 1904, to Fr. Pat. 331,997 of 1903; this J., 1904, 1079.—T. F. B.

*Fuel from Garbage; Process of Making.* E. C. May, Chicago, U.S.A. Eng. Pat. 916, Jan. 17, 1905.

SEE U.S. Pat. 732,574 of 1903; this J., 1903, 860.—T. F. B.

*Coke; Manufacture of — and Furnaces, Ovens and Apparatus therefor.* J. Armstrong, London. Eng. Pat. 14,157, June 22, 1904.

COAL, soft coke or anthracite, with or without the addition of pitch or bituminous material, is reduced to a fine powder and charged into upright furnaces, tapering towards the top, and provided with external flues heated by gas. The coking operations are divided into three distinct stages. In the first stage, the gases are distilled off from the coal dust in the upper part of the furnaces at a very low temperature, which also favours the complete extraction of ammonia. As the coal descends, it enters the second zone, around which the heating flues are constructed. The coal in this zone becomes gradually coked, and, owing to the high temperature and the pressure of the column of fuel above, the coke is rendered very hard and dense. The coke then passes down to the third zone, where it is cooled by a water-jacket or gas and air-flues, thus raising steam for preheating the mixture of water-gas and air. The coke may also be cooled by blowing steam through it, hydrogen being formed. The coke is removed from time to time below the furnaces.—R. L.

*Carburetted Air or Gas; Apparatus for —.* M. Steel and R. Thornton, Gosforth, Northumberland. Eng. Pat. 10,677, May 9, 1904.

THE carburettor, which is adapted for use in connection with internal combustion engines, comprises a closed vessel supplied through a valve in its bottom with "hydrocarbon." The air inlet is connected by means of a mercury lute with a floating chamber provided with a series of outlets consisting of small telescopic tubes extending downwards into the hydrocarbon, or of rows of graduated perforations in a flange projecting downward from the float. As the float rises or falls, air can thus be introduced at a certain predetermined depth into the hydrocarbon. The hydrocarbon-supply valve is normally kept closed by a spring, but is opened by an adjustable rod fixed on the float, when the latter falls below a certain level. Instead of this valve a separate supply vessel with floating arrangement may be employed to control the supply of hydrocarbon.—R. L.

*Peat; Obtaining Producer Gas and Electrical Energy from —.* F. T. Warburton, London. Eng. Pat. 11,917, May 25, 1904.

GAS is generated by combustion in a producer, of dried or compressed peat, in a layer from 3 ft. deep upwards, air being introduced from below. The gas thus obtained is used in gas engines for generating and transmitting electrical energy.—R. L.

*Gas Producing Plant; Impts. in —.* J. Dunlop, Handsworth and Kynoch, Ltd., Witton, Staffs. Eng. Pat. 13,517, June 15, 1904.

THE object of this invention is such improved arrangement and construction, that the action of generating the gas, and utilising it in a gas-motor, will be more perfect than hitherto in gas-plants. The producer consists of a cylindrical shell of metal lined with firebricks, having at its lower end a movable hearth lined with firebrick, and provided with an ashpit door. The gas-outlet pipe is arranged in the higher part of the generator, and is surrounded by a jacket-pipe, which serves for raising steam and heating air. The inlet branch to the jacket-pipe is fitted with an adjustable plate for regulating the quantity of air, and also with an intermittent siphon with regulating arrangement, so that the quantity of water admitted along with the air may be such as to exactly suit the rate of gas production and the quality of fuel used. The outlet pipe of the jacket communicates with the closed ashpit, and the mixture of air and steam passes from the ashpit through the incandescent zone of the fuel. The gas issuing from the producer, after passing through a cooler-scrubber, is led through a gas and air regulator, which is divided into two chambers for gas and air, communicating by a piston or diaphragm regulated by a weight or spring. The action is such that when the motor draws in the mixture of air and gas, the proportions will be automatically adjusted whatever be the condition of the fire in the generator.

—R. L.

*Gas Producers; Impts. in —.* G. Hatton, Brierley Hill, Staffs. Eng. Pat. 13,877, June 20, 1904.

THE producer consists of an upper combustion chamber containing the fuel, a lower chamber in which a blast of air under pressure is maintained, and a water-sealed ashpit. A grate having the form "of a section of an inverted cone" supports the fuel. The lower ends of the fire-bars rest on a central ring, through which a blast pipe, provided with covered top and suitable openings, extends vertically upwards. A rotary motion is imparted to the blast pipe by suitable gearing, whereby a twofold object is attained, viz., the blast is distributed equally to all parts of the producer in turn, and the clinker from the grate is crushed by means of projecting teeth on the rotary part of the blast-pipe, which rotate in close proximity to stationary teeth on the ring supporting the grate. The upper portion of the producer is lined with firebrick; the lower chamber, which is movable vertically, is sealed on its top by a circular water lute, whilst it dips, when in working position, into the water contained in the ashpit. The blast-pipe is also provided with tuyères in its lower part. By this means the blast is supplied below and through the fire-bars, as well as up the central pipe. By turning off the blast and raising the lower chamber, the grate and blast-pipe are rendered easily accessible.

—R. L.

*Gas; Apparatus for Producer or Water- —.* W. F. Mason, Manchester. Eng. Pat. 15,821, July 16, 1904.

SIDE chambers are provided in a gas producer, which are partially cut off from the main portion of the interior of the apparatus by means of firebrick walls. The gases after passing through the incandescent fuel, leave the producer through openings in the tops of the side chambers. These openings are of comparatively large area, and situated above the upper level of the fuel. The hydrocarbons, which are given off by the burning fuel, are thus prevented from making their final exit until the desired decomposition has taken place.—R. L.

*Gas Producers; Impts. in —.* A. G. Bloxam, London. From W. H. Bradley, Bellevue, Pa., U.S.A. Eng. Pat. 16,895, Aug. 2, 1904.

A GAS producer is placed so that the lower end of its inclined partition is arranged in the middle of the trough to give direction to the ashes. The pipes for the supply of air and steam to the producer are arranged above across the partition. The trough can thus be cleaned, the ashes discharged from the producer and drawn out in a direction parallel with the pipes.—R. L.

*Gas; Steam Generator for Water- — Producers.* Vogelsang and J. Born, of the Dresdner Gas- und Fabrik vorm. Moritz Hille, Dresden. Eng. Pat. 13,517, Jan. 3, 1905.

THE steam generator which permits of rapid evaporation of water, consists of an upright vessel tapering towards the top, in which "tongues" are arranged projecting the side walls and extending between each other. The vessel is suspended in the ash-trap through which the gases from the generator furnace pass. Water is made to drip into the steam generator and down over the tongues, these being inclined and offering a large surface to evaporating water. The steam raised ascends through passages along the side walls and is conducted to the generator furnace. For the purpose of removing the scale with which the tongues become encrusted after some time, the steam generator is constructed in halves which bolted together, and can be unbolted for cleaning.—

*Gas Washer Scrubbers; Impts. in —.* J. H. Drake, London. Eng. Pat. 13,236, June 11, 1904.

A FLANGED projecting pipe is fixed to the static division plate of a rotary washer scrubber. A flanged pipe which overlaps the former is fixed to a revolving frame plate, and bolted to it is a ring of invuln brushes which are in contact with the stationary flange pipe around which they revolve. Should the revolving shaft be moved from its central position, no gas can be washed, the flexible brushes being always in contact with the stationary portion.—R. L.

*Gas; Purification of Coal —.* X. Roux, Paris, 1904. From Gonin and W. Thomson, London. Eng. Pat. 13,877, June 13, 1904.

GRANULAR or lumpy peat is reduced to powder, then with a 2 to 12 per cent. solution of alkali, which it readily absorbs. The mass is then dried. It is next charged into wire baskets, and a number of these baskets are arranged in a casing through which the crude gas passes. The sulphuretted hydrogen and ammonia are taken up by the peat, which is said to be converted into a valuable fertilising material.—R. L.

*Gas Washing, Cleaning and Cooling Towers.* W. D. Glasgow. Eng. Pat. 15,688, July 6, 1904.

CLAIM is made for the combination of scrubber and "bubble washers" in a tower. The tower is packed with coke and has bubble-washers in convenient positions, as described. The gas enters the bottom washer through holes in a plate, and ascends to a washer arranged in the middle of the tower, through a column of coke or other packing material moistened by a spray of the washing liquid. It then ascends another column of coke and a washer at the top of the tower, thus coming thoroughly into contact with the washing liquid.—R. L.

*Candles and the like; Wicks for —.* V. Pfersdorff, Mülhausen, Alsace. Eng. Pat. 29,546, Dec. 31, 1904. Under Int. Conv., April 21, 1904.

SEE Fr. Pat. 343,086 of 1904; this J., 1904, 978.—T. J.

*Candles; Manufacture of —.* A. Haase, Hanover. Eng. Pat. 3438, Feb. 18, 1905.

TO facilitate the lighting of candles or tapers, the free end of the wick is treated with a solution of celluloid in an equal quantity of acetone. The acetone evaporates, and the wick remains coated with celluloid, and is now non-inflammable.—R. L.



UNITED STATES PATENTS.

*Art of Controlling Furnace* — J. W. Dougherty, Leighton, Pa. U.S. Pat. 789,844, May 16, 1905.

Formation of explosive gas mixtures in blast-furnaces avoided by replacing the air in the furnace and its connections by inert gases or steam, either by blowing, for instance, into the furnace from the bottom, or by filling the top and the connecting pipes with steam before turning on the blast, thus driving forwards a quantity of steam in sufficient quantity to prevent explosion, out of the furnace gases.—R. L.

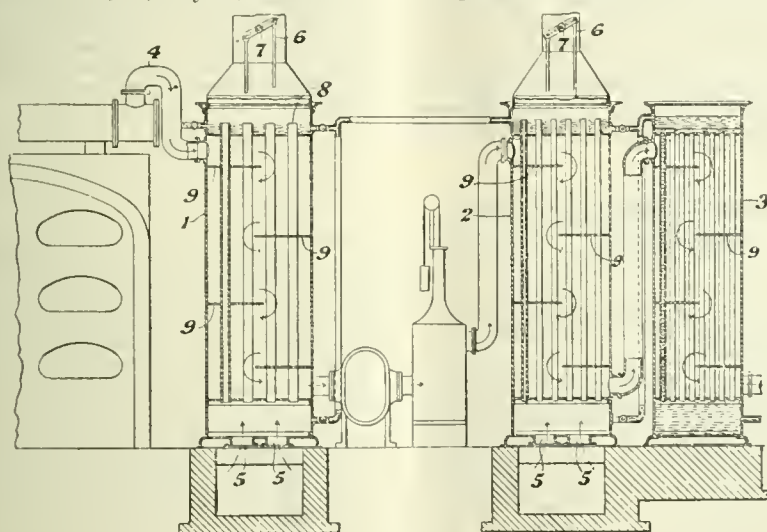
*Producing and Consuming Apparatus*. C. Ellis, Assignor to Eldred Process Co., New York. U.S. Pat. 790,253, May 16, 1905.

The apparatus consists of a gas-furnace fitted with regenerators, and a gas producer to supply the heating. The regenerators through which the gases of combustion pass, may be so located that one of them heats the gases richer in carbon dioxide. Means are provided for returning the waste gases from the regenerators to a combustion zone of the producer, and for admitting alternately, products of combustion and a mixture of air as to the regenerators by means of a reversing valve mechanism.—R. L.

*Apparatus for Making* — O. N. Guldin, Fort Wayne, Ind. U.S. Pat. 790,296, May 23, 1905.

Eng. Pat. 26,769 of 1902; this J., 1903, 1341.—T. F. B.

*Condensing Apparatus*. O. N. Guldin, Fort Wayne, Ind. U.S. Pat. 790,297, May 23, 1905.



Gas enters the first multitubular condenser 1 by the top, and is made to flow in the direction shown by the arrows, by the baffle plates 9, passing afterwards through condensers 2 and 3. A regulated current of air enters condensers 1 and 2 at the bottom by the openings 5, goes up the tubes and away by the outlets 6, controlled by dampers 7. The upper ends 8 of the tubes project through the upper tube-plate into the upper chamber containing water, which overflows down the tubes as a jacket. In the third condenser 3 the cooling is effected by water which flows up through the tubes and then serves to cool condensers 1 and 2.—W. H. C.

*Generator*. G. Apfel, Chicago, Ill. U.S. Pat. 790,418, May 23, 1905.

The generator consists of a chamber of refractory material containing a fuel-charging tank above and a water seal, in the centre of which is a cone projecting upwards into the generator. The gas is taken away from the upper part of the chamber by a pipe provided with a number of horizontal plates or "shelves." The mixture of air and fuel, after passing through an annular helical conduit

surrounding the gas-exit pipe, enters another annular helical chamber surrounding the generator and passes thence underneath the grate of the chamber.—W. H. C.

*Gas-Producer Apparatus* — C. Ellis, Assignor to Eldred Process Co., New York. U.S. Pat. 790,487, May 23, 1905.

The apparatus consists of a producer constructed to maintain a deep bed of fuel and provided with a water-seal for the withdrawal of the ash in an unfused and finely-divided condition. The blast is produced by a fan, which draws the products of combustion from a furnace by means of a pipe, and, after admixture with suitable proportions of air and steam, delivers it to the tuyères.

—W. H. C.

*Gas; Process of Generating Combustible* — C. Ellis, Assignor to Eldred Process Co., New York. U.S. Pat. 790,488, May 23, 1905.

The operation of gas producers is regulated by supplying as a blast, a mixture of air with the products of combustion. The proportion of the products of combustion, and consequently of carbon dioxide is increased temporarily, when fresh fuel is charged, so that the temperature of the producer is lowered and a more uniform distillation of the hydrocarbons of the fuel effected.

—W. H. C.

*Gas; Process of Manufacturing Combustible* — C. Ellis, Assignor to Eldred Process Co., New York. U.S. Pat. 790,489, May 23, 1905.

The process consists in passing through a deep bed of

fuel, in a producer, a mixture of air and of alternately intensely heated and cooled products of combustion, the object being to so regulate the temperature of the producer that slagging or clinkering of the fuel or ash does not occur.—W. H. C.

FRENCH PATENTS.

*Fuel [Briquettes]; Combustible Mineral* — Cie des Charbons et Briquettes de Blanzey et de l'Ouest. Fr. Pat. 349,222, Dec. 20, 1904.

See Eng. Pat. 28,126 of 1904; this J., 1905, 322.—T. F. B.

*Gas and Liquids; Mixing Apparatus for* — A. E. Riegel, et Soc. A. Thirion et Fils. Fr. Pat. 349,306, March 18, 1904.

The apparatus, which is suitable for carburetting or humidifying air or other gases, consists of a number of vertical plates placed close together and partly dipping into a liquid contained in a suitable vessel. The liquid rises by capillarity between the plates to the top and presents a large surface to the current of gas, which is passed over the surface of the liquid.—W. H. C.

## GERMAN PATENT.

*Moisture Content of Vapour, Air or Gases; Process for the Determination of the* — R. Schmidt and F. Döhne. Ger. Pat. 158,105, April 21, 1903. XI. A., page 679.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

## FRENCH PATENTS.

*Anthracene; Process for Extracting Pure* — from Crude Anthracene. E. Votocek and V. Vesely. Fr. Pat. 349,337, Dec. 22, 1904.

SEE Eng. Pat. 27,596 of 1904; this J., 1905, 191.—T. F. B.

*Hydrocarbons; Process for the Oxidation [and Distillation] of* — [Production of Fatty Acids]. Soc. Anon. des Combustibles Industriels. Fr. Pat. 349,214, Dec. 19, 1904.

THE process consists in introducing into the hydrocarbons, during the distillation, a current of air which has been dried, freed from carbon dioxide, heated, and in some cases enriched by the addition of oxygen or ozone. It is claimed that the hydrocarbons are oxidised, and that the heat generated causes the distillation to continue and to take place at a lower temperature, especially if a vacuum is maintained in the apparatus. The products of distillation are of a higher density and of more value, especially as lubricants, than those produced by distillation in the ordinary way. The pitch is improved, and is particularly suitable for the manufacture of briquettes, and further, by the employment of suitable pressure, bodies approximating in composition to fatty acids are said to be obtained.—W. H. C.

### IV.—COLOURING MATTERS AND DYESTUFFS.

*Naphthalene; Oxidation of* —, to Phthalic Acid by means of Concentrated Sulphuric Acid in Presence of Oxides or Salts of Rare Earths. H. Ditz. Chem.-Zeit., 1905, 29, 581—582.

IN place of mercury and its salts used in the production of phthalic acid by the action of sulphuric acid on naphthalene, the author has tried the catalytic action of compounds of rare earths obtained as by-products in the manufacture of thorium nitrate, such as the oxalates, carbonates and hydroxides of cerium, lanthanum, neodymium, praseodymium and yttrium. For this purpose naphthalene (25 grms.) was heated in a retort with excess of concentrated sulphuric acid (375 grms.) and the oxides or salts of rare earths (15 grms.). Evolution of gas commenced at a temperature slightly above 100° C., proceeding more rapidly at 220° C. At 230° C. the mixture began to boil, and on gradually raising the temperature to 300° C. or above until the mass became viscous, the melt turned dark and evolved sulphurous, sulphuric and carbonic acids. The distillate consisted of sulphuric and phthalic acids, the latter mainly as anhydride, but containing some sulphonic acid. The velocity of the reaction is not, however, as great, nor the yield as favourable as with the use of mercury as catalytic agent.—D. B.

*Diamines; Action of Formaldehyde and Sodium Bisulphite on* —. M. Prud'homme. Bull. Soc. Ind. Mulhouse, 1905, 75, 43—45.

THE base produced by the action of sodium bisulphite and formaldehyde upon benzidine (this J., 1905, 433), of the formula  $H_2N.C_6H_4.C_6H_4.NH.CH_2.SO_3Na$  or  $[NH_2.C_6H_4.C_6H_4.N:(CH_2.SO_3Na)]_2:CH_2$  is slowly acted upon by a mixture of nitrous and hydrochloric acids.

The greenish-yellow diazo chloride formed gives salt-R a dyestuff which dyes cotton from alkaline bath in shades of violet-blue which are rather than those dyed by the corresponding benzidine pound. From an acid bath, the new dyestuff dyes in crimson shades, dyeing much more easily than corresponding benzidine derivative. The azo dy. derived from the new base and naphthionic acid orange, that produced from benzidine and the same being a red (Congo Red).

Noelting finds that, whereas the base produced by action of formaldehyde upon benzidine is acted with partial elimination of the formaldehyde, by n acid, and converted to some extent into the ord tetrazodiphenyl base, the new base withstands such and gives a diazo derivative which on combination a series of new sulphonated dyestuff compounds, possess the property of dyeing both cotton and wool.

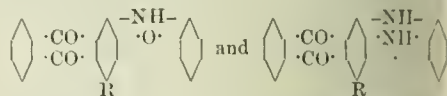
## ENGLISH PATENTS.

*Indigo or Homologues or Derivatives thereof; Manufacture of* —. L. Lilienfeld, Vienna. Eng. Pat. 10,925, May 12, 1904.

SEE Fr. Pat. 343,078 of 1904; this J., 1904, 980.—T.

*Dyestuffs [Oxazine and Azine Dyestuffs] of the Anthracene Series; Manufacture of New* —. O. Imray, London. From Farb. vorm. Meister, Lucius u. Brüning, Homburg, Germany. Eng. Pat. 14,970, July 4, 1904.

NEW dyestuffs are prepared by condensing o-aminophenol with its homologues or derivatives, or an aromatic o-diazo compound with its mono-alkyl or mono-aryl substitution product with a derivative of alizarin containing a hydroxyl amino-group in the 4-position. The hydrogen atom of the latter group may or may not be replaced by all aryl groups. The products are probably of the following types:—



For example, 18 kilos. of purpurin are heated for 8 hours under pressure at 140° C. with 8 kilos. of o-aminophenol, 13 kilos. of borie acid and 60 litres of alcohol. The product is transformed by sulphonation into purpuric acid, which dyes unmordanted wool in blue-violet shades. The purpurin may be replaced by 1,2,4-triamino-alizarin, dimethylaminoalazarin or 1,2,4-triamino-alizarin. Purpurin-3-sulphonic acid and o-aminophenol yield a dyestuff which gives blue shades on unmordanted or chrome-mordanted wool. Similar results are obtained with purpurins sulphonated in the non-hydroxyl nucleus. With purpurin and o-aminodiphenylamine a dyestuff is obtained which, after sulphonation with 10 per cent. fuming sulphuric acid at 20°—40° C., dyes chrome-mordanted wool in very fast blue shades. A similar result is obtained with o-phenylenediamine.—E. F.

*Colouring Matters [Azo Dyestuffs]; Manufacture of* —. T. R. Shillito, London. From Aniline Colour and Extract Works formerly of Geigy, Basle, Switzerland. Eng. Pat. 15,025, July 1, 1904.

SULPHONIC acids of 1-amino-2-naphthol are diazotized by the process described in Eng. Pat. 10,235 of 1904 (this J., 1905, 433), and then combined with naphthols and monosulphonic and carboxylic acids, aminonaphthols and their sulphonic acids, dihydroxynaphthalenes and their sulphonic acids, m-hydroxyphenols, m-aminophenols and m-diamines. The products dye wool from an acid bath in brick-red to dark violet-black shades, which turn to reddish to bluish or greenish black on subsequent treatment with potassium bichromate, and to reddish violet to blue on treatment with copper sulphate. The shades show, after treatment with bichromate, great fastness to milling and to potting; all are very fast to light, after treatment with bichromate or copper sulphate. For example, 11 kilos. of resorcinol



os. of sodium carbonate are dissolved in 150 litres of water and 25 kilos. of dry, powdered 1-diazo-2-naphthol-sulphonic acid are added with stirring. The formation of dyestuff commences immediately and is complete in several hours. The product dyes wool from an acid bath in dark brown shades, which become black on treatment with bichromate and dark brown with copper sulphate. The product is obtained from *m*-toluylenediamine and 1-diazo-2-naphthol-sulphonic acid dyes wool in reddish-brown shades, which become black after treatment with bichromate, and dark brown with copper sulphate. From 1-amino-8-naphthol-sulphonic acid and 1-diazo-2-naphthol-4-sulphonic acid dyestuff is obtained yielding reddish-blue shades on wool, turned to olive by potassium bichromate, and to copper sulphate.—E. F.

1-diazo-2-oxynaphthalene-sulphonic Acid or Sulphonic Acid of the Nitronaphthalene-1,2-diazo-oxide; Manufacture of — [Azo Dyestuffs]. T. R. Shillito, London. From the Aniline Colour and Extract Works, formerly J. R. Geigy, Basle, Switzerland. Eng. Pat. 118, July 11, 1904.

1-diazo-compound (or diazo-oxide) obtained by diazo-1-amino-2-naphthol-4-sulphonic acid by the process described in Eng. Pat. 10,235 of 1904 (this J., 1905, 433), is nitrated in the usual manner without decomposition, forming a stable nitro-diazo-compound (or nitro-oxide). For example, 25 kilos. of dry, powdered 1-diazo-2-naphthol-4-sulphonic acid are added gradually with stirring to 75 kilos. of concentrated sulphuric acid. A cooled mixture of 7 kilos. of 96 per cent. nitric acid and 4 kilos. of 100 per cent. sulphuric acid is then slowly added, the temperature being kept at 0°–5° C. by external cooling. Stirring is continued for some hours at the same temperature, and the whole then poured on to 100 kilos. of water. The nitro-compound separates immediately. It is very soluble in water. When combined with certain mordants it forms valuable nitro- $\alpha$ -hydroxyazo-dyeings of which on wool become very fast on subsequent treatment with potassium bichromate.—E. F.

*Naphthylaminesulphonic Acids; Manufacture of* — C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 15,624, July 13, 1904.

Eng. Pat. 344,810 of 1904; this J., 1904, 1210.—T. F. B.

*Indigo; Manufacture of* — C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 335, July 18, 1904.

Eng. Pat. 345,099 of 1904; this J., 1905, 24.—T. F. B.

[Azo Dyestuffs]; *Manufacture of New* — G. W. Anson, London. From Kalle und Co., Biebrich-on-Rhine, Germany. Eng. Pat. 16,119, July 20, 1904.

Eng. Pat. 345,083 of 1904; this J., 1904, 1210.—T. F. B.

[Azo Dyestuffs]; *Manufacture of New* — G. W. Anson, London. From Kalle und Co., Biebrich-on-Rhine, Germany. Eng. Pat. 16,120, July 20, 1904.

Eng. Pat. 345,084 of 1904; this J., 1904, 1211.—T. F. B.

*Acene Series; Manufacture of Violet-Blue Colouring Matter of the* — [Anthracene Dyestuffs], and *Intermediate Products of the said Manufacture*. J. Y. Anson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 538, July 26, 1904.

U.S. Pats. 786,085 and 787,859 of 1905; this J., 1905, 494 and 541.—T. F. B.

#### UNITED STATES PATENTS.

*Alizarin* — [Anthracene Dyestuff]. R. E. Schmidt and A. Fischer, Elberfeld, Germany, Assignors Farbenfabriken of Elberfeld Co., New York. U.S. Pat. 790,079, May 16, 1905.

Blue is treated with formaldehyde in acid solution. The product combines with alkali bisulphites

yielding compounds soluble in water, which produce grey to black shades when printed on cotton together with chromium acetate.—E. F.

*Dyestuff; [Sulphide Dyestuff]; Blue Sulphur* —, and *Process of Making same*. J. Abel and A. Lüttringhaus, Assignors to Badische Anilin u. Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 790,167, May 16, 1905.

THE alkali salts of *p*-amino-*p*-hydroxydiphenylamine, *p*-phenylamino-*p*-hydroxydiphenylamine, their homologues or derivatives are heated with sulphur. The products are soluble in aqueous sodium sulphide solution forming pale yellow solutions, without the intermediate formation of a blue liquid. From these solutions, when hot, vegetable fibres take up a leuco-compound, which on exposure to the air, becomes blue to violet-blue in the case of the dyestuff from the *p*-amino-compound and pure blue in the case of that formed from the *p*-phenylamino-compound.—E. F.

*Dyestuff, Nitroazo* — [Azo Dyestuff]; and *Process of Making same*. J. Hagenbach, Assignor to Aniline Colour and Extract Works, formerly J. R. Geigy, Basle, Switzerland. U.S. Pat. 790,363, May 23, 1905.

SEE Eng. Pat. 15,418 of 1904; preceding these.—T.F.B.

*Dyestuff, Azo, and Process of Making Same*. J. Hagenbach, Assignor to Aniline Colour and Extract Works, formerly J. R. Geigy, Basle, Switzerland. U.S. Pat. 790,364, May 23, 1905.

SEE Eng. Pat. 15,025 of 1904; preceding these.—T.F.B.

#### FRENCH PATENT.

*Indigo White; Manufacture of* — Badische Anilin und Soda Fabrik. Fr. Pat. 349,379, March 22, 1904.

SEE Eng. Pat. 6226 of 1904; this J., 1905, 127.—T. F. B.

#### GERMAN PATENTS.

*Hydroxyanthraquinone Methyl Ethers; Method of Preparing* — Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 156,762, Sept. 8, 1903.

THE  $\alpha$ -sulphonic acid groups of anthraquinone- $\alpha$ -sulphonic acids may be replaced by methoxy groups by warming with methyl alcohol in presence of alkali hydroxides. 20 kilos. of the sodium salt of anthraquinone- $\alpha$ -monosulphonic acid are heated with 250 litres of methyl alcohol and 25 kilos. of sodium hydroxide, until the greater part of the acid has disappeared, when the product is poured into water, and the  $\alpha$ -methoxyanthraquinone filtered off and washed. The dimethyl ethers of Chrysazin and Anthraflavin can be prepared similarly from 1.8- and 1.5-anthraquinonedisulphonic acids.—T. F. B.

*Indigo; Process for Purifying* — G. Ullmann. Ger. Pat. 156,829, Nov. 17, 1903.

THE solution of indigo in a mixture of sulphuric and acetic acids is treated with a sufficient quantity of an acetate or sulphate to convert the whole of the sulphuric acid into bisulphate; the acetic acid is then distilled off, and the residue treated with water to remove the bisulphate. This process permits the recovery of the acetic acid in a simple manner, without fear of sulphonating the indigotin.—T. F. B.

*Dyestuff Containing Sulphur [Sulphide Dyestuffs]; Process for Preparing a Yellow Cotton* — Farkwerke vorm. Meister, Lucius und Brünning. Ger. Pat. 157,103, Dec. 15, 1903. Addition to Ger. Pat. 156,177, Dec. 15, 1903 (see this J., 1905, 434).

THE product obtained by melting 2,2'-diamino-4,4'-oxaltoluide with two mols. of *m*-toluylenediamine is heated with sulphur to temperatures above 170° C. The resulting dyestuff dyes cotton yellow shades, which are faster to alkalis than those given by the dyestuff from diamino-oxaltoluide alone.—T. F. B.

**1.4-Diaminoanthraquinone or 1.4.5.8-Tetra-aminoanthraquinone; Process for Preparing** —. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 156,803, May 8, 1904.

**1.4-DIAMINOANTHRAQUINONE** is produced by oxidising the diazonium derivatives of  $\alpha$ -aminoanthraquinone (e.g., by means of a hypochlorite or permanganate) to the corresponding nitramine, nitrating, and then reducing the 1.4-nitronitramine. 1.4.5.8-Tetraminoanthraquinone is obtained in a similar manner from 1.5- or 1.8-diaminoanthraquinone.—T. F. B.

## V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

**Cotton Tissues; Maltng Starched** —. A. Scheurer. Bull. Soc. Ind. Mulhouse, 1905, 75, 39—42.

THE presence of boiled malt in the bath slightly diminishes the action of malt upon starched tissues. Soap, even in minute quantity, exercises an unfavorable influence upon the starch-hydrolysing power.—E. B.

**Dying Process; Dichroism in connection with the** —. K. Fox. Z. Farben-u. Textil-Ind. 1905, 4, 257—259.

THE author finds that double refraction is usually weaker in wool than in cotton or woody fibre, that indigo causes strong dichroism in vegetable fibres, and that wool and silk may be rendered dichroic by dyeing. The animal fibres show very strong dichroism if dyed, for instance, with gold chloride. Ramie dyed with basic dyestuffs without mordants, shows strong dichroism. No dichroism could be observed if the fibre were previously mordanted with tannin and tartar emetic. Acid dyestuffs from a neutral bath, without mordant, caused distinct dichroism in the ramie fibre. When the fibre had previously been mordanted with alum, the dichroism was weaker. Direct cotton dyestuffs, dyed from a neutral or weakly alkaline bath, caused strong dichroism. Unmordanted cellulose fibre, dyed with basic dyestuffs, showed dichroism which disappeared on subsequent treatment with tannin. When the tannin-lake, so formed, was dissolved by the action of acetic acid for a short time, and the whole then dried, the dichroism reappeared. Primuline shows strong dichroism on cellulose fibre, which does not disappear by diazotising on the fibre and combining with  $\alpha$ -naphthol. The author considers dichroism to be due to the disposition of minute crystals of the dyestuffs in a geometrically regular manner in the interstices of the fibre.—E. F.

**Dyes; Brown** — obtained by combining Substantive Dyestuffs with different Diazo Derivatives. L. Caberti, C. Barzaghi and P. Roggieri. Rev. Gen. Mat. Col. 1905, 9, 153—154.

THE authors have tried the effect of developing some direct cotton dyestuffs by means of various diazo derivatives in order to produce brown shades. The process consists in padding the material in a solution of the dyestuff containing an alkali such as sodium phosphate or caustic soda, and also tragacanth solution; this solution is used at a temperature of 60°—70° C. The material is dried in the hot flue, passed through the diazo solution contained in another padding machine, and then washed and dried. Some of the results obtained were as follows:—Diazotised paranitraniline gave a fine puce colour with Diamine Nitrazole Brown B and a beautiful cutch brown with Diamine Nitrazole Brown B.D. Diazotised *p*-nitro-*o*-anisidine gave a good brown with Diamine Nitrazole Brown B. Diazotised metanitraniline gave a full orange-brown with the B.D. brand, and a bright reddish-puce with the B. brand. Diazotised *m*-aminoazotoluene gave a reddish-brown with the B. brand. Diazotised benzidine and diazotised nitrotoluidine gave lighter and yellower shades with the B. mark than the diazotised *m*-aminoazotoluene. Bismarck Brown and diazotised meta-aminoazotoluene gave a fine orange-brown.

All these shades can be discharged by means of hydrosulphites, but the white is not always perfect. Best results are usually obtained on the shades developed with *p*-nitraniline.—A. B. S.

**Logwood Black suitable for Printing on Tissues prepared with  $\beta$ -Naphthol.** P. P. Wicktoroff. Bull. Soc. Ind. Mulhouse, 1905, 75, 49—54.

PRINTING mixtures were prepared from logwood extract oxidised by (i.) sodium chlorate and potassium cyanide, to which, after thickening with starch, ferrous sulphate or ferric chloride was added; and by (ii.) sodium bichromate, the precipitate formed being dissolved by heating with hydrochloric acid (in the ratio of one part of the concentrated solution to seven parts of the precipitate) and the solution obtained, after thickening, being printed alone and also with the addition of ferric chloride. Blacks produced were, however, inferior to one from a mixture of logwood extract (at 30° B.—45 parts) and acetic acid (at 6° B.—23 parts), potassium sulphite solution at 45° B.—15 parts) and ferrous sulphate (10 parts), which was heated and cooled; 10 parts of mixture being diluted with five parts of water and thickened by means of 15 parts of gum-tragacanth.

Frey states that the last described mixture gives satisfactory black without steaming, thus dispensing with the passage through the Mather-Platt steam-aging apparatus, usual for Logwood Blacks printed in association with Paranitraniline Red upon tissues prepared with sodium  $\beta$ -naphtholate, an operation which injures the shade of the red.—E. B.

**Printing with Direct Dyestuffs.** P. Wilhelm. Bull. Soc. Ind. Mulhouse, 1905, 75, 46—47.

WHEN a thickened solution of Congo Blue 2B is printed upon a cotton tissue, and this is steamed with very little steam, the dyestuff becomes more completely fixed than it would have been if ordinary steam had been employed. The same improvement results when hygroscopic substances, such as ammonium thiocyanate, sodium acetate, calcium chloride, and, especially, ammonium nitrate and glycerin, are added to the printing mixture, and steaming is accomplished with ordinary steam.

The author's experiments have been repeated by Grosheintz, who states that there is great advantage in adding ammonium nitrate (350 parts at 23° B.) and glycerin (10 parts) to the printing mixtures (composed of 30 parts of dye dissolved by the aid of 10 parts of sodium carbonate, and thickened with 500 parts of gum-tragacanth) printed in the case of Congo Blue 2B and Diamine Sky Blue. With these, the colours obtained, after steaming in the usual manner and soaping at 50° C. for 15 minutes, are twice as intense as those produced without the aid of the hygroscopic substances. The unprinted parts of the tissues are also much clearer. The action does not, however, seem to be general with the direct dyestuffs. In the case of a number tried, little or no difference in the intensity of the colours fixed, was observable. Among some, namely, Diamine Black, Diamine Green, Oxal Blue, Mikado Orange and Diamine Violet the fastest soaping was slightly increased; with others, such as Diamine Fast Red and Diamine Scarlet B, it was diminished. Ammonium chloride, magnesium chloride, glucose, sodium acetate, and other compounds, added in place of the mixture of glycerin and ammonium nitrate, to the printing mixture containing Diamine Sky Blue, gave results inferior to those obtained with the latter mixture. The difference in intensity between shades produced with moist and dry steam respectively is, according to Grosheintz, slight, but is in favour of the former.—E. B.

### ENGLISH PATENTS.

**Silk; Manufacture of Artificial** — from Solution of Cellulose [Application of Mercerising]. R. Linkmeier, Herford, Germany, and M. Pollak, Paris, France. Pat. 1501, Jan. 25, 1905.

A CUPRO-AMMONIACAL solution of cellulose is passed in the manner usual in the manufacture of artificial silk.



minute apertures, into a bath of an acid diluted to a degree as to be incapable of instantly combining the salts of the cupric solution," e.g., a 1—2 per cent. solution of sulphuric acid. The threads thus obtained when caused to enter a bath of caustic soda or potassium at  $10^{\circ}$ — $40^{\circ}$  B. After being rinsed in water, they are treated with acid, and are then washed and dried. The threads produced are, it is declared, more than those which have been passed, after their treatment, through acid or neutral baths only. (See *Fr. Pat.* 347,960, this J., 1905, 438.)—E. B.

*Process; Manufacture of Lustrous Threads of* —. Linkmeyer, Herford, Germany. *Eng. Pat.* 4761, March 7, 1905. Under Int. Conv., Aug. 26, 1904.

Sulphuric acid "in a highly concentrated state" has been previously employed in the manufacture of threads from cupro-ammoniacal solution of cellulose, owing to a decomposition of the threads which occurs when these are removed from the draw-plates in the sulphuric acid. The decomposition appears to be due to the fact that free ammonia is liberated when cellulose is dissolved in the ammonium solution, and the present invention is based upon the theory that the decomposition of threads by the dilute sulphuric acid does not take place when the liberation of ammonia in the cellulose solution has been previously prevented by the action of a vacuum or the injection of air. Hence the present invention consists in precipitating threads from a "dilute" acid, e.g., sulphuric acid of 20 per cent. strength, the cellulose from a cupro-ammoniacal solution deprived of combined ammonia as described. The threads thus obtained, which do not break during weaving, and which may be rapidly drawn out, become very fine. In addition to the advantage gained by the use of the more dilute acid, the process permits of the ready recovery of a large proportion of the ammonia employed. (See this J., 1905, 238.)—E. B.

*Machine for Washing Fabrics; Process and Means for Washing* —. Kellner, Vienna. *Eng. Pat.* 10,272, May 4, 1904.

Washing machines are "washed or cleansed" by means of a solution of an alkali hypochlorite and an alkali hydroxide. The solution is applied in dilute solution. Oils or fats, resins, especially colophony resin, turpentine and "perfuming substances," may be added to the solution.—E. B.

*Detergent for Scouring* —. S. Wohle, London. *Eng. Pat.* 12,632, June 3, 1904.

The detergent in question is composed of a vegetable alkali, prepared from linseed, and saponin. An oil, such as castor oil, an acid or acid salt, and in small proportion, a soluble peroxide, may be admixed with it. In its use, it is stated, the wool-grease is removed from the wool without being saponified, and is, therefore, easily recovered. Moreover, the wool is left in a more flexible condition than it is by ordinary scouring processes and requires less oil to be mixed with it to adapt it for spinning.—E. B.

*Process for Bleaching and Dyeing; Preparing Dried Liquor; Apparatus for [Electrolytic] Preparation of* —. F. L. Bartelt. *Eng. Pat.* 16,185, July 21, 1904. XI. A., page 678.

*Cloth and the like; Cylinders for Steaming and Shrinking* —. B. Gerlach, Crimmitschau, Germany. *Eng. Pat.* 7005, April 3, 1905.

Inside the rotating cylinder employed in the operation of shrinking cloth, is arranged an elastic support upon which is fixed a scraper which, by pressing against the inner side of the cylinder, removes steam bubbles and water drops, formed during the operation, the water being received in a trough placed below the axis of the cylinder, and thence conducted to exit pipes at the ends of the cylinder.—E. B.

#### FRENCH PATENTS.

*Wool; Apparatus for Scouring* —. P. Bastin. *Fr. Pat.* 349,243, Nov. 28, 1904.

A CYLINDER A (see Figs.) with openings *c* in it, parallel to its axis, has within it a system of rakes or forks B, borne by frames E, upon a number of shafts F, which project outside the cylinder. An arm G carrying a friction-roller *d* is mounted upon each of the shafts F. These rollers

FIG 1.

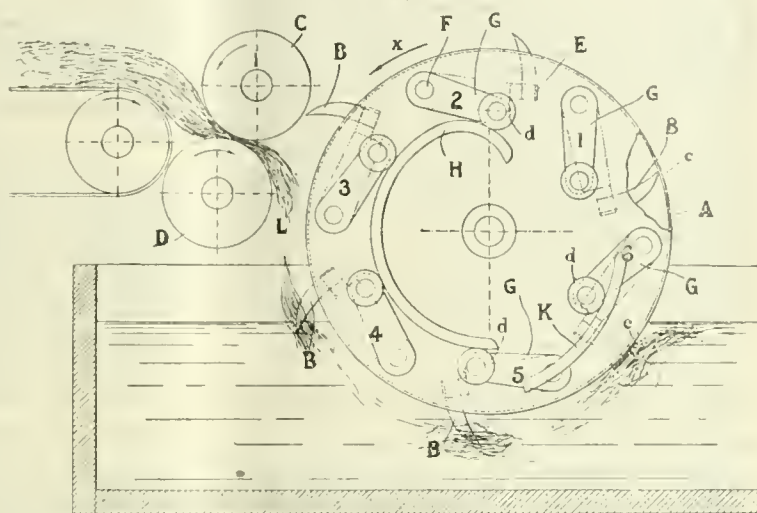
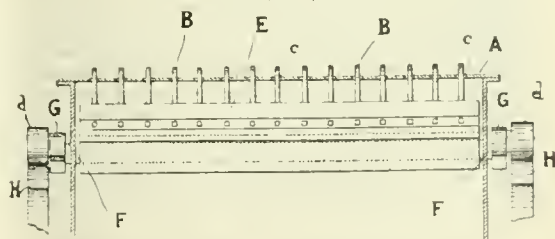


FIG 2.



follow the curved guide-plates H and K, outside the cylinder, their movement away from, or nearer to the axis of the cylinder causing the forks to project out of, or to enter the cylinder. The wool L received in the washing or scouring tank is seized by the forks, carried forward by them as they move with the cylinder, and then released at the point where the prongs of the forks are withdrawn into the cylinder.

In an alternative arrangement, fixed forks are employed. Portions of the surface of the cylinder are, in this case, constructed so as to be movable away from or towards the axis of the cylinder, their movement causing the forks to be either hidden or exposed as the case may be.—E. B.

*Plants; Preparing Dried* — for Bleaching and Dyeing. Seibt and Becker. *Fr. Pat.* 349,323, Dec. 21, 1904.

To adapt them for bleaching and dyeing, dried plants and

flowers are immersed in warm alcohol in which is suspended or dissolved either an alkali hydroxide, carbonate, or soap. After being washed in water, they are ready for bleaching or dyeing, these operations being accomplished in the usual manner.—E. B.

*Hydrosulphite Compounds [with Ketones]; Process for Manufacturing Stable* —. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 349,235, March 14, 1904.

SEE Eng. Pat. 6214 of 1904; this J., 1905, 194.—T. F. B.

*Discharges [Tissue Printing]; Producing — by means of Hydrosulphites.* Soc. Badische Anilin und Soda Fabrik. Third Addition, dated Nov. 23, 1904, to Fr. Pat. 297,370 of Feb. 19, 1900 (under Int. Conv., Oct. 24, 1904).

It has previously been discovered (this J., 1905, 87 and 130) that the keeping properties of printing-mixtures containing hydrosulphites (this J., 1900, 900; 1901, 43; 1904, 900; 1905, 333) are improved by the addition to these of either caustic alkalis or soluble salts, in sufficient quantity to prevent, to at least a considerable extent, the solution of the hydrosulphites. It is now found that a similar improvement results, but in a greater degree, when water is excluded, as far as possible, from the mixtures and its place is taken by a suitable organic liquid, such as glycerin. A thickening is prepared by heating together, for example, starch (300 grms.), dextrin (900), and crude glycerin (4800). With this, discharge printing-mixtures are made (a) by adding (to 400 grms. of the thickening) the double hydrosulphite of sodium and zinc (420 grms.) and crude glycerin (180 grms.), or (b) by mixing with it (440 grms.) caustic soda-lye (110 grms. at 45° B) and sodium hydrosulphite (300 grms.), stirred or ground into a paste with glycerin (150 grms.). The tissues printed with these mixtures are dried, steamed (for three minutes in the case of mixture (a); for four minutes in that of (b)), and are then washed and soaped as usual.—E. B.

*Printing with Indanthrene and Flavanthrene; Process of* —. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 349,376, March 21, 1904.

SEE Eng. Pat. 6848 of 1904; this J., 1905, 194.—T. F. B.

*Calender; Double-acting — for Hot-pressing Tissues either Once on each side, or Twice on One Side.* V. Cochetoux. Fr. Pat. 349,310, Dec. 20, 1904.

THE apparatus claimed, consists essentially of two cylinders mounted one above the other, round each of which an endless felt band is stretched. A curved metal plate is placed immediately beneath each of the cylinders. The tissues to be finished, after being passed at full width in contact with the felt band, between the bottom cylinder and plate, are drawn to the upper part of the apparatus and, according as they are to be operated upon again on the same or on the opposite side, are passed, either in the same direction as before or in the opposite direction, between the upper cylinder and plate.—E. B.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

### ENGLISH PATENT.

*Designs or the like in Atomised Colours; Apparatus for Applying — to Paper or other Material.* E. Marinier, Paris. Eng. Pat. 14,362, June 25, 1904.

SEE Fr. Pat. 342,484 of 1904; this J., 1904, 982.—T. F. B.

## VII.—ACIDS, ALKALIS, AND SALTS.

*Nitrogen Oxides and Nitric Acid; Preparation of — from Compressed Air by the Electrical Method.* E. Rossi. Gaz. chim. ital., 1905, 35, 89—110. Chem. Centr., 1905, 1, 1525—1526.

THE author determined the amounts of nitric oxide or

nitrogen peroxide formed from air, by the aid of the Nernst electric lamp, under varying conditions. The experiment was conducted over the Nernst electrodes in varying quantities and at different speeds, the amount of nitric oxide formed being determined with Lunge's nitrometer. It was found that the yield of nitric oxide increased rapidly with the current-strength; under similar conditions, a current of 0.22 ampère gave no nitric oxide, a current of 0.25 ampère, and 6.5 e.c. of nitric oxide with 1 ampère. In equal periods of time, the same yield of nitric oxide was obtained from 5 litres of air, from 10 litres of air passed through the apparatus at twice the speed, from 1 litre of air at rest, when the nitric oxide absorbed as it was formed. The yield of nitrogen is proportional to the pressure of the gas. With one ampère and a current-strength of 1 ampère, 100 e.c. of nitric oxide were obtained in 3½ hours from 5.2 litres of air under a pressure of 100 atmospheres. The utilisation of the energy of the lamp was, however, very poor with quiet air. By introducing concentrated sulphuric acid in the lamp to absorb the oxides as they were formed, the yield was increased to 35 per cent. in 2 ampère hours from 5 litres of air under a pressure of 50 atmospheres. The velocity of the reaction decreases with the time, owing to the air becoming deficient in oxygen. At a pressure of 90 atmospheres, the reaction proceeded much more rapidly at first, but subsequently more slowly than at a pressure of 50 atmospheres.—A. S.

*Ammonia; Direct Synthesis of* —. E. P. Peabody. Roy. Soc. Proc., 1905, A, 76, 167—174.

THE author's experiments prove that ammonia can be synthesised from nitrogen and hydrogen by the action of heat alone; the decomposition of ammonia by heat at 800°—1100° C. is, therefore, irreversible. Synthesis can be accomplished (in small quantities) when the gas is partially ionised, as by sparking them, or by exposing them with oxygen, or by heating them with many metals in the presence of moisture. In the last case it does not appear that nitrides are intermediate products, since nitride-forming metals such as magnesium are not more effective than others.—W. A. C.

*Sodium Alum; Notes on* —. J. M. Wadmore. Soc. Proc., 1905, 21, 150.

ZELLNER in 1816 stated that he had prepared this substance, but its existence has been denied by Ostwald. Mixing together solutions of suitable quantities of sodium sulphate and aluminium sulphate, a substance was obtained crystallising in octahedra, and having a composition corresponding to the formula  $\text{Na}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$ . 1 gm. of water at 10.6° C. dissolves 1.0711 gm. of the crystalline salt. When a hot concentrated solution of the salt is cooled, a pasty or oily substance is deposited which is slowly transformed into the crystalline sodium alum. Sodium alum does not effloresce appreciably at the ordinary temperature. It loses rapidly about one-third of its water of crystallisation at 50° C.—A. S.

*Hydrogen Sulphide and Sulphur Dioxide; Interaction of* —. W. R. Lang and C. M. Carsoa. Chem. Proc., 1905, 21, 158—160.

WACKENRODER'S solution, obtained by passing hydrogen sulphide into an aqueous solution of sulphur dioxide, after several periods of from two to three hours on successive days, has been found by Debus (Chem. Soc. Trans., 1888, 53, 278) to contain sulphur, and sulphur triethionic, tetrathionic, and pentathionic acids, and probably also hexathionic acid. The authors have investigated the reaction in presence of only a small quantity of water, hydrogen sulphide and sulphur dioxide being passed, at about equal rates, for 2—3 hours, in a large flask surrounded with snow and containing a little moisture. A heavy yellow deposit was obtained, which was lost from 25 to 35 per cent. by weight on heating to 100° C. for one hour, the residue then containing over 90 per cent. of free sulphur. The amount of sulphur compounds (estimated as sulphuric acid) in the deposits never exceeded 1 per cent. The deposit when kept in stoppered bottles at the ordinary temperature, became pliable and elastic, and covered with an oily liquid of acid reaction, while at



time, sulphur dioxide was evolved. The oily had a sp. gr. usually above 1.35, and corresponded the ordinary "pentathionic acid," or, as Debus d it to be, a mixture of polythionic acids. The reaction between gaseous hydrogen sulphide and ar dioxide thus appears to be that represented by  $2\text{H}_2\text{S} + \text{SO}_2 = 3\text{S} + 2\text{H}_2\text{O}$ , the sulphur and slowly interacting at relatively higher temperatures in polythionic acids.—A. S.

*Antimony Sulphide; Fusibility of Mixtures of —, with Cuprous Sulphide and Mercuric Sulphide.* H. Pelabon. *Comptes rend.*, 1905, 140, 1389—1392.

Mixture of cuprous sulphide to antimony sulphide the melting-point till the proportion of cuprous de is 0.11 of the whole (498° C.); further addition it. This eutectic corresponds nearly to the com-  $4\text{Sb}_2\text{S}_3 \cdot \text{Cu}_2\text{S}$ . Mixtures containing more than  $\text{Sb}_2\text{S}_3$  show two points on cooling, incipient iation, a temperature rising with increase of cuprous de, and complete solidification, always close to  $\text{Sb}_2\text{S}_3$ , as long as the cuprous sulphide does not overstep proportion  $10\text{Cu}_2\text{S} : \text{Sb}_2\text{S}_3$ . For the mixture  $\text{Sb}_2\text{S}_3$  these two points coalesce at 570° C. These res show a strong tendency to superfusion, and in cases no separation of the mixture of higher fusing occurs till the temperature has fallen to the solidi- point of the other mixture: when the latter begins arate, separation of the former is induced, and the ture rises again.

Mercuric sulphide behaves similarly to cuprous sulphide: tectic contains 34 per cent. of mercuric sulphide and at 455° C. Mixtures containing more mercuric sulphide his loss it rapidly by volatilisation at their melting, which are consequently difficult to determine itely. At the atmospheric pressure no mixture ning more than  $3\text{HgS} : \text{Sb}_2\text{S}_3$  can be melted, the loss tilisation is so rapid.—J. T. D.

*Phosphorus; Solubility of —, in Ether and in Benzene.* C. Christomanos. *Z. anorg. Chem.*, 1905, 45, —141.

EXPERIMENT of a weighed quantity (in excess) of phos- with definite quantities of the solvents, and nination of the weight of phosphorus remaining, as vaporation of a known weight of a saturated solution etermination of the weight of residual phosphorus, only approximate and not closely concordant results, because of the volatility of the phosphorus. The esults were obtained by oxidation of the phosphorus weighed quantity of the solution by means of cupric e, bromine, and nitric acid (this J., 1904, 1000). etermination of the phosphoric acid produced. ing-point determinations confirmed very closely the s so obtained. The amounts dissolved by 100 grms. ier were:—At 0° C., 0.4335 grm.; and at 35° C. of solvent) 1.9984 grms. The corresponding figures e case of benzene were:—At 0° C., 1.513 grms.; t 81° C., 10.027 grms. In each case the rise of dity was throughout closely proportional to the ent of temperature. Both solutions are colourless fresh, but turn yellow after a time, the ether solution so, and more rapidly, than the benzene solution. es for the densities and refractive indices of the ons at various temperatures are given. On evapora- the ether solution yields regular octahedra, the ne solution long prisms or columns, from which diary crystals branch off at right angles in frond-like on.—J. T. D.

*Nitre; Analysis of —.* R. Bensemann. XXIII., page 691.

*Sulphides; and the Purification of Coal Gas by ans of Ferric Hydroxide.* L. Gedel. II., page 664.

*Phosphorus; Detection of Yellow — in Phosphorus Sulphide.* L. Vignon. XXIII., page 691.

## ENGLISH PATENT

*Hydrosulphites; Manufacture of Stable Dry —.* J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 8816, April 26, 1905.

INSTEAD of immediately separating the hydrosulphite precipitated from its hot solution by sodium chloride, as prescribed in Eng. Pat. 19,762 of 1899 (this J., 1900, 900), it is now directed to continue the heating for some time after the precipitation, whereby the hydrosulphite is obtained free from water of crystallisation, in the form of a heavy, sand-like and stable powder. According to one example, the hydrosulphite, precipitated in the usual way, and containing water of crystallisation, is, after removal of most of the supernatant liquid, heated with the mother liquor to from 50° to 70° C., and sodium chloride is added to saturation. The stirring is continued for half-an-hour, the temperature being maintained as before, and the product is filtered hot, washed with alcohol, and dried in a vacuum. Such salts as sodium sulphate, carbonate, nitrate or acetate, may replace sodium chloride for precipitating the hydrosulphite. (Compare Eng. Pats. 901 and 18,852 of 1900 (this J., 1901, 43 and 988); 2204 of 1903 (this J., 1903, 1347), and 7397 of 1904 (this J., 1905, 132); also Fr. Pats. 336,942 of 1903; 341,718 of 1904, and First and Second Additions to the same, this J., 1903, 442; 1904, 900; and 1905, 333.)—E. S.

## UNITED STATES PATENT.

*Oxygen from Hypochlorites; Production of —.* G. F. Jaubert, Paris. U.S. Pat. 790,504, May 23, 1905.

SEE Fr. Pat. 325,627 of 1902; this J., 1903, 743.—T. F. B.

## VIII.—GLASS, POTTERY, AND ENAMELS.

### ENGLISH PATENT.

*Glass; Manufacture of Silica [Quartz] —.* J. F. Bottomley, Wallsend; R. S. Hutton, Manchester; and A. Paget, North Cray. Eng. Pat. 10,670, May 9, 1904.

SILICA glass is made by heating sand either by conduction or radiation, or both, from material such as carbon or graphite, shaped so as to give the desired heating area, and heated by the passage of an electric current, the plastic product obtained, being shaped *in situ* either by blowing it by means of a gas introduced in any convenient way, or else by pressing it between dies. The heating may be carried out either by passing a current through a resistance core of homogeneous material around which the sand is packed, or by passing the current through the walls of a vessel containing the sand. The latter may be directly in contact with the resistance material, or may be protected from it. The gas may be introduced by hollowing out the resistance material or by an independent carbon tube. When dies are used to shape the plastic mass, the material may be heated by a plate above and out of contact with it, which plate is removed when the silica has become plastic, the dies then being introduced.—A. G. L.

### UNITED STATES PATENTS.

*Insulators; Method of Manufacturing High-Potential Earthenware —.* F. M. Locke, Victor, N.Y. U.S. Pat. 790,214, May 16, 1905.

A DENSE, homogeneous, plastic mass, practically free from impurities, is formed by triturating and levigating the raw material such as kaolin, with water, and expelling nearly the whole of the moisture from the mixture. The plastic mass is then mechanically shaped under a uniformly and gradually increasing pressure, compressed air being introduced against the surface of the mass, whilst the maximum mechanical pressure is being applied. The ware is finally glazed and fired.

—A. S.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

*Brick; Hardening Lime-Sand* —. E. Cramer. Tonind. Zeit., 1905, 29, 558—560.

EXPERIMENTS were made with a fine and fairly pure sand, containing 83.5 per cent. of grains between 0.1 and 0.6 mm. diameter, and weighing 1.781 kilos. per litre when shaken down in the measure. With this sand two mixtures were made: one containing 4 per cent., the other 6 per cent. of dry-slaked Harz lime, one portion of each being mixed by 15 revs. of the Steinbrück edge-runner mill, the other by 30 revs. All the mixtures contained 3 per cent. of water. A portion of each was pressed into cubes of 30 sq. cm. face, at once, the rest being stored 24 hours before pressing. The pressures employed were 150 and 250 kilos. per sq. cm. respectively, and the blocks were hardened by steaming for nine hours, some at 6 atmos., the rest at 9 atmos. pressure. The results, referred to the number of revolutions employed in mixing, indicated that 15 revs. produced a sufficiently homogeneous mixture. The storing for 24 hours had practically no influence on the tensile strength, while the higher pressure used in moulding the cubes had an adverse effect in nearly every case. On the other hand the strength was greater in the cubes hardened under a steam pressure of 9 atmos. than in those treated at 6 atmos., a typical increase being from 59.8 kilos. per sq. cm. to 147.6 kilos. with 4 per cent. of lime, and from 119.8 to 177.0 kilos. with 6 per cent. of lime. A comparison of these figures also shows that whilst the higher proportion of lime gives a stronger brick, the increase is not comparable with that obtainable by the use of a higher steam pressure in hardening.—C. S.

### ENGLISH PATENTS.

*Stone; Manufacture of Artificial* — for Paving, Decorative and other purposes. N. G. H. von Kauffmann and C. E. H. Medberg, both of Gothenburg, Sweden. Eng. Pat. 11,830, May 24, 1904.

THREE separate mixtures are made: (1) Slate powder (55 to 80 parts) is mixed with five parts of sulphite-cellulose and five parts of blue clay and enough alum solution to give a plastic mass. (2) Zinc oxide (two parts) is mixed with one part of aluminium sulphate and one part of burnt magnesite. (3) Hydraulic lime (six parts) is mixed with 10 parts of calcium chloride and a sufficient quantity of potassium sulphite solution.

A mass of suitable consistence is prepared from these three mixtures, together with a weak solution of sodium or potassium phosphate: coarsely ground and well-dried slate is then added, the whole filled into moulds, which have been previously sprayed with chalk or similar powder under a pressure of about 2,000 atmospheres. After removal from the moulds, the stones are placed in a hardening liquid consisting of equal parts of potassium silicate, sulphuric acid, and saltpetre, at a temperature of 18° C. The stones are finally rinsed with warm water and dried.—A. G. L.

*Granite; Artificial* —, and Process for the Manufacture of the same. H. Vokes, Kingston-upon-Hull. Eng. Pat. 12,940, June 8, 1904.

GRANITE or marble chips, or a mixture of both ( $2\frac{1}{2}$  stones weight), are mixed with cement, preferably Portland cement ( $\frac{1}{2}$  stone), granite or marble dust ( $2\frac{1}{2}$  stones) and a suitable colouring matter ( $5\frac{1}{2}$  lb.). Enough water is added to give a plastic mixture, which is placed in moulds. After about five days, when sufficiently set, the blocks are removed from the moulds, and immersed in water for four days, after which they are allowed to harden in a warm, shady place, and finally polished.—A. G. L.

*Stone, Artificial Plaster, or Plastic Material; Manufacture of* —. S. Elmes, West Ealing. Eng. Pat. 17,870, Aug. 17, 1904.

ALABASTER plaster, Keene's or Parian cement, is mixed

with an equal quantity of powdered natural stone, a small percentage of borax or alum being added to harden the material. Saffron, or other fast dye, is then added well as washed sand, if desired. A little glue may be added: in this case formaldehyde may be substituted for the borax or alum. The mixed powder is gauged with water and applied directly to the laths, &c., or else it may be moulded into bricks or slabs. The surface may be covered with a coating of glue, with or without the addition of a hardening agent such as alum, borax or formaldehyde.—A. G. L.

*Bricks, Tiles, and the like; Manufacture of* —. E. Trapnell and R. L. Wood, both of Cheltenham. Eng. Pat. 28,368, Dec. 27, 1904.

CLAYS or shales, which have different colours after burning, are mixed together and worked in a semi-plastic state so as to give bricks or tiles of mottled appearance when finished.—A. G. L.

### UNITED STATES PATENT.

*Gypsum Mortar; Method of Improving* — and Utilising Dead-burnt Gypsum. C. Heintzel, Lüneburg. U.S. Pat. 790,366, May 23, 1905. SEE Fr. Pat. 349,260 of 1904; following this.—T. F.

### FRENCH PATENT.

*Plaster for Cast Plaster Floors; Method of Improving and of Utilising Over-burnt Plaster.* C. Heintzel and E. Cramer. Fr. Pat. 349,260, Dec. 20, 1904.

THE low initial hardening power of ordinary plaster for cast-plaster flooring, militates against its use for ceiling blocks, and as a building mortar. This may, however, be improved by an addition of  $\frac{1}{4}$  per cent. of potassium or sodium bisulphate, either before or during the mixing of the plaster for use. The tensile strength of the plaster (containing 20 per cent. of water) is usually 1 kilo. per sq. cm., at the end of one day after mixing, rising to 11 kilos. by the end of 28 days, whereas, with the addition of  $\frac{1}{4}$  per cent. of potassium bisulphate, the corresponding values are raised to five and 32 kilos. per sq. cm. respectively. Analogous results are obtained by treating over-burnt plaster in the same way.—A. G. L.

## X.—METALLURGY.

*Iron Sulphides and the Purification of Coal Gas by means of Ferric Hydroxide.* L. Gedel. J. f. Gasbel., 1904, 48, 412—417; 428—432. (SEE also under page 664).

I. *Iron Sulphides formed by Dry Methods.*—By heating pure iron powder with excess of sulphur till that excess is distilled off, Rammelsberg (Pogg. Ann. 121, 1863) stated that ferric sulphide,  $\text{Fe}_2\text{S}_3$ , is formed. Berzelius (Lehrbuch der Chem. 4 Aufl. 3, 437) and the author, on the contrary, have proved that ferric sulphide is not formed pyrogenetically, and the author shows that from 450°—500° C., iron disulphide is produced, and at about 700° C., yields the magnetic sulphide,  $\text{Fe}_3\text{S}_4$ , with expulsion of sulphur and formation of a mass of grey, metallic appearance and yellow lustre. On treatment with hydrochloric acid, this substance was decomposed, yielding hydrogen sulphide and iron bisulphide, but no free sulphur, the action thus resembling that which would have occurred if the compound had been one of  $6\text{FeS} + \text{FeS}_2$ . The absence of separate sulphur after the acid treatment was sufficient to prove that no ferric sulphide was present. On strongly igniting the magnetic sulphide,  $\text{Fe}_3\text{S}_4$ , for a long time, the author obtained the monosulphide with expulsion of sulphur. When iron powder was heated with sulphur in a glass tube placed in a glass tube to from 450°—500° C., with subsequent further additions of the latter, at first the mass with yellow, metallic lustre, was obtained, indicating



formation of the magnetic sulphide. This, after heating and full saturation with sulphur, at a passed into a dark greyish green mass, devoid of stic action and consisting of iron bisulphide.]

ur in Coke and its Effect in the Blast-Furnace. Wuest and F. Woolff. Iron and Steel Inst., May, 1905. [Advance Proofs].

results of experiments in which hydrogen, steam, gen, carbon monoxide and carbon dioxide respectively passed over coke heated to different temperatures, that, contrary to the view generally held, the sulphur in the coke does not reach the level of the tuyères in blast-furnace without undergoing alteration, a large on of it being previously volatilised by the ascending

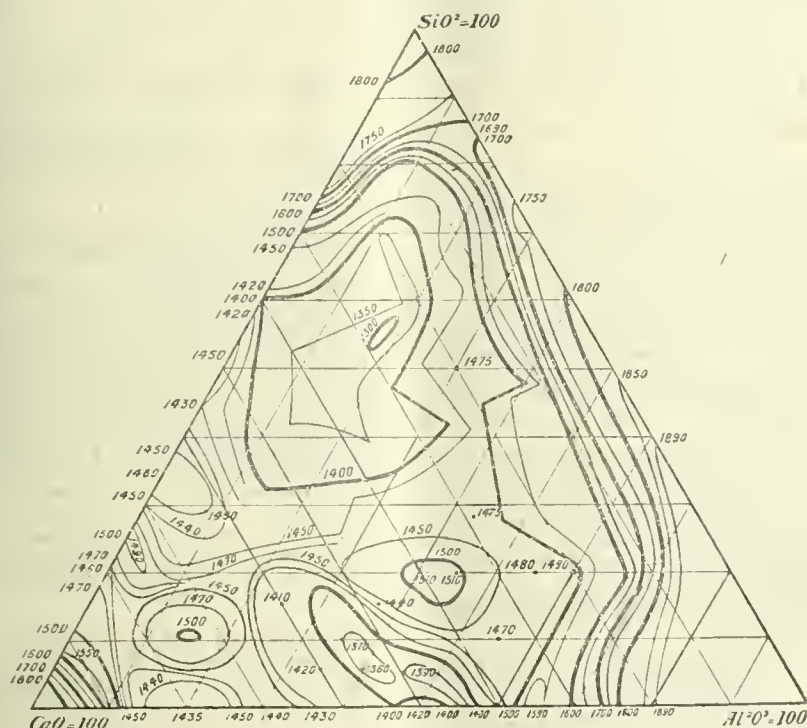
The greater part of the volatilised sulphur is, ver, again absorbed from the gases by the descending e and is thus carried to the level of the tuyères. t experiments showed that, up to 800° C., the sulphur sorbed from the gases principally by the oxides of but from 800° C. upwards, the lime is the chief bent of the sulphur.—A. S.

Furnace Slags; Experiments on the Fusibility of —. O. Boudouard. Iron and Steel Inst., May, 1905 [Advance Proof].

the level of this surface within the plane of the triangle gives the isothermal curves of fusibility. By the aid of this diagram it is possible to determine the temperature of fusion of any given calcium-aluminium silicate.

In blast-furnace practice the temperature of formation of a slag is higher than that of its fusion, as the fluxes are added in more or less large pieces, but the two temperatures approach one another the more closely, the more intimate and complete the previous mixing of the materials has been, and an economy of fuel would be realised, if the fluxes were crushed and mixed before being introduced into the blast-furnace with the charge.

The fusing point of silica is 1830° C. The addition of a small quantity (about 10 per cent.) of silica or alumina to lime causes a considerable lowering of the fusing point. The effect of the addition of lime to alumina is not so pronounced; the reduction of the fusing point to 1500° C. is not attained until nearly 40 per cent. of lime have been added. Slags containing from 30 to 90 per cent. of lime have fusing points not above 1500° C. The existence of the following definite compounds,  $\text{CaO} \cdot \text{SiO}_2$ ,  $2\text{CaO} \cdot \text{SiO}_2$ ,  $3\text{CaO} \cdot \text{SiO}_2$ ,  $\text{CaO} \cdot \text{Al}_2\text{O}_3$ ,  $2\text{CaO} \cdot \text{Al}_2\text{O}_3$ ,  $3\text{CaO} \cdot \text{Al}_2\text{O}_3$ , was proved. In the case of mixtures of lime, alumina and silica, it was found that the addition of alumina to a silicate of calcium first increases the fusibility, which ascends to a maximum, but ultimately reduces it. The



author has determined the fusibility of calcium and inium silicates, calcium aluminates, and double ates of calcium and aluminium. The results are set in a series of tables and curve-diagrams, and in the mpanying triangular curve-diagram (see Fig.), in h the points on the sides correspond to binary comds, whilst the composition of each ternary comd corresponds to a point within the triangle, the portion of each constituent being represented by a line wn from this point parallel to one of the sides. In er to represent the variation of fusibility, lines are wn from each point in the triangle perpendicular to plane, and of a length proportional to the temperature fusion of the constituents corresponding with the points h which the lines are erected. The loci of these points form surface of fusibility, whilst the projection of lines from

more basic a silicate is, the greater is the amount of alumina required to render it fusible.

In the case of calcium silicates containing more than 30 per cent. of silica, the substitution of alumina for lime up to 25 per cent. causes a marked increase of fusibility, but with larger proportions of alumina, the fusibility rapidly decreases. With a silicate containing 30 per cent. of silica, the substitution of alumina for lime has little effect until the amount reaches 35 per cent., when the fusibility falls rapidly. For slags with less than 30 per cent. of silica, there is a notable increase in the fusibility up to 50 per cent. of alumina, but beyond this the fusibility diminishes very rapidly.

In the following table the results of the determination of the temperatures of fusion of some industrial slags are given :—

Description of Metal.	Percentage Composition of Slags.								Temperature of Fusion.
	SiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	CaO.	MnO.	MgO.	FeO.	Alkalis.	CaS.	
Ferro-silicon with 14 per cent. of silicon .....	25.0	25.0	50.0*	—	—	—	—	—	0°C.
Ferro-silicon with 14 per cent. of silicon .....	35.0	25.0	40.0*	—	—	—	—	—	1450
Grey hot-blast charcoal pig iron .....	45.0	10.0	45.0*	—	—	—	—	—	1375
Grey hot-blast charcoal pig iron .....	65.0	5.0	30.0*	—	—	—	—	—	1360
Grey hot-blast coke, anthracite and coal pig iron .....	30.0	20.0	50.0*	—	—	—	—	—	1430
Grey hot-blast coke, anthracite and coal pig iron .....	35.0	10.0	55.0*	—	—	—	—	—	1420
White pig iron—charcoal .....	45.0	10.0	45.0*	—	—	—	—	—	1360
White pig iron—charcoal .....	40.0	5.0	55.0*	—	—	—	—	—	1425
White iron—coke .....	30.0	10.0	60.0*	—	—	—	—	—	1440
White iron—coke .....	40.0	5.0	55.0*	—	—	—	—	—	1425
Spiegeleisen .....	30.0	10.0	55.0	5.0	—	—	—	—	1440
Spiegeleisen .....	40.0	10.0	10.0	40.0	—	—	—	—	1440
Grey charcoal pig iron .....	63.98	3.33	22.55	5.53	0.88	1.82	3.33	0.03	1430
Grey charcoal pig iron .....	56.89	6.38	28.46	2.01	2.64	1.72	1.30	—	1375
Grey charcoal pig iron .....	53.79	13.04	25.67	2.20	0.57	2.44	—	—	1390
Grey charcoal pig iron .....	49.30	12.17	31.23	0.95	2.23	0.79	2.61	0.43	1325
Grey pig iron from coke or coal .....	27.50	9.75	58.90	—	1.37	—	—	—	1415
Grey pig iron from coke or coal .....	31.37	13.09	52.04	—	1.16	—	—	—	1425
Grey pig iron from coke or coal .....	31.20	10.81	53.17	—	1.08	—	—	—	1440
Grey pig iron from coke or coal .....	32.20	8.17	48.92	4.79	—	—	—	—	1445
Grey pig iron from coke or coal .....	37.10	16.70	38.50	0.70	1.90	0.40	—	4.10	1375
Grey pig iron from coke or coal .....	35.40	9.20	47.20	0.40	2.30	0.40	—	4.60	1410
Grey pig iron from coke or coal .....	37.38	10.94	46.14	0.72	1.99	1.00	—	—	1400
Grey pig iron from coke or coal .....	27.65	24.69	36.56	0.35	3.55	0.72	1.45	4.39	1440
Grey pig iron from coke or coal .....	40.51	19.56	30.80	—	1.09	1.20	—	2.61	1350
White pig iron .....	42.23	9.84	37.13	0.97	1.32	2.60	—	4.32	1375
White pig iron .....	31.92	9.83	46.73	3.78	2.03	0.71	—	4.36	1430
Foundry pig iron .....	31.84	20.64	43.12	—	2.49	1.03	—	—	1425
Basic pig iron .....	31.00	14.00	48.00	1.50	—	2.50	—	—	1425
Basic pig iron .....	32.60	16.50	46.00	2.00	—	2.50	—	—	1425

\* In these cases the term "lime" includes all the oxides other than silica and alumina.

*Calcium; Metallic* — K. Arndt. Ber., 1905, 38, 1972—1974.

THE author has examined the characters of three aluminium-calcium alloys supplied to him, containing respectively 25, 50 and 80 per cent. of calcium. The two latter were not homogeneous, the calcium-content varying to the extent of about 4 per cent.

*Alloy with 25 per cent. of Calcium.*—This had a dull metallic appearance, like cobalt; it was very brittle, with a granular fracture. Sp. gr., 2.12 to 2.18; m. pt., 765° C.

*Alloy with 50 per cent. of Calcium.*—The alloy resembled nickel in appearance; it was very brittle, with a finely granular fracture. Sp. gr., 2.26 to 2.38; m. pt., 1050° C. From this alloy pure calcium can be separated by distillation in a high vacuum.

*Alloy with 80 per cent. of Calcium.*—This had a brilliant white fresh surface, rapidly turning yellow and becoming coated with a thick grey layer of oxide. It was not so brittle as the other alloys, and had a crystalline fracture, showing yellow and red tarnish almost immediately. Sp. gr., 1.74 to 1.81; m. pt., 600° C. It readily furnishes pure calcium by distillation in high vacuum.

The high melting-point of the 50 per cent. alloy suggests the existence of a compound.—J. T. D.

*Silicon in Iron; Determination of* — D. F. Morgan. XXIII., page 692.

*Gas; Determination of Dust in Blast-Furnace* — E. Hubendick. XXIII., page 691.

#### ENGLISH PATENTS.

*Projectiles; Manufacture of* — R. A. Hadfield, Sheffield. Eng. Pat. 15,219, July 7, 1904.

THE projectile, after being subjected to a preliminary heating and annealing process, is gradually and uniformly heated in a furnace to a temperature ranging between 820° C. and 950° C. (or even higher in special cases), and then dipped point downwards to the depth to which it is to be hardened, in oil or in other cooling medium. In the case of a projectile of nickel-chromium steel, it is heated to about 865° C., before partially dipping, as described, in the cooling medium. Projectiles of large calibre may be heated before dipping, to a lower temperature than that mentioned, say to 800° C. The process may also be modified in other respects in certain

described cases. Reference is made to Eng. Pats. 2 (this J., 1897, 49), 27,754, and 27,755, of 1897; to 3543 of 1898; and to 7882 of 1904 (this J., 1905, —E).

*Briquettes for Steel-making, Fuel, &c.* R. F. St. London. Eng. Pat. 10,066, May 2, 1904.

BRIQUETTES for steel-making are made:—(1) From ore, purple or Spanish, 86 to 88 per cent., lime or calcined earth 4 per cent., pyroligneous tar  $7\frac{1}{2}$  to 9 cent., sodium silicate or the like  $\frac{1}{2}$  per cent.; (2) sand or other ores of sharp, gritty material 84 to 86 cent., lime or other calcined earth 3 to 4 per cent., alumina 3 to 4 per cent., pyroligneous tar  $7\frac{1}{2}$  per cent., so silicate or the like  $\frac{1}{2}$  per cent.; (3) for fuel in blast-furnace coal 88 per cent., lime 3 or 4 per cent., tar 7 per cent., sodium silicate  $\frac{1}{2}$  per cent. Anthracite, bituminous, semi-bituminous coal, lignite, peat, or charcoal may be used, slightly varying the proportions. The ore or the lime (and alumina when used) are ground to powder and thoroughly mixed, then the tar and silicate are added and thoroughly incorporated, finally the mass is compressed into blocks.—J. H. C.

*Steel; Hardening High-Speed Tool* — S. N. Braye. Manchester. Eng. Pat. 12,817, June 7, 1904.

THE steel is heated to a high temperature, quenched in a bath of salt, lead, or other material heated to 500° C., and finally quenched in water or other liquid.—J. H. C.

*Iron Ores and Concentrates; Means for Dephosphorizing* — W. Simpkin, London, and J. B. Ballar. Richmond, Surrey. Eng. Pat. 14,214, June 23, 1904.

THE ores are heated, digested for a few minutes with dilute sulphuric acid, and subsequently washed. The operation is carried out in troughs provided with revolving conveyors.—J. H. C.

*Ores; Process of and Apparatus for Refining* — W. Clark, London. From E. Goldschmidt, Frankfort-on-Maine, Germany. Eng. Pat. 11,437, May 18, 1904. SEE Fr. Pat. 343,313 of 1904; this J., 1904, 1032.—T. B.

*Separating Coal, Slack, Ores, Minerals or Substances of Different Specific Gravity.* T. A. Johnson. Eng. Pat. 13,765, June 17, 1904. II., page 665.



*Ores; Process for Smelting Sulphuretted —*,  
*ie Simultaneous Concentration of the Motte.* N.  
 eff, St. Petersburg. Eng. Pat. 14,980, July 4,

Pat. 344,530 of 1904; this J., 1904, 1095.—T. F. B.

#### UNITED STATES PATENTS.

*Steel.* R. A. Hadfield, Sheffield.

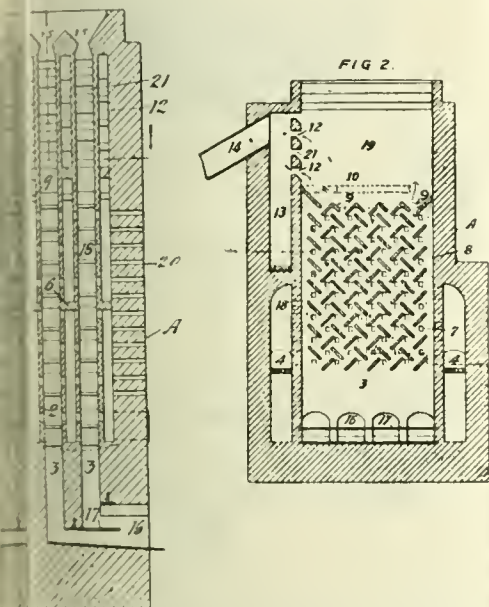
U.S. Pat. 786,561, April 4, 1905.

made for a steel containing from about 0.3 to  
 cent. of carbon, up to 0.25 or 0.3 per cent. of  
 se, 2—5 per cent. of nickel, and 1—3 per cent.  
 mium. The steel is stated to possess a high elastic  
 tenacity, with great ductility and toughness.  
 —A. S.

*face [Mercury —].* A. Skoog, Shreveport,  
 isiana. U.S. Pat. 783,903, Feb. 28, 1905.

face is shown in cross-section through the  
 of the furnace in Fig. 1. and in section in

G 1



It consists (Fig. 1) of vertical fire-chambers  
 ore-chambers 3, arranged alternately, with fire-  
 on two opposite sides of the furnace at right  
 o the chambers 2, 3. The heat and gases from  
 boxes pass through openings into the ends of  
 chambers 2, which have each a transverse partition  
 a third of the way up, so that the fire-gases are  
 pass first through the openings 7 into the ore-  
 s, through the body of ore, and subsequently  
 ough the openings 8 into the fire-chambers above  
 titutions 6. At about two-thirds of the height of  
 chambers, baffles 9, 10 are provided, between  
 und which the gases and mercury vapour pass  
 upper compartments of the fire-chambers, then  
 ough the openings 12 into the dust chamber 13,  
 and finally through the pipe 14 to the condensers.  
 chambers are provided to about two-thirds of  
 right with the usual inclined tiling 18, but the  
 ids of the tiles of the outermost row do not extend  
 walls of the ore-chambers. The space 19 in the  
 part of each ore-chamber, corresponding to the  
 ompartments of the fire-chambers is left untiled,  
 s as a drying chamber for the ore. Wet ore is

fed into the ore-chambers through the openings 15 (Fig. 1),  
 and is dried in the chambers 19 (Fig. 2) before passing  
 to the tiled compartments of the ore-chambers, where  
 the mercury is distilled off. The roasted ore is discharged  
 through the openings 16 (Fig. 1).—A. S.

*Furnace; Smelting —.* C. E. Glafke, Los Angeles,  
 Cal. U.S. Pat. 790,825, May 23, 1905.

THE furnace consists of an inclined cylindrical rotating  
 smelting-chamber mounted on a frame-work, and having  
 both ends partially closed. The ore is fed in at the upper  
 end of the chamber, into which also projects a hydro-  
 carbon burner for heating the furnace. A baffle is arranged  
 near the lower end of the smelting-chamber, which com-  
 municates with a stack.—A. S.

*Leaching Apparatus [Ores].* C. E. Dewey, Denver, Cal.  
 Assignor to American Zinc and Chemical Co., Denver.  
 U.S. Pat. 787,902, April 25, 1905.

FOR leaching ore-pulp with chemicals introduced from  
 below, a leaching vat of V-shaped cross-section is provided,  
 together with a lead pipe extending the whole length of  
 the bottom of the vat. The lead pipe serves for the  
 introduction of the acids, &c., and is provided with a  
 series of nozzles adapted to direct the liquid vertically  
 upwards. These nozzles are formed by moulding solid  
 projections in a straight line along the outer wall of the  
 pipe, and by fixing orificed nozzles of porcelain to the  
 tops of the projections, subsequently boring the lead so  
 as to extend the orifice to the interior of the pipe.—J. F. B.

*Copper; Method of Recovering — from its Ores.*  
 H. M. Wilcox. Assignor to Esmeralda Copper Pre-  
 cipitating Co., Chicago, Ill. U.S. Pat. 790,238, May 16,  
 1905.

THE ore is leached with a suitable reagent to convert the  
 copper into copper sulphate, air is blown through the  
 solution to remove iron and other impurities, and sulphur  
 dioxide is then passed in, practically to the point of  
 saturation. The solution is then subjected to heat and  
 pressure in a closed vessel only partially filled, whereby  
 the copper is deposited as metal, the sulphur dioxide  
 "escaping from the liquid into the confined space, to  
 perfect the reaction."—A. S.

*Metals and Oxides; Process of Recovering — from  
 Solutions.* A. Gutensohn, Southend, Essex. U.S. Pat.  
 790,429, May 23, 1905.

SEE Fr. Pat. 344,630 of 1904; this J., 1904, 1222.—T. F. B.

#### FRENCH PATENTS.

*Steel; Process of Reduction applied to the Manufacture  
 of —.* J. de Moya. Fr. Pat. 349,233, March 14, 1904.

A MIXTURE of 50 per cent. of sodium chloride, 25 per cent.  
 of sodium bicarbonate, and 25 per cent. of saltpetre, is  
 added to the molten metal in the proportion of 2 kilos.  
 per ton of metal, and subsequently about 3 kilos. of calcium  
 chloride are added. The additions may be made up into  
 packets either separately or together. Finally, packets  
 containing about 5 kilos. of very finely-divided "Carmoya"  
 (a carboniferous mineral) are added from time to time  
 to recarburise the metal.—J. H. C.

*[Alloy] A New Metal, "Parisis."* A. Chassereau. Fr.  
 Pat. 349,343, March 19, 1904.

THE alloy is prepared from 200 parts of mispickel ( $\text{FeAs}_2 + \text{FeS}_2$ ) 85 parts of  $\text{Ni}_3\text{As} + 8\text{As}$ , and 715 parts of aluminium.  
 These are melted in separate crucibles, and subsequently  
 mixed in presence of an alkaline salt and a borate, and  
 the mixture is submitted to the action of "carbon dioxide  
 gas to remove oxygen"; it is then refined by means of  
 silicon or a silicate. For some purposes arsenic is used  
 in place of aluminium.—J. H. C.

*Air for Blast-Furnaces; Process for Drying —.* Soc.  
 F. Grimault, Le Soufaché et Felix. Fr. Pat. 349,219,  
 Dec. 20, 1904.

THE blast before passing through the stoves or heating

apparatus, is caused to bubble through a solution of calcium chloride, which is contained in a closed vessel and kept at a temperature of about  $-12^{\circ}\text{C}$ .—W. H. C.

#### GERMAN PATENTS.

*Steel of Special Hardness; Process for the Production of —.* F. Münster. Ger. Pat. 157,881, March 15, 1902.

THE molten steel is subjected to the action of a blast of pure nitrogen.—A. S.

*[Iron] Wire, Hoop-Iron, &c.; Process for Hardening —.* H. Krautschneider. Ger. Pat. 157,683, Nov. 13, 1902.

THE metal objects to be hardened are placed in a suitable carburising bath, and are heated by passing an electric current through them. They are then quenched by immersion in a cooling liquid.—A. S.

*Casting-Moulds; Process for the Preparation of a Coating Composition for —, with Utilisation of Ash [from the Blast-heating Apparatus].* F. Graus. Ger. Pat. 158,258, Oct. 25, 1903.

IN order to prevent "burning-on" of the sand to the molten metal, the moulds are coated with a composition prepared by vigorously stirring  $\frac{1}{2}$  kilo. of dextrin with 6 litres of boiling water, and adding to the mixture sufficient of the fine ash which collects in the blast-heating apparatus to give a mass of the consistence of paint.—A. S.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A.)—ELECTRO-CHEMISTRY.

*Electrode Temperature; Relation between Electrolytic Processes and the —.* W. Moldenhauer. Z. Elektrochem., 1905, 11, 307–330.

IN accordance with the reasoning of Ostwald, the author considers the heat changes at the electrodes as the sum of the heat of ionisation, and that due to the fall of potential between electrode and electrolyte. The temperature of the electrode was measured by using a hollow electrode in which a thermometer was placed. Various preparations were carried out to study the effect of cooling the electrode upon the yield of product. In the case of persulphuric acid, ammonium persulphate and potassium percarbonate, a considerable improvement was noticeable. Potassium chloride gave better yields of hypochlorite with cooled, better yields of chlorate with heated electrodes.—R. S. H.

*Nitrogen Oxides and Nitric Acid; Preparation of — from Compressed Air, by the Electrical Method.* E. Rossi. VII., page 672.

*Adrenaline; Synthesis of Substances allied to —.* H. D. Dakin. XX., page 686.

#### ENGLISH PATENTS.

*Electrolytic Apparatus.* H. S. Blackmore, Mount Vernon, and E. A. Byrnes, Washington, U.S.A. Eng. Pat. 10,794, May 10, 1904.

SEE U.S. Pat. 759,799 of 1904; this J., 1904, 613.—T. F. B.

*Peat, Obtaining Producer Gas and Electrical Energy from —.* F. T. Warburton. Eng. Pat. 11,917, May 25, 1904. II., page 666.

*Bleaching Liquor; Apparatus for [Electrolytic] Preparation of —.* F. L. Bartelt, Bristol. Eng. Pat. 16,185, July 21, 1904.

A PORTABLE apparatus for preparing bleaching liquor for use in steam laundries, or in small bleach works, comprises a platform carrying a solution tank charged with the electrolyte (sodium chloride solution for instance), and also carrying the source of electricity. Below the platform is a storage chamber, and to one side, below the level of

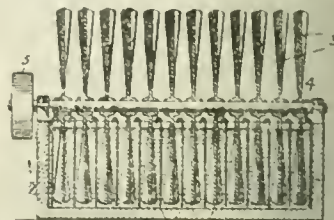
the electrolyte tank, is a relatively small "electrolytic tank," in which are the electrodes, and below which is a larger tank to receive the bleaching liquor as it is produced in the electrolyser. The electrolyte flows from the solution tank through a pipe provided with a tap into the electrolyser. A bell circuit and a switch circuit are connected to a float in the solution tank, so that when the level of the solution in this tank falls below a certain point the bell rings, and at the same time the supply of current to the electrolyser is cut off.—E. S.

*Absorbing Gases by a Liquid under the Action of a Silent Electric Discharge; Apparatus for —.* Hemptinne. Eng. Pat. 7101, April 4, 1905. I., page 682.

#### UNITED STATES PATENTS.

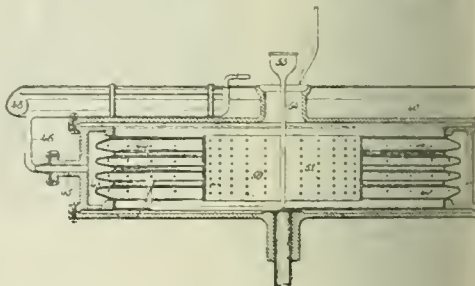
*Electrolytic Apparatus.* W. M. Johnson, Iola, Mo. U.S. Pat. 789,740, May 16, 1905.

THE anodes 3, 3 the apparatus shown in section in the accompanying figure are of lead, and disc-shaped, and



provided with vanes which, when the anodes are rotated means of the pulley 5, direct the electrolyte against the cathodes, which are situated in the spaces between a pair of anodes.—T. F. B.

*Electrolytic Purposes; Centrifugal Apparatus for —.* R. V. Heuser, Erie, Pa. U.S. Pat. 790,055, May 16, 1905.



THE apparatus consists of a rotating vessel as shown in the diagram, provided with a perforated cylindrical cathode 44, the perforations permitting the circulation of the electrolyte when the vessel is rotating. Liquid may be admitted to the vessel through the inlet 53.—T. F. B.

*Battery Solution.* F. M. Holmes, Marionville, Mo. Assignor to R. H. Stevens, Clayton, Mo. U.S. Pat. 790,502, May 23, 1905.

GUM, derived from the sap of pitted fruit trees, is dissolved in water and used as a "sealing-cover" with a suitable "acid-exciting" fluid.—B. N.

*Insulators; Method of Manufacturing High-Potential Earthenware —.* F. M. Locke. U.S. Pat. 790,444, May 16, 1905. VIII., page 673.

#### FRENCH PATENTS.

*Gum Resins; [Electrical] Treatment of — and Resulting Product [Sylvine].* A. Nodon. Addition, dated March 1, 1904. to Fr. Pat. 348,653, Feb. 16, 1904. XIII., page 682.



*and Mixtures of Gases; Process and Apparatus for the Treatment of —*, by the Electric Arc. A. J. Person. Fr. Pat. 349,227, Dec. 20, 1904.

Subject of the invention is to submit to the action of the electric arc as great a number of molecules of gas as possible. This is attained by displacing the arc continuously across the gases by means of electro-dynamic forces produced by the principal current forming the arc, secondary currents arranged so that the force which the arc is always proportioned to the principal current. The currents traversing the electrodes compel the arc to displace itself along the length of the electrodes. The arc may be in the form of upright parallel rods, one within another, or a spiral electrode may be placed within a cylindrical electrode, these being in each case placed along the length of the chamber through which the gases pass, and the electrodes are brought near each other at the entrance of the chamber to facilitate the formation of the arc.—B. N.

# GERMAN PATENTS.

*Vapours, and the like; Process and Apparatus for the Treatment of — to the Electric Discharge.* Westdeutsche Gasphosphatwerke, G.m.b.H. Ger. Pat. 157,629, 10, 1904.

A rotating drum of insulating material is wound with a conducting wire, which is connected with one end of the source of current. A strip of metal placed parallel to the axis of and some distance away from the drum is connected with the other pole of the source of current, and an injector or series of injectors is placed to discharge into the space between the metal strip and the drum. When the current is passing, a spark travels through the gas issuing from the injector, between the metal strip and the nearest point of the wire. As the drum revolves, the spark travels along the length of the drum as different portions of the spiral wire pass the metal strip. If the speed of rotation of the drum be increased sufficiently, the sparks follow each other so quickly, that practically a continuous electric flame is formed between the drum and the strip.—A. S.

*Content of Vapours, Air or Gases; [Electrical] Tests for the Determination of the —*. R. Schmidt & Döhne. Ger. Pat. 158,105, April 21, 1903.

The moisture content of vapour, air or gases is estimated by measuring the dielectric coefficient of the vapour, &c., by varying the capacity of an electrical condenser placed in contact with the vapour, &c., with that of one or several condensers in contact with the vapour, &c. The condenser placed in contact with the vapour, &c., is connected with electrical measuring instruments, and with the comparison-condensers, and are provided whereby the capacity of at least one of the comparison-condensers can be altered, so that by adjustment, the capacity of the condenser placed in contact with the vapour, &c., can be ascertained.—A. S.

*Thermo-element.* A. Heil. Ger. Pat. 158,099, March 3, 1904.

The thermo-element claimed, the positive pole consists of an alloy of manganese and silver, for example 25 parts of silver to 75 parts of the latter. The manganese-silver alloy is stated to be more malleable and stronger than the antimony alloy generally used; it is also more resistant to the latter, as it melts only at about 1000° C.—A. S.

# (B.)—ELECTRO-METALLURGY.

*Coated Iron and Steel Goods; Comparison Tests on the Coating of — by the Hot and Electrolytic Methods.* J. J. Jarmay. Z. Elektrochem, 1905, 11, 335—338.

Tests clearly prove the superiority of the electrolytic method both as regards its adhesion when the metal is subjected to mechanical tests, as also in its resistance to thermic corrosion.

Moreover, the amount of zinc required for satisfactory galvanising is much less in the electrolytic than in the hot

galvanising process. The author ascribes this to the contamination of the zinc, to the irregularity of the deposit and to the enclosed salts (zinc and ammonium chlorides) in the latter case. However, even in the electrolytic process, it is advisable to use only such electrolytes as are unlikely to corrode the iron should they become enclosed in the deposit. Otherwise the electrolytic deposit retains no advantages over those obtainable by hot galvanising.

—R. S. H.

*Metallic Wires; Electrolytic Production of Fine —*. H. Abraham. Comptes rend., 1905, 140, 1444—1445.

The wire, the cross-section of which it is desired to reduce, is made the anode in an electrolytic cell; it is suspended from the ends of two metallic leads, to one of which each of its ends is soldered, and is kept in the bath (a developing tray answers well) by two little glass hooks. The electrolyte must be very dilute, so as to interpose considerable resistance, and the current very small, so that the density all over the surface of the wire may be uniform. Water containing under 1 per cent. of copper sulphate or silver nitrate, and a current density of 0.01 ampère per sq. cm. of surface will answer.—J. T. D.

# ENGLISH PATENTS.

*Metals; Process for the Ornamentation of — and the Production of Metal Marqueterie.* S. Cowper-Coles and S. Cowper-Coles and Co., London. Eng. Pat. 12,174, May 28, 1904.

The desired ornamentation is transferred or painted on the metal article, those parts being left exposed upon which the second metal is to be inlaid, and the exposed portions are mechanically and chemically cleaned. A second metal is then electrolytically deposited upon the exposed portion in a suitable bath, and after removal of the “stopping-off” material, the article is heated sufficiently and for so long as to cause an alloy to form between the two metals. For instance, if the article to be ornamented is of copper, on the exposed portions of which zinc is electro-deposited, brass is formed; “the outer coating is practically of pure zinc, next to which is a layer of zinc-copper alloy, and below this a layer of copper-zinc alloy.”—E. S.

*Electrotypes; Improved Method of Producing —*. S. Cowper-Coles and Co., Ltd., and S. Cowper-Coles, London. Eng. Pat. 13,012, June 8, 1904.

The electrolytic bath is divided into compartments, and the mould, acting as the cathode, is suspended in the electrolyte at a distance from the anode determined by the character of the design to be produced. The electrolyte is circulated by means of a pump, the vertical partitions, which support the electrodes, causing the liquid to take a horizontal zig-zag course through the various compartments. The electrolyte may, by means of channels furnished with sluice-gates, be allowed to fall through a perforated plate into a lower filtering chamber, thus becoming aerated and then passing in a vertical zig-zag course over material acting as a sieve. The liquid finally passes into a settling tank, and, from the latter, the pump draws off the liquid for circulation through the electrolytic vessel.—B. N.

*Electro-Plating Metallic Articles; Apparatus for —*. Rudge-Whitworth, Ltd., and J. V. Pugh, Coventry, and H. L. Heathcote, Birmingham. Eng. Pat. 16,648, July 28, 1904.

The articles are mounted on a rotating carrier, which is kept in rapid motion during the deposition of the metal. The vat is provided with a partition or wall and means for causing a rapid circulation of the electrolyte.—R. S. H.

# UNITED STATES PATENTS.

*Furnace; Electrical —*. 1. S. Prenner, Assignor to G. N. Brown, Scranton, Pa. U.S. Pat. 790,226, May 16, 1905.

The furnace, which is intended for smelting ores, &c., consists of a closed chamber, containing a stationary and

movable electrodes, the distances between the electrodes being regulated automatically in accordance with the strength of the arc current. The hearth of the furnace is fixed close to the end of the fixed electrode, and the material is fed on to it through a hopper, the discharge opening of which is controlled electrically, and in such a way that the feeding of material is stopped as soon as the arc circuit is broken.—T. F. B.

*Metallic Compounds; [Electrical] Process of Reducing* — E. F. Price, Niagara Falls, N.Y. U.S. Pat. 790,389, May 23, 1905.

This invention relates to a process of reducing compounds or ores of metals, the temperatures of reduction and volatilisation of which are approximately the same. A charge of the compound and a reducing agent, acting as a resistance conductor, is heated in an electric incandescence furnace, and the current density through the charge is increased to a point where reduction is effected, the maximum temperature being maintained constant at a point at which volatilisation of the reduced metal is prevented. The latter is removed from the region of maximum temperature as it is reduced, by introducing into the furnace an alloying metal, such as iron, and causing it to percolate downward through the charge, thus collecting the scattered particles of reduced metal. The slag and reduced metal are tapped from the furnace at different levels.—B. N.

*Metallic Compounds; [Electrical] Process of Reducing* — E. F. Price, Niagara Falls, N.Y. U.S. Pat. 790,390, May 23, 1905.

The claims are similar to those in U.S. Pat. 790,389 (see preceding abstract), but in addition the process is claimed in conjunction with an electric arc furnace.—B. N.

*Metallic Compounds; [Electrical] Process of Smelting* — E. F. Price, Niagara Falls, N.Y. U.S. Pat. 790,391, May 23, 1905.

This invention relates to a process of smelting a metallic compound or compounds, containing iron or iron and chromium, for the formation of metallic products, such as iron or ferrochromium, containing a definite percentage of carbon. An electric arc is established within the electrically-conductive charge containing a predetermined amount of carbon, and the zone of reduction is surrounded by a considerable quantity of the charge, thus protecting the electrodes from the oxidising and cooling effect of the atmosphere. The minimum potential difference, requisite to effect reduction, is maintained between the electrodes, thereby preventing loss of electric current by leakage through the charge and by heat radiation. The reduced metal, or alloy, and the slag are tapped from the furnace at different levels.—B. N.

*Ferrochromium; [Electrical] Process of Producing* — E. F. Price, Niagara Falls, N.Y. U.S. Pat. 790,392, May 23, 1905.

This invention relates to a process similar to that described in U.S. Pat. 790,391 (see preceding abstract) for obtaining a metal or metals, such as ferrochromium, practically free from or low in carbon. The electric current is passed through the charge of carbon and combined iron and chromium, acting as a resistance conductor, and the current density is increased to a point where reduction is effected, the reduced metal or alloy being separated and maintained out of contact with the carbon in the charge by an intermediate layer of slag.—B. N.

*Ferrochromium; [Electrical] Process of Smelting Iron Ores and Producing* — E. F. Price, Niagara Falls, N.Y. U.S. Pat. 790,393, May 23, 1905.

The process is similar to that described in U.S. Pat. 790,392 (see preceding abstract), the charge of ore containing iron and an alloying metal and carbon, being interposed between superposed metal electrodes, which are cooled in order to maintain them at a relatively low temperature. The molten alloy, containing a minimum or definite percentage of carbon, is allowed to settle on the lower electrode of the same material, which thus comprises

a liquid and solid portion, the latter being cooled. The density of the electric current increases as it passes through the charge. The liquid product is removed, and charge materials supplied as required.—B. N.

*Ores; [Electrical] Process of Smelting Refractory* — E. F. Price, Niagara Falls, N.Y. U.S. Pat. 790,394, May 23, 1905.

The process is similar to that described in U.S. Pat. 790,393, (see preceding abstract) but is applied to the smelting of refractory ores, and it is mentioned that the charge is moved along the path of current flow.—B. N.

*Metals or Alloys; [Electrical] Process of Producing Carbon* — E. F. Price, Niagara Falls, N.Y. U.S. Pat. 790,395, May 23, 1905.

This invention relates to a process for producing carbon metals or alloys, such as ferro-chromium, by electrically smelting a charge containing an excess of carbon in order to first produce a material relatively rich in carbon. The high-carbon product is cast into an ingot, then broken into fragments, and the latter mixed with a decarburising agent containing calcium, capable of producing a non-gaseous carburised by-product, such as calcium carbide. The mixture, acting as a resistance conductor, is electrically heated to the temperature requisite to effect decarburisation, and the carbide and uncarburised product are separately removed, fresh charge materials being supplied as required.—B. N.

*Metals or Alloys; [Electrical] Process of Producing Carbon* — E. F. Price, Niagara Falls, N.Y. U.S. Pat. 790,396, May 23, 1905.

This invention is similar to that described in U.S. Pat. 790,395, (see preceding abstract) but the process is continuous one. The charge is smelted, using carbon electrodes, the latter being protected from oxidation by a considerable body of the charge. The slag is run off, and the high-carbon product is run from the zone of reduction into a separate chamber provided with a lining containing no carbon. In this chamber the material is electrically heated with lime, the slag, by-product, carbide and low-carbon product being withdrawn, and fresh charge mixture and decarburising agent supplied as required.—B. N.

*Metals or Alloys; [Electrical] Process of Producing Carbon* — E. F. Price, Niagara Falls, N.Y. U.S. Pat. 790,397, May 23, 1905.

This process is similar to that described in U.S. Pat. 790,396, (see preceding abstract) but the high-carbon product is caused to percolate through a granular material, such as lime, the latter being heated to a high temperature by interposing it as a resistance conductor in an electrical circuit in a separate chamber.—B. N.

#### FRENCH PATENT.

*Minerals and Metallurgical Products; Process of Treating* — in the Electric Furnace. K. F. Fr. Pat. 349,226, Dec. 20, 1904.

METALS and their alloys are extracted from minerals and other substances by a process of fractional vaporisation, without the addition of reducing agents, or the temperature of the electric current may be regulated in order to obtain the separate vaporisation of one of the metals.—B. N.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*Fatty Oils; Influence of Atmospheric Oxidation upon the Analytical Constants of* — H. C. Sherman, M. J. Falk. J. Amer. Chem. Soc., 1905, 27, 605-615.

THE authors have previously shown (this J., 1903, 25, 1003) that the change which takes place when non-drying or semi-drying oils are exposed to the air, consists mainly in the addition of hydroxyl groups, two of these groups



the places which, in the determination of the iodine would have been taken by two iodine atoms, according to Ballantyne (this J., 1891, 29) atmospheric oxidation causes no change in the volume of the ratio between the percentage increase in sp. gr. and rise in iodine value is the same as that between the ent weights of the hydroxyl group and the iodine or as 1:7.46. By applying a correction based on relation, samples of "exposed" olive, cotton-seed and poppy-seed oils, which had been so exposed as to give iodine values considerably below the limits, were identified. Tests of a large number of exposed oils showed that, in every case, the index of refraction had increased collaterally with the sp. gr., but to the same extent, so that the specific refractive power calculated by the formula  $\frac{(N-1)}{D}$  was in every case, considerably diminished. These results show that an oil having a low iodine value and specific refractive power, with high specific gravity, index of refraction and Maumené number may be considered as having undergone partial oxidation, as the result of either exposure or "blowing." The authors state that in order to restore the original iodine value of a semi-drying or non-drying oil, which has been altered by atmospheric oxidation, will be sufficient, in practice, to add 0.8 to the iodine value of the altered sample for each increase of 0.001 in sp. gr. at 15°/15° C. When the original sp. gr. is not known, the average sp. gr. for the species of oil under examination should be taken. The correction is applicable to all oils as well as to fatty oils.—A. S.

*Determination of Fat, Non-fatty Substances and Water in —.* P. Soltsien. XXIII., page 692.

*from Cottonseed-Meal-Fed Hogs; Examination by Bomer's Phytosteryl Acetate Method.* L. M. Bomer. XXIII., page 692.

*and Determination of the Saponification Value of —.* Schwarz. XXIII., page 692.

#### ENGLISH PATENT.

*and Manufacture of —.* A. Haase. Eng. Pat. 3438, Feb. 18, 1905. II., page 666.

#### FRENCH PATENTS.

*Acids; Liberation of — by Saponification with Potash or Other Seeds, or with the Cytoplasm Acting as a Neutral Medium.* M. Nieloux. Fr. Pat. 349,213, Dec. 19, 1904.

*and Use of an acid medium is not essential for the decomposition of fats (Fr. Pat. 335,902 of 1903; Dec. 19, 1904, 327—942), and even better results can be obtained by the use of a neutral solution of, e.g., calcium chloride, containing a small amount of magnesium chloride, the proportion of the salts varying with the nature of the fat, but not exceeding 0.5 per cent. of the weight of the fat.*—C. A. M.

*Carbons; Process for the Oxidation [and Distillation] of — [Production of Fatty Acids].* Soc. anon. des Combustibles Ind. Fr. Pat. 349,214, Dec. 19, 1904. III., page 668.

*[Liquid] and Apparatus for Distributing it.* L. Yvert. Fr. Pat. 349,232, March 14, 1904.

*Liquid soap is intended for public use in lavatories, and consists of a mixture of potash soap with glycerin. It is also made for any form of apparatus for distributing such liquid soap or soap solutions, and, in particular, a special apparatus described. This consists of a vessel, the lower part of which is prolonged into a tube which is a tap containing a hollow chamber to hold the liquid of soap intended to be distributed at each turn of the tap.*—C. A. M.

*Resins; [Electrical] Treatment of — and Residual Product [Sulphur].* A. Nodon. Addition dated March 1904, to Fr. Pat. 348,653, Feb. 16, 1904. XIII. B., page 682.

*Glycerin; Extraction of — in the Manufacture of "Mizarin" [Turkey-Red] Oil.* Syndicat internat. des Producteurs de Glycérine. Fr. Pat. 349,380, March 22, 1904.

*CLAIM is made for treating the castor oil with the sulphuric acid at a temperature not exceeding 35° C., at which temperature destruction of the liberated glycerin takes place. In the apparatus claimed for the process, the oil is placed in double-walled tanks of lead or other acid-resisting substance provided with hollow agitators, and the temperature is kept below 35° C. by means of leaden or other coils through which circulates a current of cold water. The Turkey-red oil is washed with water, with or without agitation, before being neutralised, &c., in the usual manner.*—C. A. M.

*Glycerin from Residual Liquors from Soap Works; Recovery and Distillation of —.* W. E. Garrigues. Fr. Pat. 349,352, Nov. 5, 1904.

SEE U.S. Pat. 774,172 of 1904; this J., 1904, 1153.—T. F. R.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER. Etc.

#### (A.)—PIGMENTS, PAINTS.

##### ENGLISH PATENT.

*Sulphide and other Ores; Apparatus and Process of Treatment of — [Manufacture of White Lead].* W. M. Barber, London. From G. E. Kingsley, Toronto, Canada. Eng. Pat. 23,909, Nov. 4, 1904.

*CLAIM is made for a combination of acid and water reservoirs, ore-converting and decomposing chambers, vats for lixiviation and precipitation, stills, &c., in which white lead is produced direct from galena or other ores of lead.*—J. H. C.

##### UNITED STATES PATENT.

*Paint, and Process of Preparing same.* H. V. Dunham, Bellows Falls, Vt. Assignor to Casein Co. of America, New Jersey. U.S. Pat. 790,821, May 23, 1905.

*CLAIM is made for a paint composition consisting of an earthy or mineral base, as talc or whiting, a mixture of vaseline and a vegetable oil, such as maize oil, and a binding composition comprising an "animal adhesive" such as casein or glue mixed in alkaline (ammoniacal) solution with potassium oxalate, boric acid, formaldehyde and creosote. For the preparation of a paint, a mixture of vaseline and a vegetable oil is heated until the vaseline is thoroughly melted and mixed with the oil, and the mixture is incorporated with a powdered mineral base and a binding composition containing an "animal adhesive."*—A. S.

##### FRENCH PATENT.

*Pigment; White —.* J. Gibaud and O. Bang. First Addition, dated 11 Nov., 1904, to Fr. Pat. 341,539, March 25 1904; (this J., 1904, 873).

*IN the present additional patent, claim is made for the use of calcium phosphate, either natural or artificial, as a basis upon which zinc sulphide may be precipitated, and also for the simultaneous precipitation of zinc sulphide and calcium sulphate by the reaction of a solution of calcium sulphide with one of zinc sulphate.*—M. J. S.

##### GERMAN PATENT.

*Varnish- and Oil-Colour Residues; Process for the Utilization of Dry —.* A. Gottschalk. Ger. Pat. 158,310, April 17, 1904.

*THE residues are exposed to the action of the vapours from a mixture of volatile hydrocarbons and alcohol in a closed vessel at the ordinary temperature, whereby they are softened, and can then be worked up in the usual manner.*—A. S.

## (B.)—RESINS, VARNISHES.

*Turpentine; Alteration of the Rotatory Power of Oil of —.* L. Raby. Ann. Chim. anal. appl., 1905, 10, 146—147. Chem. Centr., 1905, 1, 1471.

RIBAN has shown that the rotatory power of neutral and perfectly anhydrous oil of turpentine is not altered on distillation. If, however, oil of turpentine containing moisture, and of acid reaction, be distilled, the optical rotation of the distillate is only from  $-27^{\circ}$  to  $-28^{\circ}$  instead of the customary  $-35^{\circ}$  to  $-37^{\circ}$ . The rotatory power gradually attains the higher value if the distillate be preserved for about four months.—A. S.

## ENGLISH PATENT.

*Linoleum, Floor Cloths and the like; Manufacture of —.* L. W. Smith, Calcutta. Eng. Pat. 6371, March 25, 1905.

POWDERED "sola" (a common Indian plant) is substituted for the cork or wood meal usually employed in making linoleum. The pith only may be used for special purposes, the outer bark of the sola being removed.—A. G. L.

## UNITED STATES PATENT.

*Turpentine; Apparatus for Distilling —.* H. Birsh, Eastman, Ga. U.S. Pat. 790,635, May 23, 1905.

THE apparatus consists of a vertical cylindrical retort provided with feeding and discharging doors, and with a dome-shaped top, to which is connected a pipe leading to the condenser. Within the cylindrical portion of the retort is a supply-pipe "forming three sides of a rectangle, with the open side opposite the door, and with loops rising from the rectangular portion and extending to the dome." The pipes inside the retort are perforated.—A. S.

## FRENCH PATENT.

*Gum Resins; [Electrical] Treatment of — and Residual Product [Sylvine].* A. Nodon. First Addition, dated March 1, 1904, to Fr. Pat. 348,653, Feb. 16, 1904; this J., 1905, 552.

THE use of alkali carbonates instead of the hydroxides mentioned in the main patent (*loc. cit.*) is claimed; the mixture is distilled in the same manner, and the residue which contains an excess of alkali, but the properties of which are precisely similar to those obtained with the hydroxide, is designated "Sylvine No. 2." Inasmuch as it is found that the surfaces of the poles of the electric heater become covered with an insulating material, it is proposed to insert between the poles solid resistances imbedded in the pasty mass.—M. J. S.

## (C.)—INDIA-RUBBER, Etc.

*India-rubber; New Method of Preparing —.* P. J. Burgess. Chem. & Drug., 66, 911.

A METHOD of coagulating the latex of *Ficus elastica*, the tree from which "Rambong" rubber is obtained, is recommended by the Straits Government analyst, Mr. P. J. Burgess. On account of the acid nature of the latex from this tree, it is not possible to coagulate it by the acetic acid method as usually employed for *Hevea brasiliensis*. Up to the present the plan has been to expose the latex to the combined action of the sun and air, and if necessary to artificial heat. The method now advocated consists in warming the latex to  $40^{\circ}$  C. and treating it with a 2 per cent. solution of tannic acid. By gentle beating, the mixture in a few minutes sets to a cream, and on agitation becomes coherent, when it can be rolled or washed and prepared for the market. This is stated to be a practical process for use on rubber estates. By the use of this process it is possible to convert the coagulated latex into rubber with a saving of several months' time, and a better article is said to be produced.

*Cyclo-Oleenes.* R. Willstätter and H. Veraguth. XX., page 687.

## XIV.—TANNING, LEATHER, GLUE, SIZ.

*Hides; Weighing — in Water.* C. E. Park and G. H. Russell. Collegium 1905, 161—164, 171—

THE customary method employed in order to ascertain the percentage yield of leather from a given weight of hide is to weigh the goods after unhairing and allowing so many hours for drainage, and afterwards weigh the tanned leather. Sometimes the butts, shoulders and bellies are weighed separately, and the percentage yield of leather estimated by multiplying the pelt by a certain percentage, e.g., 70 per cent. in the butt pelt, 52 per cent. with belly pelt, and 55 per cent. with shoulder pelt. Owing to the very varied conditions under which the pelt may be weighed, and the amount of water contained in different pelts, this method is unreliable. The authors have proved the practicability of determining dry substances by weighing the goods in water as suggested by H. R. Procter and Carini. Hides are taken direct from the washing or deliming and are then weighed singly on a spring ("Sal") balance, and again after completely immersing in a length of copper wire connecting the hide to the balance. The weight in water is approximately one sixth the weight in the air. The sp. gr. of the dry substance of plumped butts having been found to be 1.425 and of plumped shoulders and bellies 1.375, the weight of dry hide substance may be calculated by multiplying the weight in water by the factor 3.38 in the butts and 3.754 in that of bellies and shoulders, the factor being calculated by division of the sp. gr. of the pelt by the difference between this sp. gr. and that of water. Having determined the weight of dry hide substance, it is possible, after ascertaining the percentage of dry substance contained in a sample of the same tanned leather by Kjeldahl's method, to predict the finished leather should weigh. Varying degrees of plumpness affect the sp. gr. of the pelt; a factor representing the degree of plumpness and termed the "average specific volume" can be obtained by deducting the weight of goods in water from the weight of goods in air and dividing by the weight of dry hide substance. This remains practically constant during the whole tanning process, and gives a true indication of the condition of goods prior to tanning. Butts gave 3.0 to 3.8, shoulders and bellies 4.0 to 4.7 c.c. of water per gram of dry substance. Carini has shown that the more plumped goods the more rapid the absorption of the tannin, and the greater the weight of leather produced. He gives a relation between the water weight and that of pelt at  $100^{\circ}$  C. as follows:—

Hides from "Soaks," with hair on ..	3.216
Hides from "Limes" after unhairing ..	3.353
Hides treated with sodium sulphide, and unhaired ..	3.227

The authors give the following results as the average determinations in each case for limed sole hides:—

	Sp. gr. Assumed.	Dry Substance per cent.	"Average specific volume"
Whole hides ..	1.4250	26.82	3.38
Bellies ..	1.3725	22.06	3.75
Shoulders ..	1.3760	21.19	3.75

## ENGLISH PATENT.

*Skins; Process for Bating and Puring —.* Amend. New York. Eng. Pat. 18,514, Aug. 26, 1903. Under Int. Conv., Sept. 3, 1903.

SEE U.S. Pat. 763,347 of 1904; this J., 1904, 756.

## UNITED STATES PATENT.

*Bones; Method of Treating — for the Production of Glue.* E. R. Hewitt, Garden City, N.Y. U.S. Pat. 783,784, Feb. 28, 1905.

THE bones are treated with successive quantities of



cent., aqueous solution of sulphurous acid, the mixture being kept below 70° F. (21° C.), and the acid separated, after each treatment, before it becomes fully saturated with the "bone salts."—A. S.

## XV.—MANURES, Etc.

### ENGLISH PATENTS.

*and other Refuse; Treatment and Utilisation of* — J. H. W. Stringfellow. Eng. Pat. 10,539, 1904. XVIII B., page 685.

*Purification of Coal* — X. Roux, B. W. Gonin & V. Thomson. Eng. Pat. 13,377, June 13, 1904. page 666.

## XVI.—SUGAR, STARCH, GUM, Etc.

*as Fuel*. R. Terry, S. Arnold and H. Fisher. *Coal of Mines Quarterly*, 1905, 26, 283–302.

It has been burned as a fuel in Hawaii, Java, Cuba, &c. The more sugar extracted from the molasses, the more its usefulness excepting for fuel, for the manufacture of alcohol and for feeding cattle. At present the usual method is to sprinkle the molasses on the bagasse as the last mill on its way to the furnace, in the proportion of 50 lb. to the ton of cane ground, or 1 part of molasses to 5 of bagasse. It is doubtful if it would pay to sprinkle the molasses on to the burning bagasse owing to the steam used for atomising, an item which does not occur in the present method of sprinkling; in factories where diffusion is used, including beet-sugar houses, where there is no bagasse, this method of spraying the molasses on to a coal fire or with oil could be used if desirable. The authors have made experiments on the efficiency of molasses when used in conjunction with fuel oil or residues of petroleum, and conclude that molasses may be evaporated of 2 lb. of water per lb. of molasses under proper conditions. Preheating of the molasses to render it sufficiently fluid to obviate clogging in the burner, and also facilitated the atomisation.

—L. J. DE W.

*Sugar; Action of Metals on Solutions of* — R. Vondráček. XXIV., page 694.

*New Reaction for* — A. Wochlk. XXIII., page 692.

### ENGLISH PATENT.

*and its Salts from the Molasses and Waste Products of Beetroot Sugar Manufacture; Manufacture of* — J. Siepel. Berlin. Eng. Pat. 15,934, July 18, 1904.

Eng. Pat. 344,954 of 1904; this J., 1904, 1229.—T. F. B.

### UNITED STATES PATENTS.

*Process of Refining* — F. Deussy, San Francisco, Cal. U.S. Pat. 790,036, May 16, 1905.

Molasses is purified by osmosis and mixed with a sugar solution, the mixture being then boiled to grain and the sugar separated, subsequently refined if necessary. The osmose water from the initial molasses is concentrated and again subjected to osmosis. The molasses freed from this second operation is mixed with the osmose water from the initial molasses, whilst the last osmose is treated with sodium nitrate, boiled and crystallised in tanks for the separation of the potassium salts, the washings of the crystals being reconcentrated with a quantity of saline liquors.—J. F. B.

*Molasses; Process of Treating* — F. Deussy, San Francisco, Cal. U.S. Pat. 790,035, May 16, 1905.

Molasses and "osmosing" water are caused to flow through the osmose vessel in contrary directions, the molasses being introduced at the bottom and the water at the top. The "osmosed" molasses is collected in a special reservoir at the top of the molasses chambers, and a portion of it is concentrated to a suitable extent and returned to the reservoir. The concentrated "osmosed" molasses from this reservoir is allowed to percolate into the molasses chambers of the osmosis apparatus, thereby increasing the mean density of the crude molasses undergoing osmosis therein.—J. F. B.

*Nitrated Carbohydrate [Starch]; Process of Making* — A. Hough. U.S. Pat. 790,840, May 23, 1905. XXII., page 691.

## XVII.—BREWING, WINES, SPIRITS, Etc.

*Mycoderma Yeasts; Some New Varieties of* — T. Takahashi. Bull. Coll. Agric., Tokyo, 1905, 6, 387–402. Chem. Centr., 1905, 1, 1476.

The author has isolated and examined several varieties of sporulating mycoderma yeasts from saké, koji, and saké mash. It was not found possible to decide whether these varieties were identical or not with the mycoderma yeasts which have been described previously. Some of the new varieties have the power of assimilating nitrogen from nitrates, in the presence of glycerol as the source of carbon, whilst some will develop in saké containing from 10.77 to 13.32 per cent. by weight of alcohol. Most of the new varieties are capable of producing from koji extract considerable quantities of methyl alcohol; this alcohol, also, is frequently present in ordinary saké. All of the mycoderma yeasts isolated, produce acetic acid from alcohol, and some also produce it from glycerol. Some of the new varieties produce also butyric acid and, occasionally, formic acid in sugar solutions.—A. S.

*Fusel Oil; Origin of* — F. Ehrlich. Z. Ver. deutsch. Zucker-Ind., 1905, 539–567.

The experiments recorded by the author corroborate the hypothesis, first enunciated by A. Müller in 1857, that the fusel oil of fermentation is a product of the action of yeast upon the albuminoid derivatives of the wort, and that the sugar plays no part in its formation. The author concludes that the two amyl alcohols of fusel oil are derived from leucine and isoleucine, and that the other higher alcohols and a portion of the fatty acids are derived from other members of the amino-acid series. It was found that, whereas pure-cultivated yeast acting upon pure sugar yielded only a trace of fusel oil, the same mixture yielded inactive amyl alcohol when leucine was added, and *d*-amyl alcohol when isoleucine was added, the quantity of amyl alcohol produced being approximately equivalent to that of the amino-acid consumed. It was also found in the case of leucine, that the yeast had selectively attacked this racemic amino-acid, and had confined its action solely to the *l*-leucine, leaving the *d*-leucine unchanged.

It is assumed that the small quantity of fusel oil produced in the fermentation of pure sugar is derived from the amino-acids of the yeast, the quantity being limited by the re-synthesis of albumin from the products of the proteolytic enzyme. It would appear that amyl alcohol is only formed in appreciable quantities when the yeast is supplied with an excess of amino-acids. Three hypotheses as to the mechanism of the formation of amyl alcohol from leucine are discussed. The most likely explanation is that the amino-acid combines with water and separates ammonia under the action of the yeast enzymes, with the production of the corresponding hydroxy-acid, and that this latter is decomposed into carbon dioxide and amyl alcohol in the same manner as lactic acid probably yields carbon dioxide and ethyl alcohol under similar conditions. It is suggested that isobutyl alcohol is produced from  $\alpha$ -amino-isovaleric acid and *n*-propyl alcohol from glutamic acid during fermentation.—J. F. B.

*Ethyl Alcohol; Acidity of Commercial — and its Variations during Storage.* R. Duchemin and J. Pourden. *Comptes rend.*, 1905, 140, 1466—1468.

THE authors have determined that alcohol is gradually oxidised in contact with air with the production of acetic acid. The degree of acidity is liable to vary more or less sensibly in both directions in comparatively short intervals of time during storage in glass vessels. The variations in the acidity may be due to differences between the rapidity of the oxidation of the alcohol and the saturation of the acid by the bases of the glass. Spirits of old manufacture scarcely ever contain more than 0.05 gm. of free acid per litre, and their acidity only changes when the containing vessel is changed. Nevertheless, whenever the free acidity of a spirit is neutralised, the acidity rapidly reappears and rises to a maximum point depending on the nature of the spirit. The acidity generally increases more rapidly in vessels of green glass than in those of white glass.—J. F. B.

*Enzyme and Ferment Action; Mechanism of —.* H. M. Dawson. XXIV., page 694.

*Oxydases; Further Observations on the —.* K. Aso. XXIV., page 694.

*Catalase.* A. Bach. XXIV., page 694.

*Fusel Oil; Detection and Determination of —.* T. Takahashi. XXIII., page 692.

*Saccharin; Detection of — in Beverages [Beer, Wine, &c.].* Villiers, Magnier de la Source, Rœques and Fayolle. XXIII., page 692.

#### ENGLISH PATENTS.

*Whisky and Brandy; Apparatus for the Distillation of —.* E. Vignier, London. Eng. Pat. 10,320, May 5, 1904.

THE apparatus consists of a pot still, provided with a heating coil and an inner still in the neck of the pot still. The vapours rising from the latter pass between the sides of the neck and the inner still, and are delivered either to an ordinary still neck and condenser or to a filtering device and condenser, from which the feints are obtained. The feints may be led back into the inner still which is in connection with a condenser. Above the neck of the pot still is placed a small feint purifying column also provided with a condenser. The casing of the feint purifying column is used as a rectifying chamber, into which the vapours are directed at the end of the distillation to cleanse them from feints and the latter are redistilled with the next charge in the pot still, or mixed with the spirit obtained during the first stage of the distillation.—W. P. S.

*Wines and Spirits; Process for the Maturing of — and for Sterilising Liquids.* V. Dorn, Berlin. Eng. Pat. 11,174, May 14, 1904.

SEE Fr. Pat. 341,671 of 1904; this J., 1904, 878.—T. F. B.

#### UNITED STATES PATENT.

*Soy Extracts; Apparatus for Making —.* T. Suzuki, Sunamura, Japan. U.S. Pat., 785,776, March 28, 1905.

THE apparatus consists of three vacuum evaporating pans, in series, working on the multiple effect system. The pans consist of a cylindrical drum containing the extract to be evaporated, surrounded by a steam jacket; a rotary stirring device is provided in each drum for keeping the liquid in motion, and the extremities of the stirring arms are fitted with brushes. The concentrated extract from the last evaporator is discharged into a vacuum finishing receptacle heated by hot water. This receptacle is divided into two sections, containing shelves composed of hot-water tubes, upon which trays containing the concentrated extract are placed for final drying; the air can be exhausted from either section independently.—J. F. B.

## XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS

### (A.)—FOODS.

*Foodstuffs; Application of Freezing in the Preparation of certain — in Japan.* T. Katayama. *Bull. Agric.*, Tokyo, 1905, 6, 433—436. *Chem. Centr.*, 1, 1508.

THE author describes the method of preparing the Japanese foodstuffs: *Kori-Konnyaku*, *Kori-Tofu*, *Kori-Mochi* (*Kori=Ice*). *Konnyaku* is obtained the roots of *Amorphophallus Rivieri* or *Conop Konnyaku*, containing chiefly mannann, by boiling lime-water, which destroys the acrid taste of the Tofu is prepared by treating the hot aqueous extract of soja beans with solutions of calcium and magnesium salts, whereby the alkali phosphates, which retain protein substances in solution, are decomposed, and protein bodies are precipitated. *Mochi* is obtained from rice. All three products are formed into tablets of soft pasty consistence, and are then subjected to a freezing process, whereby the greater part of the water is removed and the preparations are rendered stable. Owing to the formation of ice crystals in the paste, the products have a very porous structure, which not only increases digestibility, but also accelerates the drying process. Such a degree that the injurious action of bacteria and fungi is stated to be excluded.—A. S.

*Öidium Lactis and the Ripening of Cream and Cheese.* J. Arthaud-Berthet. *Comptes rend.*, 1905, 140, 1477.

*Öidium lactis* is present almost universally in the cream, and the author has isolated several varieties of it. He studied their action upon the various dairy products. Sterile milk or cream is obtained by a process of pasteurisation at 65° C., for a period of 5 minutes. Products pasteurised in this manner preserve all their natural characteristics and are devoid of the peculiar flavour of butter. The presence of *O. lactis* in cream is one of the most dangerous causes of rancidity of butter. Butter prepared from pasteurised cream keeps much longer than the unpasteurised product. The flavour of the finest butters can be reproduced by infecting pasteurised cream with lactic ferments, yeasts and casein ferment taken from good butters. In cheese making, *O. lactis* frequently the cause of a sickness known under the name of "graisse" or "frisure," especially on cheeses with mucedine. But in certain cases it plays a favourable and important part in the ripening. The ferments are the most indispensable of the micro-organisms in the dairy; they act as auto-regulators by reason of the lactic acid they produce from the lactose, which prevents the exaggerated development of *Öidium*, and also of butyric and certain injurious casein ferments. They assist the pressing of the cheese and facilitate the drying off of the whey. *O. lactis* consumes the lactic acid on the surface of the cheese, and thus induces the production of ammonia. It plays both a direct and indirect part in determining the flavour by permitting the growth of other bacteria in symbiosis and by the secretion of necessary enzymes. The casein is ripened by the specific action of the enzyme casease, and by the solvent influence of ammonia; the physical condition of ripened cheese can be imitated in sterile products by the use of ammonia alone.—J. F. B.

*Formaldehyde [in Milk and Butter]; Colorimetric Method for the Detection and Determination of —.* F. Bohn. *Bull. jun.* XXIII., page 693.

*Butter; Determination of Fat, Non-Fatty Substances and Water in —.* P. Soltsien. XXIII., page 69.

*Lard from Cottonseed-Meal-Fed Hogs; Examination of — by Bömer's Phytosteryl Acetate Method.* L. I. Tolman. XXIII., page 692.



## ENGLISH PATENTS.

*punder or Meal; Process for Making a —.* —. W. Maragliano, Rome. Eng. Pat. 15,440, July 11, 1904.

divided meat, previously freed from fat and bone, is placed in a vessel immersed in hot water, and is stirred. The volatile portion is condensed. The meat is then cooled for about 24 hours in a septic chamber, afterwards ground to a powder, and is then completely dried in a closed chamber over chloride or sulphuric acid. Over the meal thus obtained may be sprinkled the volatile portion condensed in the first part of the process. The mixture is sterilised in autoclaves, and filled into air-tight tins.—W. P. S.

*Separators; Impts. in —.* —. J. Meys, Siegen, Germany. Eng. Pat. 4841, March 8, 1905.

The separator consists of vertical curved separating walls, in the separator drum. The walls are from five to ten number and are connected tangentially with the drum, their inner edges extending up to or into the zone. The separating walls are connected to each other by means of bolts. A channel formed by a disc and the bottom of the drum provides an outlet for the skimmed milk, whilst the cream flows off by a pipe at the centre.—W. P. S.

*Separators; Centrifugal —.* —. J. Mélotte, Remilly, Belgium. Eng. Pat. 6102, March 23, 1905; Int. Conv., March 20, 1904.

ABLE ribs or projections are provided between the drum and false-bottom of the drum. By shortening or lengthening the projections, the quantity of milk passing with the cream is proportionally increased or decreased. This arrangement is of particular use in separating milks of varying richness. The alteration in the height of the ribs may be effected by a screw, or other device.—W. P. S.

## UNITED STATES PATENT.

*Method of Making Evaporated —.* —. J. A. Just, New York. U.S. Pat. 789,853, May 16, 1905.

partially digested by treatment with pepsin at a temperature of 100° to 110° F., and then quickly evaporated in the form of a film at a temperature of not over 212° F. Fat may be added to the milk after evaporation, and milk sugar to the evaporated mixture. May also be added to the milk before proceeding with digestion and evaporation. (See also Eng. Pat. 10,539, May 7, 1905, 206.)—W. P. S.

## GERMAN PATENT.

*[Milk]; Process for the Concentration of —.* —. Centrifugal Machine. A. Gürber. Ger. Pat. 277, April 18, 1901.

of all kinds, but especially milk, are concentrated by freezing out the solvent in a centrifugal machine, provided with a central rotating chamber containing a refrigerating agent.—A. S.

## —SANITATION; WATER PURIFICATION.

## ENGLISH PATENTS.

*and other Refuse; Treatment and Utilisation of —.* —. W. Stringfellow, Walthamstow, Essex. Eng. Pat. 10,539, May 7, 1904.

ject of the treatment is to convert the solid contents and soluble organic compounds of sewage, sludge, oil, household or trade refuse, and road sweepings into manures, and at the same time to obtain an unobjectionable effluent from the liquid portion of the refuse. For this purpose, the sewage is treated with caustic and aluminous products dissolved from furnace slag by sulphuric acid, and also with iron

solutions, lime and other chemicals, in order to precipitate the nitrogenous and phosphatic matters. Household refuse and the like, is, after sorting, treated with dry blast-furnace slag, a solution of an acid (sulphuric) being also added. The arrangement of tanks, automatic mixers, &c., is also claimed.—W. P. S.

*Sewage [Effluent]; Treatment of —.* —. A. McLean, London, and W. Paterson, Dumfries. Eng. Pat. 22,724, Oct. 21, 1901.

The effluent from the settling tanks is allowed to flow into a number of receptacles on the false bottom of which is placed a filtering medium. The latter consists of a layer of asbestos fibre about  $\frac{1}{2}$  in. in thickness, above which is placed a 3 in. layer of animal charcoal, and above this again a 3 in. layer of slag-wool or asbestos fibre. The layers may be of varying thickness, and each may be supported on a perforated tray. When necessary, the organic matter collecting on the filters can be burnt off, and the filters used again.—W. P. S.

*Sludge or Drain Water; Apparatus for Separating Mud or Solid Matter from —, in a Practically Dry Condition.* —. C. Kremer, Gr. Lichterfelde, and Ges. für Abwasserklärung m. b. H., Berlin. Eng. Pat. 541, Jan. 11, 1905.

The sludge is conveyed by means of a worm from a settling tank into a tall, vertical square vessel. The latter has a hinged bottom fitted with a discharge tap, and on this bottom are placed a perforated plate, a barred plate and a layer of filtering material, such as turf. A central pipe is fixed through the two plates and extends half the height of the box, where it receives a second pipe of smaller diameter and capable of sliding in it. This second pipe reaches up to and through a press filter at the top of the vessel. When the latter is screwed down, the exuding water passes down the two pipes and runs through the discharge pipe. A slide valve is provided to cut off the connection between the tank and filtering vessel, while the press is being screwed down. The cake of practically dry mud is removed by opening the hinged bottom of the vessel.—W. P. S.

## GERMAN PATENT.

*Liquids; Process for the Treatment [Sterilisation] of — with Ozone.* —. E. Fischer. Ger. Pat. 158,693, May 29, 1903.

In the usual process of treating liquids with ozone by passing the gaseous mixture from the ozoniser into the sterilising-tower, the gas, after its first passage through the liquid, is made to pass, for the most part, through a pipe connecting the upper and lower portions of the sterilising-tower, so that the ozone is brought repeatedly into contact with the same liquid, before escaping.—A. S.

## XIX.—PAPER, PASTEBOARD, Etc.

*Cellulose Aceto-Sulphates.* —. C. F. Cross, E. J. Bevan and J. F. Briggs. Ber. 1905, 38, 1859—1865.

WHEN cellulose is treated with mixtures of acetic anhydride and glacial acetic acid containing increasing proportions of sulphuric acid, a series of mixed aceto-sulphuric cellulose esters is obtained, containing proportions of combined sulphuric acid ranging from 5 to 25 per cent. The formation of the members of this series takes place in a graduated manner, the particular equilibrium obtained being determined by the concentration of the sulphuric acid in the reacting mixture. The products can be approximately separated according to their solubilities in acetone, alcohol and water. The most definite member of the series contains 8.76 per cent. of combined sulphuric acid and yields 50.6 per cent. of acetic acid on saponification. It is insoluble in water, but soluble in acetone and in

hot aqueous alcohol; the alcoholic solutions solidify to a jelly on cooling. It is distinguished by a relatively high proportion of hygroscopic moisture (about 8 per cent.), and by a great capacity for absorbing water to form a voluminous hydrated jelly. The sulphuric acid group resists the saponifying action of alcoholic potash, and remains combined with the cellulose in the form of a sulphate perfectly soluble in water.

A lower position in the series is occupied by a substance which contains 5 per cent. of sulphuric acid, and which has less affinity for water than the above, and is insoluble in hot alcohol. As the proportion of sulphuric acid is increased, the products become entirely soluble in water, but they can be precipitated by brine; these products still preserve their colloid character as cellulose derivatives.

—J. F. B.

#### ENGLISH PATENTS.

*Celluloid; Process for Producing Substances Resembling* — R. C. Gardner, London. From Chem. Fabr. vorm. Weiler-ter-Meer, Uerdingen, Germany. Eng. Pat. 15,435, July 11, 1904.

SEE Fr. Pat. 341,556 of 1904; this J., 1904, 880.—T. F. B.

*Silk; Manufacture of Artificial* — from Solutions of Cellulose. R. Linkmeyer and M. Pollak. Eng. Pat. 1501, Jan. 25, 1905. V., page 670.

*Cellulose; Manufacture of Lustrous Threads of* — R. Linkmeyer. Eng. Pat. 4761, March 7, 1905. V., page 671.

#### UNITED STATES PATENTS.

*Paper; Process of Making Stretchable* — J. Arkell, Canajoharie, N.Y. W. J. Arkell and B. Arkell, Executors of said J. Arkell, deceased. U.S. Pat. 790,921, May 16, 1905.

A SUITABLE finished paper is passed through a "saturating bath," and then deposited on a smooth-surfaced roller, the surplus moisture is squeezed out by another roller, and the paper, while still damp, is "crowded back against itself" forming crinkles in the paper. The crinkled paper is then dried to render the crinkles permanent. The paper is extended laterally before being crinkled, and may, in one variety of the process, be passed through two baths in succession. The treated paper is capable of being stretched, and is suitable for packing purposes.—W. H. C.

*Cotton Seed; Treatment of* — J. Kitsee, Philadelphia. U.S. Pat. 789,977, May 16, 1905.

COTTON seed with its adherent fibre is subjected to a process of nitration. The nitrated product is then treated with a solvent which dissolves the nitrocellulose, and the solution is separated from the residue of the seed.—J. F. B.

*Cotton Seed; Treatment of* — J. Kitsee, Philadelphia. U.S. Pat. 789,978, May 16, 1905.

THE seed is first subjected to a treatment whereby the hull is broken and the kernel is separated. The hulls and the adherent fibres are then nitrated, the nitrated product is treated with a solvent, and the solution is separated from the residues of hulls.—J. F. B.

*Triacetyl Cellulose*. A. Eichengrün and T. Becker, Elberfeld, Germany. Assignors to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 790,565, May 23, 1905.

SEE Fr. Pat. 317,007 of 1901; this J., 1902, 870.—T. F. B.

#### FRENCH PATENT.

*Celluloid; Non-inflammable* — P. Germain. Fr. Pat. 349,292, Dec. 8, 1904. Under Int. Conv., Sept. 19, 1904.

A NON-INFLAMMABLE celluloid is said to be produced by incorporating with the paste made from celluloid and acetone, some salt which, on heating, evolves a considerable quantity of gas which does not support combustion, e.g., a bicarbonate. Articles made of celluloid which are

non-porous, may be rendered porous by partially dissolving the camphor, when they are treated with as above. The fire-proofed material is then rendered non-porous by treatment with a small quantity of alcohol and drying, which process is said to cover the celluloid with a thin non-porous layer.—T. F. B.

### XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Bismuth Nitrites; Complex* — W. C. Ball. Soc. Trans., 1905, 87, 761–765.

*Bismuth Sodium Ammonium Nitrite*.—Powdered bismuth nitrate (10 grms.) was dissolved in a saturated solution of 15 grms. of ammonium nitrate at 0° C., and the solution poured gradually into an ice-cold, nearly saturated solution of 15 grms. of sodium nitrite, slightly acidified with nitrous fumes. The liquid was at once decanted, and a precipitate drained on a porous tile, pressed, and between porous plates in a desiccator at 0° C. The product was obtained as bright yellow octahedra with a slight fluorescence; it had the composition  $\text{Bi}(\text{NO}_2)_3 \cdot 2\text{NH}_4\text{NO}_2$ , and decomposed slowly even at 0° C. *Bismuth Potassium Nitrite*.—This was obtained by passing nitrous fumes into a suspension of bismuth hydroxide in a concentrated potassium nitrite solution. It is an orange-red crystalline compound of the composition  $\text{Bi}(\text{NO}_2)_3 \cdot 3\text{KNO}_2 \cdot \text{H}_2\text{O}$ ; it is immediately hydrolysed by water, but is stable at the ordinary temperature, and, unlike other compounds prepared, it does not detonate when struck. *Other Complex Bismuth Nitrites*.—By reacting bismuth nitrate with a saturated solution of sodium nitrite, filtering in absence of air, and allowing the liquid to drop slowly into a saturated solution of ammonium nitrate at 0° C., the compound,  $\text{Bi}(\text{NO}_2)_3 \cdot 2\text{NH}_4\text{NO}_2 \cdot \text{NH}_4\text{NaNO}_3$ , was obtained in small canary-yellow crystals which gradually decompose even at 0° C. A triple nitrite of bismuth, copper and ammonium, a double compound, probably a double nitrite of bismuth and cinchonine, and also an orange-coloured tetrameric ammonium salt were also prepared.—A. S.

*Phenol; Note on* — L. Reuter. Pharm. J., 1905, 74, 787–788.

IN order to prevent crystallised phenol from becoming rancid it is recommended to add sulphurous anhydride to melted phenol in quantity large enough to counteract the oxidising influence of the air or other oxidising agent. For carrying the method into effect, it is suggested to saturate liquefied phenol, containing 10 per cent. of water, with sulphurous anhydride until it contains about 10 per cent. of the latter. If from 25 to 75 c.c. of this solution are added to 200 kilos. of melted phenol, the latter may be preserved in a perfectly colourless condition for almost unlimited length of time, whereas untreated phenol from the same source soon assumes a red colour even when kept in a dark place and in tightly corked bottles. Seeing that a slight discoloration of phenol does not interfere with its application in medicine, the author considers that, to avoid mistakes and accidents, it would be advisable to tint all carbolic acid sold by druggists uniformly with some organic colouring matter rather than use a preserving or decolorising agent.—B.

*Adrenaline; Synthesis of Substances Allied to* — H. D. Dakin. Chem. Soc. Proc., 1905, 21, 154–155.

METHYLAMINOACETYL-CATECHOL,  $\text{C}_6\text{H}_3(\text{OH})_2 \cdot \text{CO} \cdot \text{CH}_2 \cdot \text{N}(\text{CH}_3)_2$ , is obtained by the action of methylamine on chloroacetyl catechol; it is crystalline, melts at 232° C., and forms crystalline salts, the solutions of which are faintly acid. According to the view generally held, adrenaline is regarded as the secondary alcohol corresponding to the ketone, methylaminoacetyl catechol. By subjecting the latter compound or its bisulphate compound to electrolytic reduction, a base is obtained which is apparently not identical with, but has similar physiological properties closely allied to those of natural adrenaline. The free base is not precipitated by



us of its salts by sodium acetate, but separates, tion of ammonia, as a white, amorphous precipitate, is very sparingly soluble in most neutral solvents, se is extremely unstable in the dry condition, but y kept for some time if suspended in water. Homobases of similar chemical and physiological ties were obtained by the electrolytic reduction of hases obtained by the action of various amines proacetylacetol.—A. S.

temisin (*Ĉ-Oxy-santonin*). E. Wedekind and A. Koch. Ber. 1905, 38, 1845—1851.

oxy-santonins have previously been described, these being products of the living organism, viz.: 1  $\beta$ -oxy-santonins, recovered from the urine of s treated with santonin, and  $\gamma$ -santonin or artemisin occurs together with santonin in *Artemisia maritima*. In itself either resists the action of oxidising agents broken down into simple products. The authors prepared a fourth oxy-santonin by heating mono-santonin under pressure, either with alcoholic potash (C), or with aqueous sodium acetate at 110°—115° C. product is  $\gamma$ -oxy-santonin or iso-artemisin  $C_{15}H_{18}O_4$ ; ts at 214°—215° C. and has  $[\alpha]_D^{20} = -108.6$ ; it yields a phenylhydrazone melting at 176°—178° C. osition and nature of the fourth oxygen atom t yet been determined, but it would appear that ot of a hydroxyl nature, since the new compound neither an acetyl nor a benzoyl derivative.—J. F. B.

Delencs. R. Willstaetter and H. Veraguth. Ber. 1905, 38, 1975—1984.

uthors applied methods used for obtaining hydro- s from alkaloids of the tropine series to N-methyl onine ( $\psi$ -peltierine). By exhaustive methylation alkaloid they obtained cyclo-octadiene, an unsatura- drocarbon of b. pt. 39.5° C., under 16.5 mm. pressure. substance is characterised by its tendency to poly- to a crystalline mixture, principally consisting of octadiene. It shares this property with cyclo- diene (this J., 1896, 443). With regard to the work of Harries (this J., 1905, 448), this property hydrocarbon opens a view on the relation of india- to the cyclo-octadienes. According to Harries, aoutchouc is a polymeride of dimethyleyclo- ene and the authors' hydrocarbon has possibly to arded as the mother substance of india-rubber. The carbon readily takes up bromine and reduces ium permanganate. Cyclo-octatriene was obtained ating the mixture of bromocyclo-octadienes with hylamine and exhaustive methylation of the thus d *des*-dimethylgranatonine. This hydrocarbon of 36°—40° C. under 13 mm. pressure does not poly- —R. L.

r-grass Oil. H. Walbaum and O. Hühlig. J. prakt. Chem., 1905, 71, 459—473.

constants of commercial ginger-grass oil should lie en the following figures:—Sp. gr. at 15° C., 0.9277—0.931;  $\alpha_D^{20} = -29^\circ 25'$  to  $+22^\circ 40'$ ; acid value, 0.9 to ester value, 9.5 to 24; saponification value after lation, 130 to 172. The oil dissolves in 1 vol. of 9 per cent. alcohol, and in 2—3 vols. of 70 per cent. ol. The constants of the samples used in this research within these figures. The oil distils from 50°—100° C. —6 mm. From the lowest fractions, the following nes were isolated:—*d*- $\alpha$ -phellandrene, b. pt. 175°—177° C.;  $\alpha_D^{20} = +44^\circ 40'$ ; *d*-limonene, b. pt. 176°—178° C.;  $+42^\circ 40'$  and *d*-limonene; the presence of each of was confirmed by the preparation of characteristic atives. An aldehyde  $C_{10}H_{16}O$  was detected in the ion boiling between 80° and 90° C. It boiled at 78° C. at 5 mm., at 221°—224° C. at 754 mm., t. at 15° C. 0.9351,  $\alpha_D^{20} = +0^\circ$ ,  $n_{D20}^{20} = 1.47348$ . The amount was about 0.2 per cent of the oil. By ing the 80°—83.5° (5 mm.) fraction of the oil with a neutral sodium sulphite solution, adding small ities of acetic acid from time to time, and then ng excess of sedi m carbonate to the aqueous portion, quantity of inactive carvone was obtained, boiling at

230°—231° C. (See this J., 1904, 303.) The alcoholic portion (50—60 per cent.) of the oil boiled between 85 and 95° C. at 5 mm. This fraction was dissolved in benzene and then pyridine and benzoyl chloride added. On steam-distillation, the benzoic acid esters of *geraniol* and a new alcohol,  $C_{10}H_{16}O$ , remained behind. The geraniol was removed by shaking with anhydrous calcium chloride, and then boiled at 229°—230° C. The portion not affected by the calcium chloride was treated with 90 per cent. formic acid at 80° C. to convert the remaining geraniol into terpenes. After fractionation, this new alcohol was obtained as a colourless, slightly viscous oil, with a characteristic odour, resembling that of terpineol. It boils at 226°—227° C. at 767 mm., and 92°—93.5° C. at 5 mm.; sp. gr. at 15° C. 0.9510,  $\alpha_D^{20} = -13^\circ 18'$ ;  $n_{D20}^{20} = 1.49629$ . By working with an oil of *levo*-rotation, a *levo*-rotatory modification of the alcohol was obtained with the following constants: b. pt. 228°—229° at 755 mm., and 94°—96° at 4—5 mm.; sp. gr. at 15° C., 0.9536;  $\alpha_D^{20} = +12^\circ 5'$ ;  $n_{D20}^{20} = 1.49761$ . Its properties agree with those of *dihydrocuminic alcohol*.—F. S.

Cananga: Essential Oil of —. Adulteration with "Cocoa Butter" and Resin. Schimmel's Report, May, 1905, 19.

CANANGA oil is frequently adulterated with "cocoanut fat," in some cases to the extent of 50 per cent. Such oil shows a separation of solid matter at normal temperatures, whereas the pure oil does not congeal even when immersed in a freezing mixture. Both this adulterant and resin are detected by submitting the oil to steam distillation, when the residue from pure oil does not exceed 5 per cent.

Pure cananga oil has the following characters:—Sp. gr. at 15° C. 0.910 to 0.950;  $\alpha_D^{20} = -17^\circ$  to  $-55^\circ$ ; saponification value, 10 to 36. —J. O. B.

Caraway: Constituents of Essential Oil of —. Schimmel's Report, May, 1905, 19—21.

CARAWAY oil, in common with other oils derived from Umbelliferous fruits, contains a trace of a base with a peculiar odour. In addition to carvone and carvene, dihydrocarvone and dihydrocarveol are found to be present in the oil.—J. O. B.

Copaiba Oleoresin [Copaiba "Balsam"]. Schimmel's Report, May, 1905, 24.

THREE varieties of copaiba "balsam" examined had the following characters:—

*Para Balsam*.—Sp. gr., 0.9692;  $\alpha_D^{20} = -41^\circ 21'$ ;  $n_{D20}^{20} = 1.51425$ ; acid value, 60.75; saponification value, 64.72.

*Bahia Balsam*.—Sp. gr., 0.9603;  $\alpha_D^{20} = 0^\circ 18'$ ;  $n_{D20}^{20} = 1.50693$ ; acid value, 57.90; saponification value, 67.40.

*Angostura Balsam*.—Sp. gr., 0.9882;  $\alpha_D^{20} = 26^\circ 15'$ ;  $n_{D20}^{20} = 1.51603$ ; acid value, 86.54; saponification value, 96.41. The above figures for the saponification value were obtained by Dieterich's cold saponification method; by the hot process, official in the Ph. G. IV., lower figures resulted.

All three "balsams" behaved similarly with light petroleum spirit, giving at first a clear solution, becoming turbid with more of the solvent, finally forming a flocculent separation. All dissolved to a clear solution in chloroform. Para and Angostura balsams also gave clear solutions in alcohol and in amyl alcohol; but Bahia balsam gave cloudy solutions with both of these solvents.

*Essential Oil of Para Balsam*.—Yield, 62.5 per cent.; colour, yellow; sp. gr., 0.9180 at 15°;  $\alpha_D^{20} = -78^\circ 48'$ ;  $n_{D20}^{20} = 1.50096$ ; acid value, 3.14; ester value, nil; solubility in 95 per cent. alcohol, 1:7.5 to 1:8.

*Essential Oil of Bahia Balsam*.—Yield, 61.93 per cent.; colour, faint yellow; sp. gr., 898.2 at 15° C.;  $\alpha_D^{20} = -9^\circ 37'$ ;  $n_D^{20} = 1.49460$ ; acid value, 7.89; saponification value, 9.82; solubility in 95 per cent. alcohol, 1:8 to 1:40 with slight turbidity.

*Essential Oil of Angostura Balsam*.—Yield, 52.3 per cent.; colour, faintly green; sp. gr., 0.9161;  $\alpha_D^{20} = -2^\circ 20'$ ;  $n_{D20}^{20} = 1.50169$ ; acid value, 10.89; ester value, nil; solubility in 95 per cent. alcohol, 1:5.5.—J. O. B.

Cypress [*Cupressus sempervirens*]; Essential Oil of —. Schimmel's Report, May, 1905, 26—27.

French Distilled Cypress Leaf Oil.—The oil distilled in

the South of France from fresh material has the following characters:—Sp. gr. at 15° C., 0.868 to 0.878;  $\alpha_D^{22}$  to +31°; acid value, 0; ester value, 5 to 10; acetyl value, 10 to 15; solubility, 1.5 to 1.6 and more in 90 per cent. alcohol.

*German Distilled Cypress Leaf Oil*, from partially dried French material, has the sp. gr., 0.880 to 0.892;  $\alpha_D^{22}$  to +18°; acid value, 1.5 to 3.0; ester value, 15 to 22; acetyl value, 43 to 49; solubility in 90 per cent. alcohol, 1.2 to 1.6 or more.

*French Distilled Cypress Fruit Oil* has the sp. gr., 0.866 at 15° C.;  $\alpha_D^{22}$  +30° 48'; acid value, 0; ester value, 6.74; acetyl value, 11.78; solubility in 90 per cent. alcohol, 1.6 and more.—J. O. B.

*Cypress [Cupressus lambertiana]; Essential Oil of ——. Schimmel's Report, May, 1905, 83.*

THE oil, distilled in the South of France, has a balsam-like odour probably due to a small amount of citronellal. Aldehydes were detected by the bisulphite reaction, but the amount present was too small to permit of identification. The non-aldehydic portion had a pepper-like odour, and may contain cymene. The oil had the following characters:—Sp. gr. at 15° C., 0.8656;  $\alpha_D^{22}$  +31° 53'; acid value, 1.5; ester value, 13.9; acetyl value, 50.82; solubility in 90 per cent. alcohol, 2.1, and more; with 80 per cent. alcohol the 1:9 or 1:10 solutions are cloudy.

—J. O. B.

*Hops; Essential Oil of ——. Adulterated with Gurjun Balsam. Schimmel's Report, May, 1905, 49.*

ADULTERATION with gurjun balsam is recorded in a specimen of hop oil. The sophisticated oil, which had a faint, greenish fluorescence, had the sp. gr., 0.9189,  $\alpha_D^{22}$  = -40° 40'; when fractionated, the  $\alpha_D$ -rotation of the fractions increased up to -86° 50'. Genuine hop oil has the sp. gr. 0.855 to 0.880 and is almost inactive optically, as are its fractions.—J. O. B.

*Lavender; Adulteration of Essential Oil of ——. Schimmel's Report, May, 1905, 50.*

THE scarcity of lavender oil and the consequent high prices ruling have occasioned the appearance of much adulterated lavender oil in the market. The chief adulterants used are oils of turpentine, rosemary, spike, and the so-called Spanish lavender oil.

*Turpentine oil* lowers the sp. gr. and solubility, and affects the rotation, whilst French turpentine oil increases the normal  $\alpha_D$ -rotation of lavender oil, and American turpentine lessens it. *Spike oil* increases the sp. gr. and lowers the rotation, but does not affect the solubility. *Spanish lavender oil* behaves like spike oil, but has less influence on the rotation, while *rosemary oil* affects the constants similarly, and renders the oil less soluble. All these oils, having lower ester values, considerably lower the ester content.

The characters of *pure French lavender oil* are—Sp. gr., 0.882 to 0.895;  $\alpha_D^{22}$  -3° to -9°; ester content, 30–40 per cent. or more (calculated as linalyl acetate); solubility in 70 per cent. alcohol, 1.2 or 1.3, and more, with slight opalescence in oils rich in ester.

A fictitious ester value was found to be given to one sample of lavender oil adulterated with Spanish lavender oil, by the addition of *ethyl succinate*. In addition to determining the ester value, it is necessary, therefore, when examining lavender oil, to also ascertain the nature of the ester by liberating and identifying the acid and alcohol after saponification.—J. O. B.

*Patchouli Leaves; A Basic Constituent of Essential Oil of ——. Schimmel's Report, May, 1905, 60–61.*

FURTHER details are now given of one of the two basic bodies previously recorded (this J., 1904, 679). On prolonged standing, a considerable crop of a crystalline hydrochloride was obtained, which, after purifying by recrystallisation from benzene, had the m. pt. 175° C., and the formula  $C_{14}H_{23}NO.HCl$ . The crystalline platinum-chloride,  $(C_{14}H_{23}NO.HCl)_2PtCl_4$  had the m. pt. 175° C.—J. O. B.

*Peppermint; Essential Oil of French ——. Schimmel's Report, May, 1905, 6.*

ALTHOUGH peppermint is grown in considerable quantity in the South of France, and oil is produced there, it does not appear in commerce, since the whole is consumed in the country of its production.

Three specimens recently examined had the following characters:—Sp. gr. from 0.9108 to 0.9219;  $\alpha_D^{22}$  -5° 20' to -35° 18'; menthol as esters 9.95 to 20.81 per cent. total menthol 45.75 to 60.29 per cent. Only one specimen was soluble in 70 per cent. alcohol 1:3.5; the other were insoluble 1:10. All showed opalescence on further dilution with 80 per cent. alcohol, due to separation trace of a paraffin. The marked variation in the results, attributed to differences in the maturity of plants, is also probably influenced by conditions of soil and culture.—J. O. B.

*Lemon "Petitgrain" and Sweet Orange "Petitgrain" Essential Oils of ——. Roure-Bertrand Fils, through Schimmel's Report, May, 1905, 64–65.*

"*Lemon petitgrain oil*" obtained from the twigs and leaves of *Citrus limonum* is yellow in colour, and has the following characters and constituents:—Sp. gr. at 15° C., 0.8824;  $\alpha_D^{22}$  = +21° 8';  $n_D^{25}$  = 1.4725; citral, 24 per cent. citronellal, none; ester content (calculated as geranyl acetate) 10.5 per cent. Total alcohols 19.4 per cent. comprising 11.6 per cent. of geraniol. The oil closely resembles "sweet orange petitgrain oil."

"*Orange Petitgrain Oil*" from the leaves and twigs of *Citrus aurantium* is also yellow; sp. gr. 0.8602;  $\alpha_D^{22}$  56° 46';  $n_D^{20}$  = 1.472; it contains 4 per cent. of citral, 4.1 per cent. of esters, total alcohols 19.7 per cent. of which 12.7 per cent. was geraniol; dextro-camphene, limonene were also detected with, possibly, some linalyl.—J. O. B.

*Sandalwood; Adulteration of Essential Oil of ——. Castor Oil. Schimmel's Report, May, 1905, 70–71.*

TWO samples of sandalwood oil in capsules have been found to be adulterated with castor oil. Steam distillation is an efficient method of detecting this sophistication; the residue thus obtained with genuine sandalwood after 10 hours' distilling, was 8.6 per cent., compared with 26.76 and 22 per cent. with the adulterated samples. The residue of genuine sandalwood oil is soluble in all proportions in both light petroleum spirit and in 90 per cent. alcohol. Castor oil is insoluble in the former solvent and any other fatty oil in the latter.—J. O. B.

*Finland Pine Tar Oil, the so-called "Crude Oil of Turpentine." E. Sundwik. Schimmel's Report, May, 1905, 79, after Pharm. Centralh., 45, 859.*

IN Finland, the essential oil of *Pinus silvestris* is obtained by dry distillation, as a by-product in the distillation of tar and other bodies. Although known there, it is widely used for technical and medicinal purposes. "Crude turpentine oil," it is quite distinct from the essential oil of turpentine, having an empyreumatic odour, and a more pronounced toxic action. The latter property renders it unsuitable for use as an antidote for phosphorus. It shows but slight reaction with iodine or chlorine, and does not absorb oxygen, since it contains much less pinene than true turpentine oil. It should be described as pine tar oil, and not as "crude oil of turpentine."—J. O. B.

*Fagara Octandra; Essential Oil of the Wood of ——. Schimmel's Report, May, 1905, 82.*

THE oil of the Mexican tree *Fagara octandra* Nat. C. Rutaceae, is yellow in colour, and has an odour of linalyl sp. gr. 0.922 at 15° C.;  $\alpha_D^{22}$  +2° 30'; solubility in 90 per cent. alcohol, 2:1 becoming cloudy when more than 1.5 volume of solvent is added; ester value 6.09.—J. O. B.

*Inula Gravacens; Essential Oil of ——. Schimmel's Report, May, 1905, 82.*

THIS composite, common in the Mediterranean region, yields, on distillation, a brown oil with a greenish fluor-



Sp. gr. 0.9754 at 15° C.;  $\alpha_D = -36^\circ 40'$ ; acid 8.45; ester value, 161.3; acetyl value, 239.38; in 70 per cent. alcohol 1:3 to 1:3.5 and more, considerable separation of paraffin. From its odour would seem to contain bornyl acetate.—J. O. B.

*Isia Citriodora*; *Essential Oil of* —. Schimmel's Report, May, 1905, 83.

right yellow oil of this Australian Myrtaceous as a similar odour to lemon-grass oil, but is more; sp. gr. 0.8972 at 15° C.;  $\alpha_D = +0$ ; it contains 15 per cent. of aldehyde, probably wholly citral; in 70 per cent. alcohol 1:1.8 and more.—J. O. B.

*Camphora*; *Essential Oil from the Leaves of* —. Schimmel's Report, May, 1905, 83.

colourless oil distilled from the leaves of the camphor growing at Cannes, has a pronounced cardamom odour, and closely resembles cardamom oil in odour. Yield 0.52 per cent.; sp. gr. 0.9058;  $\alpha_D = 15^\circ$ ; acid value, 0.34; ester value, 8.82; acetyl 6.49; solubility in 80 per cent. alcohol 1:1, and more; under 4 mm.) 35° to 95° C. The lower boiling contains pinene and probably camphene. Cineol present in considerable quantity. The higher-boiling contains levo-terpineol. This oil is quite different from any camphor leaf oil previously recorded.—J. O. B.

*Mala*; *Essential Oil of Fruit of* —. Schimmel's Report, May, 1905, 84.

oil, closely resembling cardamom oil, obtained by distilling the fruit of this African Zingiberaceous plant at German East Africa, was brownish-yellow in colour. Yield 0.76 per cent.; b. pt. (under 7 mm.), 51° to 52°; sp. gr. 0.9016 at 15° C.;  $\alpha_D = -10^\circ 54'$ ; acid value, 1.7; acetyl value 67.05; solubility in 70 per cent. alcohol 1:1 to 1:1.5, or more, with turbidity. Contained much cineol and terpineol.—J. O. B.

*Hardwickia Binata*; *Oleoresin of* —. Schimmel's Report, May, 1905, 85.

oleoresin of the Indian Leguminous tree, known as "ikulavo oil," is reddish-brown, with a green odour and a peculiar odour. Sp. gr. 1.0021 at 15° C.; acid value, 96.15; ester value 12.31; insoluble in 80 per cent. alcohol. On steam distillation yields 44 per cent. of colourless oil, the residual being green and brittle. The essential oil has the following properties:  $\alpha_D = 7^\circ 42'$ ; acid value, 0.85; ester value, 2.88; solubility in 95 per cent. alcohol, 1:5 and 1:10.—J. O. B.

*hera Polyantha*, var. *Citrata*; *Essential Oil of the Leaves of* —. Schimmel's Report, May, 1905, 85.

oil.—Yield, 0.81 per cent.; colour, lemon yellow; sp. gr. 0.8404 at 15°;  $\alpha_D = 10^\circ 11'$ ; solubility in 80 per cent. alcohol, 1:1 and more; it contains aldehydes, pinene and citronellal.

oil.—Yield, 5.42 per cent.; colour, bright yellow; sp. gr. 0.9042 at 15° C.;  $\alpha_D = 15^\circ 41'$ ; solubility in 70 per cent. alcohol 1:2.5 to 1:3. Citral appears to be the only aldehyde present, to the extent of about 30 per cent. was found in the non-aldehydic portion.—J. O. B.

*Aldehyde*; *Study of Methods for the Determination of* —. R. H. Williams. XXIII., page 693.

*Valene*; *Oxidation of* — to *Phthalic Acid*, by means of *Concentrated Sulphuric Acid in presence of* — or *Salts of Rare Earths*. H. Ditz. IV., page 668.

*Aldehyde*; *Colorimetric Determination of* — by means of *Indane*. J. E. Abelous, A. Soulié and G. Tonian. III., page 693.

#### ENGLISH PATENTS.

*Aldehydes*; *Impts. relating to* —, and to the *Manufacture of the same*. S. Gärtner, Halle-on-the-Saale. many. Eng. Pat. 14,955, July 4, 1904.

Eng. Pat. 768,744 of 1904; this J., 1904, 950.—T. F. B.

*Chloroform*; *Preparations for the Production of* —. O. Liebreich, Berlin. Eng. Pat. 15,930, July 18, 1904.

The invention relates broadly to a product consisting of a dry mixture of chloral hydrate and alkali, which may be compressed into any convenient shape. On treating with water, chloroform is produced.—F. S.

*Pyrimidines*; *Method for the Preparation of* —. E. Merck, Darmstadt. Eng. Pat. 22,126, Oct. 14, 1904. Under Int. Conv., Jan. 28, 1904.

For the production of 4-imino-2,6-dioxypyrimidines, an acidyl urea or its alkyl derivative is mixed with sodamide or other alkali metal amide, and xylene, then a cyanacetic ester is cautiously added, and after a time the mixture heated in an oil bath to 120°–150° C. for 5–6 hours. Water is added, and the product isolated from the aqueous portion. (See this J., 1905, 151, 456 and 512.)—F. S.

*Pyrimidines*; *Method for the Preparation of* —. E. Merck, Darmstadt. Eng. Pat. 22,127, Oct. 14, 1904. Under Int. Conv., Jan. 28, 1904.

CLAIM is made for the preparation of 4-imino-2,6-dioxypyrimidines by a method similar to that of the previous patent, but using finely divided sodium in place of sodium amide, or using sodium alcoholate in alcoholic solution.—F. S.

*Pyrimidines*; *Method for the Preparation of* —. E. Merck, Darmstadt. Eng. Pat. 22,128, Oct. 14, 1904. Under Int. Conv., Nov. 14, 1903.

UREA or its alkyl derivatives may be readily condensed with esters of cyanacetic acid to form 4-imino-2,6-dioxypyrimidines with the aid of alkali metals or their alcoholates.—F. S.

*Pyrimidines*; *Method for the Preparation of* —. W. L., E. A., and C. E. Merck, Darmstadt, Germany. Eng. Pat. 22,129, Oct. 14, 1904. Under Int. Conv., Nov. 12, 1903.

SEE Fr. Pat. 349,353 of 1904; following these.—T. F. B.

#### FRENCH PATENTS.

*Ureas* [or *Pyrimidines*]; *Process for Producing Cyclic* —. E. Merck. Fr. Pat. 349,353, Nov. 8, 1904. Under Int. Conv., Nov. 12, 1903.

UREA, or one of its mono-alkyl or symmetrical dialkyl derivatives is condensed with cyanoacetic esters in presence of an alkali amide, with or without some solvent such as xylene, with the formation of 4-imino-2,6-dioxypyrimidine or alkyl derivatives thereof. These compounds may be converted into the corresponding barbituric acids in the usual manner.—T. F. B.

*Dialkylbarbituric Acids*; *Process for Preparing* —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 349,320, Dec. 21, 1904. Under Int. Conv., March 18, 1904.

SEE U.S. Pat. 787,360 of 1905; this J., 1905, 559.—T. F. B.

#### GERMAN PATENTS.

*Aldehydes, and Negatively Substituted Acetic Acids*; *Process for Producing Condensation Products* [Perfumes] *from Aliphatic* —. E. Kooevenagel. Ger. Pat. 156,560, Dec. 16, 1902.

The condensation of aliphatic aldehydes with negatively mono-substituted acetic acids may be brought about by carrying out the reaction in presence of a quantity of ammonia or a primary or secondary amine insufficient to neutralise all the acid. It is stated that by this method 1 mol. of aldehyde may be condensed with one of acid to form acrylic acid derivatives, and with 2 mols. of acid to give glutaric acids. Ethylamine, diethylamine and piperidine are suitable amines for the process. The condensations of valeraldehyde and malonic acid (to  $\beta$ -isobutylglutaric acid) and of citral and cyanoacetic acid (to citrylidene-acetic acid) by this means are described.—T. F. B.

*Dextrin and Formaldehyde; Process for Preparing a Hard Compound of —, Soluble in Water, and which can be Pulverised.* M. Busch. Ger. Pat. 155,567, April 12, 1903.

THE sticky product obtained by heating dextrin with formaldehyde solution may be converted into a hard substance, soluble in water, by drying *in vacuo*. The aldehyde appears to exist in a state of solid solution. Thus, by heating 1 kilo. of dextrin with 1.5 litres of 40 per cent. formaldehyde, a product is obtained containing 29.7 per cent. of formaldehyde.—T. F. B.

*Amides of Monobasic Acids; Process for Preparing Compounds of — with Formaldehyde.* A. Einhorn. Ger. Pat. 157,355, June 20, 1902.

IN presence of acid condensing agents, formaldehyde and amides of monobasic aromatic acids condense to form diacyl-methylenediamines; but in presence of alkaline agents, such as sodium hydroxide or carbonate, compounds of the general formula:— $R.CO.NH.CH_2.OH$ , are obtained, where R represents an aromatic radical. On hydrolysis, formaldehyde is separated from these compounds. They are stated to be of use medicinally.

—T. F. B.

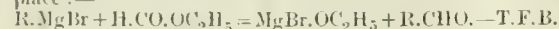
*Benzylamine Derivatives; Process for Producing Acylated —.* A. Einhorn. Ger. Pat. 156,398, June 25, 1903.

THE methylol derivatives of acid amides described in Ger. Pat. 157,355 (see preceding abstract) may be condensed with various aromatic compounds (e.g., hydrocarbons, phenols, acids, &c.), in presence of acid condensing agents or zinc chloride, acylbenzylamines resulting; e.g., from *p*-nitrophenol and methylolbenzamide, *o*-hydroxy-*m*-nitrobenzoylbenzylamine is obtained. These products are stated to be suitable as intermediate products for pharmaceutical and photographic preparations.

—T. F. B.

*Aldehydes; Process for Preparing —.* Farbenfabr vorm. F. Bayer und Co. Ger. Pat. 157,573. Dec. 10, 1903.

ALDEHYDES are obtained by the interaction of equimolecular weights of formic acid or a formic ester and an alkylmagnesium halide. The following reaction takes place:—



## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

### UNITED STATES PATENT.

*Photographic Printing Paper; Sensitive —.* E. C. Morgan, Richmond, Surrey. U.S. Pat. 790,647, May 23, 1905.

SEE Eng. Pat. 26,247 of 1904; this J., 1905, 152.—T. F. B.

### GERMAN PATENT.

*Benzylamine Derivatives; Process for Preparing Acylated —.* A. Einhorn. Ger. Pat. 156,398, June 25, 1903. XX. (see above).

## XXII.—EXPLOSIVES, MATCHES, Etc.

*Mercury Salts; Explosive —.* K. A. Hofmann. Ber. 1905, 38, 1999—2005.

THE author has prepared *Chlorato-dimercuraldehyde*,  $ClHO.C:(Hg)HgClO_3$ , by direct reaction of an alcoholic solution of aldehyde on a solution of basic mercuric chlorate. The substance crystallises in shining prisms, which explode with great violence on the slightest mechanical disturbance or on contact with a flame or electric spark. It is too dangerously unstable to be used as a substitute for fulminating mercury. The corresponding *chlorotri-*

*mercuraldehyde*,  $ClHO.C:(Hg_2O)HgClO_3$  is readily prepared by leading acetylene into mercuric chlorate sol (or a mixture of mercuric chloride and sodium chlorate). It is less sensitive to shock than the first-described compound, but explodes violently in contact with phosphorus. The similar *perchlorato*-compound is much more stable but its explosion when it does occur is equally violent not more so. In such compounds, the maximum explosive effect is attained when the carbon in the carbon-containing constituent is just sufficient to combine with the oxygen supplied by the other constituent; excess of carbon is wasted, and weakens the effect. Compounds of pyridine with mercuric chlorate and perchlorate,  $HgR(C_5H_4N)_2$  were also prepared, both explosive, though not so sensitive to shock. By treating mercuric-potassium nitrite with acetylene, *nitrito-di-* and *tri-mercuraldehyde* obtained, both explosive, though much less violent than the chlorate or perchlorate derivatives.—J. T. D.

*Explosion of Collodion Cotton; Circumstances attending an —, which occurred at the Factory of The Irmoid Co., at Edmonton, Middlesex, on March 7, 1904.* By Captain J. H. Thomson, H.M. Chief Inspector of Explosives.

SOME 400 lb. of dry collodion cotton exploded in a stove, while it was being unloaded. The compartment from which the trays were being removed was fitted with brass angle pieces and on these the zinc bottoms of the trays slid. The ignition was without doubt due to friction between these surfaces, collodion cotton having been lodged on the brass angle pieces. The explosion in question is considered to be unique in that it is an instance of a really violent explosion of collodion cotton of low nitration (10.61 per cent. of nitrogen) is suggested, as a preventative of such accidents in future that sliding trays should be altogether done away with, that drying cupboards should not be used as they are difficult to clean out, and that all corners in which explosive dust can accumulate should be avoided. (See also J., 1904, 560.)—G. W. McD.

*Nitre; Analysis of —.* R. Benzenmann. XX. page 691.

### ENGLISH PATENTS.

*Guncotton Blocks; Method of and Apparatus for the Formation of —.* G. W. Bell, Hayle, Cornwall. Eng. Pat. 10,663, May 9, 1904.

THIS guncotton pulp is fed into and subjected to pressure in a mould with a perforated end wall adapted to receive the guncotton, and allow the water to pass through. The mould becomes filled with guncotton which is forced into a block. Pistons are provided to compress the block endwise and the pulp may be fed through the pistons. The mould is provided with means for distributing the guncotton evenly. (See also this J., 1904, 882.)

—G. W. McD.

*Dinitroglycerin; Manufacture and Use of —.* Centralstelle für Wissenschaftlich-Techn. Untersuchungen. G. m. b. H., Neubabelsberg, Germany. Eng. Pat. 28,808, Dec. 29, 1904. Under Int. Conv., March 1, 1904.

TO obtain high yields in the manufacture of dinitroglycerol and to avoid as much as possible the formation of trinitroglycerol it is essential that the composition of the nitrating acid and also the proportion between it and glycerol used should be very carefully regulated. Glycerol (100 parts) is allowed to flow, with constant stirring, at 18°–20° C., into an acid mixture (500 parts) consisting of sulphuric acid (67.5 per cent.), nitric acid (22.5 per cent.) and water (10 per cent.). No oily separation takes place in this case, or if so only to a very slight degree, and such small quantities as are separated out can be removed exclusively of trinitroglycerol which can be removed in the usual manner. The acid mixture (one part) in which all the dinitroglycerol is contained,



with water (10 parts) and the extracting agent; by this dilution, action of the acid on the extracting is avoided. The dinitroglycerol with the ether is used, and leaves an oily liquid on distillation, then purify the product it is dissolved in water, any trinitroglycerol remains undissolved. The solution is then extracted a second time, the ether agent distilled off, and the dinitroglycerol remains, dried. The acetyl and benzoyl esters of dinitroglycerol possess considerable gelatinising power on dextrin, &c., and can, therefore, replace nitrobenzene, camphor, &c., in the manufacture of powder, by freezing temperature of dinitroglycerol makes it use as an addition to prevent trinitroglycerol explosion from freezing. (See also this J., 1904, 680.)

—G. W. McD.

*Explosive*; *New* —. R. Imperiali, Naples, Eng. Pat. 3789, Feb. 23, 1905.

*Explosive* consists of barium nitrate (20 parts), potassium nitrate (40 parts), and picric acid (40 parts), these being finely powdered and intimately mixed. —G. W. McD.

#### UNITED STATES PATENTS.

*Explosive Compound*. A. E. Stanley, Ellinwood, Kansas. U.S. Pat. 789,943, May 16, 1905.

is made for an explosive compound comprising a mixture of corn meal, sulphur, glycerin, alcohol, saltpetre and potassium chlorate. —G. W. McD.

*Explosive Composition* —. L. Thomas, Paris. U.S. Pat. 790,089, May 16, 1905.

claim is for an explosive compound consisting of glycerin having admixed therewith dinitrotoluene at 20° C., and obtained by nitrifying nitrotoluene, with cellulose and soda. —G. W. McD.

*Starch*; *Process of Making* —. Hough, Dover, N.Y. U.S. Pat. 790,840, May 23, 1905.

it is introduced below the surface of a mixture of sulphuric acid and sulphuric acid containing an excess of sulphuric anhydride, the strength of the acid mixture such that a product containing about 16.5 per cent. nitrogen is obtained. During the nitration, further quantities of sulphuric anhydride are added to maintain strength of the acid mixture at a practically constant temperature.

The nitrated product is separated from the excess acid, washed, and rendered stable by treatment with solution of ammonia. —A. S.

### XXIII.—ANALYTICAL CHEMISTRY.

#### INORGANIC—QUALITATIVE.

*Phosphorus*; *Detection of Yellow* — in *Phosphorus Sulphide*. L. Vignon. Comptes rend., 1905, 140, 9—1451.

SCHERLICH's method of distillation with water does not detect the detection of phosphorus in the sulphide, for the sulphide itself, exhibits phosphorescence under these circumstances. Nor can phosphorus be detected by reaction with solvents, nor by observation of the green point under reduced pressure. If, however, a stream of dry hydrogen be passed over the substance, a small proportion of free phosphorus causes the oxygen to exhibit phosphorescence in a dark room, and burn with a green flame, producing phosphoric acid, while the pure sulphide produces none of these effects.

—J. T. D.

#### INORGANIC QUANTITATIVE.

*Determination of Dust in Blast-Furnace* —. Hubendick. Oesterr. Z. Berg- u. Hüttenw., 1905, 1, 200; Chem.-Zeit., 1905, 29, Rep., 153.

proportion of dust in gas from blast-furnaces containing coke is 2—4 grms. per cb. m. in the case of solid

ores, and 4—6 grms. with loose ore, but only 1.5—2.5 grms. when charcoal is used. For use in gas engines the gas is purified until it contains only 0.1—1 gm. of dust per cb. m. To obviate the objections to the ordinary method of determining the dust, the author employs a double cone of sheet metal, the two necks of which are corked, while a tared sheet of filter paper is fixed between the flanges of the wider ends which come together at the middle of the vessel. The gas is drawn through this filter, all the dust collecting on the filter paper. The suction and measuring apparatus consists of two tubulated flasks, fitted with thermometers and graduated so that a volume of 5 litres can be measured. By connecting these flasks with each other and the filter, and altering their relative altitude, 5 litres of gas can be drawn through the filter at a time, so that about 200 litres of gas can be filtered in 30—60 minutes. A correction being made for the temperature and pressure of the gas, the filter is removed, and the collected dust is weighed after drying. —C. S.

*Nitric Acid*; *Analysis of* —. R. Bensemann. Z. angew. Chem., 1905, 18, 816.

The sample is dissolved in water, and evaporated to dryness with twice its weight of oxalic acid; to the residue water is added, and the evaporation repeated. This is done from one to five times. The nitrate and chloride present are completely decomposed, the perchlorate and sulphate are not. The residue is now heated to redness in a platinum basin for some minutes, to decompose the perchlorate; it is then dissolved in water, and the solution made up to a known volume. In a portion of this the alkalinity (carbonate) is determined by titration; this corresponds to the nitrate and chloride originally present. A second portion is acidified with nitric acid, and titrated with silver nitrate; this gives the chloride corresponding to the original perchlorate. A third portion (or some of the original substance) is used for the determination of sulphate. The chloride is also determined in a portion of the original substance, and the nitrate is, of course, obtained by subtracting an amount equivalent to this chloride from the joint result given above. —J. T. D.

*Lead*; *Determination of* —, by *Persulphate in Acid Solution*. M. Dittrich and A. Reise. Ber., 1905, 38, 1829—1831.

On adding to a solution of lead nitrate a 10 per cent. solution of ammonium persulphate, a white precipitate falls, which darkens on long heating on the water bath. It consists of an indefinite mixture of lead sulphate and peroxide, but the authors have never been able to attain complete conversion into peroxide. The precipitation of the lead is complete, however; and after five hours the liquid can be filtered, the precipitate washed with dilute solution of ammonium sulphate, and after burning off, converted completely into sulphate by evaporation with a drop or two of sulphuric acid. The addition of a little silver nitrate to the lead solution hastens the reaction, and allows filtration to be carried out three hours after precipitation (compare Marshall, Chem. News, 1901, 33, 76). This mode of precipitation is much more rapid and convenient than the usual precipitation by sulphuric acid and alcohol, and is equally accurate. No other metals are carried down with the lead. —J. T. D.

*Arsenic*; *New Method for the Determination of* —. H. Cantoni and J. Chautems. Arch. Sc. phys. nat. Genève, 19, 364—366. Chem. Centr., 1905, 1, 1481.

The author finds that arsenic can be separated from antimony by making use of the volatility of methyl arsenite at the ordinary temperature. The solution containing the arsenic and concentrated hydrochloric acid is treated with methyl alcohol, and introduced into a 250 c.c. flask connected with a condenser, the other end of which dips into a flask containing sodium hydroxide solution and provided with a guard-tube. A current of dry air is then led through the apparatus through a tube reaching to within a few mm. of the surface of the arsenic solution. Under these conditions the whole of the arsenic is stated to be carried over into the sodium hydroxide solution, whilst any antimony present remains behind. —A. S.

*Silicon in Iron; Determination of* — D. F. Morgan. Eng. and Mining J., 1905, 79, 756.

For iron containing from 6 to 11 per cent. of silicon, 0.47 grm. of the sample is dissolved in 10 c.c. of sulphuric acid (1:3), and 15 c.c. of a solution containing 120 grms. of sodium chloride and 50 grms. of potassium chlorate per litre, are added. The solution is evaporated until sulphur trioxide fumes are evolved, and the heating continued for one or two minutes. After cooling, the residue is treated with hydrochloric acid (1:1), the solution boiled, filtered, and the residue washed with hydrochloric acid and water, ignited and weighed.

In the case of irons containing more than 11 per cent. of silicon, 0.235 grm. of the sample, 2 grms. of cuprous chloride, and 1 grm. of ammonium chloride are dissolved in 20 c.c. of sulphuric acid (1:3), and 15 c.c. of the solution of sodium chloride and potassium chlorate and 15 c.c. of water are added. The solution is evaporated until sulphur trioxide fumes are evolved, the residue treated with hydrochloric acid (1:1), and the solution boiled. The copper solution is then decanted on to a filter, leaving as much of the silica as possible in the beaker. A few crystals of oxalic acid are placed on the filter, and the latter washed with hydrochloric acid and water until free from copper. The residue in the beaker is treated with 2 grms. of oxalic acid and 50 c.c. of dilute hydrochloric acid, and the whole boiled, filtered through the same filter, and the silica washed with oxalic acid, hydrochloric acid and water, ignited and weighed.—A. S.

#### ORGANIC—QUALITATIVE.

*Lactose, New Reaction for.* A. Woelk. Z. anal. Chem., 1904, 43, 670.

0.5 GRM. of milk sugar is cautiously heated on the water-bath with 10 c.c. of 10 per cent. solution of ammonia, avoiding ebullition. In 10 to 15 minutes a madder-red colour appears in the solution. Other sugars when thus treated give, at the most, a straw-yellow colour. Owing to the shade of the colours produced, the reaction is not available for the detection of cane sugar in milk sugar. The spectroscopic characters of the red milk-sugar solution is quite distinct from those of other sugar solutions obtained in a similar manner.—J. O. B.

*Saccharin, Detection of* — in Beverages [Beer, Wine, &c.], Villiers, Magnier de la Source, Rocques and Payolle. Ann. Chim. anal. appl., 1904, 9, 418; from Rev. gén. Chim., 1904, 144.

THE liquid, deprived of alcohol by evaporation or distillation, and if not already slightly acid, rendered so by the addition of 1 per cent. of acetic acid, is precipitated with excess of normal lead acetate solution; the excess of lead is removed as sulphate or phosphate and filtered off. The acid filtrate thus obtained is shaken out thrice in succession with half its volume of pure benzene. The benzene extract is partially distilled and the residue shaken with a small quantity of a 1:1000 solution of ferric chloride to determine the presence or absence of salicylic acid. Without removing the ferric chloride solution the rest of the benzene is then distilled off, the aqueous residue is acidified with sulphuric acid of 10 per cent. strength, warmed on the water-bath and treated with solution of potassium permanganate as long as the colour is discharged. This is preferably performed with the hot solution. In this way all salicylic acid, or aldehyde, or other bodies which may mask the taste or reaction of saccharin are destroyed. The liquid is again shaken out thrice with pure benzene, the benzene extract distilled or evaporated, and the residue taken up with 2 c.c. of water. One drop of this will give the sweet taste of saccharin. If the result is positive the rest of the liquid is transferred to a test tube, treated with 2 c.c. of caustic soda solution, sp. gr. 1.334, and evaporated to dryness. The tube is then attached to a thermometer, plunged into a fusible-metal bath and kept at 270° C. for three minutes. The fused mass is dissolved in 10 per cent. sulphuric acid, the solution shaken out with benzene, the benzene extract filtered and shaken with

5 c.c. of 1:1000 neutral ferric chloride solution. If saccharin be present, the characteristic violet colour and acid reaction will be obtained.—J. O. B.

*Lard from Cottonseed-Meal-Fed Hogs; Examination of* — by Bömer's Phytosterol Acetate Method. Tolman. J. Amer. Chem. Soc., 1905, 27, 589 (See this J., 1904, 832.)

THE author confirms Soltien's statement that lard hogs which have been fed on cotton-seed meal do not contain phytosterol. Experiments with pure lard, beef tallow, mixtures of the same with both ordinary cotton-seed oil and cotton-seed oil which had been previously heated, and also with different species of commercial lard, showed that lards which give the Halphen test because of added cotton-seed oil can be distinguished by Bömer's phytosterol acetate test (this J., 1898, 954; 1901, 1147) from lards which give the test because the hogs had been fed on cotton-seed meal. An addition of even 2 per cent. of cotton-seed oil can be detected by the increase of the refractive index of the cholesteryl (together with phytosterol) acetate. Heated cottonseed oil which does not give Halphen's test can be detected by the phytosterol acetate method.

#### ORGANIC—QUANTITATIVE.

*Beeswax; Determination of the Saponification Value* — Schwarz. Z. oeffentl. Chem., 1905, 6, 149 Centralh. 1905, 46, 260.

CONY has stated that in the case of wax adulterated with paraffin, the saponification values obtained after boiling for three-quarters to one hour with N/2 alcoholic potassium solution are much too low. The author is unable to confirm this statement, and finds that one hour's boiling is sufficient to completely saponify even these adulterated waxes. In order to obviate any error, due to hydrolysis of the soap, when titrating back with aqueous N/2 hydrochloric acid solution, the previous addition of 30 c.c. absolute alcohol is advised, or the N/2 acid may be used with alcohol instead of water. This precaution is specially needful when the cold saponification method in benzene solution is followed.—J. O. B.

*Fusel Oil; Detection and Determination of* — Takahashi. Bull. Coll. Agric., Tokyo, 1905, 6, 437. Chem. Centr., 1905, 1, 1483-1484.

THE author has examined Komarowsky's method (this J., 1903, 1017, 1259), but finds that satisfactory results for fusel oil or isoamyl, isobutyl, propyl and isopropyl alcohols are given only by benzaldehyde, anisaldehyde and vanillin. From 4 to 6 c.c. of the liquid to be examined are treated with 5-10 drops of a 1:1000 cent. alcoholic solution of benzaldehyde or anisaldehyde and then about an equal volume of sulphuric acid is added. With benzaldehyde, a reddish coloration above a clear layer is obtained, and with anisaldehyde a brown-yellow coloration changing to red, above two layers, green changing to blue, and the other yellow changing to purple-brown and violet; if the liquid be shaken some time a purple-red colour is obtained. When vanillin is used, 5 c.c. of a 1 per cent. alcoholic solution of the reagent are mixed with an equal volume of concentrated sulphuric acid. After the appearance of a yellow colour, the mixture is treated with an equal volume of the liquid containing fusel oil, when a blue coloration is produced. For the determination of the fusel oil, 10 c.c. each of the liquid containing it and of standard solutions of fusel oil are well mixed with 2 c.c. of a 1 per cent. alcoholic solution of anisaldehyde, and 20 c.c. concentrated sulphuric acid added carefully. The colours produced are compared immediately after adding acid, and also after 10 minutes from the time the mixtures are first shaken.—A. S.

*Butter; Determination of Fat, Non-fatty Substances, and Water in* — P. Soltien. Chem. Rev. Fett-Harz-Ind., 1905, 12, 125.

ACETONE (b.pt. 56°-58° C.) extracts fat and water simultaneously from the butter. The weighed quantity (ab-



a.) of the sample is gently warmed in a weighed beaker under a reflux condenser with 50 to 75 c.c. mixture in equal parts of acetone and absolute ether, filtration of the latter causing the non-fatty substances to separate more rapidly. After solution has taken place, 10 to 15 c.c. of absolute ether are added, and the solution filtered through an ash-free filter, into a distillation flask, after which the filter is washed with about 50 c.c. of the slightly warmed mixed solvent, and finally with about 25 c.c. of absolute ether. The residue in the distillation flask, in which some fragments of known weight are placed, is distilled on the water bath to remove the acetone and ether, the flask is then opened, the water evaporated by heating the flask with air blowing through, as in the determination of the Reichert-Meissl value, and the residue of fat dried until it is in weight. The residue of non-fatty substances in the original flask (and also the filter) is dried and weighed, and the water can then be calculated by difference.—C. A. M.

*Formaldehyde [in Milk and Butter]; Colorimetric Method for the Detection and Determination of —.* F. Bonnet, *J. Amer. Chem. Soc.*, 1905, 27, 601—605.

The author makes use of the characteristic coloration, which changes from pink to dark blue, given by formaldehyde with morphine, for the detection and determination of formaldehyde.

*Detection and Determination of Formaldehyde in Milk.*—60 c.c. of milk are placed in a 3-in. evaporating dish, 1-in. watch-glass containing 1 c.c. of a solution of morphine sulphate in 100 c.c. of sulphuric acid (1:84) is floated upon the surface of the liquid. The dish is then covered with a 4 by 5-in. glass plate and allowed to stand at 20° C. With four parts of formaldehyde 100,000, a fairly good coloration was produced in 10 min., and with four parts per million, a slight coloration appeared after 2½ hours. To determine the amount of formaldehyde, comparative tests are made, at the same time, with samples of milk containing known quantities of formaldehyde.

*Detection of Formaldehyde in Butter.*—A suitable quantity of the butter is spread upon the bottom of an evaporating dish, and the test carried out as in the case of milk.—A. S.

*Formaldehyde; Study of Methods for the Determination of —.* R. H. Williams. *J. Amer. Chem. Soc.*, 1905, 27, 606—601.

The author has examined the different methods which have been proposed for the determination of formaldehyde in dilute solutions, he finds that the iodometric method is preferable, but when impurities are present, the potassium cyanide method should be used (see this J., 366). The results obtained by the potassium cyanide method are slightly lower than those obtained by the iodometric methods. For strong impure solutions of formaldehyde, the hydrogen peroxide method (this J., 79, 614) is the most satisfactory, but care must be taken to ensure complete oxidation, the time required being within limits, depending upon the concentration of the solution and the temperature. (See also this J., 1260.)—A. S.

*Adrenalin; Colorimetric Determination of — by means of Iodine.* J. E. Abelous, A. Soulié and G. Toujan. *Comptes Rendus Soc. de biol.*, 1905, 301. *Bull. Soc. Chim.*, 1905, 23, 624.

Adrenalin is prepared so that 10 c.c. represent 1 mgrm.; to this 5 c.c. of N/10 iodine are added. After standing for an hour, a little starch paste is added and the color of iodine removed by sodium thiosulphate. At the moment when the iodine disappears, the blue tint is needed by a rose tint. The liquid is diluted to 50 c.c. and serves as the standard tint for 1 mgrm. of adrenalin. As the color fades on keeping, a standard can be made with a solution of litmus reddened with acid. For the assay of adrenal glands, 10 grms. are crushed with sand, and extracted with a 7 per cent. solution of common salt at 40°—50° C. The liquid is rendered faintly acid with hydrochloric acid, boiled for a few seconds, filtered,

and made up to 150 c.c. Ten c.c. of this solution are treated with iodine as indicated above. The suprarenal gland of a sheep was found in this way to contain 1.47 mgrm. of adrenalin per gm.—F. S.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Radio-Active Minerals.* R. J. Strutt. *Proc. Roy. Soc.*, 1905, A, 76, 88—101.

The author procured a series of radio-active minerals, had chemical analyses made, and determined the amounts of radium and of helium in them. He finds that the amount of radium in a mineral is proportional to the uranium present; incidentally the hitherto unsuspected presence of uranium in monazite was brought to light. Thorium minerals, which vary greatly in radio-activity, were invariably found to contain the uranium-radium combination, which may possibly indicate that thorium is producing uranium. Helium was never found to occur in appreciable quantity except in presence of thorium; hence it seems probable that the helium of minerals is a product rather of thorium than of radium.—W. A. C.

*Hydrate Theory of Solutions; Application to Electrolytes of the —.* T. M. Lowry. Paper read before Faraday Soc., May 18, 1905. [Advance Proof.]

According to the hydrate theory an aqueous solution consists of a mixture of hydrates in equilibrium with the solvent, and with one another. Further hydration leads to ionisation, the cause of which is looked for in the hydration of the ions. The author collates the evidence in favour of the hydrate theory of ionisation and also explains the conductivity of fused salts and mixtures of solid oxides, such as the Nernst filament, as due to the presence of positive and negative ionic complexes. In the discussion W. R. Bousfield mentioned that the evidence from the relation between freezing point depression and concentration, from the volume changes, and from the variations of ionic sizes with temperature and concentration all pointed to the increasing combination of solvent with solute as the dilution increased.—R. S. H.

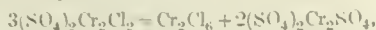
*Chemical Equilibrium; Determination of —, from Explosive Reactions.* Fincke, Z. anorg. Chem. 1905, 45, 116—125. Nernst, *ib.*, 126—131.

The authors have attempted to determine the amount of hydrogen peroxide formed during the explosion of hydrogen and oxygen, and of nitrogen dioxide formed during the explosion of hydrogen and air, varying the proportions of the reacting gases, and the pressure under which (and hence the temperature at which) the explosion occurs. Their results show that it is in general not possible, from the analysis of the cooled products after the explosion, to draw conclusions as to the composition of the mixture in chemical equilibrium at the moment of the explosion. In especial, it is certain that the amount of hydrogen peroxide present after the explosion of hydrogen with excess of oxygen is far less than that corresponding to equilibrium. It seems probable that where the explosive reaction is not too rapid, application of the principles of chemical kinetics may solve the problem, or perhaps measurement of the maximum pressure of explosion.—J. T. D.

*Chromic Sulphate; Reaction of Green —, with Discontinuous Speeds.* A. Colson. *Comptes rend.*, 1905, 140, 1451—1453.

MEASUREMENTS of the heat of reaction of green chromic sulphate with potassium hydroxide show that it is isomeric with, and more easily decomposed than, the violet salt. If solutions of 1 mol. of the green salt and 1 mol. of barium chloride be mixed, barium sulphate, equivalent to the barium salt added, is precipitated in a very short time; but if the amount of barium chloride used be 3 moles, very little more heat is evolved, and very little more barium sulphate is precipitated at once than in the first case, and the liquid remains turbid for weeks. The reaction is not stopped, however, but retarded, for the quantity of barium chloride in solution gradually

diminishes. If the solution be boiled, the whole of the sulphate is precipitated. Or if, after adding to 1 mol. of the chromic salt 1 mol. of barium chloride, the precipitate be allowed to settle and a second molecule be then added, further precipitation occurs; and after the settling (slower than the first) of this precipitate, addition of a third molecule of barium chloride causes still more precipitate to be formed. The author considers that the reaction  $(\text{SO}_4)_2\text{Cr}_2\text{SO}_4 + \text{BaCl}_2 = (\text{SO}_4)_2\text{Cr}_2\text{Cl}_2 + \text{BaSO}_4$  occurs, and the chlorosulphate so formed ionises and reacts gradually so that



the latter salt now being able to react on more barium chloride. If a large excess of barium chloride is present in solution, however, the ionisation of the chlorosulphate is hindered, and further reaction is thus checked.—J. T. D.

*Cane Sugar; Action of Metals on Solutions of —.*  
R. Vondráček. Z. Zuckerind. Böhm., 1905, 29, 447—453.

FURTHER experiments confirm the author in his views concerning the mechanism of the catalytic action of platinum black (see this J., 1904, 388). It is shown that platinum black acts on cane-sugar solutions solely by means of the oxygen contained in it, which disappears if the action is continued for a long time. Measurements of the conductivity of a solution containing cane-sugar and platinum black and of the velocity of the inversion of the sugar, show that the latter is oxidised, forming compounds of an acid character. The inversion proceeds according to the logarithmic law.—T. H. P.

*Enzyme and Ferment Action; Mechanism of —.* H. M. Dawson. J. Inst. Brewing, 1905, 11, 288—307.

THE behaviour of enzymes in chemical change appears to correspond with the properties which characterise a catalytic agent, and, provided the conditions of the system be maintained constant, there seems to be no limit to the quantity of substance which a given small quantity of enzyme is capable of converting.

The phenomena of enzymic action are undoubtedly regulated according to the law of mass action, but owing to complicating factors the cases are not of the simplest order. It can no longer be held that the function of the enzyme in the reaction is simply one of contact, i.e., that of imposing new conditions of a stimulating nature upon the system. The case of a simple bimolecular non-reversible chemical change which would occur if the action were merely one of contact generally only holds for a portion of the reaction. Recent work all tends to show that the enzyme combines with the substance on which it acts, to form an intermediate product which then splits up. The total change is then resolved into the resultant of two distinct component changes, each regulated by the fundamental law of mass action. But since the enzyme plays a part as one of the reacting substances, certain complex cases arise depending, for instance, on the affinity of the enzyme for the substance on which it acts, the proportion of enzyme present, the possibility of a decrease in the reacting portion of the enzyme as conversion progresses, affinity between the enzyme and the products of change and the possibility of equilibrium owing to the reversibility of the process. It has been found that the retardation of the action under the influence of the accumulated products depends on a relation between the stereochemical structure of the latter and that of the enzyme in the same manner as does the initial reaction. The phenomenon of hydrolysis by enzymes may be regarded as being effected by hydrogen ions, the enzyme forming a combination with the initial substance more sensitive to the action of these ions than the substance itself.—J. F. B.

*Catalase.* A. Bach. Ber., 1905, 38, 1878—1885.

THE author has studied the quantitative relations between catalase, prepared from the tissues of beef fat, and hydrogen peroxide, as the concentrations of the reacting substances were progressively increased. It was found that the

quantity of hydrogen peroxide decomposed increased with increase in the concentration of both reagents to maximum points, after which it remained constant. The complete exhaustion of the catalase, a certain concentration of hydrogen peroxide was necessary, and the complete decomposition of the hydrogen peroxide at certain concentration of catalase was required. The action of catalase follows the same law as that of pepsin and other ferments, viz., with excess of ferment action is directly proportional to the quantity of substance acted on, and with an excess of this the action is directly proportional to the quantity of ferment. The above relations are best expressed by the statement that the rate and quantity of substance acted on take part in the reaction in constant proportions, with the formation of intermediate compounds. As regards the velocity of the reaction between hydrogen peroxide and catalase, as the concentration of the latter was increased, it was found that the velocity increased in a far greater measure than the concentration of the catalase.

In studying the relative distribution of hydrogen peroxide between catalase and peroxidase in a system containing catalase, peroxidase, hydrogen peroxide and an oxidisable substance (pyrogallol) simultaneously, it was found that the presence of the catalase was entirely without influence upon the course of the oxidation. This circumstance is due to the fact that pyrogallol completely paralyses the decomposing action of catalase on hydrogen peroxide.—J. F. B.

*Oxydases; Further Observations on the —.* K. Bull. Coll. Agric., Tokyo, 1905, 6, 371—374. (Centr., 1905, 1, 1476—1477. (See this J., 1903, 1097.)

THE author is unable to confirm the statement of Clau and Bach (see this J., 1904, 210) that the guaiacol reaction for peroxides is far more delicate than the potassium iodide-starch test. Ordinary commercial guaiacol contains an impurity, probably acetyl-hydroperoxide, which can be removed by treatment with sodium carbonate; this aldehyde produces a strong iodine reaction with the potassium iodide-starch reagent, while it does not react with guaiacum tincture. The guaiacol reaction is also a much less delicate test for nitrites than the potassium iodide-starch reaction. Most vegetable juices give a strong guaiacum reaction (oxydases), but not iodine reaction (nitrites). Experiments with faintly acid and alkaline solutions of potassium nitrite and asparagin and with faintly acid and alkaline aqueous extracts of *Sagittaria* buds indicate that the cause of certain vegetable juices, which are capable of liberating iodine, losing this property after heating, lies in the acidity of the juice; the presence of traces of amino compounds, since under such conditions nitrites are readily decomposed.

On treating the expressed juice of *Sagittaria* buds with 90 per cent. alcohol, washing the precipitate and then taking it up in water, the solution gives the guaiacum reaction but not the iodine reaction with the potassium iodide-starch reagent. The evaporation-residue of the alcoholic extract of the juice, on the other hand, gives only the iodine reaction, and the Griess reaction. The substance which gives the guaiacum reaction is thus not identical with that which liberates iodine from potassium iodide.—A.

#### UNITED STATES PATENT.

*Luminous Composition.* G. F. Kunz, New York.  
Pats. 789,811, and 789,812, May 16, 1905.

(789,811) CLAIM is made for a luminous composition consisting of a mixture of a substance containing radioactive or other radio-active material, a zinc compound such as willemite [ $2\text{ZnO} \cdot \text{SiO}_2$ ], and a vehicle such as "oil," enclosed in a casing of rock crystal or other translucent substance.

(789,812). The composition consists of a mixture of a luminescent or radio-responsive material such as kunzite, a radio-active radium exciting material and a vehicle such as "oil," enclosed in a casing of rock crystal or other translucent substance.—A. S.



## New Books.

**DYNAMIK TECHNISCHER GASREACTIONEN.** Sieben Vorträge von Dr. F. HABER, Professor an der Kaiserlichen Hochschule, Karlsruhe i. B. R. Oldenbourg's Verlag, Munich and Berlin. 1905. Price

1 sh. 6d., containing 296 pages of subject matter, 10 illustrations. There is no alphabetical index of the whole work, but a chapter of contents for each of the 7 Lectures. The subjects of these Lectures are: I. Latent Heat of Chemical Decomposition, Relation to the Energy of Reaction. II. Entropy, Significance in Gas Reactions. III. Other Consequences of Relationships established, besides Exposition of Connection with changes in Solid Substances, Examples of Reactions proceeding without change in number of Molecules. V. Examples of Reactions proceeding with change of the number of Molecules, Determination of the Specific Heat of Gases. VII. Application of the Equilibria of Gases, with Theoretical and Practical Considerations on kindred questions.

**LE COUR D'ELECTRIQUE, son Origine, ses Transformations et ses Applications. Forces Naturelles. Métallurgie—Chimie par Voie Sèche.** Par M. MINET. Librairie Scientifique A. Hermann, 112, rue de la Sorbonne. Paris. 1905. Price

1 sh. 6d., volume, containing 72 pages of subject matter, 49 illustrations, and 20 tables. There is also a chapter of contents, but no alphabetical index. After general Considerations, the principal subjects treated are as follows:—I. DESCRIPTIVE PART. The Furnace of the Laboratory (1808—1886). Electrolytic Ignition Fusion. Furnaces of different kinds. II. THEORETICAL PART. UNITS AND PHYSICAL UNITS. Mechanical Units. Electrical Units. Units of the Current. Power and Electric Work, &c. III. TEMS AND ELECTRICAL CYCLES. IV. FUNDAMENTAL ELECTROCHEMISTRY.

## Trade Report.

### I.—GENERAL.

**IDEAUX; CHEMICAL TRADE OF — IN 1904.**

*Foreign Office Annual Series, No. 3381.*

Exports of chemicals figure in the Customs returns of 1904 as follows:—

Chemicals.		Quantity.	
		1903.	1904.
.....	Cwts.	7,755	3,594
.....	Cwts.	1,613	1,802
es, nitrates, &c.	Tons	5,076	907
.....	Tons	13,707	1,289
s, tartrates, superphosphates, &c.	Tons	18,817	22,062
manures	Tons	10,223	9,637
products	Tons	7,625	219
dyes	Cwts.	2,895	2,769
&c.	Cwts.	5,171	5,984

As above, the United Kingdom furnished, in 1904, 10,000 tons of sulphates, tartrates and superphosphates, as against 1903 of 3225 tons, of which the largest item was of sulphate of copper; some 1336 tons of manures (a decline of 4026 tons); only 80 tons of products, against nearly 7000 tons in 1903; and 10,000 tons of ink and colours.

The year 1904 was considered a very satisfactory one by importers of copper sulphate, of which the total import into France reached 29,657 tons. Of the 16,479 tons landed at Bordeaux nearly all was of British origin. The increase over the import in 1903 was due to the development of the vines caused by a warm wet spring, which encouraged the attacks of cryptogamic disease. About nine-tenths of the total sulphate of copper was used for agricultural and viticultural purposes, the remainder serving for wood injections and other industries. Prices, which were high in the early months, gradually declined, notwithstanding the increased demand, until July, when they resumed an upward tendency which continued until December. This was due principally to a rise in the price of copper, but also in part to an active speculative demand for forward deliveries during 1905. Trade was animated and remunerative to merchants and promises satisfactory results for the present year.

The following table shows the most important chemical products exported in 1903—04:—

Articles.	Total.		United Kingdom.	
	1903.	1904.	1903.	1904.
Acids .....	Cwts. 18,223	Cwts. 21,402	Cwts. 9,932	Cwts. 9,139
Oxides .....	3,950	4,804	797	985
Salts, &c. ....	16,961	18,170	2,202	1,903
Acetate of copper	2,838	2,835	443	587
Glycerin .....	7,360	5,044	2,893	1,126
Kermes (mineral)	969	1,216	—	25
Wine lees .....	4,739	2,028	977	1,057
Crude tartar ...	32,974	1,907	5,094	1,038
Cream of tartar.	42,888	1,699	41,244	1,504
Superphosphate of lime .....	36,765	1,429	—	—
Chestnut and other tannin extracts	307,847	280,646	238,020	206,129

There was an increase in the export of gums in 1904 to the extent of 4252 cwts., the total sent to all countries being 25,744 cwts., of which 15,052 cwts. were taken by the United Kingdom, showing a slight falling off in 1903.

Exports of resin and pitch in 1904 amounted to 335,419 cwts., an increase compared with 1903 of 39,685 cwts. The United Kingdom was a purchaser to the amount of 135,093 cwts., an increase on 1903 of 90,353 cwts. Turpentine exports were 48,214 cwts., a decline of 29,257 cwts. Of the latter, British purchases were only 8,158 cwts., against 12,107 cwts. in 1903.

India-rubber and gatta percha exports amounted in 1904 to 17,176 cwts., of which 11,436 cwts. were sent to the United Kingdom. This shows a decrease of 2,853 cwts. in the general and 2662 cwts. in the British purchases.

Of pure olive oil the total exported was 27,472 cwts., a slight increase from 1903. Exports of pure olive oil to the United Kingdom amounted to 9486 cwts.

Groundnut or "Arachide" oil showed a falling-off in the amount exported, the total sent to all countries being 26,761 cwts., which is less than the export in 1903 by 13,057 cwts. The United Kingdom purchased 12,875 cwts. cwts., a decrease from 1903 of 6815 cwts.; of other vegetable oils the total exported amounted to 12,315 cwts., which shows a slight increase on 1903. Next to no business was done in these latter articles with the United Kingdom.

Under the head of sugar, exports in 1904 amounted to 12,804 cwts. of raw and 89,585 cwts. of refined sugar, a decrease as compared with 1903 of 13,835 cwts. in the former and 1229 cwts. in the latter article. Exports to the United Kingdom were 3208 cwts. of raw and 13,234 cwts. of refined, the former showing a slight decrease and the latter an increase of 5061 cwts.

**HOLLAND; CHEMICAL TRADE OF —.**

*Foreign Office Annual Series, No. 3391.*

The following tables give details of imports and exports of certain products from and to Holland during 1903 and 1904:—

## Imports.

Articles.	Quantity.			
	1903.		1904.	
	Total.	From United Kingdom	Total.	From United Kingdom
Beer and malt extracts	Tons. 16,760	Tons. 593	Tons. 18,497	Tons. 509
Cement	2,122,462	32,171	2,192,748	32,090
Chemicals	8,267	1,412	8,823	1,220
Copper—				
Raw	53,628	7,255	72,873	4,483
In ingots	972	66	1,206	77
Drugs, paints and chemicals	553,580	25,145	506,807	22,184
Earthenware and china	447,067	16,243	446,257	17,221
Fertilisers	495,814	18,621	936,085	14,716
Glass and glassware	100,123	3,481	84,250	3,216
Hides, skins and leather	49,021	7,372	47,634	6,977
Lard	26,910	342	36,669	1,035
Margarine—				
Raw	43,403	1,080	43,386	610
Edible	583	143	492	130
Metals—				
Raw	1,619,919	166,292	1,701,952	196,228
Manufactured	772,915	23,532	630,006	12,870
Oils				
Groundnut	1,826	—	1,782	—
Cotton seed	30,620	8,317	31,643	6,064
Sesame and other edible	17,461	91	16,967	142
Palm and other...	166,884	26,075	172,351	25,491
Ores	4,135,145	—	4,287,699	—
Paper	106,970	—	105,168	—
Petroleum	421,849	—	469,913	—
Salt	155,851	18,365	142,522	17,968
Spelter	40,816	—	43,596	—
Spirits	20,563	535	22,904	447
Steel, in bars	105,913	3,666	105,744	3,796
Sugar—				
Beet and cane	149,254	1,100	229,733	1,826
All other	65,001	—	64,824	—
Sulphur	11,852	—	13,349	—
Tallow, soot, grease and stearine	53,247	23,043	50,606	22,169
Tar and pitch	54,616	—	35,079	—
Tin	21,493	3,826	18,121	3,808
Train oil	8,617	894	8,225	789
Treacle and molasses	27,594	491	35,101	907
Wine—				
In barrels	48,894	470	53,004	388
Bottled	17,766	—	18,300	—
Wood—				
Dye	32,000	1,470	29,690	861

## Exports.

Articles.	Quantity.			
	1903.		1904.	
	Total.	To United Kingdom	Total.	To United Kingdom
Beer and malt extracts	Tons. 22,531	—	Tons. 23,248	—
Cement	472,959	—	619,300	—
Copper	49,100	56	67,667	74
Drugs, paints and chemicals	429,704	39,793	478,824	47,596
Earthenware and china	154,655	13,561	154,398	11,657
Fertilisers	401,821	—	512,411	—
Glass and glassware	84,791	45,328	78,274	29,575
Hides, skins and leather	47,249	8,385	44,007	7,246
Lard	22,047	—	25,774	—
Margarine—				
Raw	25,206	499	26,281	600
Edible	45,441	41,951	46,100	42,731
Metals—				
Raw	1,315,019	183,506	1,001,417	115,449
Manufactured	570,430	88,959	490,771	69,655
Nitrate	91,355	—	105,373	—
Oils—				
Groundnuts	3,405	—	3,645	—
Cotton seed	25,189	—	27,903	—
Sesame and other edible	18,088	—	18,241	—
Palm and others	167,261	9,268	167,103	6,779

## Exports—continued.

Articles.	Quantity.			
	1903.		1904.	
	Total.	To United Kingdom	Total.	To United Kingdom
Paper	Tons. 213,160	Tons. 153,423	Tons. 187,295	Tons. 137,295
Petroleum	311,045	—	321,773	—
Pig iron	253,318	45,050	158,672	—
Salt	51,322	—	44,234	—
Spelter	42,383	26,832	47,188	—
Spirits	5,952,401	779,852	6,401,977	—
Steel, in bars	Tons. 81,008	Tons. 55,040	Tons. 45,588	Tons. 31,711
Sugar—				
Beet and cane	101,182	16,121	175,358	—
All others	177,044	125,990	207,466	—
Sulphur	11,325	—	13,975	—
Tallow, soot, grease and stearine	31,312	1,249	34,819	—
Tar and pitch	77,635	—	53,187	—
Tin	17,723	512	17,550	—
Train oil	6,151	91	7,133	—
Treacle and molasses	20,346	—	16,473	—
Vinegar	15,084	1,158	14,553	—
Wine—				
In barrels	41,096	3,547	46,650	—
Bottled	16,024	4,369	16,235	—
Wood—				
Dye	39,444	—	26,517	—
Yeast	5,000	4,837	5,220	—

## IV.—COLOURING MATTERS, Etc.

## LOGWOOD EXPORTS FROM HAYTI.

Foreign Office Annual Series, No. 3385.

For the year ending September 30, 1904, 102,540 lb. of logwood and 51,920,567 lb. of root were shipped compared with 120,095,733 lb. of logwood 48,368,408 lb. of root for preceding year. This shows a falling-off in export of logwood. The largest quantities were sent from Cape Hayti and Port de Paix. Most shipments went to the United States.

Only 4,982,502 lb. of guaiac wood were exported against 10,378,452 lb. in the preceding year. The greater portion was shipped from St. Marc and Port au Prince.

## ORCHIL: U.S. CUSTOMS DECISION.

Sulphonated orchil extract constituting a colour employed in food products was decided to be dutiable 30 per cent. *ad valorem* as a "colour," under paragraph of the tariff. It was held neither to be "orchil" "orchil liquid," which are free under paragraph 62, nor an article made from them.—R. W. M.

## VII.—ACIDS, ALKALIS, Etc.

## SULPHUR AND OTHER CHEMICALS IN SICILY.

Foreign Office Annual Series, No. 3396.

The shipments of sulphur during 1904 amounted to 508,980 tons, of which France took 115,897 tons and the United States and Canada 107,994 tons. The stock of sulphur in Sicily on December 31, 1904, was computed at 370,606 tons.

The quantity of sulphuric acid produced in Sicily in 1903 amounted to 5540 tons, of which 3500 tons were exported. The manufacture of superphosphates in the province of Messina amounted to 7500 tons. The province of Messina and Palermo produced 192 tons of sulphuric ammonia in 1903. There are 113 pumice stone quarries in Sicily, which in 1903 produced 8300 tons of stone. Exports in 1903 were 2544 tons, of which 368 tons went to the United Kingdom. During 1904 the principal ports from which asphalt was shipped was Syracuse (10,950 tons) and Mazzarelli, an open roadstead in the province of



The United States Circuit Court decided that a soluble grease made from tallow and sulphonated is not dutiable

at 30 per cent. *ad valorem*, as "alizarin assistant," under paragraph 32 of the tariff, but at 20 per cent. *ad valorem*, under Section 6, as a "manufactured article, unenumerated." The article in question is used to soften the cloth after the application of the dyestuff.—R. W. M.

### XIII. A.—PIGMENTS, PAINTS, Etc.

#### ONIDE OF IRON PAINT: U.S. CUSTOMS DECISION.

May 3, 1905.

Paint containing 92 per cent. of oxide of iron is dutiable at 30 per cent. *ad valorem* as a "crude colour," under paragraph 58 of the tariff. The claims of the importer for assessment under paragraph 49 as "crude sienna earth" at  $\frac{1}{2}$  c. per lb., or at 40 c. per ton, under paragraph 121, were overruled. The evidence showed that the article had been washed and calcined, and was in fact a crude paint.—R. W. M.

#### GREEN EARTH: U.S. CUSTOMS DECISION.

May 29, 1905.

"Green earth," of a greyish-green tint, used as a base for lime proof greens made with aniline colours, is not dutiable at 30 per cent. *ad valorem* as a "colour or pigment" under paragraph 58 of the tariff, but at 2 dols. per ton as a "wrought or manufactured earth" under paragraph 93. The testimony showed that it was used as a base in paint making, and not as a pigment to impart colour.—R. W. M.

### XIII. C.—INDIA-RUBBER, Etc.

#### FACTICE: U.S. CUSTOMS DECISION.

May 16, 1905.

Assessment of duty at 20 per cent. *ad valorem* as a "manufactured article unenumerated" under Section 6 of the tariff was affirmed on india-rubber substitute made from oils. The claim of the importer for free entry under paragraph 573 as "india-rubber" was overruled.—R. W. M.

### XIV.—SUGAR, STARCH, GUM, Etc.

#### SUGAR; THE COST OF —.

A return relating to the cost of sugar has been prepared by the Board of Trade and published as a Parliamentary paper (174). It shows the price per lb. retail of the kind of sugar most largely consumed by the working classes, whether refined or unrefined, on or about March 1, 1905, in the capital cities of Germany, Austria-Hungary, Belgium, France, Holland, Russia, Denmark, and Great Britain respectively, together with the amount, in English currency, of the existing Customs and Excise duties respectively per lb. in each case. It is explained that it is not to be understood that the prices given refer to a uniform grade of sugar in the various capitals:—

Country and Capital City.	Retail Price.	Customs Duty.	Excise Duty.
	d. per lb.	d. per lb.	d. per lb.
Germany—			
Berlin .....	2½	1·02*	0·76
Austria-Hungary—			
Vienna .....	3½	1·08*	1·72
Budapest .....	3½		
Belgium—			
Brussels .....	3½	1·11*	0·87
France—			
Paris .....	3½	1·44*‡	1·18‡
Holland—			
Amsterdam‡ .....	4½	2·45†	2·45
Russia—			
St. Petersburg .....	4½	4·22	1·23
Denmark—			
Copenhagen .....	2½	0·73	0·27
Great Britain—			
London .....	2½	0·45	—

\* In the cases of Germany, Austria-Hungary, Belgium and France, imported sugar is subject to excise duty in addition to import duty proper. The "Customs duty" stated above for these countries includes the total amount of duty payable on importation—i.e., it includes both import and excise duty.

† In the case of Holland, imported sugar is subject to excise duty only.

‡ Amsterdam has been taken instead of the Hague.

§ Including also the "taxe de raffinage," levied equally on imported sugar and on sugar of home production.

### XVII.—BREWING, WINES, SPIRITS, Etc.

#### PERFUMERY ALCOHOL TAX: U.S. CUSTOMS DECISION.

May 8, 1905.

The British alcohol tax accruing on alcohol content in perfumery is held to be an element of market value and subject to the *ad valorem* duty of 45 per cent. Although the British tax is not paid on the merchandise since it is exported, the open market rather than value in bond is taken as the basis for assessing duty.—R. W. M.

#### FERMENTS: U.S. CUSTOMS DECISION.

May 16, 1905.

"Assorted ferments" have to pay duty of 20 per cent. *ad valorem* as "manufactured articles unenumerated." The claim of the importers for free entry as a "value of drug" under paragraph 548 was overruled.—R. W. M.

### XX.—FINE CHEMICALS, Etc.

#### CITRUS INDUSTRY OF SICILY.

Foreign Office Annual Series, No. 3396.

During the 1903-04 season it was calculated that Italy produced 5,250,000,000 of citrus fruit, or an amount of 750,000,000 over the preceding season. To this production Sicily contributed 3,652,800,000, or than half of the production of all Italy.

The harvest for the season 1903-04 in Sicily by province was as follows:—

Province.	Number
Messina .....	1,125,000.
Palermo .....	1,005,000.
Catania .....	800,000.
Syracuse .....	465,000.
Trapani .....	174,000.
Caltanissetta .....	30,000.

Out of 16,700,000 citrus fruit trees in all Italy, accounted for 10,390,000. On an average each tree is calculated to produce 352 fruits.

A good quantity of essence of lemon is produced in Palermo and all along the eastern coast of Sicily. lemon, oil of orange (both bitter and sweet), oil of darin and oil of cedrat are produced in various parts of the northern and eastern coasts.

Calcium citrate is produced at Palermo, Messina, Catania. Efforts are being made to create a combination in this article.

Citric acid has hitherto been produced by the St. method. At Palermo a new combination has been found under the title of "La Citrica" for the production of citric acid by a method due to a Sicilian called Rest, whose process is said to be a modification of one covered by F. Arrosto in 1831. It remains to be seen whether the Restuccia method is a commercial success.

#### CAMPHOR IN JAPAN.

Foreign Office Annual Series, No. 3387.

Refined camphor steadily increased in price from 12s. to 9l. 12s. per 100 lb. at the beginning of 1904 to 12l. 16s. to 14l. 10s. at the end of December. High prices have provoked a demand by American refiners for an increased import duty of 6 c. gold (3d.) per lb. refined camphor, so that, at present prices with that Japanese refined camphor would have but a poor chance.

Although the export of crude camphor was not on a large scale as in 1903, prices did not advance as might have done. The Government have allotted larger quantity for home consumption, but the increased quantity is still far from satisfying the home demand, which is chiefly for the manufacture of tablets for medicinal purposes. Although the export of these tablets to a certain extent interferes with the operations of refiners abroad, who find difficulty in competing with the Japan-made tablets, owing to labour being cheaper there.

The quality of the camphor has become more and more



ply was much less than had been estimated. Estimate was 36,000 piculs (4,788,000 lb.) from India and 13,000 piculs (1,729,000 lb.) from Japan; actual receipts were 41,000 piculs (5,453,000 lb.) from India and 6,000 piculs (798,000 lb.) from Japan; 47,000 piculs (6,251,000 lb.) were refined in Japan for export, 10,000 piculs (1,318,000 lb.) to India, 10,000 piculs (1,318,000 lb.) to the United States and Canada, 27,000 piculs (3,542,000 lb.) to go to India.

#### CHRYSAROBIN: U.S. CUSTOMS DECISION.

May 17, 1905.

United States Circuit Court decided that chrysarobin, not dutiable at 25 per cent. *ad valorem* as a medicinal preparation "under paragraph 68 of the tariff act of 1902," but dutiable at 1 cent per lb. and 10 per cent. *ad valorem* under paragraph 20, as a "drug advanced in value." The court followed a previous decision on gaduol, in which it stated that the substance in question was not a medicinal preparation in the form in which it was imported, and hence medicinal preparation"—R. W. M.

## Patent List.

In these lists, [A.] means "Application for Patent," and [C.S.] means "Complete Specification Accepted."

A Complete Specification accompanies an Application, and is affixed. The dates given are (i) in the case of Applications, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals of acceptance. The Complete Specifications are advertised. The Complete Specifications thus advertised as accepted are open to opposition at the Patent Office immediately, and to opposition for six months of the said dates.

### LANT, APPARATUS, AND MACHINERY.

- 5,204A (1904). Macquesten. Method and apparatus for separating solid particles from each other. June 9.
- 1,206. Johnson (Feld). Apparatus for subjecting gases or vapours to the action of liquids. May 29.
- 1,393. Stubbs. Apparatus for heating or cooling fluids, also applicable for condensing steam or other vapours. May 31.
- 1,438. Meeredy. Method and apparatus for drying and pulverising liquid or semi-liquid substances. May 31.
- 1,686. Saatmann. Drying and absorbing apparatus. June 3.
- 1,708. Greaves. Furnaces. June 5.
- 1,724. Hargreaves. Evaporating solutions. June 5.
- 1,776. Clark. Apparatus for promoting the absorption or solution of substances by liquids, suitable (*inter alia*) for use in the purification of illuminating and other gases. June 5.
- (1,941. Reed. Condenser. June 7.
- 11,957. Dryfus, Meyenberg, and the Clayton Aniline Co., Ltd. Apparatus for filtering or separating liquids from solids or matters from impurities, and for analogous operations.\* June 7.
- 12,114. Hellström. Lincers for centrifugal liquid separators. [Appl. in Sweden, June 14, 1904.]\* June 9.
- 12,201. Soest. Drying drums.\* June 10.
- 12,300. Forster. Crucible furnaces. June 13.
- 12,333. Barthelmess. See under II.
- 13,227 (1904). Lennox. See under XVII.
- 13,481 (1904). Sulman and Picard. Removal of precipitates from liquids. June 15.
- 13,638 (1904). Dewar. Method of absorbing gases and the application thereof to the production of high vacua and the separation of gases. June 15.

- [C.S.] 15,761 (1904). Groll. Furnaces. June 7.
- " 17,625 (1904). Small, and Frictionless Engine Packing Co., Ltd. Separator and filter for mixed liquids. June 21.
- " 19,565 (1904). Hauberg. Feeding arrangement for centrifugal separators. June 7.
- " 20,319 (1904). Van Westerborg. Safety tanks or vessels used in filtering or for other purpose. June 7.
- " 4332 (1905). McNeil. Apparatus for separating liquids from vapours. June 15.
- " 5761 (1905). Holmes. Apparatus for washing and scrubbing gases. June 7.
- " 7168 (1905). Newton (Worthington). Apparatus for cooling or evaporating liquids. June 15.

### II.—FUEL, GAS, AND LIGHT.

- [A.] 11,284. Drury and Pulman. Producing a combustible charge from oil, alcohol, or other liquid. May 30.
- " 11,372. Hills. Manufacture of gas and apparatus therefor. May 31.
- " 11,373. Hills. Enrichment of gas for illuminating, heating, or power purposes. May 31.
- " 11,413. Assmann. Process for preparing compressed gas for power purposes. [Ger. Appl., June 1, 1904.]\* May 31.
- " 11,657. Hutchins. Gas producer. June 3.
- " 11,681. Hennequin and Cayeux. Combustible liquids for explosion motors. June 3.
- " 11,725. Goskar and Burn. Suction gas producer plants. June 5.
- " 11,751. Moores and Bailey. Manufacturing air gas.\* June 5.
- " 11,758. Wakefield. "Flare" lights. June 5.
- " 11,776. Clark. See under I.
- " 11,859. Marriott and Darch. Agglutinants for artificial fuel and the like. June 6.
- " 11,929. Heinrichsdorff. Conversion into gas and superheating of liquid fuel.\* June 7.
- " 11,940. Galley and Hatton. Apparatus for mixing gases for heat, light, and power. June 7.
- " 11,949. Just, Hanaman, and Verein. Electricitäts Act.-Ges. Manufacture of incandescent filaments for electric lamps. June 7.
- " 11,956. Woodall and Duckham. Vertical retorts for the carbonisation of coal.\* June 7.
- " 12,059. Moore and Livens. Gas producers.\* June 9.
- " 12,160. Eveno. See under XI.
- " 12,251. Kiderlen. Gas generator.\* June 13.
- " 12,289. Woodall and Duckham. Vertical retorts for the carbonisation of coal.\* June 13.
- " 12,468. Delage. Manufacture of and method of heating by radio-incandescent bodies. [Fr. Appl., Oct. 26, 1904.]\* June 15.
- " 12,516. Noll and Trainer. Manufacture of briquettes from fuel, ores and the like. [Ger. Appl., Sept. 14, 1904.]\* June 16.
- " 12,533. Barthelmess. Method of and apparatus for purifying blast furnace gases, dust-laden air and the like, and for dissolving gases and other matter in liquids.\* June 16.
- " 12,563. Wilson. Gas producers. June 17.
- [C.S.] 9608 (1904). Whitfield. Gas producer plant. June 7.
- " 13,253 (1904). Crawford. Manufacture of filaments for incandescent electric lamps. June 21.
- " 13,822 (1904). Whittaker, and C. Whittaker and Co. (1900), Ltd. Manufacture of peat fuel and apparatus therefor. June 21.
- " 14,288 (1904). De Valeriola, Sepulchre, and Moeller. Manufacture of incandescent mantles. June 7.
- " 15,846 (1904). Spencer. Gas regenerative furnaces. June 15.
- " 17,906 (1904). Zuiderhoek. Process for the manufacture of coke briquettes. June 21.
- " 3154 (1905). Woltmann. Artificial fuel. June 7.
- " 5761 (1905). Holmes. See under I.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [A.] 11,893. Macalpine, Simmance and Abady. Refining petroleum and mineral oils. June 6.  
 .. 11,998. Leatherbarrow. Method of treating pitch. June 8.

### IV.—COLOURING MATTERS AND DYE STUFFS.

- [A.] 11,196. Newton (Bayer und Co.). Manufacture of anthraquinone derivatives. May 29.  
 .. 11,205. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters.\* May 29.  
 .. 11,759. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of amino-hydroxylated derivatives of phenyl-naphthimidazole. June 5.  
 .. 12,444. Johnson (Badische Anilin und Soda Fabrik). Reduction of indigo and similar colouring matters. June 15.  
 [C.S.] 16,268 (1904). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of sulphur dyes and of materials for their production. June 15.  
 .. 17,274 (1904). Shillito (Aniline Colour and Extract Works, formerly J. R. Geigy). Manufacture of azo colouring matters. June 7.  
 .. 17,318 (1904). Ransford (Cassella und Co.). Manufacture of sulphine colours. June 15.  
 .. 19,165 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters and intermediate products. June 21.  
 .. 19,474 (1904). Inray (Basle Chem. Works). Manufacture of indoxyl, its homologues or their derivatives. June 21.  
 .. 7835 (1905). Johnson (Dye Works, formerly Durand, Huguenin & Co.). Manufacture of leuco-galloyaniline dyes. June 21.  
 .. 7839 (1905). Lake (Oehler). Production of blue mono-azo dyes. June 15.

### V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 11,294. Hasselmann. *See under IX.*  
 .. 11,410. Mackey. Means or apparatus for purifying dye-water and similar effluent. May 31.  
 .. 11,417. Matthey and Campbell. Means for recovering solvents from wool and other substances. May 31.  
 .. 11,577. Moeller. Dyeing cotton, any vegetable, animal, artificial fibres and wool or materials composed of such fibres. June 2.  
 .. 11,617. Wohle. Method of degumming ramie, rhea, or other fibre. June 2.  
 .. 11,987. Young and Hardman. Bleaching vegetable fibres in the raw or manufactured state. June 8.  
 .. 12,169. Johnson (Badische Anilin und Soda Fabrik). Manufacture of discharging pastes for use in the discharge of dyed textile fabrics.\* June 10.  
 .. 12,277. Cathelineau and Fleury. *See under XIX.*  
 .. 12,278. Cathelineau and Fleury. *See under XIX.*  
 [C.S.] 13,227 (1904). Lennox. *See under XVII.*  
 .. 16,798 (1904). Hulme. Printing calicos and other woven fabrics. June 7.  
 .. 17,152 (1904). Howorth (Soc. Frane. de la Viscose). Apparatus for the manufacture of artificial silk. June 21.  
 .. 17,330 (1904). Mitchell. Process of removing grease from cotton waste. June 21.  
 .. 20,178 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of discharging pastes for the discharge of dyed textile materials. June 21.  
 .. 20,633 (1904). De Naeyer. Apparatus for dyeing or bleaching textile materials. June 21.  
 .. 2873 (1905). Greenwood. Mechanism for dyeing wherein the material to be dyed is continuously submerged within the dye without exposure to the atmosphere during the dyeing process. June 15.  
 .. 6726 (1905). Baudot. Scouring, washing and like machines. June 21.

### VI.—COLOURING WOOD, PAPER, LEATHER,

- [C.S.] 18,096 (1904). Abel (Act.-Ges. f. Anilin). Process of dyeing leather. June 21.

### VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 11,180. Wetter (J. D. Riedel, Akt.-Ges.). *See mercury.\** May 29.  
 .. 11,300. Cie. Thermo-Electrique (Systeme He Soc. Anon. Manufacture of copper sulphate thermo-electric couples. [Fr. Appl. Apr 1905.]\* May 30.  
 .. 11,347. Thompson (Goldschmidt and Polzer). Manufacture of white lead, oxides of lead, mixture of the latter with white lead.\* May 30.  
 .. 11,539. Brake. Carbonic acid gas production apparatus. June 2.  
 .. 11,986. Garroway. Manufacture of sulphuric acid and glauber salts. June 8.  
 .. 12,021. Bloxam (Soc. Anon. d'Etudes Et Chimiques). Manufacture of lead per June 8.  
 [C.S.] 16,504 (1904). Wolterreck. Production of monia. June 7.  
 .. 4762 (1905). Johnson (Badische Anilin und Fabrik). Manufacture of dehydrated alkalies. June 7.  
 .. 6885 (1905). Deutsche Gold- und Silber-Anstalt vorm. Rössler. Manufacture of superphosphate. June 15.  
 .. 9875 (1905). Morgan Crucible Co., Ltd., Speirs. Manufacture of stratified blood plumbago. June 21.  
 .. 11,300 (1905). Cie. Thermo-Electrique (S Hermite) Soc. Anon. Manufacture of sulphide for thermo-electric couples. June 1

### VIII.—GLASS, POTTERY, AND ENAMEL

- [A.] 11,723. Thornton, Sharp, and Ingle. Kilns for firing colours in glass, earthenware, enameled &c., supplied with a self-burning mixture of made from carburetted air. June 5.  
 .. 12,107. Pilkington. Manufacture of plate or glass and apparatus therefor. June 9.  
 .. 12,122. Cowper-Coles. Process of enamelling metals. June 10.

### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 11,191. Braschler-Kurtz. Method of treating asphalt and like substances. [Ger. June 2, 1904.]\* May 29.  
 .. 11,294. Hasselmann. Chemically impregnated wood and other textile or fibrous substance preventing putrefaction, rot, or fungus.\* May 29.  
 .. 11,594. Eccles. Treatment of wood for rendering it inflammable. June 2.  
 .. 11,696. Carr and Urwin. Manufacture of bricks and other fireclay goods. June 3.  
 .. 11,807. Bruce. Manufacture of cement. June 6.  
 .. 12,105. Meyenberg. Insulating material and process for preparing the same.\* June 9.  
 [C.S.] 12,664 (1904). Fitzsimons. Preparation for laying dust on roadways, &c. June 7.  
 .. 16,657A (1904). Butterfield. Composition for coating roads, pipes, walls, and other surfaces. June 21.  
 .. 16,940 (1904). Müller and Jarek. Heat non-conducting material. June 21.  
 .. 19,737 (1904). Boulton (Hülsberg und Co.). Impregnation of wood and other porous material. June 21.  
 .. 25,787 (1904). Michell. Manufacture of non-conducting coverings, blocks and slabs suitable for covering steam pipes, boilers, &c. June 7.



- 5,788 (1904). Michell. Manufacture of non-conducting coverings, blocks and slabs, suitable for covering steam pipes, boilers, &c. June 7.  
 76 (1905). Singer. Composition for laying and absorbing dust. June 7.  
 457 (1905). Armstrong. Manufacture of Keen's or other cements having a gypsum base. June 21.

# X.—METALLURGY.

- 1,268. Brayshaw. Process of hardening high speed steel. May 30.  
 1,331. Boulf (Cheswright). Alloys. May 30.  
 1,335. Boulf (Cheswright). Nickel steel alloys. May 30.  
 1,572. Atkinson. Preliminary treatment of refractory ores. June 2.  
 1,681. Plumer. Hardening and tempering copper or its alloys.\* June 3.  
 1,793. Swinburne. Treatment of sulphide and other metallic ores. June 5.  
 1,833. Fyfe. Ore roasting furnaces and means for producing and depositing fumes from ores. June 6.  
 2,001. Auchinachie. Extracting gold from sea water. June 8.  
 2,422. Cowper-Coles. *See under VIII.*  
 2,209. Haddan (Fellner und Ziegler). Process of treating finely granulated or pulverised ores. June 10.  
 2,320. Greenawalt. Roasting furnaces.\* June 13.  
 2,516. Noll and Trainer. *See under II.*  
 2,582. Rock. Process for the recovery or separation of gold and other metals from sea water. June 17.  
 1,123 (1904). MacArthur. Treatment of ores containing antimony. June 15.  
 2,347 (1904). Steuart. Apparatus for the extraction of metals from their ores. June 7.  
 2,816 (1904). Brayshaw. Melt or bath for hardening steel. June 15.  
 3,121 (1904). Nicholas. Treatment of zinc ores. June 15.  
 11 (1905). Gayley. Method of smelting ore. June 7.  
 194 (1905). Baggaley and Allen. Smelting sulphide ores. June 15.  
 589 (1905). King, and Advertising Mirrors Co. Solder or flux whereby ordinary solder can be used to solder aluminium. June 21.

# ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- 1,353. Luckow. Process for regenerating electric accumulators.\* May 30.  
 1,407. Teuber. Electric heating apparatus.\* May 31.  
 1,654. Schanschoeff. Accumulator plates. June 3.  
 11,861. Hubbell. Battery plates.\* June 6.  
 11,862. Hubbell. Battery plates.\* June 6.  
 12,160. Eveno. Electro catalytic process for obtaining fixed gases from any suitable carburant. June 10.  
 12,221. Hepburn. Electrolytic apparatus. June 13.  
 12,253. Kelly. Accumulator plates. June 13.  
 12,291. Classen. Electrolytic production of lustrous metallic coatings upon metals.\* June 13.  
 12,454. Cowper-Coles. Electrodeposition of copper and other metals. June 15.  
 13,579 (1904). Cowper-Coles and Co., Ltd., and Cowper-Coles. Deposition of metals or metallic compounds upon metals or metallic articles. June 21.  
 14,958 (1904). Potthoff. Solutions for the electrodeposition of metals. June 7.  
 28,134 (1904). Billwiler and Karrer. Electric insulating material and process of manufacturing the same. June 7.  
 23,13 (1905). Rosworth. Electric furnaces. June 15.

# XII.—FATTY OILS, FATS, WAXES, AND SOAP.

- [A.] 11,444. Marchado da Cruz and Cardoso. Candles.\* May 31.  
 .. 11,679. Hennequin and Cayeux. Lubricants.\* June 3.  
 .. 11,950. Zonca. Devices for recovering waste oil.\* June 7.  
 .. 12,525. De Hemptinne. Process for eliminating the odour of fish oil. June 16.  
 [C.S.] 17,218 (1904). Armstrong, Armstrong and Armstrong. Manufacture of soap and detergent compounds. June 15.  
 .. 27,105 (1901). Lockell. *See under XX.*  
 .. 12,92 (1905). De Sales. Process of manufacturing soap. June 15.  
 .. 7646 (1905). Buchanan. Apparatus for heating linseed oil with driers. June 15.

# XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

## (A.)—PIGMENTS, PAINTS.

- [A.] 11,347. Thompson (Goldschmidt and Polzeniusz). *See under VII.*  
 .. 11,782. Moysse. Method of protecting metallic construction against oxidation. June 5.

## (B.)—RESINS, VARNISHES.

- [A.] 12,460. Wachendorf. Manufacture of varnishes for producing mat surfaces. [Ger. Appl. April 3, 1905.]\*

## (C.)—INDIA-RUBBER.

- [A.] 11,371. Hill and Leeson. Vulcanising rubber solution. May 31.  
 .. 11,574. Perkin, and Whipp Bros. and Todd, Ltd. Manufacture of materials more especially for use as substitutes for india-rubber and gutta-percha. June 2.  
 .. 11,575. Perkin, and Whipp Bros. and Todd, Ltd. Manufacture of a material more especially intended for use as a substitute for india-rubber and gutta-percha. June 2.  
 [C.S.] 2655 (1905). Steenstrup and A/S. Gumm-Regenerations Societet. Process for de-vulcanising india-rubber. June 15.  
 .. 8378 (1905). Gregory and Thom. Process for reclaiming waste vulcanised india-rubber. June 24.

# XIV.—TANNING; LEATHER, GLUE, SIZE, Etc.

- [A.] 12,230. Thompson. Process for treating and utilising the spent bark of tan pits. June 13.  
 .. 12,266. Trenckmann. Manufacture of parchment like skin. [Ger. Appl. Oct. 3, 1904.]\* June 13.  
 [C.S.] 12,388 (1904). Tullis. Tanning of hides into leather. June 7.  
 .. 18,511a (1904). Amend. Bating, de-acidifying and oxidising of hides and skins. June 7.  
 .. 19,244 (1904). Sonoff and Zwerhoff. Curing skins and hides. June 15.

# XVI.—SUGAR, STARCH, GUM, Etc.

- [A.] 11,838. Wetter (Weinrich). Process for purifying misse-cuite syrups or impure sugar solutions. June 6.  
 [C.S.] 10,664 (1904). Ewen and Tomlinson. Process for converting wood cellulose into sugar. June 21.  
 .. 16,262 (1904). Börner. Manufacture of starch-like or amyloid-like substances and sugar. June 15.  
 .. 16,546 (1904). Stein and Loewenthal. Manufacture of sugar. June 7.

- [C.S.] 16,546A (1904). Stein and Locwenthal. Manufacture of mulin. June 7.  
 .. 3972 (1905). Schütze. Process and apparatus for producing crystals from sugar solutions and the like. June 15.

## XVII.—BREWING, WINES, SPIRITS, Etc.

- [A.] 11,117. Barker (Ronnberg and Co.). Manufacture of a product which enables beer to be hopped in a rational, economical manner.\* May 29.  
 .. 11,453. Hahn and Reiser. Method for the production of dry yeast.\* May 31.  
 .. 11,471. Dewar. Malting apparatus. June 1.  
 [C.S.] 12,417 (1904). Storrier. Production of non-deposit beers and stouts for bottling. June 7.  
 .. 13,227 (1904). Lennox. Evaporator for evaporating the liquid in brewers' wash, sewage, waste or spent dyes and the like, and concentrating the solids in the same. June 21.  
 .. 16,992 (1904). Baker and Ling. Sulphuring of hops, malts and other materials with special reference to the avoidance of contamination with arsenic and apparatus therefor. June 7.  
 .. 17,651 (1904). Linzel and Bischoff. Process for the production from fermented liquid of a drink free from alcohol, by means of a vacuum. June 21.

## XVIII.—FOODS; SANITATION, WATER PURIFICATION; &amp; DISINFECTANTS.

## (A).—FOODS.

- [A.] 12,095. Heritte. Method of preserving organic substances. June 9.  
 [C.S.] 2948 (1905). Schon. Apparatus for treating milk and like liquids to reduce the globules of cream or fat to a state of fine sub-division. June 15.  
 .. 6617 (1905). Jones. Composition for making aerated beverages. June 21.

## (B).—SANITATION; WATER PURIFICATION.

- [A.] 11,410. Mackey. *See under V.*  
 .. 11,431. Walker. Destruction of noxious or poisonous fumes or gases in blasting operations in mines or the like. May 31.  
 .. 12,092. Swallow, Swallow and Filburn. Composition for purifying sewage and other foul waters. June 9.  
 .. 12,481. Spivey. Treatment of sewage, trade effluents, and other foul or polluted waters. June 16.  
 [C.S.] 12,540 (1904). Casimir Bez et ses Fils. Means for preventing incrustation in steam generators. June 15.  
 .. 13,227 (1904). Lennox. *See under XVII.*  
 .. 13,436 (1904). Vial. Water clarification. June 7.  
 .. 13,588 (1904). Henderson. Treatment of sewage. June 21.  
 .. 17,690 (1904). Bramley. Utilisation of a waste product for the treatment of boiler feed water. June 21.  
 .. 17,920 (1904). Mather and Platt, Ltd., and Hepburn. Method of and means for softening water. June 15.  
 .. 1776 (1905). McLean and Paterson. Process of treating and utilising sewage. June 21.  
 .. 5200 (1904). Guttman. Apparatus for purifying or softening water. June 7.

## XIX.—PAPER, PASTEBOARD, Etc.

- [A.] 11,165. Hawke. Printing papers. May 29.  
 .. 11,166. Hawke. Writing papers. May 29.  
 .. 11,479. Hawke. Manufacture of printing paper. June 1.  
 .. 11,480. Hawke. Manufacture of writing paper. June 1.  
 .. 11,512. Béal. Manufacture of celluloid.\* June 1.  
 .. 12,085. Zwick and Zwick. Process of producing proofing paper, &c. June 9.  
 .. 12,277 and 12,278. Cathelineau and F. Plastic transparent product for the manufacture of fibres, films, plates, or blocks, and process of preparing the same. June 13.  
 .. 12,413. Binns. Manufacture of paper. *Appl.* June 15, 1904.\* June 15.  
 .. 12,523. Erkens. Paper making machines.\* June 16.  
 [C.S.] 10,664 (1904). Ewen and Tomlinson. *See XVI.*

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 11,219. Ellis (Merck). Manufacture of carbimide acids. May 29.  
 .. 11,926. Lieber. Method of making radium sulphate. [U.S. Appl., July 30, 1904.]\* June 7.  
 .. 12,292. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of salts of p-aminobenzoic ether. June 15.  
 .. 12,526. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of preparations of pepsin containing hydrochloric acid. June 16.  
 [C.S.] 18,825 (1904). Newton (Bayer and Co.). Manufacture of a pharmaceutical compound. June 15.  
 .. 27,105 (1904). Loebell. Process for preparing and fats containing iodine and sulphur. June 15.  
 .. 10,976 (1905). Merck, Merck, Merck and Co. Manufacture of guanines from cyanamide diamido-6-oxypyrimidine and its homologs. June 15.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 11,239. Schaak. Production of collotype. [Ger. Appl., May 31, 1904.]\* May 29.  
 .. 11,452. Mercier. Means for developing photographic images.\* May 31.  
 [C.S.] 17,192 (1904). Strasser. Chrome-gelatine process of photography. June 7.

## XXII.—EXPLOSIVES, MATCHES, Etc.

- [A.] 11,431. Walker. *See under XVIII. B.*  
 [C.S.] 15,053 (1904). Cocking, and Kynoch, Ltd. Smokeless powders and their manufacture. June 15.  
 .. 6651 (1905). Haddan (Roth). Explosives containing aluminium or other light metals. June 15.

## XXIII.—GENERAL ANALYTICAL CHEMISTRY.

- [C.S.] 18,047 (1904). Haber. Process of and means for testing the composition of gaseous mixtures. June 15.



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H. Perkin, LL.D., Ph.D., F.R.S. ....	1884—1885.
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James Dewar, M.A., LL.D., F.R.S. ....	1887—1888.
Ludwig Mond, Ph.D., F.R.S. ....	1888—1889.
Lowthian Bell, Bart., F.R.S. ....	1889—1890.
Rider Cook ....	1890—1891.
Emerson Reynolds, M.D., F.R.S. ....	1891—1892.
John Evans, K.C.B., D.C.L., LL.D., C.D., F.R.S. ....	1892—1893.
C. C. Stanford ....	1893—1894.
E. Thorpe, C.B., LL.D., Sc.D., Ph.D., F.R.S. ....	1894—1895.
Thomas Tyrer ....	1895—1896.
Edward Schunck, Ph.D., F.R.S. ....	1896—1897.
Frank Clowes, D.Sc. ....	1897—1898.
George Beilby ....	1898—1899.
F. Chandler, D.Sc., M.D., Ph.D., LL.D. Jos. W. Swan, D.Sc., M.A., F.R.S. ....	1899—1900.
Ivan Levinstein ....	1900—1901.
W. Ramsay, K.C.B., D.Sc., LL.D., F.R.S. H. Nichols, M.Sc., M.S., LL.D., D.Sc. ....	1901—1903. 1903—1904. 1904—1905.

† Deceased.

### LIST OF COUNCIL, 1905—1906.

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## Official Notices.

### COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

### CONGRESS OF CHEMISTRY AT LIEGE.

In connection with the Liège Exhibition, a Congress of Chemistry and Pharmacy will be held from the 27th to the 30th July next. By a subscription of 10 francs, members may take part in the Congress, and will receive a copy of the transactions. Application for Adhesion Forms and programmes should be made at once to M. J. Raymond, Pharmacien, Liège, or M. J. Wauters, Chimiste-adjoint de la Ville de Bruxelles.

### SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

The Sixth International Congress of Applied Chemistry will be held in Rome in April, 1906, during Easter week. All communications should be addressed to the President, Prof. E. Paternò, Via Panisperna, 89 Rome.

## List of Members Elected.

July 10th, 1905.

Allpass, James, c/o The Clayton Aniline Co., Ltd., Clayton, Manchester, Secretary.  
 Collett, John H., Hillfield, Gloucester, Chemical Manufacturer.  
 Delal, Vasanji Premji, Dwarkadas Building, Hornby Road, Fort, Bombay, Lecturer on Chemistry, Elphinstone College.  
 Danker, Fred. E., 1, Atlantic Street, South Boston, Mass., U.S.A., Salesman, Oakes Manufacturing Co.  
 Dolan, H., "Dunesk," Grappenhall Road, Stockton Heath, Warrington, Chemist.  
 Duggan, Edward J., The Charles E. Shoes Co., 164, Front Street, New York City, U.S.A., Vice-President.  
 Ernst, C. A., Lansdowne, Pa., U.S.A., Chemist.  
 Lewis, F. W., Aetna Powder Co., Room 1718, Tribune Building, Chicago, Ill., U.S.A., Secretary.  
 McKerrow, W. J., c/o J. C. & J. Field, Ltd., Lambeth, S.E., Analytical Chemist.  
 McLellan, Basil G., c/o Rowntree & Co., Ltd., The Cocoa Works, York, Analytical Chemist.  
 Morgan, Jerome J., Scandia, Warren County, Pa., U.S.A., Teacher.  
 Nichols, W. H., jun., 25, Broad Street, New York City, U.S.A., President, San Carlos Copper Co.  
 Palmer, Dr. Charles S., c/o *Engineering and Mining Journal*, 505, Pearl Street, New York City, U.S.A., Associate Editor.  
 Raschig, Dr. F., Ludwigshafen a. Rhein, Germany, Manufacturing Chemist.  
 Sellers, George E., Rock View, Milnsbridge, near Huddersfield, Aniline Colour Maker.  
 Teeple, Dr. J. E., Industrial Laboratories, Easton, Pa., U.S.A., Director.  
 Waters, C. D., c/o Morrison & Carr Paper Co., Tyrone, Blair Co., Pa., U.S.A., Chemist.  
 White, Clarence B., 25, North Mountain Avenue, Montclair, N.J., U.S.A., Chemist.  
 Zinkeisen, Oscar T., 15, Cortlandt Street, New York City, U.S.A., Importer of Chemicals.

## Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they temporary or permanent. Multiplication of addresses also to be avoided as tending to create confusion. Sending subscriptions, the use of the form attached the application helps in the verification of addresses which the safe delivery of the Journal depends.

Appleby, Jos., 1/o Bootle; Farnley, Moor Lane, C Crosby, Liverpool.  
 Canadian Mining Institute, 1/o Stanley Street, 877 chester Street, Montreal, Canada.  
 Cooper, T. S., 1/o Beckfoot; 36, Demesne Road, Alexa Park, Manchester.  
 Corse, W. M., 1/o 1233; 1279, Third Avenue, Del Mich., U.S.A.  
 Davis, Alf. R., 1/o Stockport; The Church H Hawarden, Flintshire.  
 Dobb, Thos.; all communications to c/o J. T. Dobb & West Bar, Sheffield.  
 Dreyfus, Dr. Wm.; Journals (July 15 to Sept. 30) to Endingen, Aargau, Switzerland.  
 Dufty, L., 1/o Broomhall Place; 8, Clarke St Sheffield.  
 Feilmann, Dr. E., 1/o Wimbledon; 368, Green L Finsbury Park, N.  
 Grimwood, R., 1/o Lady Margaret Road; Oakh Woodland Rise, Muswell Hill Road, N.  
 Guthrie, Alex., 1/o Boeking; Inglewood, Eaton F Coventry.  
 Haas, Herbert, 1/o Redding; 218, California Street, Francisco, Cal., U.S.A., Metallurgical Engineer.  
 Harrington, E. M., 1/o Paterson; c/o W. B. Lewis, Broadway, New York City, U.S.A.  
 Howard, Bernard F.; Journals to Quantocks, Mo Road, Woodford Green, Essex.  
 Jones, Chas. H., 1/o Cuba; 195, Inderwick Road, Cr End, N.  
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 Miller, H. Harold; Journals to 6, McMaster Ave Toronto, Canada.  
 Molesworth, F. H., 1/o Sydney; Jersey Road, Antar N.S.W., Australia.  
 Moore, Quintin, jun., 1/o Rumford Street; c/o Beardmore & Co., Ltd., Parkhead Forge, Glasgo.  
 Mnspratt, Sydney K., 1/o Flint; 14, Northgate, Reg Park, N.W.  
 Pattison, Percy J., 1/o Forest Gate; St. Budeaux, De shire Road, Horthchurch, Essex.  
 Sharwood, W. J., 1/o Berkeley; c/o Homestake M Co., Lead, S. Dakota, U.S.A.  
 Shuler, D. P., 1/o Cass Avenue; 110, Selden Ave Detroit, Mich., U.S.A.  
 Slater, Dr. Arthur, 1/o Nottingham; The Priory, Bu on-Trent.  
 Sodean, Dr. Wm. H., 1/o Park Road; 19, East Pa Newcastle-on-Tyne.  
 Spencer, Robt., jun., 1/o Bowling; 3, Woodville Ter Bradford.  
 Tatlock, R. R., 1/o Stirling; 11, Bellshaugh R Kelvinside West, Glasgow.  
 Van Marken, J. C., 1/o Reperen; Myrtle Cottage, Shorel Kent.  
 Westmoreland, J. W., 1/o London; 12, Arthin Terrace, Hunslet, Leeds.

## Birthday Honour List.

His Majesty has been pleased to confer a Baron upon Mr. Samuel B. Boulton; and the honour of Knighthood upon Dr. Boverton Redwood and Col. Samuel Sadler, M.P.



## PROCEEDINGS

OF THE

## TWENTY-FOURTH ANNUAL MEETING.

LONDON.

MONDAY, JULY 10TH, 1905.

Twenty-fourth annual general meeting of the Society was held in University College, Gower Street, on Monday, July 10th, the President, Dr. Wm. H. Diver, occupying the chair.

Among those present were Dr. E. Divers, F.R.S. (President Elect), Sir Henry E. Roscoe, F.R.S., Dr. Perkin, F.R.S., Mr. E. K. Muspratt, Dr. L. Mond, Dr. J. Emerson Reynolds, F.R.S., Mr. Thos. Tyrer, F. Chandler, and Sir Wm. Ramsay, K.C.B., (Past Presidents); Dr. L. Baekeland, Dr. Virgil L. Zsigmondy, Prof. W. R. Hodgkinson, Messrs. E. Grant, Max Muspratt, T. J. Parker, Dr. F. B. Power, (Residents), Dr. J. Grossmann, Messrs. Oscar Reisch, Hemingway, Ling, Dr. K. E. Markel, Prof. Pope, F.R.S., Sir Boverton Redwood, Mr. W. F. Dr. W. S. Squire (Ordinary Members of Council), Gordon Salamon (Chairman, London Section), Lian L. Baker (Hon. Sec. London Section), Mr. Wightman (Treasurer, London Reception Committee), Mr. E. Carey (Chairman, Liverpool Section), Roscoe Hardwick (Hon. Sec., Liverpool Section), H. Bailey (Chairman Elect, Manchester Section), Julius Hübner (Hon. Sec., Manchester Section), T. Dunn (Chairman, Newcastle Section), Mr. Howard, (Chairman, New England Section), Dr. W. Moore (Chairman, New York Section), Dr. H. L. H. (Hon. Sec., New York Section), Mr. R. C. Beck (Hon. Treasurer, New York Section), Mr. J. T. Chairman, Nottingham Section), Mr. S. R. Trotman Sec., Nottingham Section), Mr. T. Fairley (Hon. Yorkshire Section), Mr. Samuel Hall (Hon. Sec. of the Society), Mr. Theo. Armstrong, Mr. Barry, Dr. Chas. Baskerville, Messrs. V. G. E. A. Byrnes, A. A. Claffin, Dr. W. A. Converse, Dreyfus, Miss Mary Lynn, Dr. H. A. Metz, Mr. Nichols, Dr. Maximilian Toch, Dr. Ida Welt, Dr. Viley, Mr. J. Bernays, Dr. Chas. A. Keane, Mr. J. Dr. L. T. Thorne, Prof. H. E. Armstrong, F.R.S., A. S. Calder, Mr. R. Forbes Carpenter, Dr. B. Dyer, O. Forster, F.R.S., Mr. S. K. Muspratt, Mr. F. Sutton, Dr. W. A. Tilden, F.R.S., and Major-Lt. J. Waterhouse, F.R.S.

PRESIDENT, in opening the proceedings, called upon Gordon Salamon, Chairman of the London Section, a few words of welcome to the meeting.

A. GORDON SALAMON said that he had been asked by his colleagues to convey to the President, and to all those who crossed the Atlantic with him, their keen delight in meeting them amongst them; and also, in the name of the various Sections, to give them a hearty welcome, and to express the feelings of the British members from their own point of view. They were delighted to have an American President for the Society, and especially to have one who had some time ago under the presidency of Dr. Chandler. Also, they held their friendship with their American brethren in very great esteem, and above all, they felt that the appearance of so many of their friends from America was good evidence that the Society was going to be cemented for many years, and he hoped for all time. As representative of the interests of the Anglo-Saxon race in applied chemistry, they were proud to know that the continuity of development and progress of the Society was in their hands.

PRESIDENT, on behalf of the Society, thanked Gordon Salamon and the English members for the cordiality

of their welcome. He did so from the bottom of his heart because he knew it came from the heart, and on that account was all the more appreciated. It was most difficult to express the feeling of appreciation which he and his associates from the other side of the Atlantic had of the magnificent reception which had been accorded them.

The GENERAL SECRETARY (Mr. U. G. Cresswell) then read the minutes of the twenty-third annual meeting held in New York, on September 8th last, which were confirmed.

On the motion of Dr. H. W. WILEY, seconded by Dr. W. H. PERKIN, F.R.S., Dr. Wm. Dreyfus and Prof. W. R. E. Hodgkinson were appointed scrutineers of the ballot papers.

## REPORT OF COUNCIL.

The SECRETARY then read the Report of the Council as follows:—

The number of members on the register is 4326 as compared with 4134 at the last Annual Meeting. During the year 452 members have been elected, as compared with 400 last year; the losses have been 260, as against 216 and there have been 41 deaths, as compared with 29 last year.

The names of the deceased members are as follows:—Wm. Ackroyd, Wm. Allen, Sir L. Lowthian Bell, G. A. Bicknell, J. Lloyd Bullock, John Campbell, Wm. Chattaway, J. F. Wyllie Clarke, W. Martyn Cook, P. Coward, Sir J. Neilson Cuthbertson, Fred Lall Dey, T. H. Dodd, Prof. T. M. Drown, John Dunn, C. D. Ekman, J. L. Ferrell, Jas. Foster, Jos. Glatz, F. A. Goodhue, Prof. E. B. Kenrick, Wm. J. Kent, J. G. McArthur, J. K. Mackenzie, F. M. Mercer, Dr. H. Salvin Pattinson, Archibald Pearson, F. G. du Pont, T. A. Pooley, Dr. A. B. Prescott, H. A. Rademacher, W. H. Richmond, Sir B. Samuelson, Geo. Shaw, Wm. R. Shaw, E. Sorel, John Storar, T. T. P. Bruce Warren, Dr. C. Otto Weber, G. N. Williamson and F. G. Worth.

The JOURNAL for 1904 numbered 1252 pages, equal to 52.2 pages per issue, as against 57.5 in 1903. During the past session 92 original papers, with discussions, have appeared in the JOURNAL, as compared with 90 in the previous session. Of 17 papers returned to authors by the Publication Committee for amendment or condensation, 12 have been published after having been recast, rewritten or condensed, and five have been withdrawn.

The Hon. Treasurer's financial report was issued in the JOURNAL for June 30th and will be laid before the meeting.

The Council, on behalf of the Society, wish to express their very hearty appreciation of the exceedingly cordial welcome given to the Society by the New York Section on the occasion of the last Annual General Meeting, a welcome which was confirmed in every city visited in the United States, and it takes this opportunity of expressing the pleasure it now has in the visit of members of the New York, New England, and Canadian Sections.

In the autumn of 1904, the President requested Dr. Edw. Divers, F.R.S., to act as his deputy during his year of office. Whilst hearty thanks are due to Dr. Divers for his unremitting services in that capacity, a special welcome is offered to the President himself on his arrival in this country.

The Council has had the pleasure of congratulating its late President, Sir Wm. Ramsay, K.C.B., F.R.S., on having been awarded one of the Nobel Prizes, and its thanks are due to him for the manner in which he represented the Society during the visit to America.

The agreement with Messrs. Eyre and Spottiswoode for printing and publishing the JOURNAL terminated at the end of 1904, and a new contract, for three years, has been entered into with Messrs. Vacher and Sons, of Westminster. This involves some increased cost. The thanks of the Council are due to the Hon. Treasurer, Mr. David Howard, and Mr. B. E. R. Newlands, for their services in connection with the negotiation of the new contract.

The postage of the JOURNAL reaches the considerable sum of £550 a year; and enquiry is being made as to the possibility of joint action with other Learned Societies with a view to obtain some reduction on the rates of postage of Scientific Journals.

Since the last Annual Meeting, a New England Section has been constituted, covering the States of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. The inaugural meeting of the new Section, at which the President and many members of the New York Section were present, to give it encouragement and support, was held on May 12th. The Birmingham Section has also been revived.

Last August, the Chancellor of the Exchequer appointed a Departmental Committee, which included our members Sir Wm. Crookes, F.R.S., Dr. T. E. Thorpe, C.B., F.R.S., and Mr. Thos. Tyrer, to enquire into the existing facilities for the use, without payment of duty, of spirits in arts and manufactures, and in particular into the operation of Section 8 of the Finance Act, 1902. By permission of the Controller of H.M. Stationery Office, the report, with its appendices, was published in the Society's JOURNAL for April 29th, 1905, and, in reply to a letter of thanks from the Council, the Chancellor of the Exchequer stated that it was his intention to propose legislation during this session of Parliament to carry out the recommendations of the Committee.

The Council has placed on record its appreciation of the persistent efforts of Mr. Thomas Tyrer in the cause of Industrial Alcohol, and has tendered him its thanks for his services on the Committee.

In this connection it may be stated that the Spirit Committee of the Society, the Chemical Sections of the London, Manchester, and Bury Chambers of Commerce, the Drug Club, the Automobile Club, the Society of Motor Manufacturers and Trades, and the West India Committee, all co-operated in obtaining evidence to be laid before the Alcohol Committee.

Dr. VIRGIL COBLENTZ moved the adoption of the Report, which was seconded by Dr. BAEKELAND and carried unanimously.

#### THE TREASURER'S REPORT.

The HON. TREASURER (Mr. Samuel Hall) read his Report as follows:—

It is my pleasant duty, as your Treasurer, to report on the finances of last year, 1904, and to give some indications of the probable condition of the present year.

The statement of "Income and Expenditure" for 1904 is in the 30th June number of our JOURNAL, as is also the Hon. Treasurer's account with the Society at 31st December, 1904.

The salient points, as compared with 1903, on the receipt side are £4,814, being an increase of £200 from subscribing members—naturally we have no annual receipts from members who have compounded, except in the form of dividends on accumulations.

Entrance and life composition fees amount to £472 and show an increase of £50. This money is always invested and does not reckon as ordinary income. The accumulations, as you will notice, are all in first-class securities, and are in the names of three trustees. They amount to £14,124 stock, giving a yearly income of £443, or £3 2s. 8d. per cent. duty paid.

Sales of the JOURNAL are £509 and are almost exclusively from non-members (but not at a lower price); this shows the appreciation of the JOURNAL by the outside world. Altogether, the amounts make an available income of £5,776.

Turning to the other side of the account, 5000 copies cost for publishing, £1064; Editorial expenses, £1533. Your Publication Committee meet twice monthly and give their very careful attention to the work, having corrected the slip proofs which have been sent them. These items of publishing and editorial work together cost in 1904, £2597, or £120 less than in 1903. Annual and Sectional Meetings cost £884, an increase of £160. Salaries, £30 more, office expenses £70, the cost of enlarging the Council Room having been paid in 1903.

The result enabled us to give £100 to the National

Physical Laboratory, to devote £212 towards the Dece Index for 1896-1905, which we hope to complete 1906, and left a balance to the good of £1117 4s. During 1904, £1000 was invested, and £1000 has invested this year, coming into the accounts of

The following is the Auditors' Certificate on the Account of December 31st, 1904. The securities the same in both accounts, and the balance practical

"We have compared the above statement with vouchers, counterfoils of the receipts issued and records, and are of opinion it correctly exhibits cash transactions of the Society for the year. The amounts of the Metropolitan 3 per cent. solidated Stock, 3 per cent. New Zealand and cent. New South Wales Stocks have been confirmed by the Chief Accountant to the Bank of England. Certificates for the remaining investments have been inspected and the Bank balances have been confirmed to us by the Bankers.

"(Signed) MALL, WILKINS, RANDALL & Co. Chartered Accountants"

This is very satisfactory for 1904, but you must give the credit to your Hon. Treasurer, it belongs wholly to our late President, Mr. Levinstein, who in the twice monthly JOURNAL and made the contract our late printers; at that time we thought advertisement would have paid better than it appears to have. I still hope that it may be increased to the advantage of the Society, both in money and usefulness.

As foreshadowed in last year's Report, our late President having the option, terminated the three years' agreement at the end of 1904. To continue the work they ran terms involving so much extra cost, that we could accept them, and were obliged to obtain tenders where; from among several, we selected that of Messrs. Vacher and Sons, and have contracted with the three years certain, at a considerably greater cost in 1904, but equally considerably less than of printers required.

From this it is clear that unless made up in other ways more members, advertisements, &c.—we cannot expect to put by as much in the next three years as we have in the last three.

Though this may make your Treasurer have to lay a tight hand in some things, speaking from my personal knowledge of the Council and its individual members, the primary idea of us all is that the JOURNAL must only be kept up to its present position, but to the highest standard for information and promptness.

The Publication Committee are always glad of new useful papers read before the Society; if too long, hardly receive their proper attention from the readers; it is, therefore, desirable for their authors' sake to keep them as terse as possible; this may also assist the Society and your Treasurer, as every page has to be paid for *pro rata*.

I also wish to lay emphasis on our rule that for the next months, January and February, numbers of the JOURNAL are sent to all Members whether they have paid the year's subscription or not. If the subscription has been received by the end of February, the 15th March following numbers ought to be received by the Member; should he by chance not receive it, there is some excuse, and I shall be obliged by his communicating with Members who have not paid, and consequently have not received the March and following numbers will I understand that their subscriptions have not been received.

In conclusion I will only add that our relations extended over the world, that our members live in different countries, though the great divisions, the British Isles, United States, Australia, Canada, Germany, and are only reckoned as one each. I claim that we are a large amount of seen and unseen good. We are a profit-making institution, though it is necessary to strengthen our backbone as we grow bigger. The JOURNAL is the flesh and muscles, the diffuser of the good work into it that energy is good seed—grow it will—we cannot see how; but the world will be the better.



H. SCHWEITZER proposed a vote of thanks to the Treasurer for his continued and successful management of the financial affairs of the Society.

R. C. WOODCOCK seconded the motion, which was unanimously.

## PRESIDENT'S ADDRESS.

### THE MANAGEMENT OF A CHEMICAL INDUSTRIAL ORGANISATION."

I think it will be generally admitted, that the presidency of the Society of Chemical Industry is the highest honour kind within the reach of the chemical manufacturer, who pursues science in the abstract may hope for occasionally attain to niches in the Temple of Fame; a man whose life must be given up to its practical aim hardly hope that such a result will crown his

There may be other compensations, but fame is not to be expected. Not the least of these compensations is the opportunity that is afforded to so influence the work of others, that the world as well as the individual shall be the richer for it. Many a new discovery or useful invention would be still-born, if not at all, were it not for the aid, at the right time, of a practical man of science in affairs.

When you crossed the Atlantic and elected me to your office, I held an exalted opinion of the office. I pictured it as one of the highest honours which had come to my lot. Looking over the list of my distinguished predecessors, as I have often done, I beheld a long line of men who have had large influence for good in the world, of them having even attained to the niche in the temple. Some have passed away, full of honours, to leave an account of useful lives; some remain for their work and the enjoyment of the fruits of that work accomplished. As I find myself about to be elected to that list, I am humbled by the knowledge of the smallness of my services to the Society, and of my thinness to appear in that company. In one respect, however, I am the equal of any, and that is in the earnestness of my wish for the welfare of the Society, and that wish shall profit in increasing measure by the work of its members. What the world already owes cannot be estimated. Its debt in the future will be limitless. The science of Chemistry and its applications enter very largely into the life of the men who form this and other societies, and those who shall be born into them, will assume the major portion of the responsibility of the debt our science owes the world in turn.

The Society is an international Society, and yet it is after all a British Society. It was born here. Here it was nurtured and wisely tended, during its childhood and youth. Its members residing in all parts of the globe, it is not, though not insular. Broad in its conception and foundation, with a spirit of liberal conservatism, it has come from the beginning, and always will welcome the progress of science, theoretical or applied, of any country or language. What could be more natural, then, that its largest section should be in the new world, that the fourteen hundred or more members coming to it should be as loyal to the parent body, as the best living in the Old Country. If, however, anything is needed to cement that loyalty, it was supplied when you elected, not only once but twice, an American President, thus giving additional evidence of that mutual respect and esteem which have been steadily growing between the Anglo-Saxons everywhere, and which are to be potent forces working for the industrial welfare of the world, as well as for the peace of the nations.

The meeting in New York last year, the first ever held on this side of the Atlantic, was, I think, very successful. It was largely due to the size and quality of the representation from this side, headed by that great scientist and one of our good fellows, Sir William Ramsay. Ours is a country of magnificent distances, so we could do little in the three weeks allotted, than take you to St. Louis, give you a glimpse of the Exposition, and then, stopping occasionally to give the hospitality of one of our cities a chance to express itself. We were embarrassed by the number of invitations we were

obliged to decline, for your good. It was apparent on all sides that this Society was held in the highest esteem, and was widely known and understood. I allude to this memorable meeting, as I wish to thank you, on behalf of the American members, for coming over in such goodly numbers. You did us good. You brought us together closer than we had ever been brought before, and caused a cohesiveness in our membership, which on account of its rapid growth it needed greatly. I am glad that so many from our side are now returning the visit; and I thank you on their behalf as well as on my own, for the delightful programme you have prepared for our entertainment and instruction, in which everything is provided for except, possibly, time for meditation and sleep.

Residing as I do in New York, it has, of course, been impossible for me to attend the stated meetings of the Council, or to do many of the things which your President should do. Whatever may have been my own loss, the Society has not suffered, as my place has been more than filled by a resident Vice-President, Dr. Edward Divers, soon to be your President-elect. I desire to thank him publicly, as I have already done in private, for this expression of his good will and loyalty. He will enter upon his duties as President *de facto* with a ripeness of experience, and a wealth of good wishes, which he will find to be very tangible assets indeed. I desire also to thank the Council for all the courtesies it has extended to me, and the kindnesses which have made me feel so comfortable in spite of my distance. I have been kept posted on all matters proposed. When delay would not be dangerous, my views have been awaited patiently, and, where advisable, have been carried out. In short, I have been made to feel that I was your President, without the fear that distance was preventing or hindering desired legislation. My correspondence with individual members also has been very delightful, and I realised I had made many friends, long before I had seen them, or felt the pressure of their hands. My experience since I landed on your shores has more than confirmed all that I have heard of English hospitality, and I have heard a great deal. I have, however, during my tenure of office, been able to perform at least one presidential duty of a most agreeable nature. I was present at and took part in the initial meeting of the New England Section, at Boston, on May 12th. I congratulate the Society on this latest acquisition, which I believe will develop into one of our largest sections, and trust its example will be followed in three or more other districts in the United States. The territory is much too large for one section, and many of the members have none of the advantages, except the JOURNAL. While this is worth the cost of membership many times over, it cannot take the place of regular meetings.

My distinguished predecessor, in his admirable address last year, gave the results of thirty years' experience in the education of chemists, as far as that education can be completed in the College laboratory. He suggested that I take up the question where he laid it down, and give the result of an experience, equal in years at least, from the point of view of one who made use of the chemist after graduation. He said: "The education of a chemist must be conceived in the sense that it consists in an effort to produce an attitude of mind rather than to instil definite knowledge. Of course, the latter must not be neglected." The "attitude of mind" is the pith of the matter. The young chemist, fresh from the College laboratory, is only after all just prepared to learn how to apply the knowledge he has acquired, and to build on it by his daily experiences. He must have learned how to study, and have a mind open to see the truth, and courage to follow wherever it may lead. He must have a good knowledge of the theory and science of Chemistry, and be expert in analytical work. If he has had a good teacher, he will have a strongly developed taste for research and original work, and considerable practice in the same; and to this end I recommend both teacher and student to commit Sir William's address to memory. It has occurred to me that it may be profitable to follow the suggestion though not too closely, even widening the field a little, and at the risk of dryness and over-abundance of detail, discuss the question of the

management of a chemical industrial organisation. In looking over the addresses of former presidents, I do not find this matter treated, and it seems to be a subject not out of place in a meeting of a society of the name and character of this. What I have to say will be but the expression of my own experience, and may vary widely from the views of others whose experiences have differed. Being the result of many years of observation and work of one who started as a raw chemical graduate, with but a single labourer to help him, it may be of some value to others, even if it serve only to emphasise what to avoid. In any event, I know the plan outlined has answered fairly well for the management of large and extended chemical industrial enterprises in a vast and rapidly growing country like the United States, and has stood the test of years in a company operating more than a score of plants, widely separated, and yet all working as a unit, controlled by the central governing body, but leaving the local managers sufficient freedom of action. While it possesses all the advantages of centralisation, it is intended to extract from the individuals of the staff wherever located, the entire benefit of their ability and superior knowledge of local conditions. I do not put it forward as novel, for I do not know whether it be novel or not, such matters not being often discussed publicly. In fact, I fear I may be addressing you on a subject with which many of you are more familiar than I am; myself: but I could hardly expect in this distinguished hearing to tell all of you something new and useful.

I have said that the plan is applicable in a large and rapidly growing country like the United States. I suppose it should be modified in a country in which industrial growth is slow. Few who have not lived in it, and studied the question carefully, can have an adequate idea of the wonderful progress made by the United States during the last thirty years, in the arts, manufactures and all else which makes for the greatness of a nation. And fewer yet are those even of our own prophets, who have been bold enough to forecast the wonders of the future. The gradual though rapid unfolding of limitless resources which are only now beginning to be understood, remind one of an infant Newton attracted by the vision of his fingers and toes, and yet who knows nothing of the vast possibilities of his little life for time and eternity. Almost every natural resource needed by man in his most complex civilisation, is found there in prodigious abundance. Coal sufficient for ages. Water powers of wonderful proportions. Forests almost extensive enough to withstand the shortsighted and brutal assaults made on them by ignorance and greed. Ores of nearly all metals in surpassing abundance. Fields of grain and cotton, of tobacco and fruits sufficient to supply the home market and leave vast quantities for export. Such is the empire which in these last years has been opened up in some degree for its fortunate inhabitants, and for the benefit of that portion of the world less blessed with physical wealth. Whatever may be thought concerning the mission of the United States in the realms of thought and ethics, there can be no disagreement as to its destiny to supply food and raw materials to many millions without its borders. The growth of exports of manufactured goods as shown by statistical reports, indicates that we long ago entered the field as competitors for a share of the world's needs of these products as well.

In discussing the industrial future of the world we must take into account these new and enormous resources. The Americans did not create them. They might even feel humiliated that they have not accomplished more with them. The problems of the future for us are very great. If we were obliged to rely solely on natural increase of population, the unfolding would not be sufficiently rapid; but we are not. We can surely count upon a vast influx of immigrants, nearly a million a year, some of whom will be undesirable it is true, but most of whom will make useful citizens after they have learned the difference between liberty and license, and have become assimilated and Americanised. Indeed, it is our pride that many come to us qualified from the start to bear their part of the burdens, and to contribute their full share to the elevation of the country.

Of course, in all this growth the chemical industry has

not stood still. It has kept full pace with all the world. Thirty years ago it was comparatively insignificant. A study of the census reports for those three decades show startling advances. I shall leave the development of this subject to some future American President allude to it only as an excuse for the details to follow. In spite of its growth it is only in its youth, and to its full stature must be organised to accommodate it conditions which require almost constant construction of plants to meet the demand, and modifications to keep pace with the growth of knowledge.

I will pass over the necessary and customary Board of Directors, with its officers and Executive Committee, carry out its policies, simply saying that the success of any enterprise must depend very largely on the character and ability of its leading men. In the chemical industry they must of necessity include men educated as chemists and engineers, who are able to understand what subordinates are doing and to direct them as they offer. I have sometimes thought they must have the virtues and graces, especially patience, as it sometimes takes many months to work out a process worth improving, and many years to bring to even partial completion important matters as the ammonia-soda process, the production of sulphuric acid by catalysis, and the coal tar chemical industry.

The detail work may be divided into the following general departments: Purchasing, Sales, Transportation, Finance, Construction, Operating, Research or Investigation, and Statistical; and yet all of these must be closely interwoven and work in such harmony that best results shall be obtained without delay. To this object I have found it necessary to arrange committees composed as follows: First, a Manufacturing Committee; consisting of the managers of the Operating, Construction, Purchasing, and Investigation Departments, the chairman being the Chairman of the Executive Committee. This brings all departments having to do with the turning out of products, present and prospective, in regular and systematic touch with each other in the Executive Committee. Second, a Sales Committee, composed of the managers of the Sales, Operating, and Purchasing Departments, together with a member of the Executive Committee. This also results in a close touch of the department distributing products with the manufacturing department and with the active governing body.

The Purchasing Department should be managed by a man with a wide knowledge of the innumerable things required in a large chemical enterprise, and where the best results can be obtained. If he be also a good mechanical engineer, so much the better, as that class of ability is frequently called upon in the purchase of parts of plants. If not, however, he must have the services of one at least in this respect. In any case the efforts of the department must result in prompt work, properly inspected articles at low prices, and this is a most difficult and complex matter, a large number of plants are calling constantly and simultaneously for supplies.

Time does not admit of a discussion of the work of the Sales, Transportation and Finance Department, but to do them justice would be too great a tax on your patience. I have always believed that if your goods are well produced, economically produced—but not over-produced—at the right geographical points, their sale follows almost as a matter of course. I do not pin my faith very strongly to that method of doing business, by means of which manufacturers by agreement fix prices without reference to cost, and thus court the competition, which is sure to ensue. I believe that the best results in the long run are obtained by following natural laws, rather than by combating them, invite the disaster which is certain to follow the temporary benefit so derived.

The Operating Department is one of great consequence and importance, involving as it does all the detail management of the various works in connection with the corps of superintendents and chemists and the foremen, processmen and labourers under them. Its headquarters should be in the main office of the company, in close touch with the officers. The questions daily before this department are so varied and of such great number that the necessity is a complete and systematic organization.



nipped as to be competent to carry on its business easily and without confusion. Its affairs being so interwoven with the transactions of all of the other departments of the company, it is necessary that the complete co-operation should be maintained with all, whether located at the main office or at branch offices, and such methods must be employed as to prevent as possible the occurrence of friction in transactions, the interests of several departments are involved. The administration of this department should be headed on by a manager and assistant manager, who each morning for disposition of the mail, the disposition of such specific questions as require immediate attention, and for the formulation of general plans. This department being the one to which all technical questions are referred, except those concerning construction and litigation, its correspondence and telephone work is considerable, necessitating a suitable clerical force. From the questions submitted by correspondents, works in the vicinity of the head office receive daily instructions from the Operating Department regarding factoring, shipment of goods, &c. The manager and assistant manager, through membership on committees by frequent consultation with department heads, by correspondence with branch managers, are kept advised regarding the general policy and manufacturing of the company, and regulate manufacturing so far as possible in such manner as to provide a sufficiency of goods wherever required. While details of work management are of necessity left to the discretion of the various superintendents, this department should dictate general manufacturing policy to be pursued in accordance with the information which it collects by consultation with committees and with department heads relative to the company's manufacturing needs. Therefore the superintendents must look to this department for instructions defining the amount and quality of goods to be manufactured, and concerning all questions of works management requiring official direction and authorisation. The maintenance of the plants in a condition of proper manufacturing efficiency should receive continual attention, the cost of producing goods should be the subject of constant watchfulness. At frequent intervals the works should be visited by the manager or assistant manager for purposes of inspection and consultation with the superintendents. Upon these visits the physical condition of the plant should be carefully gone into, the methods of administration and manufacturing employed by the superintendents discussed, and such changes directed as appear warranted by the facts. Unusual trade demands strain points a deficiency of goods caused by interruption of manufacturing, the ability to produce goods cheaply in one works than another, owing to some change in conditions, and the greater convenience of one works as regards either or both the customer and the manufacturer, are all causes requiring the more or less frequent transfer of goods from one works to another. This department should watch the stocks on hand at all works, and carefully regulate transfers in order to provide stocks at points requiring additional amounts and to prevent the unnecessary moving of goods from one place to another. This is a more important question than it at first appears, and requires constant watchfulness. During periods of excessive trade demands it is an extremely difficult matter to so distribute the goods as to provide each works or shipping point with its proper stock and to prevent a dearth of goods at any locality outside the jurisdiction of the department. It is, therefore, a matter of what precedes that the Order Department should be under the direction of the Operating Department. The Sales Department sells goods and designates grade and where and when required, but the Operating Department alone can keep track of where the goods are located and can best decide regarding the proper grade to be supplied to each customer. Thus undue accumulations of stock at any point will be avoided, and advantage taken of the lowest freight rates in making deliveries. The costs of manufacture of every article produced by the company should be tabulated in detail each month by the Statistical Department, which will be alluded to later. From these records the Operating Department

is enabled to keep close watch upon the variations in the cost of producing goods and has constantly at hand a large amount of information to which frequent reference should be made in the conduct of manufacturing affairs.

This department naturally requires the services of a number of chemists used for the daily routine of the works. The selection of these men is highly important, as from their number may come those who will go into the research laboratory of the company, or possibly fill its superintendents' positions, and in later years its offices. It is not sufficient that they shall show that they have received a good education and have completed a technical course, but they must evidence such personal characteristics as lead to the belief that they are capable of advancement to positions requiring the exercise of thought and judgment, and the assumption of responsibility. It is desirable that they should have some knowledge of mechanical engineering and the general principles of construction, but it has been found in my experience that this combination is rare, and we have been compelled in most cases to engage men who are either good chemists with but moderate knowledge of engineering, or good engineers possessing only an elementary knowledge of chemistry. It is to be hoped that the courses in technical chemistry now given in some of our colleges may turn out men better prepared for the work than those who have entered the field hitherto. In the past I have not found it a matter of so much importance from which technical school a man has obtained his degree, as that he should be practical, reliable, hard working and possessed of natural ability, and the capacity for development and advancement, or, as Sir William puts it, "have the right attitude of mind." As I have said before, the chemical education of the graduate can only be a foundation upon which the chemist who intends to become a manufacturer must build by study, observation and experience, and, therefore, it is only the ambitious, self-reliant, able, practical-minded men who can expect to graduate from the laboratory into the wider field of works management, where the personal equation is so largely a determining factor.

The apprentice should be kept long enough on one subject to make rapid and accurate analyses and at the same time be encouraged to make himself familiar with all the different methods of analysis bearing upon his particular work, and to be sure that he thoroughly understands the basic principles and theory upon which the work rests. For example, if a man be analysing sulphuric acid by the particular method employed by the company, he should not only know that method thoroughly, but by reading become familiar with all other methods of analysing sulphuric acid. Knowledge acquired in this way is apt to be more permanent than that acquired by promiscuous reading. After a sufficient experience along these lines, the apprentice arrives at a position where he may be able to improve existing methods or even invent new ones, owing largely to the thorough acquaintance with the needs of the department that would be apt to follow work and study carried on in this way. Of course all new methods he must test by rigid experiment before recommending.

In a works laboratory a variable degree of accuracy is required, depending upon the object for which the analysis is made. In some cases a tenth of 1 per cent. variation would not be serious. In other cases a ten-thousandth of 1 per cent., or even much less, is highly important, and as the object is to turn out analyses of the required accuracy in the least amount of time, it is of great advantage for the chemist to have such general knowledge of the use to be made of each analysis as will enable him to avoid waste of time in unnecessary accuracy. For routine work it is becoming more and more the custom to employ in works laboratories bright young men, graduates of high schools. Such young men are, of course, useful, but unless they pursue their scientific studies outside, as, for instance, at night schools, they are not likely to make great advances. In every laboratory there must be a chemist in control, who in turn shall be supervised by the chief chemist of the company. Unnecessary duplications being avoided, a force thus organised

becomes capable of doing an enormous amount of work in a given time and with great accuracy.

The apprentice confines his duties for a number of months, and frequently for years, to a works laboratory, and incidental to his analytical work he gains a certain knowledge of the general routine which obtains at that plant. After the laboratory service, if the chemist has displayed ability to advance, he is promoted to a position which will bring him into direct contact with the manufacturing processes, and his duties will gradually change from those of analyst to those of a manufacturing assistant, until he has become proficient enough to warrant promotion to the position of assistant superintendent, to which he is thereafter advanced at the earliest opportunity, either at the works at which he has received his tuition or at another works where such a position has become vacant.

The assistant superintendent is under the direction of the superintendent, and from him should receive a regular training in all the various duties pertaining to the position of superintendent, and when such a position becomes vacant, the assistant who, in the judgment of the department, is best qualified to fill the advanced position, is recommended for the promotion. The ability to administer chemical works can be obtained only by experience, and realising this fact the most efficient superintendents should act as teachers to the younger men in their development from one position to another.

Chemists who are not attracted by outside or works positions but who prefer research work, naturally graduate in due time from the works laboratory to the research laboratory. Occasionally one is found whose ambitions lie in the direction of mercantile affairs, for which he thinks the experience of the chemical laboratory will best qualify him. As a rule, however, the educated chemist does not select advancement in the Sales Department, or other business parts of the organisation, nor does it often happen that he is qualified.

The chemist, to succeed in technical work, must strive for material results. It has been my experience that the post-graduate course seems to incline him toward the search of learning rather than to its application. He must have a clear, logical mind, a singleness of purpose, and he must be able to separate the essential from the non-essential. This is true of all professions, but it is particularly true in chemical work, where the essential must be selected from an unusually large assortment of non-essentials.

The efficiency of a navy depends very largely on the "man behind the gun." So with chemists in a works or laboratory. The personal equation has much to do with the results. There is no "royal road" to success here. The rewards are for those who are willing to pay the price, and that price includes constant and intelligent work. The habit of study is rarely acquired after college days, and if the undergraduate does not develop it, he should seek a less exacting profession than that of chemistry, unless his ambitions will be satisfied with the daily grind of routine work.

The Construction Department, as its title implies, should have entire charge of the designing and construction of all new plants or parts of plants, and should, of course, act in the closest touch with the Investigation Department. In fact, all construction should be the result of careful investigation, and it rarely happens that it is wise to exactly duplicate a plant already constructed, for the reason that improvements are made so rapidly that a construction of a year or two in age frequently becomes in that time obsolete or partially so. This is one of the difficulties of all manufacturing business, but I believe the chemical industry from this cause is in a more difficult position than any other. The necessity of keeping plants up to the most modern standards makes an exceedingly large repair or reconstruction bill, which must not be lost sight of in determining the cost of the finished product. If this were more generally understood it would be better for the industry at large. No construction should be entered into that is not a part of a well digested plan, otherwise the result will be a heterogeneous mass of buildings and apparatus placed haphazard, without sufficient regard to the economical disposition of men, or the handling of materials. As a chemical industry,

like most others, is usually the growth of many years is, of course, difficult, but none the less important, course, no one is far-sighted enough to anticipate all requirements of the future, but I believe that if sufficient care be given to the question, enough can be foreseen to result in better engineering than we sometimes obtain in chemical plants.

The Construction Department should control all constructions, important repairs and maintenance. Maintenance requires the assistance of the Engine Department. It is responsible for preparing specifications for all building materials, machinery, apparatus, supplies required in connection with construction important repairs, and approves of all works required in carrying out this branch of work.

Constructions include all new installations of apparatus, new structures, extensions or betterments of plants, and may be subdivided into constructions of plants and minor constructions.

*1st. Constructions Proper.*—These are formally entered and numbered. Plans, specifications, and estimates are prepared, and presented to the Executive Committee for approval and appropriation before construction work is begun.

*2nd. Minor Constructions.*—These are authorised by the department without submission to the various committees for approval. They are aggregated quarterly and the necessary appropriation obtained for completion of the work. This list should be kept as short as possible and only permitted at all to save time in the many, but necessary matters which come up unexpectedly in chemical plants.

Superintendents should be encouraged to make recommendations to the Home Office for constructions which they deem necessary, but in no case should construction be permitted until the proper authority has been obtained by the Construction Department. A construction may be executed under the supervision of a superintendent or by a special superintendent or inspector appointed at the discretion of the Construction Department.

Necessity for constructions may originate through recommendations of a superintendent, supported by the Operating Department, or may be ordered by the Executive Committee on account of general business developments. When a construction is settled, the Manager of the Construction Department confers with the General Manager, in order to arrive at a scheme of procedure which would be likely of adoption. The Engineer and Manager of the department then visit the works or property involved, to confer with the Superintendent, if it be not found practicable to decide something by a study of the plans and records only in the head office. A pencil sketch with preliminary estimate is first prepared for a more intelligent consideration of the proposed construction and its cost. Consultations take place frequently with the Superintendent and Operating Department, so that no part may be omitted.

A construction at this stage does not reach the drawing office, and no attempt is made to develop plans until the approval of the General Manager has been received, as to the form the proposal has now taken. When approval has been obtained, the design is put into the draughting office for development and final estimate. The final plans and estimates are presented to the Manufacturing Committee for approval, and recommendation made to the Executive Committee for the necessary appropriation.

When a plant is to be designed or built involving new process or apparatus with which the staff is unfamiliar, the Investigation Department furnishes the data necessary or a consulting engineer is retained for that purpose.

The Investigation Department is that part of the manufacturing organisation which deals with all the propositions of a technical nature. Its work, which is entirely distinct from current manufacturing, has to do with new, and the improvement of old processes. A proposition is in the control of the Investigation Department from the time of its inception until sufficient data has been obtained to enable the Construction Department



sign the necessary plant, if one be authorised by Executive Committee. It is turned over to the Operating Department only after the process is working fully and the results considered satisfactory. The organisation of the Investigation Department is sufficiently broad to permit the consideration of manufacturing proposition from the points of view of business man, the chemist, the engineer and the attorney. It consists of the Manager, a Chemical Engineer composed (in addition to the Manager) of the Chemical Engineer, the Chief Chemist who is in charge of the Research Laboratory, and such consulting chemists and engineers as the company employs. Appointments in this Council are intended to cover the most varied field of theoretical and technical chemistry. The Manager is permitted to consult outside experts if the company has not the necessary talent at hand. A number of chemists on Research Laboratory work, an expert in current chemical literature, patent experts, and a small office force complete the department staff. The Research Laboratory, a body of chemists, under the supervision of the Chief Chemist, is employed on research work connected with investigation in hand. A limited number of men are permanently retained on research work.

Research Laboratory reports weekly the progress of work in hand, and at the completion of each investigation sends in a statement of the steps taken, sanctioned by the chief's recommendation as to further work. These reports are passed upon by the Chemical Council at its regular meetings.

Analyses required are made by the Analytical Laboratory, which is specially equipped for turning out quick and accurate estimations. Each works has its own analytical laboratory, but there is a central laboratory for the work of the head office. This laboratory fully examines and selects all analytical methods, and adopts as standards and furnishes to all laboratories.

The work of the Investigation Department originates from sources which may, in a general way, be divided into three classes:—

- (a) The probability of reducing manufacturing costs.
- (b) A decision to produce well established products not previously manufactured by the company.
- (c) New applications of science to industry.

The largest field is perhaps that of improving the processes at present in use at the different works, and which usually yields very profitable results. Aside from the chronic aim of the Operating Department to secure uniformly low costs, a decision to investigate a process in use may result from a drop in the market value of a product on account of trade conditions, or because the process is technically unsatisfactory. There are developed, therefore, new methods or important modifications involving reconstruction or even new plants.

Consideration of the manufacture of products not previously produced by the company is usually given at a meeting of market conditions or special wants of customers. A large consumption of a product of interest is increasing, and the raw materials prove to be available. Investigation may be undertaken with a view to the improvement of a process and the construction of a plant.

The third source of investigation originates in the discovery of new processes so frequently offered to the company. Such processes, whether for a product manufactured by the company or of prospective interest, always given the attention which their merits seem to warrant. No one who has a sensible process to offer is refused a hearing, and the treatment accorded the inventor soon becomes public opinion. As a rule, the inventor is retained to direct the development of his process under the management of the department.

An investigation of a new manufacture includes a thorough examination of both the commercial and technical sides of the proposition, the commercial side, which the assistance of the Manager of the Sales

Department and other commercial branches is invoked, calls for consideration of the following:—

1. Its relation to the interests of the company.
2. The market.
3. Manufacturing costs.
4. Investment necessary.
5. Source of raw materials.
6. Transportation.

1. *Its relation to the interests of the company.*—The product should, in a general way, belong to its branches of chemistry. Consideration is frequently restricted by questions of policy, and the General Manager is always approachable if his views are required. The probable effects on the market of embarking in the manufacture must be studied. To a certain extent, new features arise in connection with the consideration of every proposition.

2. *The market.*—This calls for an examination of its general character and history, its probable stability, tonnage, whether local or general, and consequent freight costs; whether distributed over the twelve months or confined to a limited season, and the consequent question of storage and capital necessary to be tied up by goods in storage; cost of reaching the market, and advertising.

3. *Manufacturing Costs.*—This must have such a relation to the market price and the cost of marketing that a legitimate profit from the manufacture and sale of the product is apparent. No manufacturing should be undertaken for the purpose of injuring a competitor.

4. *Investment necessary.*—The investment must be so limited that a legitimate return is possible.

5. *Source of Raw Materials.*—The permanent availability of raw materials is a matter of the first consideration. As there is no likelihood of a chemical business controlling the supply of raw materials, the cost must at least be as low as that of any competitor.

6. *Transportation.*—Includes the investment and maintenance for containers, whether casks, drums, carboys, tank cars, tank boats or pipe lines.

On the technical side a study must be made of:—

1. The process.
2. Other processes.
3. Raw materials.
4. Quality of product required.

These topics indicate the method of working out or testing the practicability of the process. This phase of the proposition is entirely a chemical and engineering one, and calls for most of the work of the investigation staff.

In the usual order of procedure, a proposal reaching the Investigation Department is subjected to a preliminary consideration, and is entered for record if it is to be made a subject for investigation. It is then submitted to the Chemical Council, who decide on the method of investigation to be pursued. A résumé of the literature is generally made and a report obtained from foreign representatives on the latest European developments. We may soon have to add the Japanese. As the inquiry progresses, the Chemical Council, which meets weekly, is kept informed of the progress made.

The thorough consideration given at this early stage frequently prevents useless laboratory expense and much loss of time.

Where an investigation of a process in use is being made, a member of the Investigation Department is sent to each of the Works using it, to study the methods and management and analyse its defects. His reports thereon are considered by the Chemical Council in the manner indicated above.

If the final result of the investigation of a new process be favourable, an experimental plant may be recommended and an appropriation asked for. This may be advisable not only to assist in reaching a decision regarding the wisdom of adopting the process, but also for furnishing

data for the designing of a manufacturing plant, if one be ultimately decided upon.

In the case of the adoption of a process and the designing of a plant, the work of the Investigation and Construction Departments is very intimately connected. An investigation covers the inquiry regarding the proper design of the apparatus or plant, as well as the process *per se*.

Investigations in connection with construction naturally differ, to a certain extent, and include consideration of methods for handling the raw material, the solids, liquids and gases involved in the process; furnacing, dissolving, filtering, evaporating, crystallising, distilling, subliming, drying, &c., and the packing and handling of the finished product.

The materials to be used in different parts of the construction are determined if an investigation into that important side be necessary, whether wood, cast iron, steel, lead, tin, aluminium, alloy, earthenware, porcelain, rubber, cement, &c. Any special data requested by the Construction Department in carrying out its work is furnished by the Investigation Department, such as the selection of fuel for special work, boiler and engine tests, consumption of steam, &c., and all chemical work.

The benefits resulting from organisation in the consideration of improvements and new processes are very evident. The results of experiments in one instance are applicable to others of distinctly different character. The full use of them demands a central bureau and clearing house of information.

The conferences held so frequently are not permitted to drag. Records are kept of all decisions, and even the local heads of departments present are notified in writing.

The routine work of the department consists in the collection and filing for easy access of technical and commercial data of all kinds connected with chemical manufacturing, for immediate and prospective use. Circulars containing useful information applicable to the works, and copies of research reports that may help operations, are transmitted to Superintendents. Records of failure are just as important as those of success. Every encouragement is given Superintendents to confer freely on any modifications, developments or conceptions which may occur to them. The *esprit de corps* resulting naturally reaches the junior men and foremen, so that a keen sense of responsibility and importance is felt throughout.

The frequent visits of Managers and Superintendents to the head office, and the periodic meetings of Superintendents which are called for conference and discussion enable the responsible men to continue in perfect familiarity with the technical resources of the company.

The Research Department would not be complete without a laboratory plant, large enough to work out processes on a small manufacturing scale. Such a plant should have all the standard appliances, and be so arranged that the results obtained in it are sufficient to form the basis for the engineering work resulting in the experimental plant to follow the successful investigation.

After all of the organisation has been perfected and the machinery lubricated and put in motion, it would be apt to run wild if some reliable and absolute method of control should not be at hand. This I have found completely accomplished by a department which has to do with the compilation of facts and the deductions from them. It is absolutely essential, in a company operating a number of plants, that those in control should not only know what each one of its manufactured products costs, but what enters into making up that cost, so that if for any reason there is a drain going on it will be quickly known, located and stopped; or if, on the other hand, something advantageous shall have been accomplished, that will also be noted and imitated at other points. This may seem like an exceedingly difficult undertaking in an industry of such infinite variety, but a brief consideration will show that it is not so. The Statistical Department, to which I allude, is not only able to advise the officers within a reasonable time after the end of each month of the cost of every product and step, but also of the profit or loss on each article and the total profit or loss of the company. These results have been so exact that for several years the profits

determined by public accountants at the end of the year have not varied 1 per cent. from those which have worked up in this Statistical Department month by month. The importance of this information to those in control will be readily understood. For my own part, I see how it would be possible to intelligently run an enterprise involving a number of plants without such arrangement.

The exact plan which I would recommend is as follows:  
Each factory furnishes monthly the following reports:

- Raw materials received.
- Raw materials used.
- Shipments of finished products.
- Stocks of raw materials.
- Stocks of finished products.

Productions and statement of statistical data (including manufacturing labour, labour on material taken from the storehouse for repairs, all material taken from the storehouse for manufacturing fuel and raw materials), packages, dry barrel included in the selling price and not returnable, facturing cartage (i.e., teams used around the steam and water).

The first shows the number of pounds of raw material received, together with cost of placing in the mill by adding the amount of bills, freight, &c., we have actual cost per hundred pounds of each. These are used in obtaining the material cost of each hundred pounds of production, which, with sundries, fuel and repairs, makes up the total manufacturing cost and in connection with that shows what each department has accomplished during the month.

As each of the factory sheets is checked and every item of raw material and finished product accounted for, nothing escapes which should be considered in cost.

In addition to the manufacturing cost are shown cost per 100 lbs. of special factory charges (including accounts as docks, dredging, fire equipment, labour, lighting, roads, maintenance of yards, watchmen, &c.) and cost per 100 lbs. of goods produced. Salaries of superintendents and chemists, based on a portion of labour of each department and the total facturing labour.

The factory shipment sheets are checked by the Accounting Department as well as repairs and net prices obtained, lighterage, cartage, allowances, commissions, &c., being deducted.

By using the manufacturing costs and the net prices, we arrive each month at the gross manufacturing profits, and deducting taxes, insurance, office and general expenses, the net results are obtained.

All organisation, whether in the chemical industry or any other, would fail to attain the best and most permanent results, if the personal equation be forgotten. We are not dealing with a collection of apparatus with an organisation of men, everyone an individual with his own peculiarities and ambitions. The end will not come, if it ever will, when from purely selfish motives a man will give his most efficient services must realise that while his best work must be done, it will not go unnoticed and unrewarded. He must be sure that he will receive just and proportionate treatment. His proper ambitions must not be smothered, they must be directed. From an experience of many years, I believe the plan outlined above, provides fully for the most important fact, and I can point with the pleasure to many men as proof of my statement that every one more enthusiastic than at the beginning. The places of the leaders will some day be vacant, then shall fill them? Those whose lives have been in preparation for the work, and who will enter without shock or derangement of existing conditions, but as naturally as the stream flows into the river, will the natural ambition of the young man reach fulfilment in due time and thus will our beloved progress to points of attainment which some of us dream of, but will never see.

Dr. DIVERS, F.R.S., proposed a hearty vote of thanks to the President for his address, saying that he could



no subject of more interest and importance to a Society of Chemical Industry, or to chemical factoring at large than that of the management of chemical industrial organisation, especially when treated, as it had been, by a man of such great science as their President. The benefit conferred on the Society was inestimable. No words could be long for him to use in expressing on behalf of the Society, of chemical technology, and of technical education at large, their high appreciation of this address. The President happily made last year by their previous President, Sir William Ramsay, that his successor, Dr. Nichols, should take up the subject of technical education. He had dropped it, namely, at the point where students had been trained at a College, University, or Technical School, had been most happily adopted by the President.

HENRY ROSCOE, F.R.S., said it was his great pleasure to second the motion. He was almost overcome with the ordinary value of this discourse. To put it very briefly, it was a lesson to them from America—a wonderful lesson, a most valuable lesson; and it was for all manufacturers and all those interested in that industry to take this lesson to heart, if they could carry out all the splendid ideas of this wonderful nation which had been sketched out (and he doubted whether it would be possible to find in this country an institution so complete as that which had been figured out by the President). Still, they could, no doubt, improve their methods and adopt some, if not all, of the recommendations which had been put before them, and so get the benefit of this lesson from America. The idea of founding the Society came from three of his sons, whom he was proud and happy to see present that day: Mr. Edmund Muspratt, Mr. Eustace Carey and Dr. George Mond. Those gentlemen with some other friends to see him in Manchester nearly a quarter of a century ago, skilfully co-operation in the foundation of a Society, as they then thought, should be limited to the interests of the manufacturing districts, that of South Lancashire. He at once agreed with the desirability of founding a Society of the kind to bring together in common the interests of those engaged in scientific industry and in carrying out those principles in chemical industry, but he said that if it was worth doing at all, it was worth making a national society; and so the Society arose. It had now become far more than a national society, for it was an international one. The fact that it had had two Presidents from the United States was a good proof of that. They all welcomed Dr. Nichols, thanked him for the address, and they would endeavour to carry out to the best of their ability the lessons taught. He wished to express on his own part, and he was sure he was only the spokesman of all the British chemists, the feeling that as time passed the two countries would become united in still more common bonds, and they might be brothers in heart and in deed.

EDW. DIVERS put the motion to the meeting, which was carried by acclamation.

THE PRESIDENT then read the report of the Scrutineers, which stated that 179 votes were cast, of which 11 were invalid. The nominations of the Council for the President and Vice-Presidents had been confirmed, and the following gentlemen were duly elected ordinary members of Council: Mr. T. Dunn, Mr. Arthur R. Ling, Mr. J. S. McArthur, and Mr. K. E. Markel.

THE PRESIDENT, having read the names of the retiring Presidents and Members of Council, said it was impossible to ask all those gentlemen to speak, although he should have liked to have done so; but when he considered that Mr. Tyrer had been on the Council since the beginning, and had rendered yeoman service in so many ways to the Society, it would not be unreasonable to let that opportunity pass without calling upon him for a few words.

THOMAS TYRER said that they had never had any but a unanimous vote in the acceptance of the

Reports of Council, and only twice had they had their bye-laws amended, once in a direction which they now regretted, when the subscription was reduced from 30s. to 25s., with a view to increasing the influx of the younger members; but still the success of the Society since then had shown that that step was after all not an unwise one. The only other alterations had been one or two of very minor character to facilitate business. He mentioned this because Sir Henry Roscoe had referred to the Society having grown to be international. The reason was that under his wise guidance and that of the Council at the time when they had no home or habitation, and no Council Meetings, the first Hon. General Secretary, Mr. George E. Davis, and Mr. Eustace Carey and himself (the Secretaries respectively for the North and the South), had a great deal to do in framing rules, which had never been altered, and which were framed on the basis referred to by Sir Henry, namely, that the Society should be so broad as to include everybody. They had had some difficulties and troubles, but through them all the Rules had been adhered to, and faithfully carried out; and the fact that they had been found equal to every stress and to the needs of every occasion, proved that the Society had been thoroughly well laid, and its foundation secured. He had had some experience in public, municipal and philanthropic matters and various governing bodies, but he had never heard of greater freedom of expression and never seen so little friction, as in their Society. He felt it a great compliment to have been thus referred to, and he was very well satisfied in retiring to see how thoroughly the idea of internationalism was being carried out.

THE PRESIDENT said it now became his very pleasing duty to inform the new President, Dr. Divers, of his election. Dr. Divers had, in fact, been the President of the Society for the past year, and he had done the work willingly, gladly, and very ably. He had intended to say something more on that point, but, as time pressed, he would reserve that for some other occasion, because he had something a little out of the ordinary to bring forward, and about which he hoped the Council would take appropriate action. That the Society at its formation had amongst its members 20 or 30 Americans was typical of the fact that, at any rate, from the standpoint of those gentlemen, it was an international society, and that American membership had grown until, in the New York and New England Sections, they had about 1500 members. He wished to state in the strongest possible terms that those 1500 gentlemen were members of the Society of Chemical Industry of Great Britain, and hoped to remain so, as long as the Lord would permit them. It was the desire of those gentlemen that there should be some little memento left with the English members of this visit. They did not quite know what to do, especially as they were aware that England was a country full of precedents, and they were afraid of destroying one at every turn. He did not know that he was not going to do something unprecedented now, but at any rate, he would take the blame. He found that the President of the Chemical Industry had no insignia of office in which to appear on public occasions such as the present. So they had ventured to provide something in the shape of a little medal which they hoped the Council would receive in the spirit in which it was offered, and instruct Dr. Divers and all future Presidents to wear it on official occasions.

The President then opened the case and displayed a very elegant star, having in the centre an excellent head of Sir Humphrey Davey, surrounded by the name of that Society, and an appropriate wreath joined together beneath by the two Hemispheres, the Eastern and the Western.

He hoped that as long as that Insignia of Office should endure, all Sections, whether in the New World or the Old World, would be part and parcel of the one old Society of Chemical Industry, started by the two or three men whom they had heard of that day. On behalf of the New York Section, he begged to present Dr. Divers with this medal, and to express the hope that the Council would instruct him to wear it on such occasions as might seem fit, and to hand it down to his successor as long as time should endure.

DR. DIVERS said he desired to express his very deep appreciation of the honour which had been conferred upon him in electing him as President. He felt that the duties, with which he was somewhat familiar, were of an arduous character, and that the work of the Society at present was a very great work, that the possibilities of the future were exceedingly great, and that it required all the energies year by year of the President, supported by the other officers, to take full advantage of the opportunities that were presenting themselves. He therefore felt very deeply responsible of the task before him, but he would, as far as possible, emulate the example of his distinguished predecessors in office. With regard to the beautiful badge which had been brought over by the President, from himself and the American members, he could only thank him on behalf of the Society in general, and especially the British members, and could assure them that it would be greatly valued and esteemed as a special mark of the *rapprochement* that had been made between the members of the Society on both sides of the Atlantic.

On the motion of Mr. H. A. METZ, seconded by Mr. V. G. BLOEDE, Messrs. Miall, Wilkins, Randall, and Co. were appointed Auditors for the ensuing year, at a fee of 10 guineas.

DR. G. H. BAILEY said that he had been requested by the Manchester Section to invite the Society to meet next year in Manchester. The Section would do everything possible to ensure the comfort, enjoyment, and instruction of the Society.

MR. JULIUS HUBNER (Secretary of the Manchester Section) seconded the motion, and assured the Society of a hearty welcome.

SIR HENRY ROSCOE, as an old Manchester man, supported the resolution, which was carried unanimously.

Prof. C. F. CHANDLER, in moving a vote of thanks to the Council and Senate of University College, London, for the use of their room, said it was eminently appropriate that the Society of Chemical Industry should hold this meeting in London, in the first institution of the world that offered instruction in Practical Chemistry—an Institution which had been made familiar to every chemist in the civilised world by the eminent services rendered to chemical science by Sir Thomas Graham, Professor Williamson, and Sir Wm. Ramsay.

SIR BOYERTON REDWOOD seconded the motion, which was carried unanimously.

SIR WILLIAM RAMSAY, F.R.S., said the Council and Senate of University College had with the utmost willingness acceded to the request of the Council to place that room at their disposal. It had been the custom of the University College for the last 75 years to do all they could for the promotion of learning. Professor Chandler had mentioned the names of his predecessors in the Chair of Chemistry, but he ought to say that it was Professor Turner who, about 1828, opened his laboratories to a few young gentlemen. He was succeeded by Professor Graham, who subsequently became Master of the Mint, and by his colleague Professor Williamson, and he himself had the honour to succeed Professor Williamson. The College, therefore, had done its share in contributing what was possible to the advancement of chemistry.

The official business being then completed, the members adjourned to the Midland Hotel, where luncheon was provided by the London Section.

## New York Section.

Meeting held at the Chemists' Club, on Friday, May 1905.

DR. RUSSELL W. MOORE IN THE CHAIR.

### THE QUANTITATIVE ANALYSIS OF LARD

BY DAVID WESSON AND NATHANIEL J. LAN

It is proposed in this paper to collate and prepare a compendious form the processes necessary to a quantitative analysis of lard. The methods here described have been employed by the writers in the course of somewhat wide and varied experience with satisfactory results. In many instances, the accuracy of the conclusions reached has been checked by work on the composition of which was known to the person making the same, but not to the chemists.

In the preparation of commercial lard, the materials used are lard, cottonseed oil, oleostearin and so on. In lard compound the lard is omitted. Occasional paraffin has been detected, but this is a rare adulterant and only used by unscrupulous makers.

In the analysis the following preliminary qualitative tests should be made as follows:—1. The H test. 2. The Bechi test. 3. Microscopic examination. After which the following determinations are made: (1.) Free acid as oleic. (2.) Titer test. (3.) Saponification value. (4.) Iodine value (Hübl or Wijs', not the iodine value). (5.) Liquid acids and their iodine value. (6.) Warming test.

### QUALITATIVE TESTS.

1. *Halphen test*.—This well-known test is applicable. It will not indicate cotton oil which has been heated to 150° C. in iron vessels. (Oilar, Amer. J., 24, 3.) It also fails to give a decided reaction with oils which have undergone special refining processes. The test is of value as a confirmation of other tests, or as an indication, but must not be considered conclusive. (Lewkowitsch, Vol. II., page 534.)

2. *Bechi test*.—(Wesson's modification, J. Amer. Soc., 17, 725.) This method, while it has been superseded by the Halphen test, is nevertheless valuable on account of its speed. The solution required is made from alcohol, 160 c.c.; ether, 40 c.c.; silver nitrate, 10 g. Allow this to stand in the light until the supernatant liquid is clear; then decant into a glass stoppered bottle. Take about 50 c.c. of the melted lard, add an equal volume of 4 to 5 per cent. solution of sodium hydroxide, shake and allow to stand on the water bath until it separates into two layers. Draw off the aqueous solution, and wash the residue twice with hot water; add the same volume of 10 per cent. nitric acid, warm, shake, settle and wash in the same manner. After the last washing has been drawn off, heat on the bath until the lard is clear, filtering if necessary. Take 10 c.c. of the lard and 10 c.c. of the solution in a small beaker, and heat on the water bath for fifteen minutes out of contact with the light. A reduction in the presence of cotton oil.

Without this purification there is usually a reduction to render the result doubtful, although on occasions it may give none.

3. *Microscopic Examination*.—Melt 2 or 3 c.c. of lard in a test tube; dissolve in 7 or 8 c.c. of ether; the tube with cotton and allow to stand in a moderately cool place until crystals separate; decant the supernatant liquid; melt the residue; re-dissolve it in ether, and crystallize again. Under a microscope with a power of 250 diameters the lard will show straight crystals with oblique ends, tall or oleostearin curved crystals with sharp pointed ends.



# QUANTITATIVE TESTS.

**Free Fatty Acids (Wesson's Method).** *Apparatus required.*—A burette accurately divided into tenths; a convenient form is one holding 10 c.c., and about  $\frac{1}{4}$  in. in diameter. A pipette to deliver 7.05 grms. cottonseed oil at 15° C. A number of sample oil bottles. About 100 c.c. of phenolphthalein, 1 gm. dissolved in 100 c.c. alcohol. A solution of brine containing 150 grms. of sodium chloride per A one-fourth normal sodium hydroxide solution. Using the salt solution add a few drops of the phenolphthalein and run in enough of the caustic soda to render it slightly pink.

A 4 oz. bottle one half full of the salt solution, add 4 drops of phenolphthalein, then fill pipette to the mark with the oil to be tested and deliver same into the bottle, draining the pipette carefully. Do not blow oil from pipette. Start with the burette filled to the zero mark with the standard soda solution. Close the mouth of the bottle containing brine and oil and shake well, and then add a few drops from the burette and shake thoroughly, continue until the salt solution gives a distinct pink colour after continual shaking. Reading of the burette gives the percentage of free acid.

Separation of the oily emulsion from the salt brine to observe the colour is hastened by holding the bottle in a slanting position.

Solids and solid fats the samples should be melted in salt solution heated 10° or 15° above their melting point.

**Water Test.**—By proposed method in U.S. Department of Agriculture, Circular No. 22:—

Put 75 grms. of fat into a metal dish and saponify with 60 c.c. of 30 per cent. sodium hydrate (36 per cent. caustic soda) and 75 c.c. of 95 per cent. by volume or 120 c.c. of water. Boil down to dryness, with stirring to prevent scorching. This should be done over a very low flame, or over an iron or asbestos plate. Dissolve the dry soap in a litre of boiling water. Sulphuric acid has been used, boil for 40 minutes in order to remove it, adding sufficient water to replace that lost by evaporation. Add 100 c.c. of 30 per cent. sulphuric acid and 100 c.c. of water to free the fatty acids, and boil until they form a clear transparent layer. Collect the fatty acids in a small beaker and place on the steam bath. The water has settled, then decant them into a dry filter, using a hot-water funnel, and dry twenty minutes at 100° C. When dried, cool the fatty acids to 20° C. above the expected titer and transfer to a test tube, which is 25 mm. in diameter and 100 mm. high (1 by 4 in.) and made of glass about 1 mm. in thickness. This is placed in a 16 oz. salt-mouth bottle of glass, about 70 mm. in diameter and 150 mm. high (6 in.), fitted with a cork, which is perforated so that the tube rigidly when in position. The thermometer graduated to 0.1° C., is suspended so that it can be stirred, and the mass is stirred slowly until the thermometer remains stationary for 30 seconds. The thermometer is then allowed to hang quietly, with the bulb in the centre of the mass, and the rise of the mercury is noted. The highest point to which it rises is taken as the titer of the fatty acids.

The fatty acids are tested for complete saponification as follows:—

A few c.c. of the fatty acids are placed in a test tube with 5 c.c. of alcohol (95 per cent. by vol.) added. The mixture is brought to a boil and an equal volume of water (0.96 sp. gr.) added. A clear solution should be obtained (turbidity indicating unsaponified fat. The room temperature must be reported.

**Saponification Value.**—This is taken as usual. It is 193 to 198; a lower number would indicate the presence of paraffin.

**Iodine Value.**—The Hübl or Wijs' method should be used. The Hanus method is unsuitable owing to its action on the liquid acids of cottonseed oil, which will be referred to later. The iodine value of the lard is taken as a check; it has no significance in determining the composition of lard.

**5. Liquid Acids and their Iodine Value.** This method is based on the separation of the lead soaps by ethyl or petroleum ether and is too well known to require a detailed description, which may be found in Lewkowitsch, Vol. I, p. 348, and J. Amer. Chem. Soc., Feb., 1893. There are several precautions which it is essential to observe. In saponifying the fat use pure ethyl alcohol, best prepared as follows: To ordinary alcohol add potassium permanganate in very fine powder or saturated solution until the pink colour holds for about 10 minutes; allow to stand overnight, filter and distil over a fixed oil and sodium hydroxide, the first portion of the distillate (about a quarter) being rejected. A sample of cotton oil having a liquid acid iodine value of 141.7 gave with impure alcohol a result of 131.7. The fat should be saponified as recommended by Muter in the original paper, by adding 50 c.c. of alcohol and about 1 gm. of pure potassium hydroxide to the fat in a 4 oz. Erlenmeyer flask, a guard tube being attached when boiling. It has been recommended to saponify with N/2 potassium hydroxide (stock solution); when a few days old this has a tendency to oxidise the unsaturated acids, as may be observed in the following results obtained with cotton oil by using an N/2 solution four days old.

	Regular Method.	N 2 Alkali.
	Per Cent.	Per Cent.
Liquid acids .....	76.20	77.38
Iodine Value, Hübl .....	140.5	137.5
Iodine Value, Wijs .....	143.7	138.7

As low a result as 121 has been obtained by using an old N/2 solution. Furthermore, the ether solution of the liquid acids will be yellow instead of practically colourless as it should be. In precipitating the lead soaps use 1 gm. of lead acetate to each gm. of fat. Boiling the aqueous solution for five minutes after precipitation causes the lead soaps to fall down quicker, and the solution clears more readily on cooling. After the lead soaps are precipitated and washed, immerse the flask in a water-bath until the contents melt, then cool and shake out the water; it is unnecessary to dry. Dissolve the soaps in ether which has been distilled over calcium chloride; ether containing alcohol gives the amount of liquid acid too high, and their iodine values too low.

A lard gave these results:—

	Ether containing Alcohol.	Purified Ether.
	Per Cent.	Per Cent.
Liquid acids .....	68.00	65.55
Iodine Value, Hübl .....	92.18	92.70

The use of the Buechner filter is an improvement in the filtration of the lead soaps. A convenient size is 10 cm. with three 12.5 cm. filter papers pressed on the plate with a bottle, which is nearly the same diameter as the funnel; this forms a tray-shaped filter. Use low suction, not more than 2 in. of mercury. If the filtrate is cloudy, it will clear on warming to 15°. The turbidity is due to cooling.

Another method is to weight 6 grms. and pour the ether solution into a 500 c.c. graduated tube. Dilute to 500 c.c., allow 2 c.c. for volume of precipitate, allow to stand overnight, and draw off an aliquot part, filtering if necessary, then proceed as usual (dilution method). This is especially recommended for use with petroleum ether.

If petroleum ether is used in the separation, the filtered solution should be decomposed with 20 per cent. acetic acid; when hydrochloric acid is employed, a compound is formed insoluble in petroleum ether and not decomposed by the acid. The liquid acids may be determined volumetrically or gravimetrically. The former method is far more rapid and convenient, the latter takes longer; it is difficult to get constant weight and guard against oxidation even when done in an atmosphere of carbonic acid, and the results are not as concordant. Apparently

there is some loss, the acids from the gravimetric determination requiring less alkali than is used for the acids in the same volume of ether. In a sample of cotton oil, the acids in 50 c.c. of the ether solution in the volumetric determination required 16.83 c.c. N/10 sodium hydroxide, while the weighed acids from the same volume required 16.70. In lard, the differences are greater.

The iodine value of the liquid acids should be determined by the Wijs' or Hübl method. The Hanus method fails to give concordant results on cotton oil liquid acid, as indicated by the following results.

Liquid acids—			
Iodine Value, Hanus ..	2 hours	143.0	3 hours 148.5
Iodine Value, Hanus ...	1 hour	135.0	3 hr. 15 m. 152.4
Iodine Value, Hanus ...	1 hour	140.7	2 hours 147.1
Iodine Value, Wijs ....	1 hour	145.1	2 hours 143.7

The following results were obtained by the different methods on a sample of lard.

*Ether not purified, solution not cooled.*

Method.	Ordinary Filter.	Buechner.	Dilution.
Liquid acids—	Per Cent.	Per Cent.	Per Cent.
Vol. ....	67.48	68.00	67.12
Grav. (wt.)	—	67.45	—
Iodine value—			
Hübl .....	93.00	92.18	91.69
Wijs' .....	(2 hrs. 95.28 2 h. 30 m. 95.28	2 h. 25 m. 95.22 3 h. 12 m. 94.85	95.18
Hanus .....	93.00	2 h. 25 m. 91.08 3 h. 12 m. 91.90	92.75

*Ether purified, solution cooled to 15° C.*

Method.	Ordinary Filter.	Buechner.	Dilution.
Liquid acids—	Per Cent.	Per Cent.	Per Cent.
Vol. ....	65.30	1st 64.30 2nd 64.39	66.70
Grav. (wt.)	62.60	61.90 Diff. wt. sep. dets.	—
Iodine value—			
Hübl .....	94.50	96.35	93.72
Wijs' .....	96.78	96.83	95.62
Hanus .....	95.15	99.30	95.30

*Ether Purified, Solution not Cooled.*

Method.	Ordinary Filter.	Buechner.	Dilution.
Liquid acids	65.55	—	—
Iodine value, Hübl .....	92.70	—	—

	Liquid Acids.		Iodine Value, Hübl.	Iodine Value, Wijs'.	Iodine Value, Hanus.
	Vol.	Grav.			
Highest .....	68.00	67.45	96.35	96.83	99.30
Lowest .....	64.30	61.90	91.69	94.85	91.88
Average .....	66.13	63.98	93.16	95.63	94.18
Difference .....	3.70	5.55	4.66	1.98	7.42

These results indicate that the lower the percentage of liquid acids found, the higher is the iodine value.

It will be seen from the above, that the Buechner filter gives the most accurate results (this has been proved on peanut and other oils repeatedly), also that the Wijs' is by far the best method for the iodine value, and that the ether solution of the lead soap should be cooled to 15° C. before filtration, in order to obtain concordant results. The Wijs' solution should be allowed to act for two hours, the Hübl overnight: this applies only to liquid acids. The following formula gives the per cent. of cotton oil.

a = Iodine value of liquid acids found.  
b = Iodine value of liquid acids of lard (96.1)  
c = Iodine value of liquid acids of cotton oil  
j = Per cent. of liquid acids found.  
k = Per cent. of liquid acids in cotton oil.  
x = Per cent. of cotton oil.

$$\text{Then } \frac{a-b}{c-b} \times \frac{j}{k} = x.$$

The results are from 3 to 5 per cent. low when ether is used in the separation, with petroleum nearly correct. (See this J., 1901, 1083.)

**6. Wesson's Cooling Test. Determination of Stearin in Lard Mixtures.**—Melted lard may be considered as a solution of the solid fats which it contains in which are liquid at ordinary temperatures, frequently been noticed in working with mixtures that a mixture of oleostearin and cottonseed oil of definite titer would crystallise at a much higher temperature than a mixture of pure lard of the same titer has also been noticed that a mixture of lard oil and stearin would crystallise at a much lower temperature than a similar mixture of lard oil and oleostearin, is because the hard portions of the beef fat which in the bulk of the oleostearin are less soluble in cotton and lard oils at low temperatures than are the portions of hog fat.

In order to obtain the approximate amount of stearin in a mixture, it is, therefore, only necessary to observe the manner of its crystallisation as compared with a known mixture. This test will show as between 2 or 3 per cent. of oleostearin when mixed with pure lard.

The apparatus required is as follows:—A 600 c.c. beaker, a 2000 c.c. beaker, a thermometer, and 6 test tubes. A piece of wood 8 in. square,  $\frac{1}{2}$  in. thick, with six or eight holes to fit the test tubes and a hole in centre for the thermometer, to be laid on top of the 600 c.c. beaker, and a thin piece of board with a large hole to fit the 600 c.c. beaker to be laid on top of the 2000 c.c. one. The apparatus is then put together.

The percentage of cottonseed oil having been determined, the approximate amount of oleostearin is calculated by the following formula

$$a-b' - \frac{3700-37b}{100} = 13x$$

When 37 is the average titer of lard; 33° average titer of cotton oil; 50° average titer of oleostearin;  $a$  the titer of sample;  $b$  the percentage of cotton oil;  $b' = 33b$ ;  $x$  the percentage of oleostearin.

In a sample of lard the titer was 38, the cotton oil found by the liquid acid method 40 per cent.  $33 \times 40 = 132$ .  $38 - 132 = 24.8$ .  $37 \times 40 = 1480$ .  $1480 \div 100 = 22.2$ .  $24.8 - 22.2 = 2.6$ ;  $2.6 \div 13 = 20$  per cent. Therefore, 20 per cent. is the approximate amount of oleostearin in the sample. Make standards containing the per cent. of cotton oil found, lard, and 5, 2.5 and 1 per cent. of oleostearin above and below the amount indicated by the formula. These standards are carefully dried samples are filtered, as any moist solid particles of dust, &c., seriously interfere with the results. The test tubes are half filled with the standards, and placed on the steam bath in a beaker of hot water, so that all may be of the same temperature. Sufficient distilled water to nearly fill the inner beaker is boiled to expel the air, and cooled to about 100° according to the melting point of the lard. The thermometer is inserted so that the bulb is in the lower part of the water, the beaker is put in the larger one, the test tubes corked and put through the holes, keeping them about half an inch from the bottom of the beaker by means of rubber bands around them. The apparatus is allowed to cool, and when the oleostearin commences to separate in the sample, it is compared with the standard which matches most closely and which consequently contains the same amount.

The cooling test must be taken as a whole. When the first indications (crystallising out) are generally correct.



will sometimes "catch up" with a standard, case that standard must be taken as the correct one. This method may also be used in determining the purity of lard. In making the standards, only the highest quality of oleostearin need be made, the others being obtained by mixing these in different measured amounts. The method is accurate to about 2 per cent., and the difference in gravity would be negligible. Three per cent. of oleostearin in lard may easily be detected by this method.

In cases, the calculations on the titer give a very close result; nevertheless, this should not be taken, as a test has been found by experience to be far more accurate.

Following results were obtained by the formula and applied to lard:—

Composition of Lard.	1.	2.	3.
.....	70.0	70.0	30.0
.....	15.0	25.0	60.0
.....	15.0	5.0	10.0
.....	17.35	7.5	11.5
.....	38.8°	36.3°	36.1°

### CONCLUSIONS.

At present time there is no method for the determination of tallow, its constants being very similar to those of lard, it can only be detected qualitatively by the phytosterol test. The phytosterol test is probably one of the best methods for detecting vegetable oil in lard, but is not mentioned in this paper, because it was not in use when the writers were doing the work described. The methods described will give results which are accurate to 3 per cent. of the truth, and sufficiently accurate for commercial purposes. While the lard having the highest iodine value of 115 on the liquid acids (see Vol. II., p. 788) may occasionally occur, it is infrequent to be taken into consideration.

## Nottingham Section.

Held at Nottingham on Wednesday, May 24th, 1905.

MR. J. T. WOOD IN THE CHAIR.

### TEMPERATURE CORRECTIONS FOR USE WITH THE ABBE REFRACTOMETER, AND REFRACTIVE INDICES OF SOME FIXED AND ESSENTIAL OILS.

BY T. F. HARVEY.

The determination of the refractive index of fluids is now a somewhat common laboratory operation. For ordinary commercial work the Abbe refractometer when fitted with a constant temperature bath is very convenient. The readings obtained with this instrument by a practised observer are easily accurate to 0.0002. It has distinct advantages over the Bausch & Lomb refractometer in that (1) it possesses a wide range from 1.3 to 1.7 and enables one to determine the refractive index of most substances, (2) by means of a cal arrangement a sharply defined shadow, free from fringes, can always be obtained, (3) the temperature can at any time be checked and adjusted if necessary against pure distilled water. With liquid substances the use of a thermostat may be entirely avoided, and the operation much simplified by making the observa-

tion at the temperature of the water as it comes from the main, reducing the readings so obtained to the standard temperature, viz., 20° C. To ensure that the prisms and water are at a common temperature the water should be allowed to circulate for about half an hour previous to use, no attention being required during this time. For solid fats an elevated temperature is, of course, necessary. Very few temperature corrections, so far as I am aware, have been published. A few scattered figures are to be found, e.g., Allen (Commercial Organic Analysis, Vol. II., p. 1) quotes from the Bulletin of the A.O.A.C., the corrections for butter fat as 0.000176. This appears to be erroneous, since I find the value 0.00036 on three samples, which is in agreement with the Zeiss correction, published for use with the Butyro-Refractometer, and is also in keeping with my other figures.

Lewkowitch gives the correction in the case of pure water as 0.00008 for 1° C. Tolman and Munson calculated the correction for oils from observations made by Procter as 0.000365. Listing gives the correction 0.00032 for glycerin of sp. gr. 1.2535. Table I. gives the corrections for each 1° C. expressed as units of the fourth decimal, e.g., the correction for olive oil is 0.00036. The corrections are negative for lower temperatures than the standard temperature adopted, and positive for higher temperatures than the standard, since the refractive index decreases with rise of temperature. Two series of observations were made in each case, the lower at about 10° C., the higher about 25° C., each series comprising several observations. To test the accuracy of these corrections the refractive indices of a few oils were determined in the usual manner, and also directly at 20° C., with the following results:—

	Rape Oil.	Bergamot Oil.	Cubeb Oil.	Sandal-wood Oil.
$n_D$ at 12.5° C. calculated to 20° C.	1.4728	1.4666	1.4976	1.5057
$n_D$ observed at 20° C.	1.4729	1.4667	1.4977	1.5057

It may be noted that the temperature effect due to the glass of the prisms is so small as to be negligible over a range of 30° C. See Pulfrich in "Zeitschrift für Instrumentenkunde," 1898.

Appended is also a table of refractive indices of a number of fixed and essential oils obtained in the ordinary routine work of the laboratory, distilled water at 20° C. being taken as 1.3330. Care has been taken to exclude all oils of doubtful purity. In no case were free fatty acids removed from fixed oils by washing with alcohol as has been recommended by some observers, an erroneous procedure with this class of instrument.

Most of the observations recorded in this paper have been made by my assistant, Mr. A. Tompkin.

TABLE I.

Correction for each 1° C.

Oil, &c.	Corr.	Oil, &c.	Corr.
Anise .....	5.2	Clove .....	4.5
Pinus Pectinata .....	5.1	Lavender .....	
Cumin .....	4.9	Rosemary .....	
Fennel .....		Rue .....	
Nutmeg .....		Copaiba .....	4.4
Bergamot .....		Cubeb .....	
Cinnamon .....	4.8	Savin .....	
Eucalyptus .....		Palmarosa .....	
Juniper .....		Pennyroyal .....	4.3
Pimento .....		Peppermint .....	
Turpentine .....	4.7	Cedarwood .....	
Wintergreen .....		Santal .....	
Chamomile .....		Alcohol, 90 per cent. ..	3.8
Dill .....		Castor .....	
Orange .....	4.6	Linseed .....	
Spearmint .....		Cod Liver .....	
Thyme .....		Sperm .....	3.7
Pinus Pumilio .....		Rape .....	
Cajeput .....	4.6	Olive .....	
Caraway .....		Butter .....	
Cassia .....		Glycerin (1.26) .....	2.4
Coriander .....		Water .....	
Lemon .....			0.73

TABLE II.

Oil.	No. of Sples	Refractive Index at 20° C.
Water—standard		1.3330
Cassia	4	1.6015—1.6040
Cinnamon	3	1.5897—1.5936
Anise	5	1.5527—1.5559
Fennel	2	1.5335—1.5364
Pimento	2	1.5363—1.5365
Wintergreen	0	1.5359—1.5366
Clove	16	1.5300—1.5349
Santal	9	1.5051—1.5068
Cedarwood	1	1.5022
Cumin	2	1.4971—1.4975
Copaiba	4	1.4955—1.4982
Cubeb	3	1.4926—1.4980
Spearmint	1	1.4863
Caraway	3	1.4862—1.4874
Dill	2	1.4842—1.4846
Nutmeg	3	1.4786—1.4841
Pennyroyal	2	1.4800—1.4836
Pinus Pambilio	1	1.4786
Savin	2	1.4752—1.4758
Spike	1	1.4753
Orange Bitter	1	1.4749
Orange Sweet	1	1.4730
Canada Balsam Oil	1	1.4746
Lemon	3	1.4748—1.4751
Juniper	11	1.4726—1.4778
Pinus Pectinata	1	1.4717
Turpentine	27	1.4701—1.4712
Palmarosa	9	1.4712—1.4759
Coriander	1	1.4677
Cajuput	4	1.4665—1.4679
Rosemary	8	1.4662—1.4710
Bergamot	6	1.4656—1.4669
Lavender	4	1.4619—1.4628
Eucalyptus	11	1.4605—1.4626
Peppermint	14	1.4600—1.4613
Chamomile	1	1.4429
Rue	1	1.4331
Linseed	27	1.4800—1.4812
Cod Liver	162	1.4785—1.4825
Castor	24	1.4783—1.4789
Croton	1	1.4781
Poppyseed	6	1.4749—1.4754
Mustard*	8	1.4742—1.4752
Sesamé	3	1.4727—1.4730
Rape	22	1.4726—1.4742
Cottonseed	1	1.4722
Apricot Kernel	10	1.4708—1.4717
Almond	35	1.4702—1.4709
Arachis	1	1.4698
Olive	41	1.4687—1.4693
Neatsfoot	11	1.4677—1.4687
Sperm	9	1.4646—1.4655

\* From mixed black and white seed.

## DISCUSSION.

Mr. WHITE said the Abbe Refractometer did not appear to him to be so useful as the Zeiss Butyro-Refractometer. The latter apparatus showed on an arbitrary scale the difference between butter and margarine, and was therefore of some value in applying a "sorting" test. The actual refractive index of the substance examined was not often wanted. The Butyro-Refractometer could also be used for the examination of other oils and fats.

Mr. S. R. TROTMAN thought the instrument had many advantages over the Butyro-Refractometer; at the same time he thought the refractive index of little use except in case of very gross adulteration, and he could hardly recall more than six examples where it had been of much use to him in detecting 10 or 20 per cent. of adulteration. In a cod oil, for instance, the difference caused by 90 per cent. of adulteration might be taken to be simply due to experimental error.

Mr. S. F. BURFORD expressed himself satisfied with the earlier instrument of Jean. He asked also whether clarifying the oils by means of calcium chloride would not give more constant results.

Mr. T. F. HARVEY, in reply to questions, said the refractive indices of petroleum products used for acidifying turpentine would be liable to much variation that he thought one of the best ways of examining turpentine, and the one which he had adopted, fractionate 50 or 100 c.c. and take the refractive index of the fractions.

The refractometer was of great value in the case of series of oils coming from the same source, giving indication of their uniformity, and so avoiding the necessity of making a complete analysis of each. Persons had found it a most useful instrument for examining medicinal cod liver oils—for fresh cod oils the refractive index was nearly proportional to the iodine value, in fact the latter could usually be calculated from within one or two units. The refractive index was undoubtedly of most use for fixed oils showing extreme values such as sperm, linseed and castor. For essential oils systematic fractional distillation, as in the case of turpentine, greatly enhanced its value.

The instrument was just as useful for butters. The Butyro-Refractometer. In point of delicacy the two instruments were nearly comparable, on the Abbe equalling about 0.0007 on the Refractometer. The alteration in refractive index caused by temperature was practically constant for the same substance, and was very appreciable for no matter what instrument was used. He thought it a mistake to remove free fatty acids from butters by washing with alcohol previous to determining the refractive index. The oils were liable to oxidation and adulteration during the process, with consequent changes of refractive index, and the beautiful rapidity of the method was destroyed.

Meeting held at Nottingham on Wednesday, May 1905.

MR. J. T. WOOD IN THE CHAIR.

## THE COMPOSITION OF NUX VOMICA

BY T. F. HARVEY AND J. M. WILKIE.

The occurrence of fat in nux vomica seeds has long been a source of annoyance in pharmaceutical preparations. On exposure of the liquid extract of the present macopæia to cold, deposits of fat are so common that various devices have been suggested for diminishing the fat during the process of manufacture. Since a examination of the fat presented somewhat peculiar features, it seemed desirable to examine it somewhat more fully.

The only references we have found concerning nux vomica fat have been the following:—

Bullock ("Year Book of Pharmacy," 1871) obtained 5 pints of oil from 150 lb. of nux vomica seeds.

Greenish and Smith (*Pharmaceutical Journal*, 1901, 667) found in nux vomica seed from 2.6 to 3.2 per cent. of fat (average, 3.2).

Pancoast and Graham (*Analyst*, 1904, 121) give at 15° C. as 0.935.

Three samples of fat were prepared by percolating the seeds with ether from nux vomica seeds reduced to powder, the ether being removed from the ethereal solution by agitation with dilute acid, about 4 per cent. of the fat being obtained.

The fats so prepared varied somewhat in consistency, all were slightly fluorescent when melted, of a yellowish



colour, with characteristic odour, and an ant taste, but not bitter.

eculiar nature of the fat appears at once from its tent of unsaponifiable matter and great variation id, the latter ranging from 56.7 in (a) to 6.9 in (b) d as oleic.

nsaponifiable matter amounts to 12.4 per cent, in 12 per cent, in (b), and probably exists in a free n, at any rate in sample (b).

a yellow, waxy, rather sticky substance bearing able resemblance to anhydrous wool-fat, and d of a harsh odour. It therefore does not appear ble the well-known aliphatic alcohols, while its alue is much higher than that of phytosterol or ol. Yet, after partial purification with alcohol, e colour reactions were obtained somewhat ng those of cholesterol or phytosterol.

pts to crystallise it from absolute and slightly l alcohol were unsuccessful, as also from chloro- nyl acetate, ether, and petroleum ether. On ous evaporation of the alcoholic solutions an ns substance progressively separated which after eatments with alcohol still refused to crystallise, xperiments were temporarily abandoned through material. No greater success has yet attended to crystallise the acetates.

olid fatty acids were repeatedly crystallised from the last melting point obtained being 69.5, ng the presence of stearic acid.

iquid fatty acids seemed to possess no abnormal rs, the iodine value and mean molecular weight ating much from those of pure oleic acid.

lycerol in sample (b) was estimated in the usual y oxidation with permanganate in alkaline ure being taken to eliminate other substances ight give rise to the formation of oxalic acid, tion was also obtained by the actual isolation 9 per cent. of impure glycerol.

her characters of the fat, as shown by analysis, are the appended table :—

	Sample (A)	Sample (B)	Sample (C)
Specific gravity, 100/15.5° C. ....	0.8638	—	—
Melting point .....	softens at 20° C. clear at 31.2° C.	—	—
Iodine value .....	79.3	73.8	—
Hehner number .....	—	95.2	—
Free acid by weight .....	59.4	—	—
Free acid as oleic by titration .....	56.7	6.9	35.4
Acid value .....	112.6	13.7	70.3
Ether value .....	58.0	15.5	—
Saponification value .....	170.6	168.9	—
Glycerol .....	—	8.8%	—
Reichert-Wollny No. ....	1.33	0.70	—
Total soluble fatty acids as KOH in mg. per grm. ....	5.31	2.4	—
Without previously isolating the fatty acids—			
Acetyl acid value .....	167.11	—	—
Apparent acetyl value .....	16.99	—	—
Acetyl saponification value ....	184.10	—	—
True acetyl value (= app. value — total soluble fatty acids) .....	11.68	—	—
Per cent. solid fatty acids .....	—	24.2	—
Per cent. liquid fatty acids .....	—	58.4	—
Iodine value, liquid fatty acids ..	96.2	94.0	—
Mean mol. weight, ditto ..	—	281.0	—
Mean mol. weight mixed fatty acids	—	281.2	—
Unsaponifiable matter .....	12.4	12.0	—
Iodine value, unsaponifiable matter	112.9	(89.1 W ijs' (89.1 H übl	—
Acetyl value, ditto .....	—	105.9	—
Specific rotation, ditto in chloroform sol. ....	—	+ 39°	—

DISCUSSION.

Mr. T. F. HARVEY, in reply to questions, said that they had not been able to account for the great variation in the content of free acid in the different samples. They had found it was not due to enzymic action occurring after the seeds had been ground, for the fat from different samples of freshly-ground seed still showed the same great variation. The unsaponifiable matter was strongly dextro-rotatory; no combustion experiments had been made upon it, since the authors had not yet obtained from it anything of the nature of a pure substance.

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## I.—PLANT, APPARATUS &amp; MACHINERY.

## ENGLISH PATENTS.

*Temperatures of Liquids and Gases; Apparatus for Effecting Exchange of —.* A. C. Christensen and Aktieselskabet P. J. Buuæs Fabrikker, Aalborg, Denmark. Eng. Pat. 11,756, May 21, 1904.

The apparatus consists of a hollow conical vessel divided into zones by horizontal partition plates, and surrounded by an outer jacket. The vessel is mounted so as to be rotated upon a steam supply pipe, which passes to the top. The liquid to be heated, or, when the apparatus is used as a condenser, the cooling water, is circulated in the annular space between the conical vessel and the outer jacket. The condensed water is directed by centrifugal action to holes in the periphery of the plates and so to vertical channels on the inner surface of the vessel, and led away to the bottom, where it is discharged. In this way the interior surface is kept dry and consequently the heat passes through the walls to the liquid more easily.

—W. H. C.

*Separators; Impts. in Liners for Centrifugal Liquid —.* J. A. Oldsson, Stockholm. Eng. Pat. 29,136, Dec. 30, 1904. Under Int. Conv. Jan. 5, 1904.



THE liner plates of centrifugal machines are arranged in groups of two or more, attached to the same axis, about which they can be turned independently. The groups are placed successively around, but eccentrically to, the axis of the machine (see Fig.).—W. H. C.

*Filtrating; Safety Tanks or Vessels used in — or for other purposes.* N. W. van Westerborg, London. Eng. Pat. 29,319, Dec. 31, 1904.

THE (inflammable) liquid to be filtered is passed through a tank fitted with a removable bucket having a perforated cover or sieve to retain the impurities; the feed pipe enters the tank below the sieve, whilst the discharge pipe is arranged above the latter. In the event of fire occurring in the room where the mouth of the feed pipe is situated, the access of the flame to the tank is prevented by a tap with weighted lever, which is automatically closed as soon as the fusible plugs in a suspensory cord are melted by heat. Undue gas pressure in the filtering tank is prevented by a safety-valve, arranged in the cover so as to carry away the escaping gas to a safe distance.—C. S.

## UNITED STATES PATENTS.

*Dryer.* W. F. Robinson, Anacortes, Wash. U.S. Pat. 791,578, June 6, 1905.

A CIRCULAR drying chamber has double walls, with an

annular space between them. The inner wall is perforated and the chamber is covered by an unperforated door, provided with an opening through the walls closed door. A rotary fan placed in the chamber directs the current of air towards the perforated walls, through it passes into the annular space and escapes.—W. H. C.

*Dryer.* C. H. Caspar, Wilkesbarre, Pa. U.S. Pat. 791,877, June 6, 1905.

SEE Eng. Pat. 23,066 of 1904; this J., 1905, 100.

*Separator; Centrifugal —.* W. G. Laird, D. Colo. U.S. Pat. 791,703, June 6, 1905.

A SEPARATING bowl is mounted eccentrically on a support and bowl being rotated at slightly different speeds. The solid matter separated is removed by a scraper and discharged through the bottom of the bowl. The liquid or semi-liquid portion is discharged near the top of the bowl into a trough, where bodies of different specific gravity are separated by settling.—W. H. C.

*Centrifugal Machine.* W. G. Howell, Washington. U.S. Pat. 792,042, June 13, 1905.

CLAIM is made for a centrifugal liquid-purifier, composed of a closed outer vessel for receiving the separated impurities, and a perforated vessel rotating within the first-named. The liquid is introduced tangentially at one end of the inner vessel and discharged tangentially at the opposite end. Motion is imparted to the vessel by a water motor, actuated by peripheral discharge water from the outer vessel. The inner is divided into compartments by radial partitions.—

*Condensing Apparatus —.* A. F. Burdick, B. U.S. Pat. 791,876, June 6, 1905.

A METAL sheet is folded on itself alternately in opposite directions, within a casing, forming two independent series of passages. To assist in condensation, "nodes" are formed on the walls of one series of passages, "ridges" are formed on the walls of the other series.—W. H. C.

*Granular or Pulverulent Materials; Method of separating — into Lumps.* E. Pohl, Harsum, Ger. U.S. Pat. 792,449, June 13, 1905.

THE granular or pulverulent material is introduced at one end of a revolving furnace, and, while travelling to the other end, is treated with binding substances and divided molten slag, injected through jets at the discharge end of the furnace. The agglomerated material is then passed between rollers.—A. S.

## FRENCH PATENT.

*Separators; Linings for Centrifugal Liquid —.* J. A. Oldsson. Fr. Pat. 350,525, Jan. 4, 1905. Under Int. Conv., Jan. 5, 1904.

SEE Eng. Pat. 29,136 of 1904, preceding these.—T. H. C.

## II.—FUEL, GAS, AND LIGHT.

## ENGLISH PATENTS.

*Gas; Apparatus for Washing and Scrubbing —.* J. Holmes, Huddersfield, Yorks. Eng. Pat. 5761, Jan. 18, 1905.

TO prevent corrosion of the steel fittings of gas works of the type described in Eng. Pat. 5113 of 1895, and of 1902 (this J., 1896, 340; 1902, 1524), these parts are covered with cast-iron. The cast-iron sleeves surrounding the shaft are let into the adjacent boxes of the brush-carriers, whilst those at the two ends extend into stuffing-boxes in the casing. The brush-carriers are in segments with their outer ends braced by staybolts which are attached to stirrers consisting of obliquely arranged tooth-shaped projections.—C. S.



*ts of Electric Incandescent Lamps; A New Form of Carbon Specially Suitable for —.* H. C. Lewis, jun. From General Electric Co. of Schenectady, York. Eng. Pat. 6959 A., March 22, 1904.

ment is first formed in the usual way, and then to a high temperature in a carbon tube electric It is afterwards "flashed" in the presence of a rhon, and then again heated very strongly in face. The resulting carbon filament consists of a m of graphite, the specific resistance of which at apertures is less, and at high temperatures is than that of the ordinary filament; it is very nd flexible, and is claimed to last much longer and ore efficient.—W. H. C.

## UNITED STATES PATENTS.

*Bagasse-Burning —.* H. G. Guinea and . Keech, Honolulu. U.S. Pat. 791,023, May 30,

nace consists of a front wall and a rear wall, a y short horizontal grate at the lower end of the ll, an inclined, step-ladder grate, which supports asse as it burns and extends from the horizontal pward towards the front wall, an inclined floor, ng from the top of the inclined grate to the front hich the bagasse rests before it reaches the grate, elion depending from the arch of the furnace the inclined floor and forming with the rear wall ution chamber above the inclined grate; lastly, ue in the rear wall at its lower end, for delivering above the horizontal grate, the rear wall extending to the same height as the downward projection ng a throat-way above it for the products of tion.—J. F. B.

*Combustion; Process of Preparing —.* G. W. l and T. A. Tyas, Hoboken, N.J. U.S. Pat. 13, June 6, 1905.

air are mixed and heated in a chamber, and the mixture formed together with the unvaporised hen passed downwards through a narrow passage, hey are agitated together, into a second chamber. second chamber the mixture is further heated and d downwards to the burner.—W. H. C.

*ducer Apparatus.* C. Ellis, New York. U.S. Pat. 791,461, June 6, 1905.

RODUCER is combined with a gas-burning furnace extensive "baffling-surfaces" and containing one receptacles for the material to be heated. By a arrangement of flues and a fan or other draughting device, a regulated portion of the products ution is returned to the producer mixed with a d quantity of air. The mixture is preheated in y the hot products of combustion.—W. H. C.

*Apparatus for Washing —.* J. S. Oursler, nor to J. Reis, Newcastle, Pa. U.S. Pat. 791,160, 30, 1905.

paratus consists of a receiving chamber having a t pipe, and placed above a washing chamber a gas-outlet pipe. In the bottom of the receiving r, a number of dust-receiving pockets are formed. s passes from the receiving to the washing vessel row channel, having vertical sides, and projecting rds to a point just below the level of the water n the washing chamber. The pockets, which have penings at the bottom, are separated by vertical ns, placed between them and reaching to a point ow the level of the water outlet.—W. H. C.

## FRENCH PATENTS.

*Mineral or Vegetable Origin; Process for Reducing Density of]* —, *in View of their Application as* A. Canera di Salaseo and C. Rovere. Fr. Pat. 77, Dec. 7, 1904.

g. Pat. 26,192 of 1904; this J., 1905, 236.—T. F. B.

*Briquettes; Process of Consolidating — by Carbonising the Agglutinant.* B. Wagner. Fr. Pat. 350,530, Jan. 5, 1905.

THE briquettes are passed continuously through a slightly inclined tube, through which furnace gases flow in the opposite direction. The tube is rotated so that the briquettes, as they travel forward, are turned over and over, exposing each side in turn to the action of the gases. The briquettes leave the tube at the lower end, through an opening provided with a flap door, opening outwards. This allows the briquettes to pass out easily, but hinders the entrance of air which might cause combustion of the material.—W. H. C.

*Coke Ovens; Ercene Coppée —.* E. Coppée. Second Addition, dated Dec. 30, 1904, to Fr. Pat. 290,799, July 13, 1899.

ACCORDING to the present additional patent, the conduit through which the mixture of gas and air is conveyed to the heating flues, is constructed with a progressively decreasing cross-section, the object being to ensure a more uniform distribution of the mixture, and also, owing to the increased velocity consequent upon the diminishing section, to prevent it burning in the conduit before reaching the heating flues.—W. H. C.

*Gas; Process for Making a Combustible —.* J. Bowing. Fr. Pat. 349,426, Dec. 22, 1904. Under Int. Conv., Dec. 28, 1903.

SEE Eng. Pat. 28,498 of 1903; this J., 1904, 1140.—T. F. B.

*Gas Generator.* A. von Kerpely. Fr. Pat. 350,509, Jan. 3, 1905.

SEE Eng. Pat. 28,966 of 1904; this J., 1905, 321. T. F. B.

*Gases; Electro-catalytic Process for Obtaining Fixed — from any Carburetted Body.* A. A. Eveno. Fr. Pat. 350,528, Jan. 4, 1905.

THIS invention consists of a process of obtaining gases, such as hydrogen, oxides of carbon, methane, ethylene, &c., from a carburetted body for lighting or heating purposes, the feeding of motors, &c. The liquid is submitted in the form of spray to the action of the electric spark or an electric discharge at a high tension, in the presence of catalytic bodies such as platinum, iridium, &c.—B. N.

*Gas; Process of Desulphurising Illuminating — by means of Ozone.* J. Maréchal. Fr. Pat. 350,679, Jan. 11, 1905.

SEE Eng. Pat. 28,765 of 1904; this J., 1905, 491.—T. F. B.

*Gases from Explosion Motors; Utilisation of Nitrogen contained in Exhaust —.* E. Bouchaud-Praciq. Fr. Pat. 349,425, Dec. 22, 1904.

THE claim is for the use of compressed exhaust gases from explosion motors, which after purification consist of nearly pure nitrogen, instead of compressed air to displace combustible liquids from monte-jus apparatus or blowing eggs. The absence of oxygen prevents any danger of explosion.—W. H. C.

## GERMAN PATENTS.

*Briquettes; Process for the Manufacture of Durable — by means of a Binding Agent Soluble in Water.* Sächsishe Bankges. Quellmalz und Co. Ger. Pat. 158,497, June 14, 1901.

THE briquettes are exposed to a temperature at which the binding material is carbonised or coked, whilst the combustible material from which the briquette was prepared suffers no appreciable alteration.—A. S.

*Briquette with an outer Layer consisting of a Mixture of an Oxygen-yielding and a Combustible Substance.* F. Schumann and F. Sattler. Ger. Pat. 158,469, July 25, 1903.

A LARGE portion of the surface of the briquette is provided with a coating of a mixture of an oxygen-yielding sub-

stance and a combustible material (powdered charcoal, &c.) the composition of the mixture being so adjusted that the oxygen-content of this coating progressively decreases from the outside towards the interior, so that on placing the briquette in the fire, the first evolution of gas is accompanied by the strongest evolution of oxygen, whilst as the briquette burns away, the amount of oxygen evolved diminishes concurrently with the amount of gas produced.—A. S.

*Fuel from Carbonised Peat: Process for the Manufacture of Artificial* — J. Kuops. Ger. Pat. 158,756, Feb. 16, 1904.

THE binding agent used consists of a meal prepared by boiling leather waste and grinding the dried residue. Peat charcoal is mixed with this meal, and briquettes are formed from the mixture by the simultaneous application of heat and pressure.—A. S.

*Water-Gas: Process for the Purification of* — W. Lazarus. Ger. Pat. 159,136, March 19, 1904.

THE water-gas is first passed through a heated retort filled with coke, whereby the carbon dioxide contained in it is converted into carbon monoxide, and is then freed from sulphur and cyanogen by passing it, in the hot condition, over oxides, hydroxides, carbonates or silicates of alkali, alkaline earth, or earth metals, or the oxides or hydroxides of iron or zinc, heated for example to 500° C.—A. S.

*Gas Retorts: Process for Cleaning* — by means of Compressed Air. Berlin-Anhaltische Maschinenbau Act.-Ges. Ger. Pat. 159,203, April 4, 1904. Addition to Ger. Pat. 149,854, Feb. 24, 1903.

AFTER the layer of tar and carbonaceous matter adhering to the walls of the retort has been burned by the aid of compressed air, steam, together with air under a lesser pressure is introduced, in order by reduction of pressure in the retorts to accelerate the removal of the graphite adhering to the walls. The steam may be introduced directly into the retorts, or may be produced in the retorts from water introduced through the air-inlet pipe.—A. S.

*Mantles for Oxygen-Coal-gas Burners: Process for the Manufacture of Incandescence* — S. Saubermann. Ger. Pat. 157,811, March 18, 1903.

A TEXTILE fabric is impregnated with a solution of calcium and cerium nitrates or of calcium-zirconium and cerium nitrates, then dried, ignited, immersed in a solution of thorium nitrate, either pure or containing cerium, and again ignited. It is stated that by this after-treatment with thorium nitrate, the illuminating power of the mantle is increased to a much greater extent than by impregnating with an equal quantity of thorium nitrate added to the first bath.—A. S.

*Carbon Electrodes of Arc Lamps: Process for the Utilisation of Waste* — R. Peters. Ger. Pat. 158,151, Jan. 19, 1904. XIII.L., page 742.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

*Pyridine: Purification of* — [also Determination of Ammonia in Pyridine, and Preparation of Ammonium Magnesium Phosphate and its Substitution Derivatives]. L. Barthe. Bull. Soc. Chim., 1905, 33, 659—661.

COMMERCIAL samples of pyridine contain from 1 to 20 per cent. of ammonia, which cannot be completely removed by ordinary methods of separation. It is removed by the author by shaking with magnesium hydrogen phosphate,  $MgHPO_4$ , in excess, together with a very little water, filtering, and rectifying. Pyridine, freed in this manner

from ammonia, does not turn litmus solution deep blue, but only to an undecided claret colour. It is therefore possible to determine the amount of ammonia in commercial pyridine by titration with N 10 sulphuric acid, using litmus solution as an indicator. Ammonium magnesium phosphate and its aliphatic derivatives such as methylammonium magnesium phosphate  $Mg(NH_2CH_3)PO_4$ , may be prepared by agitating magnesium hydrogen phosphate with ammonia or an amine in presence of water.—E. F.

#### ENGLISH PATENT.

*Spirituos Fluid from Water-Gas Tar] and Process for Obtaining Same.* W. Oppenheimer and T. C. London. Eng. Pat. 4271, Feb. 20, 1904.

WATER-GAS tar from which the greater part of it has been removed (see Fr. Pat. 334,172 of 1903; 1904, 55) is distilled until the residue consists of pitch; the distillate is then acidified, neutralised and distilled, the distillation being continued until the distillate assumes a yellow tinge and an oily nature, the process is then repeated. The product has then a specific gravity of 0.86—0.94, and contains toluene, the xylenes, and a trace of naphthalene. It is intended for use as a solvent for rubber, resins, &c., and also for other purposes; it is stated to have a higher flash point than petroleum.—T. F. B.

#### UNITED STATES PATENTS.

*Wood Distillation: Retort for* — A. J. Assignor to the International Wood Distillation Co. Cleveland. U.S. Pat. 790,097, May 16, 1905.

THE still consists of an inner retort adapted to receive charge of wood, surrounded by an outer casing, in a manner as to leave a space between the latter and the sides of the inner retort. The furnace, placed around the retort, is connected with the space between the retort and the casing by means of flues. Both the retort and the casing are divided into a series of compartments by vertical partitions; in each of these compartments is provided a valved outlet pipe connected with a main air inlet. Air inlets are also provided in the lower parts of each compartment.—T. F. B.

*Ammonia-Still.* H. A. Abendroth, Berlin, Germany. U.S. Pat. 792,379, June 13, 1905.

THE still consists of a series of superimposed cylindrical bottoms of which are constructed to form inclined terraces, each of which has terraces sloping from the point of inlet to the point of outflow of the ammonia water. The terraces except the highest and lowest are provided with hooded steam-inlet pipes. (Compare U.S. Pat. 712,891 of 1902; and 771,031 of 1904; this J. 1526, and 1904, 978.)—E. S.

#### GERMAN PATENTS.

*Hydrochloric Acid: Manufacture of* — with the Simultaneous Recovery of the Products of the Dry Distillation of Wood. Bosnische Elektrizitäts AG. Ger. Pat. 158,086, April 24, 1903.

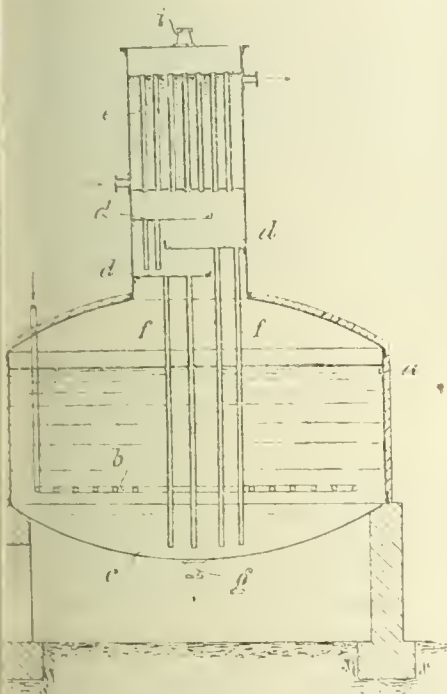
It is claimed that by subjecting wood or allied substances such as cellulose, paper, peat, &c., to distillation at 150—350° C. in a current of chlorine, 70 per cent. of the latter is converted into hydrochloric acid, while the distillation products of the wood, &c., contain smaller quantities of substances of empyreumatic origin than those obtained in the usual manner. In carrying out the process, the retorts, which are provided with thermometers, are heated slowly to 150° C., and chlorine is then introduced. The reaction which takes place causes a rise of temperature, so that further heating of the retorts is unnecessary. When the temperature falls considerably, the supply of chlorine is cut off, and the retorts are heated strongly, in order to extract the chlorine from the residual charcoal.—A. S.



ignite and the like; *Process of and Furnace for drying Combustible Substances containing Large amounts of Moisture, such as —*. P. Hoering and Möjen. Ger. Pat. 158,032, June 27, 1903.

Steam evolved from the fresh charge of peat, &c., cooler part of the furnace is led away with the gaseous products, either directly or after being heated in the coking zone of the same or a neighbouring furnace. Another part of the furnace through which the peat, &c., passes first, communicates by a suitable connection (lumber, or the like) with the coking zone of the furnace or an adjacent furnace; the gas-discharge pipes from the coking zone of the furnace. By this means the dry peat which is being carbonised in the coking zone is subjected to the action of the steam during the drying of the wet peat, whereby, it is found, larger yields of tar and ammonia are obtained. —A. S.

*Processes, especially Mineral Oils; Process and Apparatus for Drying —*. Dampfessel- und Gasen-Fabrik vorm. A. Wilke and Co. Ger. Pat. 28, July 14, 1903.



hydrocarbon or mineral oil is heated by hot air circulated through *b*) to 100° C., in the apparatus shown in figure; the steam and light oils are condensed in denser *c*, and run back through the pipes *f* to the bottom of the vessel, where they are no longer heated, after which accumulates at the bottom of the vessel and run off from time to time by the cock *g*. —T. F. B.

#### IV.—COLOURING MATTERS AND DYE-STUFFS.

*Compounds [and Nitrites]; Reduction of — with Sodium Hydrosulphite*. J. Alloy and Rabaut. Bull. Chim., 1905, 33, 654—655.

The authors reduced various nitro compounds of both aromatic and the fatty series by boiling with con-

centrated sodium hydrosulphite solution. The yields of aniline and *a*-naphthylamine from the corresponding nitro compounds were good. The yields from polynitro compounds such as *m*-dinitrobenzene were poor. The 1,2- and 1,4-nitrophenols were reduced to the corresponding aminophenols. Nitromethane was reduced, in part at least, to methylamine. Inorganic nitrites are easily reduced by sodium hydrosulphite in alkaline solution to ammonia; nitrates, on the contrary, are not reduced. —E. F.

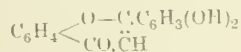
*Diazo-Derivatives of Monoacylated Aromatic Para-diamines*. G. T. Morgan and F. M. G. Micklethwait. Chem. Soc. Proc., 1905, 21, 179—180.

DIAZO-ANHYDRIDES of the type  $X \begin{smallmatrix} \diagup \\ \diagdown \end{smallmatrix} \begin{smallmatrix} \text{N} \cdot \text{SO}_2 \text{R} \\ \text{N} \cdot \text{N} \end{smallmatrix}$ , where X

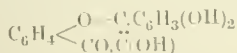
represents a phenylene or analogous group, and R an acyl group, are formed by treating monoacylated para-diamines with nitrous acid. The following compounds have been prepared:—*Benzene* sulphonyl-*p*-phenylenediazoimide, *camphor-β*-sulphonyl-*p*-phenylenediazoimide, *benzenesulphonyl-2,5-tolylenediazoimide*, *benzenesulphonyl-2,5-xylenylenediazoimide*, and *benzenesulphonyl-1,4-naphthylenediazoimide*. Similar cyclic diazoimides could not be obtained from formyl, acetyl, succinyl and benzoyl derivatives of *p*-phenylenediamine. The formyl and acetyl compounds yielded ill-defined nitrosoamines of the type  $R \cdot \text{CO} \cdot \text{NH} \cdot \text{C}_6\text{H}_4 \cdot \text{NH} \cdot \text{NO}$ , whilst benzoyl-*p*-phenylenediamine when diazotised and treated with a cold aqueous solution of potassium carbonate, yielded a stable diazonium carbonate,  $\text{C}_6\text{H}_5 \cdot \text{CO} \cdot \text{NH} \cdot \text{C}_6\text{H}_4 \cdot \text{N}_2 \cdot \text{HCO}_3$ . This salt is very sparingly soluble in cold water; it forms azo compounds readily with phenols and aromatic amines, and gives benzoyl-*p*-aminophenol when boiled with acidified water. A sparingly-soluble yellow diazonium nitrite, which readily forms azo compounds, was also obtained from benzoyl-*p*-phenylenediamine. —A. S.

*Fisetin; Some Less Highly Hydroxylated Compounds Related to —*. J. Berstein, C. Fraschina and St. v. Kostanecki. Ber., 1905, 38, 2177—2182.

FOURTEEN compounds which differ from Fisetin, 3,3,4'-trihydroxyflavonol, by the absence of one or more hydroxyl groups are theoretically possible. These had all been prepared by Kostanecki and his pupils during recent years with the exception of two compounds, namely, 3',4'-dihydroxyflavone and 3',4'-dihydroxyflavonol, which compounds have now been prepared by the authors. 2'-Hydroxy-3,4-dimethoxychalcone, prepared from veratric aldehyde and *o*-acetophenone, was converted by boiling with alcoholic hydrochloric acid, into 3',4'-dimethoxyflavanone. This was brominated, forming a monobromo-derivative which, on boiling with alcoholic potassium hydroxide solution, was converted into 3',4'-dimethoxyflavone, which yields 3',4'-dihydroxyflavone on heating with strong hydriodic acid. This dihydroxyflavone,



dyes mordanted wool strongly, in light yellow shades on alumina mordant, and grey to black on iron mordant. 3',4'-Dimethoxyflavanone is converted by amyl nitrite and hydrochloric acid into an isonitroso-derivative which yields 3',4'-dimethoxyflavonol on boiling with dilute sulphuric acid. 3',4'-Dihydroxyflavonol, prepared by boiling the dimethoxy compound with strong hydriodic acid, has the formula



It dyes mordanted fabrics strongly, in orange-yellow shades on alumina, and grey to black shades on iron mordant. These hydroxyflavones which dye on mordants,

yield pure yellow shades on alumina mordants, whereas the corresponding hydroxyflavonols (including Fisetin) give orange-yellow shades under these conditions. A similar difference is apparent on comparing Luteolin (1,3,3',4'-tetrahydroxyflavone) with Quercetin (1,3,3',4'-tetrahydroxyflavonol), the former yielding jonquil-yellow and the latter brownish-yellow dyeings on alumina mordant.—E. F.

*p*-Nitrobenzene-diazonium Chloride: Rate of Decomposition of —. C. Schwalbe. Ber., 1905, 38, 2196–2199.

THE author finds that the stability of *p*-nitrodiazobenzene solutions is much improved by the addition of neutral salts, such as common salt. This effect is most marked in the case of acetic acid solutions, containing no free mineral acid (as used for ingrain colours), which are much less stable than mineral acid solutions. The presence of free nitrous acid reduces the stability of the solutions very seriously, as does also the action of light. The decomposing action of light is greatly helped by the presence of free nitrous acid. Strong solutions, as prepared under technical conditions, are less stable than weak ones. The author states that it is possible to prepare solutions of such strength that solid *p*-nitrobenzene-diazonium salts separate out.—E. F.

$\alpha$ - $\alpha$ -Dichloro- $\beta$ - $\beta$ -dinaphthylamine. W. Schaposechnikoff and F. Goloff. Z. Farben- u. Textil-Chem., 1905, 4, 281–283.

DILUTE solutions of equimolecular quantities of quinone-dichloroimine and  $\beta$ - $\beta$ -dinaphthylamine were mixed and allowed to stand at a temperature not higher than 45° C. The main product which was isolated, consisted of  $\alpha$ - $\alpha$ -dichloro- $\beta$ - $\beta$ -dinaphthylamine  $\text{ClC}_{10}\text{H}_6\cdot\text{N}(\text{Cl})\text{C}_{10}\text{H}_6\text{Cl}$ , which forms dinaphtho-carbazole on heating with quick-lime. A dyestuff was obtained as a by-product, which dyes silk in a similar manner to Safranine, and can be acetylated and diazotised.—E. F.

have been unsuccessful. On heating trimethylbrasilone with phenylhydrazine, Gilbody and Perkin obtain deoxytrimethylbrasilone by the removal of two atoms of oxygen, the phenylhydrazine acting as a reducing agent. However, by moderating the reaction with phenylhydrazine, the authors have obtained a nitro compound  $\text{C}_{25}\text{H}_{22}\text{N}_2\text{O}_4$ , which crystallises in yellow needles melting at 235°–242° C. For its preparation trimethylbrasilone (one part) is heated on the water-bath with phenylhydrazine (four parts) and glacial acetic acid (10 parts). Attempts to obtain a nitro compound from tetramethylbrasilone have given negative results, a substance analogous to deoxytrimethylbrasilone being formed, which crystallises from benzene in small white needles, melt at 170°–175° C.—D. B.

*Dyestuffs; Sensitising of Properties of some New —*. K. Kieser. XXI., page 751.

ENGLISH PATENTS.

*Colouring Matters [Azo Dyestuffs]; Manufacture of Nitro-ortho-oxazo —*. T. R. Shillito, London. From Aniline Colour and Extract Works, formerly J. R. Geigy, Basle, Switzerland. Eng. Pat. 15,666, July 19, 1904.

THE nitro-1-diazo-2-hydroxynaphthalene-4-sulphonic acid (or its anhydride) is combined with bodies of the following classes: Naphthols and their monosulphonic and carboxylic acids, aminonaphthols and their sulphonic acids, dihydroxynaphthalenes and their sulphonic acids, *m*-dihydroxybenzenes, *m*-aminophenols, and *m*-diamines. The products dye wool from an acid bath. After subsequent treatment with an alkali chromate or copper sulphate, the shades range from reddish-violet to green black. The effect of the nitro-group is to intensify the tinctorial power of the dyestuffs, and also to increase the combining power of the diazo-compound, enabling combination to be effected at a lower temperature.

Some of the results which can be obtained are shown in the following table:—

Second Component.	Shade of Dyeing on Wool.		
	From Acid Bath.	After Chroming.	After Treatment with Copper Sulphate.
<i>m</i> -Tolylene diamine .....	reddish-brown	dark-brown	dark violet
$\beta$ -Naphthol .....	dark reddish-brown	soot-black	dark brownish-violet
2,6-Naphthol sulphonic acid (Schäffer) .....	blackish-violet	greenish-black	dark violet
1,5-Aminonaphthol .....	greenish-black	greenish-black	dark bluish-black

—E.]

*Dyestuffs; New Class of Quinoline —*. H. E. Besthorn and J. Ibele. Ber., 1905, 38, 2127–2129.

IN a previous communication (this J., 1904, 542) the authors described a new class of red dyestuffs, distinguished by forming strongly fluorescent solutions, and by great instability to light, which were obtained by the action of quinoline- $\alpha$ -carboxylic acids on the acid anhydrides of aromatic monocarboxylic acids. They now find that the same dyestuffs can be obtained in almost quantitative yields, by the action of the acid chloride of quinaldine acid on 2 mols. of quinoline or of any quinoline derivative which is not substituted in the  $\alpha$ -position. For instance, the quinoline cannot be replaced by quinaldine. The quinaldine acid chloride may be replaced by the acid chlorides of other quinoline- $\alpha$ -carboxylic acids, but not by cinchoninic acid chloride.—E. F.

*Brasidin and Hamatoxylin*. J. Herzog and J. Pollak. Ber., 1905, 38, 2166–2168.

IT has been previously shown, that trimethylbrasilone and tetramethylhamatoxylone react with hydroxylamine hydrochloride to form oximes, but attempts to prepare phenylhydrazine derivatives from these compounds

*Colouring Matters [Azo Dyestuffs]. Manufacture of Ortho-oxazo —* from 2-Diazo-1-naphthol Sulphonic Acids. T. R. Shillito, London. From Aniline Colour and Extract Works, formerly J. R. Geigy, Basle, Switzerland. Eng. Pat. 16,566, July 27, 1904.

2-DIAZO-1-HYDROXYNAPHTHALENESULPHONIC ACIDS (or their inner anhydrides) are combined with bodies of the following groups: the naphthols and their monosulphonic and carboxylic acids, aminonaphthols and their sulphonic acids, dihydroxynaphthalenes and their sulphonic acids, *m*-hydroxybenzenes, *m*-aminophenols, and *m*-diamines. In most cases combination takes place very easily at ordinary temperature. The products dye wool from an acid bath in shades ranging from violet to bluish-black and green after subsequent treatment with alkali chromate or copper sulphate. Some of them are distinguished by fastness to light and by the beauty of the blue shades produced on subsequent treatment with copper sulphate. Some of the results obtained are shown in the following table:—



Diazo-compound from	Combined with :	Shade of Dyeings on Wool.		
		From Acetic Acid Bath.	After Treatment with Bichromate.	After Treatment with Copper Sulphate.
amino-1-naphthol-4-sulphonic acid	m-Amino-phenol	dark brown	black with violet tint	dark violet brown
Ditto	$\beta$ -Naphthol	dark violet brown	blue black	dark violet
Ditto	1-Amino-8-naphthol-3-6-disulphonic acid	dark violet blue	green	dark blue
amino-1-naphthol-3-6-disulphonic acid	$\beta$ -Naphthol	blackish violet	dark blue	violet
Ammino-1-naphthol-5-sulphonic acid	1-Amino-8-naphthol-3-6-disulphonic acid	dark violet blue	green	deep dark blue

—E. F.

uring Matters. [Azo Dyestuffs.] *Manufacture of* —. T. R. Shillito, London. From Aniline flour and Extract Works, formerly J. R. Geigy, Basle, Switzerland. Eng. Pat. 17,274, Aug. 8, 1904.

the non-nitrated and the nitrated diazo-compounds 1-amino-2-naphthol-4-sulphonic acid described in Eng. 10,235, 1904 (this J., 1905, 433) and in Eng. Pat. 18,1904 (this J., 1905, 669) combine readily with methyl-5-pyrazolones which are not substituted in position 4, to form dyestuffs which dye wool from an acid in shades ranging from crimson-red to brownish-red or subsequent treatment with an alkali chromate or per sulphate.

Colouring Matters [Sulphide Dyestuffs]; *Manufacture of Sulphur* —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 3083, Feb. 14, 1905.

SEE U.S. Pat. 790,167 of 1905; this J., 1905, 669.—T.F.B.

Colouring Matter [Dyestuff] of the Naphthalene Series; *Manufacture of* —. J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 9547, May 5, 1905.

NAPHTHAZARIN is heated in aqueous solution with more than 2 mols. of sodium hydroxide, preferably whilst passing air through the mixture. For example, 10 parts of a

Dyeing stuff from 1-phenyl-3-methyl-5-pyrazolone, and	Dyeings on Wool.		
	From Acetic Acid Bath.	Treated with Potassium Bichromate.	Treated with Copper Sulphate.
azo-compound from 1-amino-2-naphthol-4-sulphonic acid	reddish brownish yellow	crimson-red	brownish-red
Nitrodiazo-compound from 1-amino-2-naphthol-4-sulphonic acid.	brownish-red	red	brownish yellowish-red

—E. F.

dyestuffs; *Manufacture of Violet Sulphurised* [Sulphide] —. O. Murray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine, Germany. Eng. Pat. 16,269, July 22, 1904.

U.S. Pat. 778,713 of 1904; this J., 1905, 83.—T.F.B.

Anthraquinone Derivatives [Anthracene Dyestuffs]; *Manufacture of New* —. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,589, Aug. 12, 1904.

8-TRIHYDROXYANTHRAQUINONE is obtained by saponifying the sulphuric ester produced by the action of fuming sulphuric acid (or sulphuric anhydride) and boric acid on resazurin. Ten parts of the latter are added to a solution of three parts of boric acid in 200 parts of fuming sulphuric acid (80 per cent. of  $\text{SO}_3$ ) at a temperature of  $30^\circ$ – $35^\circ$  C., the mixture is maintained at this temperature until resazurin can be no longer detected in the mixture (about 4 hours); the melt is then stirred into 200 parts of sulphuric acid (60° B.), and the resulting mixture poured into water. The precipitate is dissolved in hot sodium hydroxide solution, dilute hydrochloric acid is added, and the 1,4,8-trihydroxyanthraquinone is filtered off, and may be purified by re-crystallisation from pyridine. It is soluble in sodium hydroxide solution with a violet colour, and its solution in sulphuric acid is violet-red, turning bluish-violet and showing a red fluorescence on addition of boric acid. It is stated to be a "valuable intermediate product for the production of dyestuffs."

—T. F. B.

50 per cent. Naphthazarin paste, 500 parts of water, and 22 parts of a 24 per cent. solution of sodium hydroxide are boiled together, a current of air being meanwhile passed through the mixture, until the colour has changed to a magenta tint, which occurs in three to four hours. After cooling, the new dyestuff is precipitated in brown crystals by the addition of sulphuric acid. It is soluble in water and dyes wool from an acetic acid bath in orange-red shades, which become reddish-black on subsequent treatment with a bichromate. When printed with chromium acetate on cotton, a fast, full black shade is obtained, superior to that obtained similarly with Naphthazarin. The new dyestuff is converted into a soluble compound by treatment with sodium bisulphite.—E. F.

## UNITED STATES PATENTS.

Dyestuffs; *Yellow Tetrazo* —. H. Witter, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pats. 791,524, 791,525 and 791,526, June 5, 1905.

SEE Fr. Pat. 347,376 of 1904; this J., 1905, 329.—T. F. B.

Dyestuff; *Blue-black Azo* —. M. Herzberg, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pats. 792,032, 792,033 and 792,034, June 13, 1905.

SEE Fr. Pat. 347,655 of 1904; this J., 1905, 329.—T. F. B.

Dyestuff; *Brown Anthracene* —. R. Bohn, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany.

hafen-on-Rhine, Germany. U.S. Pat. 791,869, June 6, 1905.

SEE Addition of Nov. 15, 1904, to Fr. Pat. 341,126 of 1904; this J., 1905, 434.—T. F. B.

*Dyestuff adapted to form Lakes*; Azo ——. P. Julius and E. Fussnegger, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 792,421, June 13, 1905.

A *m*-NITROAMINOBENZENE derivative containing a methyl group in the *p*-position to the amino group, is diazotised and combined with 2-naphthol-3-6-disulphonic acid. The products are soluble in hot water, and yield insoluble barium salts. The product from diazotised nitroxyldine  $[\text{NH}_2\cdot\text{NO}_2\cdot\text{CH}_3\cdot\text{CH}_3=1:3:4:6]$  and 2-naphthol-3-6-disulphonic acid is specially claimed.—E. F.

#### FRENCH PATENTS.

*Dyestuff suitable for the Manufacture of Lakes*; *Production of a Red Monazo* ——. Badische Anilin und Soda Fabrik. Fr. Pat. 349,381, March 23, 1904.

SEE U.S. Pat. 765,079 of 1904; this J., 1904, 819.—T. F. B.

*Dyestuff [Azo] Insoluble in Water, Derived from 2-Chloro-4-toluidine and 3-Naphthol*; *Production of a* ——. Badische Anilin und Soda Fabrik. Fr. Pat. 349,382, March 23, 1904.

SEE U.S. Pat. 765,080 of 1904; this J., 1904, 819.—T. F. B.

*Dyestuffs*; *Manufacture of a New Series of Anthracene* — and their Application in Dyeing and Printing.

a solvent, is treated, at a temperature of 200° C. or at with chlorine or bromine. The product is identical that obtained, according to Fr. Pat. 313,608 (this J., 1206), by the action of certain metallic salts on 1-an-2-bromo-anthraquinone.—E. B.

#### GERMAN PATENTS.

*Dyestuff*; *Method of Preparing a Sulphide* ——. Chim. des Usines du Rhone, ancien. Gilliard, P. M. et Cartier. Ger. Pat. 158,927, Dec. 1, 1903.

By boiling dinitrosalicylic acid with alkali sulphide sodium carbonate and sulphur, (the solution being of a strength that it boils at about 120° C.) under a condenser for a long time, a valuable black dyest obtained.—T. F. B.

### V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILE YARNS, AND FIBRES.

*Fibres from British Central Africa*; "Denji" "Nzonogwi" ——. Bull. of the Imp. Inst., 1903, 23—25.

SAMPLES of the fibres of *Sida rhombifolia* ("Denji") and of *Triumfetta rhomboidea* ("Nzonogwi" fibre) of which grow abundantly in the neighbourhood of Zomba, gave the following figures as the results of chemical examination:—

	<i>Sida Rhombifolia.</i>		<i>Triumfetta Rhomboidea</i> "Nzonogwi."	
	"Denji."	From Bengal.	"Extra Fine Indian Jute."	
	Per cent.	Per cent.	Per cent.	Per cent.
Moisture .....	10.3	12.7	10.4	9.6
Ash .....	1.0	1.6	0.6	0.7
Loss on "α-hydrolysis" .....	8.5	8.7	9.1	9.1
Loss on "β-hydrolysis" .....	13.5	14.5	14.7	13.1
Loss on mercerisation .....	7.5	13.2	8.5	8.5
Loss on acid purification .....	1.8	1.9	3.4	2.0
Gain on nitration .....	23.6	32.2	30.2	36.7
Cellulose .....	77.4	79.3	76.2	77.7
	Inches.	Inches.	Inches.	Inches.
Length of ultimate fibre .....	0.07—0.12	0.08—0.10	0.08—0.11	0.06—0.12

Badische Anilin und Soda Fabrik. Fr. Pat. 349,531, Dec. 21, 1904. Under Int. Conv., March 25, and Aug. 12, 1904.

New derivatives of anthracene, termed *benzanthrones*, are obtained by condensing with glycerol, in presence of a dehydrating agent such as sulphuric acid, any of the following compounds: β-aminoanthraquinone and other derivatives of anthraquinone with an amino group in the beta position (with the exception of 1,2-dihydroxy-3-aminoanthraquinone and its derivatives), anthraquinone and its homologues and also sulphonic acids of these compounds and their reduction products, anthracene and its homologues and derivatives, and naphthanthraquinone and its reduction products and derivatives. By heating the benzanthrones with caustic alkalis, with or without the addition of alcohol, dyestuffs suitable for vat dyeing and for printing are obtained. (See also this J., 1905, 192.)—A. S.

*Arylsulphamides*; *Process for Manufacturing Nitro Derivatives of Aromatic* ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 349,566, April 2, 1904.

SEE Eng. Pat. 6741 of 1904; this J., 1905, 193.—T. F. B.

*Lakes*; *Process for Preparing* ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 349,587, Dec. 21, 1904. XIII.A., page 742.

*Dyestuff of the Anthracene Series [Blue Anthracene Dyestuff]*; *Production of* ——. Soc. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 349,606, Dec. 27, 1904. Under Int. Conv., May 31, 1904.

α-AMINOANTHRAQUINONE, alone or in the presence of

The figures for samples of *Sida rhombifolia* Bengal, and for Indian jute of "extra fine quality" (the new fibres closely resemble), are added for comparison. The fibres are considered somewhat inferior to jute in spinning qualities, and to be suitable chiefly for tow yarns. Each is valued at approximately 12l. per ton.—T. F.

*Dyestuffs*; *Affinity of Artificial* — for Conn. Tissues. Curtis and P. Lamont. Comptes Rendus, 1905, 140, 1606—1608.

In preparing histological preparations a mixture of Picric acid and Acid Magenta is frequently employed, and so to differentiate the connective tissue very well at first, but the coloration is fugitive. The authors have experimented with substitutes for both the picric acid and Acid Magenta. They find that the picric acid may be replaced by other trinitro-derivatives, such as those of cresols, β-naphthol and resorcinol without disadvantage, and that the Acid Magenta can be satisfactorily replaced by triphenylmethane-, mono-azo- or polyazo-dyestuffs; these contain at least three sulphonic acid groups, distributed, as far as possible, uniformly throughout the molecule. Under these conditions only the connective tissue is selectively dyed in a satisfactory manner. Satisfactory results were obtained with Acid Magentas Violet Reds 4 R S and 5 R S, and also with Ponceau Extra, Diamine Blue 2 B and Naphthol Black B; the latter dyestuffs offering the advantage that the results are permanent.—E. F.



## ENGLISH PATENTS.

*ing Agents; Manufacture and Application* — J. V. Johnson, London. From the ische Anilin und Soda Fabrik, Ludwigshafen-on-le, Germany. Eng. Pat. 13,955, June 20, 1904.

MALDEHYDE-HYDROSULPHITE compound, of sodium tate, is extracted by methyl alcohol, to obtain, on ating the filtered solution *in vacuo*, a crystalline dehyde-sulphoxylate, having a greater reducing on indigo than the original substance, whilst the s left undissolved by the methyl alcohol only feeble reducing power. Or the form- de-hydrosulphite compound is treated with l alcohol; the crystals formed, of practically lueing power, are separated, and the solution is ated as in the previous case. Or, again, a con- ted solution of the formaldehyde-hydrosulphite und is slowly evaporated at a gentle heat, and the a are separated from time to time as they form, heir reducing power is tested with iodine solution. er method of obtaining the reducing compound s in heating a formaldehyde-sodium hydrosulphite n with zinc dust in presence of acetic acid; the precipitated by sodium carbonate, and on evaporat- filtrate *in vacuo*, a crystalline mass is obtained of hum salt of formaldehyde-sulphoxylie acid, mixed sodium acetate. The same product is obtained sodium bisulphite and formaldehyde by g a solution containing the two substances alternate additions of zinc dust and of acid. After addition of sodium carbonate and g, the filtrate is evaporated *in vacuo*. The use of agents in dyeing, and in discharging colouring s from textile fibres, is claimed. (Reference is made s, Pats. 3288 of 1900; 5867 of 1903; and to 7397 1; this J., 1901, 247; 1904, 369; and 1905, 132, tively. (See also Fr. Pat. 341,718 of 1904; this J., 1905, 100.)—E. S.

s; *Method of and Means for Producing a High Degre smoothness or Gloss on* — by Roller Action. H. Hall, eld, Germany. Eng. Pat. 15,693, July 14, 1904. : Pat. 344,658 of 1904; this J., 1904, 1213.—T. F. B.

## UNITED STATES PATENTS.

s; *Process of Manufacturing Viscose-coated* —. A. Waite, Lansdowne, Pa., Assignor to S. W. Pettit, eladelphia, Pa. U.S. Pat. 791,385, May 30, 1905. AL coats of viscose are applied in succession to fibres, which are dried after each such application. s, the viscose is "reverted." The viscose on the may be superficially redissolved before "reverting" R.

s, *Waterproof, Viscose-coated* — and *Process of nufacturing same*. C. N. Waite, Lansdowne, Pa., gnor to S. W. Pettit, Philadelphia, Pa. U.S. Pat. 386, May 30, 1905.

s are coated with viscose, as described in U.S. Pat. 5 (see preceding abstract), and are then covered layer of "a varnish." —E. B.

s; *Apparatus for Dyeing* —. C. M. Hanson, cedale, R.I. U.S. Pat. 791,148, May 30, 1905.

ATED, rotary, cylindrical cages, serving for the ion of textile fibres in the form of sliver, are arranged d a central, vertical shaft, above a dye-tank. The has an inclined, false bottom, with a central opening d by a dome, from which radiate liquor-conducting connected with (i.) perforated pipes, which extend ally upwards close to the inner sides of the rotary and with (ii.) branch-pipes, leading into perforated, al pipes at the centres of the cages. When the cages volved, the dyo-liquor in the tank is raised and ed into them by centrifugal action.—E. B.

s; *Process of Making Coloured* —. C. Bucher, a, Germany. U.S. Pat. 790,718, May 22, 1905. method consists of moistening the fabric and then

progressively applying under pressure the parts of a design in colour to it, and removing the pressure from the portion upon which the parts of the design have been applied, thereby producing a coloured fabric with mottled design.—T. F. B.

## FRENCH PATENTS.

*Textile Fibres and Threads; Conting — with Colloids or Cellulose*. J. M. de Sauverzac. Fr. Pat. 349,620, Dec. 27, 1904.

TEXTILE threads, composed of fibres of either animal or vegetable origin, are passed in a continuous manner through solutions of cellulose or of colloidal substances. They are thus rendered more lustrous and thicker. Vegetable textile fibres in an unspun condition, may be united together, by means of the same solutions, to form continuous threads.—E. B.

*Bleaching and Dyeing Textiles in Vacuo or under Pressure; Apparatus for* —. C. Crépelle-Fontaine. Fr. Pat. 349,821, Nov. 26, 1904.

THE apparatus consists of an air-tight vat of suitable shape, in the top and bottom of which are situated the liquid inlet and outlet. The fabric is wound on rollers or bobbins mounted on rods, which are connected, outside the vat, with suitable means for rotating them. A number of empty rollers is provided in the vat, and the fabric is wound on these as the operation proceeds; when the latter rollers are fully wound, the driving machinery is automatically reversed, so that the fabric is rewound on the original rollers, this process continuing until the treatment is complete.—T. F. B.

*Tissues, Paper, &c.; Apparatus for Printing — by means of Sprays of Dye-stuff Solutions [Stencil Printing]*. Soc. Welting, Calisch Fils et Cie. Fr. Pat. 349,616, Dec. 27, 1904.

THE tissues, sheets of paper, &c., to be printed are drawn from a roll and intermittently passed downwards in contact with a vertical, printing table, in front of which a stencil plate is mounted so as to be capable of being strongly pressed against them. While they lie against the table, solutions of mordanting compounds, dye-stuffs, &c., are applied in the form of sprays to their exposed parts. The stencil is afterwards removed, the tissues, &c., are pulled downwards to withdraw the printed portion and to substitute another portion for it. The stencil, which may be the same as was previously employed or one bearing another pattern, is then again applied, and a second length is printed as before, this procedure being repeated as often as is necessary to effect the printing of the tissue, &c.—E. B.

*Aldehyde Derivatives and their Application as Discharging Agents; Production of* —. Badische Anilin und Soda Fabrik. Fr. Pat. 350,607, Jan. 7, 1905. Under Int. Conv., April 21 and 25, 1904.

SEE Eng. Pat. 13,955 of 1904, preceding these.—T. F. B.

*Condenser for Benzene [from Dry-Cleaning Works]; Radiating* —. E. Delhotel. Fr. Pat. 349,360, Dec. 3, 1904.

THE apparatus consists of three condensing chambers, placed side by side, the first cooled by a worm condenser traversed by a current of water, and the second by the overflow from the third, which is cooled by water at a temperature of about 0° C., passing through a series of pipes. The current of hot air containing benzene, &c. (e.g., such as is obtained in cleaning fabrics; see Fr. Pat. 344,848 of 1904; this J., 1904, 1213) is thus cooled progressively, and the fractions which condense in the three compartments may be collected separately if desired. The cooled air passing from the last condensing chamber is led to a larger vessel, provided with any suitable means for arresting any admixed particles of benzene. The whole apparatus is surrounded by an insulating jacket. —T. F. B.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

UNITED STATES PATENT.

*Printing upon Pyroxylin Materials; Process of —.*

R. E. Roehm, Assignor to The Whitehead and Hoag Co., Newark, N.J. U.S. Pat. 791,503, June 6, 1905.

AN adhesive coating is applied to the surface of the "pyroxylin material," which has previously been rendered porous, and the pattern is then printed on and allowed to dry. The material is now subjected to simultaneous heat and pressure, and the surface is afterwards suddenly chilled, pressure being maintained.—T. F. B.

FRENCH PATENT.

*Tissues, Paper, &c.; Apparatus for Printing — by means of Sprays of Dye-stuff Solutions [Stencil Printing].* Soc. Weßling, Calisch Fils et Cie. Fr. Pat. 349,616, Dec. 27, 1904. V., page 727.

## VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

*Alkali, &c., Works; Forty-first Annual Report on —, by the Chief Inspector. Proceedings during the year 1904, &c. Feb. 27, 1905. Price 8d.*

WORKS scheduled as alkali works show a reduction of two as compared with 1903; but other works subject to registration have increased by eight. There have not been any prosecutions under the Alkali acts for the year dealt with. The "Alkali, &c., Works Bill, 1904," was withdrawn under pressure of time in August last, but will be, it is expected, re-introduced in the coming session. There has been increased demand for salt-cake, though not for chlorine products. The production of chlorine for bleaching powder manufacture in different countries, by the electrolytic and Leblanc processes respectively, is quoted from Hasenclever as follows:—

	Electrolytic.	Leblanc.
	Per cent.	Per cent.
Germany .....	65	35
England .....	18	82
France .....	19	81
America .....	100	—
Austria .....	66	34
Spain .....	100	—
Russia .....	55	45
Belgium .....	54	46

Of the total 260,000 tons of bleaching powder produced by the world, half is stated to be contributed by electrolytic methods, and the other half by methods having hydrochloric acid as their source.

Experiments in treating the acid discharges from the chimneys of alkali-waste works with alkaline waste slurry described in the Report for the preceding year (this J. 1904, 784) have been continued, but under somewhat changed conditions, the residual gases entering the absorbing towers at a much higher temperature than before. Under these circumstances difficulties arose; "the carbonator waste assumed an extraordinary gelatinous physical condition, so much so that it was necessary to revert to the use of carbonated waste itself in the absorbers in place of alkaline raw waste slurry." The function of the waste, at this higher temperature, was limited to neutralisation of the sulphurous acid portion of the gases, the hydrogen sulphide portion being unaffected. A table is given showing details of the relative efficiency of the raw and the spent slurry used, as derived from laboratory experiments.

The average amount of acid gases escaping from sulphuric acid works for the year covered by the Report, is slightly under that of the preceding year, and none of the 168 works concerned has given serious cause for anxiety,

although there have been occasions for protests, involving temporary stoppages of plant.

Further experience has been gained in the past year to details of the lead chamber process for the manufacture of sulphuric acid, especially in reference to securing steadiness of draught and in the replacement of steam by finatomised water. The statement of C. R. Alder Wright is quoted and italicised, that the normal action of a vit chamber "does not go on in virtue of the interaction of one another of gaseous or vaporous substances solid but takes place on the surface of the liquid water vesicles formed by the partial condensation of the steam at the moment of its entering the chamber," and it is inferred that "the greater part of the steam blown in must precipitate as vesicles of liquid water mist immediately on entering the chamber;" and that the chemical changes "largely go on at the surface of the floating vesicles." (See E. Divers; this J., 1904, 1178.) In respect to any desired enquiry as to the sources of the loss of nitre in the chamber system, the chief inspector directs attention to the novel method introduced by Mr. Inglis, in his paper on "The Loss of Nitre in the Chamber Process" (this J., 1904, 643-5), of freezing the exit gases and subjecting the product to fractional distillation, whereby it has been shown that only a small proportion of the losses are attributable to formation of nitrous oxide. In one sulphuric acid factory in Scotland, Dr. Meyer's tangential system, in which the chambers are cylindrical or drum-shaped, the gases entering at the top of the drum tangentially and being withdrawn at the bottom from the centre, have been introduced. The initial difficulties met with in the process have been overcome. In contact processes for sulphuric acid manufacture, there has been no extension; but at one of the works the conditions of successful application of dilute milk of lime for reducing the acidity of the exit gases run down a coke-packed scrubber have been studied. It is found necessary to arrange that the milk of lime should not settle until it enters the top of the tower, and it is therefore delivered from a tank supplied with an agitator and a constant stream of water, into "a trough in which is an air-pipe at the bottom, compressed air keeping the lime from settling." Four or five pipes from this trough deliver into four or five smaller troughs in which also are air-pipes delivering compressed air." The milk of lime flows from several openings in these smaller troughs to the lutes on the top of the tower.

The Kessler process for rectifying sulphuric acid continues to give satisfaction. In a recently developed process of concentration, rectification has been effected at a low temperature by blowing heated air through the acid in the concentrating vessel.

The increased demand for sulphuric acid free from arsenic, has directed the attention of manufacturers to the precautions necessary in the use of hydrogen sulphide for precipitating arsenic from the acid. An explosion (happily without loss of life) occurred at a factory, attributed to contact of an explosive mixture of hydrogen sulphide and air with the scaly iron oxide on the pipe leading to the lime purifier. The ignition was presumed to have been caused by the rapid sulphiding and re-oxidation of the iron oxide. In the case referred to, the iron pipe was subsequently replaced by a lead pipe.

In chemical manure works, the manufacture of superphosphate is practically dependent on imported water, of which the amounts, in tons, are:—

	1904.	1903.	1902.
Guanos .....	24,276	28,000	9,000
Mineral phosphates .....	419,221	302,714	365,000
Nitrate of soda .....	120,526	115,000	105,000

The exports of ammonium sulphate in 1904 were 177,000 tons, the home consumption being 68,500 tons as against 162,300 tons and 71,700 tons respectively for the preceding years. The manufacture of superphosphate in Belgium, largely for export to this country, is to a great extent dependent upon the supply of crude sulphuric acid from



ced as a bye-product of the spelter works, the activity which have increased of late, there, as well as in Silesia and in the United States.

In gas-liquor and ammonium sulphate and chloride works, account is given in the Report of numerous points at which the working is liable to go wrong, unless under careful supervision. A fatality, involving the loss of six lives, occurred at the Batley Corporation Gas Works, due to a mistake in the order of closing and opening the purifying apparatus in the foul-gas branch pipes. It is stated that "the Claus sulphur recovery plant has advanced value now that the recovery of cyanogen is being undertaken at many of the larger gas works." Gas-liquor sometimes contains a very notable portion of ammonium cyanide, and attention is directed to the necessity of precautions against poisoning, owing to the presence of hydrocyanic acid gas in the gaseous effluents evolved.

Under the heading "Recovery and Production of ammonia," the following table is given:

Amount of Sulphate of Ammonia Produced in the United Kingdom:—

	1904.	1903.	1902.
Gas works .....	150,208	149,489	150,055
Iron works .....	19,568	19,119	18,801
Coke works .....	42,486	37,353	36,931
Coke oven works .....	20,848	17,438	15,852
Producer gas and carbonising works (bone and coal) ...	12,880	10,265	8,177
Total .....	245,990	233,664	229,816

There has been considerable extension of the application of ammonia recovery to coke oven plants, an extension which will probably be still greater in the current year. A table is given showing the analyses of ammoniacal liquors from two different sources, in one of which the proportion of cyanide is exceptionally large. There is a further Memorandum from Mr. Linder respecting the Analysis of Ammoniacal Liquors," supplementary to that given in the Report for the preceding year. Feld's method of estimation of thiocyanate (thiocyanate) and thiosulphate (this J., 1903, 1068) with some variations, is followed, and the results summarised in two tables, a third table being given of details of the estimation of ferrocyanide. Certain precautions are to be observed, one of which is that in the thiosulphate present must be exactly oxidised to tetrathionate by the iodine used.

This process has been applied, with certain precautions, to the following cases:—Ferrocyanide alone present; ferrocyanide and thiocyanate both present, organic matter absent; and ammonium ferrocyanide in gas-works liquor. In the first case, either hydrochloric or sulphuric acid may be used to decompose the mercuric cyanide in the final distillation; in the second and third cases, the best results are obtained when sulphuric acid is used. Attempts to quantitatively estimate ferrocyanide as Prussian blue (method given in detail) did not afford satisfactory results.

In salt works, gaseous fuel from Mond producers fitted for ammonia recovery, has been applied with good effect. The salt obtained being of good quality and colour. It is further intended to utilise the steam evaporated from the brine as a source of supply of water vapour to the producer itself. The output of white salt and salt contained in brine used in the ammonia-soda process was, in 1903, 1,719,223 tons, as compared with 1,731,688 tons in 1902. There is an increase in the output of coke oven works in which producer gas manufacture is accompanied by ammonia recovery. In one of these works, the purified gas is used for the production of electrical energy in an engine of 1000 h.p. of the Oechelhauser type, in which a cylinder with open ends is provided with two pistons moving in opposite directions, the charge being compressed by their approach on the return stroke, so that a fresh impulse is given by explosion in every revolution of the shaft. Such gas engines have

been successfully used at Hörde in Germany. In connection with blast-furnaces using coke, a large gas-engine of the Société Cockerill type to compress the blast, is worked by the gases coming from the plant for the recovery of ammonia. The effluent gases are singularly free from fixed impurities.

There has been depression in the cement manufacture, both at home and in Germany, lower prices practically supplies her own needs. The use of the rotary kiln is extending, and the smoke nuisance is being minimised by the improvements introduced.

The production of arsenic continues to diminish, with the final closing of operations at Devon Great Consols. The chief inspector states that "with increasing demand for tungsten for alloying steel, wolfram is now especially valuable: it occurs associated with mendelee, and is first calcined for separation of arsenic by volatilisation."

Although in the production of zinc no electrical process has as yet succeeded in (generally) supplanting the old-established processes, yet one such process, that of Höpfer, forms the basis of operations whereby the metal is obtained from blende at one factory, from which no nuisance proceeds, the earlier difficulties encountered having been overcome.

Part III of "Studies of the Claus Kiln Reaction," is given under the heading "Influence of the various Contact Substances on the Interaction of Steam and Hydrocyanic Acid." (A) in absence of hydrogen sulphide and air: and (B) in presence of these bodies. Under (A), experiments were made using as contact material, broken brick, iron oxide, and Weldon mud, of which the latter exerts a "much more powerful oxidising action upon the reaction-products than oxide of iron, no carbon monoxide or hydrogen surviving." Under (B) the three contact materials named were tried. Generally, the presence of hydrogen sulphide and air favours a high yield of ammonia under certain conditions of temperature for the several contact substances used. With respect to the presence of ammonium sulphate in the sulphur recovered from Claus kilns in gas-liquor works, and its relation to the nitrogen entering with the saturator gases in the form of hydrocyanic acid, the paper appearing in this J., 1904, 586, is referred to. The results of further experiments are given in tabular form, accompanied with descriptions of processes and apparatus.

The Report consists of 155 pages, of which 11 pages are devoted to Scotland.—E. S.

*Sulphuric Acid Manufacture; Equilibrium in the Contact Process of — M. Bodenstein and W. Pohl. Z. Elektrochem., 1905, 11, 373—384.*

RESEARCHES undertaken to ascertain whether the reaction in the contact process obeys the law of mass-action, i.e., whether (C being the concentration)

$$\frac{C_{SO_2}^2 C_{O_2}}{C_{SO_3}^2} = K \text{ a constant, dependent}$$

on temperature only, not on the proportions of the reacting gases, their dilution with inert gas, or the nature of the catalyst. Knietseh, in his report to the 1903 Congress of Applied Chemistry, gave the results of some measurements indicating a constant value for K, but only for one mixture and for almost complete conversion; and Bodländer and v. Köppen's measurements (this J., 1903, 1128), were restricted in range of temperature, and lacked the necessary exactness to decide the question. The authors have adopted a method similar to that of Knietseh, passing a steady stream of sulphur dioxide and air or oxygen, or both, over platinum in a quartz tube heated by an electric furnace, and determining the composition of the mixture before and after contact. Extreme care was taken to keep the composition of the mixture constant during the whole time of an experiment, to secure as nearly as possible uniformity of temperature throughout all parts of the hot tube, to ascertain that temperature accurately, to maintain it constant, and to prevent alteration of the composition of the gas in its passage from the catalytic chamber to the absorption tubes in which it was analysed.

The experiments of the first series, 14 in number, were carried out at 727° C. (1000° Abs.). The actual variations of temperature in the different experiments were from 998 to 1003° C.; but after the results of the later series were obtained, it became possible to apply a correction, which gave the value of  $K$  at 1000° in each case. The pressure varied from 753 to 770 mm.; the amount of sulphur dioxide present with 1 vol. of oxygen varied from 0.21 to 3.97 vols.; in some of the experiments there was also present nitrogen to the extent of 3.76 vols. per vol. of oxygen; the speed of travel varied from 5.4 to 53.4 c.c. per minute; and in one of the experiments the apparatus was so arranged that the amount of sulphur trioxide formed in the first portion of the catalytic apparatus was greater than that ultimately present, so that equilibrium was reached from the other direction. The amount of sulphur trioxide formed, expressed as percentage of the original dioxide, varied from 20.8 to 59.6; and the value of  $K$  varied only from  $3.42 \times 10^{-3}$  to  $3.67 \times 10^{-3}$ , averaging  $3.54 \times 10^{-3}$ .

A number of shorter series of experiments at different temperatures were then undertaken, and showed in all cases most satisfactory concordance among the individual results. The average results of the whole are tabulated below:—

Temp. C.	Value of $K$ $\times 10^6$	Temp. C.	Value of $K$ $\times 10^6$
528	1.55	727	354
579	7.55	789	1260
627	31.6	832	2800
680	112.0	897	8160

The correctness of these values is confirmed by the fact that the heat-evolution of the reaction  $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$  calculated from them agrees well with the determined value, and that the specific heat of gaseous sulphur trioxide deduced from them ranks amongst those of similar gases. The values of  $K$ , however, determined by Knietseh and by Bodländer and v. Köppen do not agree at all well with those of the authors. Probably in Knietseh's case errors in the determination of the temperature account for the difference; were his temperatures too high by amounts varying from 15 to 70—quite a possibility, as the difficulties of fixing and determining it are so great—his results would agree with those of the authors'. Lunge and Reichardt are in agreement, as close as the nature of the case allows, with the authors. The conclusion is that this reaction obeys the law of mass-action closely, and may indeed be chosen with advantage from among other reactions as illustrating and demonstrating the operation of the law.

The authors have also calculated from their results, and embodied in the following tables, the yields (per-

Composition by Volume.				Temperature.				
Air.	N <sub>2</sub>	SO <sub>2</sub>	O <sub>2</sub>	400°	500°	600°	700°	800°
<i>Sulphur Dioxide and Oxygen without Nitrogen.</i>								
—	—	66.67	33.33	98.1	91.3	76.3	51.5	30.1
—	—	33.33	66.67	99.7	97.3	88.5	66.6	40.4
—	—	14.00	86.00	99.8	97.9	90.3	63.8	43.9
—	—	7.00	93.00	99.8	98.1	90.5	70.7	44.9
—	—	2.00	98.00	99.8	98.2	90.8	71.2	45.5
<i>Burner Gases diluted with Air.</i>								
—	84.85	10.10	5.05	96.2	83.2	59.1	31.9	15.0
1.144	83.00	7.00	10.00	99.3	93.4	73.3	42.5	20.5
2.194	81.40	4.00	14.60	99.4	94.0	78.3	48.1	24.2
3.044	80.00	2.00	18.00	99.5	95.6	85.0	51.3	26.3

—J. T.

*Sodium Carbonate and Hydroxide; Densities of Solutions of —.* R. Wegscheider and H. Walter. *Monatsh. Chem.*, 1905, 26, 685–725.

The following determinations were made of the density at 60° and at 80° C. of solutions of sodium carbonate and sodium hydroxide (always containing some carbonate), and of mixtures of the two:—

Grm.-Equivalents per Litre.			Percentage by Weight.		Den. (Wat. 4° C.)
Na <sub>2</sub> CO <sub>3</sub> .	NaOH.	Total.	Na <sub>2</sub> CO <sub>3</sub> .	NaOH.	
At 60° C.					
7.027	—	—	28.74	—	1.20
5.960	—	—	25.20	—	1.20
5.111	—	—	22.25	—	1.2
4.036	—	—	18.23	—	1.17
2.988	—	—	14.06	—	1.13
0.142	6.938	7.080	0.61	22.57	1.27
0.108	6.018	6.126	0.48	20.04	1.20
0.078	4.976	5.054	0.35	17.04	1.10
0.082	4.018	4.100	0.38	14.16	1.13
0.074	3.007	3.081	0.36	10.92	1.10
3.660	3.348	7.008	15.38	10.63	1.20
3.198	2.923	6.121	13.79	9.52	1.2
2.725	2.474	5.199	12.10	8.29	1.17
2.178	1.986	4.164	9.965	6.86	1.1
2.056	1.927	3.983	9.47	6.70	1.1
1.618	1.453	3.071	7.69	5.22	1.1
6.900	—	—	28.59	—	1.2
3.495	—	—	18.26	—	1.17
0.127	6.951	7.078	0.55	22.81	1.27
0.088	3.927	4.015	0.42	14.01	1.17
3.598	3.480	7.078	15.26	11.14	1.2
2.040	1.975	4.015	9.48	6.03	1.1
At 80° C.					
7.027	—	—	28.74	—	1.20
5.960	—	—	25.20	—	1.20
5.111	—	—	22.25	—	1.2
4.036	—	—	18.23	—	1.17
2.988	—	—	14.06	—	1.13
0.142	6.938	7.080	0.61	22.57	1.27
0.108	6.018	6.126	0.48	20.04	1.20
0.078	4.976	5.054	0.35	17.04	1.10
0.082	4.018	4.100	0.38	14.16	1.13
0.074	3.007	3.081	0.36	10.92	1.10
3.660	3.348	7.008	15.38	10.63	1.20
3.198	2.923	6.121	13.79	9.52	1.2
2.725	2.474	5.199	12.10	8.29	1.17
2.178	1.986	4.164	9.965	6.86	1.1
2.056	1.927	3.983	9.47	6.70	1.1
1.618	1.453	3.071	7.69	5.22	1.1
6.900	—	—	28.59	—	1.2
3.495	—	—	18.26	—	1.17
0.127	6.951	7.078	0.55	22.81	1.27
0.088	3.927	4.015	0.42	14.01	1.17
3.598	3.480	7.078	15.26	11.14	1.2
2.040	1.975	4.015	9.48	6.03	1.1

The following results were obtained by weighing measured quantity in a graduated pipette at 11° measuring the expansion, and hence calculating density at 80° C.:—

Grm.-Equivalents per Litre.			Percentage by Weight.		Density.	
Na <sub>2</sub> CO <sub>3</sub> .	NaOH.	Total.	Na <sub>2</sub> CO <sub>3</sub> .	NaOH.	At 11° 5.	At 80°
0.866	4.207	5.073	3.845	14.10	1.196	1.157
0.706	4.020	4.726	3.171	13.63	1.182	1.142
0.483	3.631	4.114	2.204	12.51	1.164	1.126
0.351	2.879	3.230	1.642	10.17	1.136	1.097
0.060	4.923	4.083	0.269	16.64	1.186	—

centage of  $\text{SO}_2$  converted into  $\text{SO}_3$ ) for different mixtures and at different temperatures:

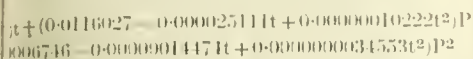
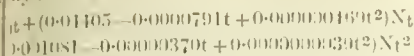
Composition by Volume.				Temperature.				
Air.	N <sub>2</sub>	SO <sub>2</sub>	O <sub>2</sub>	400	500	600	700	800° 900°
<i>Stoichiometric Mixture, with Nitrogen.</i>								
—	0.0	66.67	33.33	98.1	91.3	76.3	51.5	30.1 16.0
—	79.00	14.00	7.00	99.3	84.7	62.2	35.2	18.3 8.2
—	84.85	10.10	5.05	95.7	83.2	59.1	31.9	15.0 7.0
—	89.50	7.00	3.50	95.2	81.2	55.5	28.5	12.9 6.0
—	97.00	2.00	1.00	92.7	73.2	43.0	18.4	7.5 3.3

Interpolation formulæ were calculated, by which densities of all solutions of sodium carbonate and hydroxide of concentrations up to 8N, for all temperatures between 0° and 100° and between 15° and 80° C. respectively could be calculated. The formulæ giving results agree most closely with the determinations of the authors and those previously published by others were for carbonate  $d_t = d_{(w)} + (0.05534 - 0.0001273t + 0.000000867t^2) \text{ N}$

or  $d_t = d_{(w)} + (0.0111726 - 0.00002918t + 0.000000232t^2 + (0.000016956 + 0.0000007272t - 0.0000000478t^2) \text{ N}$



hydroxide



(wt) is the density of water at the given temperature;  $\rho$  is the number of gram-equivalents per litre and percentage by weight of the substance. Formulae for densities of mixed solutions can be calculated from the formulae

$$d = d'' + \frac{(d' - d'') N'}{N}$$

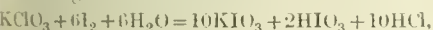
$N$  is the total number of gram-equivalents per litre and  $d''$  the densities respectively of sodium hydroxide and sodium hydroxide solutions of that "normality" and  $N'$  the "normality" in sodium carbonate solution (so that  $N - N'$  is its "normality" in hydroxide). These formulae do not apply with accuracy to all solutions, but for details of the cases the original must be consulted.—J. T. D.

*Reduction of* ——. C. Brückner. *Monatsh. f. Chem.*, 1905, 26, 675—682.

Thor has examined the phenomena of reduction of the sulphates when heated with magnesium powder, and carefully excluded. The alkali sulphates give sulphur dioxide under these circumstances; but, sulphide, thiosulphate and polysulphide are always in the products. The alkaline-earth sulphates, those of magnesium, zinc, aluminium and nickel, and sulphur dioxide, and there remain sulphide, phosphate, and polysulphide of the metal, together with some free sulphur and, of course, magnesia. The behaviour of copper sulphate is similar, save that cuprous and metallic copper are always among the products, ferrous and manganous sulphates leave no metallic higher oxide, along with the products of reduction. Iron takes place to some extent with most of these when they are merely rubbed in a mortar with magnesium powder. In this case sulphide is the only product. Magnesium reacts on sulphur trioxide, promagnesia and magnesium sulphide, and liberating sulphur dioxide.—J. T. D.

*Iodine Chlorate; Conversion of* — into Iodate, means of Iodine in presence of Nitric Acid. M. Otter. *Z. angew. Chem.*, 1905, 45, 270—274.

Progress of the reaction depends upon the concentration of the nitric acid. If that be low, the chief re-occurring is that of Ostwald:—



With high concentrations, Thorpe and Perry's reaction:  $2\text{KClO}_3 + \text{I}_2 = 2\text{KIO}_3 + \text{Cl}_2$  takes place almost exclusively, if the proportions of chlorate and of iodine be appropriate. With excess of iodine, however, chlorine is produced instead of chlorine:  $\text{KClO}_3 + \text{I}_2 + \text{HCl} = \text{KI} + \text{HIO}_3$ . The conversion of chlorate into iodate is effected in this way with quantitative exactness analytical purposes.—J. T. D.

*Nitric Acid; Volumetric Determination of* — by valent Cerium Salts. G. Barbieri. *XXIII.*, p. 752.

*Compounds [and Nitrites]; Reduction of* — with lithium hydrosulphite. J. Aloy and Rabaut. *IV.*, p. 723.

*Ammonium Magnesium Phosphate and its Substitution Derivatives*. L. Barthe. *III.*, page 722.

*Potassium Peroxide; Determination of* — in Presence Potassium Persulphate. J. A. N. Friend. *XXIII.*, p. 752.

## ENGLISH PATENTS.

*Furnaces for Use in the Manufacture of Soda, for the Smelting of Metals, and for like purposes*; *Impts. in* ——. H. L. Wrinkle, Thebe, and N. Wrinkle, Keeler, both of California. Eng. Pat. 15,792, July 15, 1904.

The furnace is built for use with fluid or pulverised fuel, and is formed with a molting chamber having tangential tuyères, and an upright shaft having at the top a charging hopper and bell, and outlet conduits on opposite sides for the passage of waste gases. The crucible or molting chamber has a lower dome constituting its top, and an upper dome which supports the shaft (both removable), the space between the domes forming an air chamber, in which is a radial partition serving to deflect the air-blast led into it. The air thus heated leaves the chamber on the opposite side of the partition to that by which it enters, and passes into a pipe half-surrounding the furnace, and thence to the tangential tuyères through which the liquid fuel is injected. The crucible is so constructed that the material charged into it from the stack takes the form of a truncated cone, affording an unobstructed passage for the burning gases which reverberate from the sides upon the mass of the charge. The arrangements for mechanically discharging the furnace material are shown as adapted to a soda-manufacturing furnace; but may be modified by addition of a fore-hearth with separate means for tapping off slag, when the furnace is used for smelting metals.—E. S.

*Alkalis; Manufacture of Dehydrated Caustic* ——. J. V. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 4762, March 7, 1905.

SODIUM or potassium hydroxide, or a mixture of these, hydrated, but solid at ordinary temperatures, is dehydrated by moderate heating in a vacuum. An iron vessel may be used. Reference is made to Eng. Pat. 12,320, 1895.—E. S.

*Ammonia; Process for the Production of* ——. H. C. Woltereck, London. Eng. Pat. 16,504, July 26, 1904.

SEE FR. PAT. 345,399 OF 1904; THIS J., 1904, 1215.—T. F. B.

## UNITED STATES PATENTS.

*Hydrohalogenic Acid [e.g., Hydrochloric Acid]; Process of Making* ——. F. W. Westhauser, Stuttgart, Germany. U.S. Pat. 791,306, May 30, 1905.

HYDROCHLORIC acid is produced by bringing a moist mixture of its "components" into contact with aluminium chloride under the influence of heat. In more general terms, the process for the production of a hydrohalogenic acid consists "in conducting a mechanical mixture of its components in a humid condition and under the influence of heat over porous bodies charged with decomposable corresponding halogenides of metals."—E. S.

*Sulphuric Anhydride; Catalytic Apparatus for Making* ——. G. Eschellmann and A. Harmuth, Assignors to Tov. Tentelevskago Khimichesk Zavoda, St. Petersburg. U.S. Pat. 792,205, June 13, 1905.

SEE ADDITION OF OCT. 4, 1904, TO FR. PAT. 321,275 OF 1902; THIS J., 1905, 277.—T. F. B.

*Oxides of Alkaline Metals; Apparatus for Obtaining* ——. G. W. Roepper and W. E. Harmar, Assignors to Amer. Electrolytic Co. U.S. Pat. 790,922, May 30, 1905. *XI.A.*, page 738.

*Ammonia; [Electrical] Process of Manufacturing* ——. W. Hoopes, Pittsburg, Pa. U.S. Pat. 791,194, May 30, 1905.

AN aqueous solution of an ammonium salt is electrolysed in the cathode compartment of a cell having a porous diaphragm, whilst the anode compartment is charged with sodium chloride, or other chloride than ammonium chloride. The ammonia and hydrogen produced at the cathode are separated, and the hydrogen is combined with chlorine.—E. S.

*Apparatus Still.* H. A. Abendroth. U.S. Pat. 792,379, June 13, 1905. III., page 722.

*Furnace [for Limestone]; Burning* —. G. Walzel. Assignor to E. Zusi, both of Newark, N.J. U.S. Pat. 791,660, June 6, 1905.

THE furnace consists of a single stack containing two or more upright chambers or shafts, each having a water-sealed charging device at the top. The lower portions of the shafts communicate with a main receiving chamber having at either end a discharge opening, connected to a water-sealed hood or box.—E. S.

*Hydrosulphites; Process of Making* —. L. Descamps, Lille, France. U.S. Pat. 791,675, June 6, 1905.

SEE Eng. Pat. 6933 of 1903; this J., 1903, 950.—T. F. B.

*Cyanides; Process of Making* —. J. Grossmann. Assignor to Grossmann's Cyanide Patents Synd., Ltd., Manchester. U.S. Pats. 792,259, 792,260 and 792,261, June 13, 1905.

SEE Fr. Pat. 331,331 and Eng. Pat. 4513 of 1903; this J., 1903, 1130, and 1904, 370.—T. F. B.

*Nitrites; Process of Making* —. J. Grossmann, Manchester. U.S. Pat. 792,515, June 13, 1905.

SEE Eng. Pat. 1452 of 1904; this J., 1905, 28.—T. F. B.

#### FRENCH PATENTS.

*Aluminium Hydroxide; Calcination of* —. Comp. des Prod. Chim. D'Als et de la Camargue. Fr. Pat. 349,709, April 8, 1901.

THE calcination of aluminium hydroxide for the production of anhydrous alumina, suitable, for instance, for use in obtaining aluminium by electro-metallurgical processes, or for lining furnaces, is found to be greatly facilitated by the addition to the hydroxide of a small proportion, such as 1 per cent., or less, of a fluoride. Preferably, the fluorine is added as ammonium fluoride; or the aluminium hydroxide may be moistened before calcination with hydrofluoric acid. The calcined product is stated to retain, at most, only traces of fluorine.—E. S.

*Calcium Phosphate; Minerals containing Calcium Carbonate; Process of Treating* —. A. Gardeur and F. Gernaert. Fr. Pat. 349,715, Dec. 29, 1904.

MINERALS composed of calcium phosphate together with calcium carbonate, but comparatively free from aluminous compounds, such as might form double silicates under the intended treatment, are mixed with silica, and, if not previously calcined, also with an agglutinant, preferably with calcined calcium phosphate. The moistened mixture is agglomerated into bricks, which, after drying, are roasted at a high temperature, to induce the formation of calcium silicate from the calcium carbonate present. The product is treated with an acid, preferably with dilute sulphuric acid, in proportion to form phosphoric acid or soluble compounds of the same, and calcium sulphate, the silicate remaining unattacked.—E. S.

*Nitrites; Process for Preparing* —. Aktieselskabet det Norske Kvaestofkompagni. Fr. Pat. 350,619, Jan. 9, 1905. Under Int. Conv., Jan. 22, 1904.

SEE Eng. Pat. 28,613 of 1904; this J., 1905, 619.—T. F. B.

*Nitrites; Process for Preparing Pure* — from a Mixture of Nitrates and Nitrites. Aktieselskabet det Norske Kvaestofkompagni. Fr. Pat. 350,620, Jan. 9, 1905. Under Int. Conv., Jan. 26, 1904.

SEE Eng. Pat. 28,614 of 1904; this J., 1905, 619.—T. F. B.

*Carbon Dioxide; Process of Manufacture of Liquid* —. Mdme Syssoyeff, née Fischer, and C. Cheynet. Fr. Pat. 349,416, March 24, 1904.

A STRONG reservoir, communicating on one side with a series of iron bottles, adapted for holding liquid carbon dioxide, and on the other with another strong vessel containing moistened sodium carbonate, is charged with a

milk of chalk and with an aqueous solution of sodium bisulphate. Connection being made to the bottles, are suitably cooled, the carbon dioxide evolved collects in them. The charge is renewed as often as may be necessary to attain a stated pressure, when the connection bottles is cut off, and the current of gas is directed to the vessel containing sodium carbonate, the latter cooled. When the sodium carbonate is converted to bicarbonate, the vessel is put into communication with the bottles, and heat is applied to it until the carbon dioxide is driven off and collected as desired, with recovery of sodium carbonate. E. S.

*Carbon Monoxide; Apparatus for the Detection and Determination of* —. A. Lévy and A. Péc. Pat. 319,714, Dec. 29, 1904. XXIII., page 72

#### GERMAN PATENTS.

*Hydrochloric Acid; Manufacture of* — with the Simultaneous Recovery of the Products of the Destructive Distillation of Wood. Bosnische Elektrizitäts Act. Ges. Pat. 158,086, April 24, 1903. III., page 722.

*Electrolysing Salt Solutions with the use of a Liquid Electrode* —. R. F. Andersson. Ger. Pat., 1 Dec. 2, 1902. XIA., page 739.

*Zinc Chloride; Process for Obtaining* — from Substances containing Zinc. E. H. Wikander. Ger. Pat. 1 Aug. 11, 1903.

SUBSTANCES containing zinc, such as zinc waste &c., are treated at about 550° C. with hydrochloric gas, either alone or mixed with air, and the product is then lixiviated with water.—A. S.

*Chlorates of the Alkalies or Alkaline Earths. Process of Preparing* — by Electrolysis. H. Landolt. Ger. Pat. 159,747, May 31, 1904. XIA., page 739.

### VIII.—GLASS, POTTERY, AND ENAMELS.

#### UNITED STATES PATENT.

*Glass; Process of Manufacturing* —. C. Ellis, Assignor to Eldred Process Co., both of New York, N.Y. Pat. 792,123, June 13, 1905.

THE raw materials for making glass are heated to temperature by means of combustible gas. The products of the reaction are withdrawn from the furnace, passed, together with air or oxygen, if necessary, to a deep bed of fuel to produce a combustible gas, owing to its low contents of nitrogen and carbon dioxide, is of high calorific value.—A. G. L.

### IX.—BUILDING MATERIALS, CLAY, MORTARS, AND CEMENTS.

*Lime-sand Bricks; Influence of added Fine Sand* —. M. Glasenapp. Tonind. Zeit., 29, 689—690.

IN order to increase the conversion of calcium hydroxide into hydrosilicate, and thus minimise the waste caused by the presence of the former in the finished product, it is advisable to replace a portion of the ordinary sand by some in a more finely divided condition. Thus, a mixture of 97 parts of dune sand and three parts of lime as a standard, the substitution of three parts of fine quartz powder for an equal weight of sand increases the dissociation of silica by 8.38 per cent., five parts of quartz powder giving an increase of 16.76 per cent. In the case of a mixture containing 6 per cent. of lime, the corresponding figures were 11.88 per cent. and 23.76 per cent. respectively. Similar results have been obtained with other mixtures.



large scale by Seger and Cramer, the use of 3 per cent fine quartz powder increasing the crushing strength out 58 per cent. A further advantage is that the soft bricks are (theoretically at least) better able to stand the action of fire, the free lime or calcium being a special source of weakness under the effect of high temperatures.—C. S.

*Purifying* — C. Lorenz. *Tonind.-Zeit.*, 1905, 29, 621.

so by sedimentation is the best means of eliminating ties, since any lime, marl, or pyrites present are rushed and more widely distributed in the mass mills are used, the result being deterioration of the batch. In any event, before deciding on the purifier to use, the clay should be subjected to tests, to determine whether mills or washers should be used.—C. S.

*and Cement: Constitution of* — from a Physico-chemical Standpoint. C. Richardson. Association of Portland Cement Manufacturers, Atlantic City, N.J., 15, 1904.

well-known that the mineral constituents of rocks identified under the microscope, in thin sections, ally with the aid of polarised light, and these petrographic methods have been applied to sections of Portland cement clinker. In this way Le Chatelier and Törnebohm identified four constituents, which were named *alite*, *celite* and *felite*, and are recognisable by their optical properties. The author has synthesised the corresponding compounds which might exist in Portland cement, mono-, di-, and tricalcium silicates, and mono-, di- and tricalcium aluminates, and tricalcium di-silicate. Definite compounds of iron and lime and magnesia exist, but are not essential to the formation of clinker, and the author has also found that so-called silico-aluminates, such as  $2\text{SiO}_2 \cdot \text{Al}_2\text{O}_3 \cdot 6\text{CaO}$ , and definite mineral entities such as occur in industrial cements, but solid solutions of aluminates in silicates, a consideration of the theory of solid solutions, the author concluded that Portland cement might be a solid solution of aluminates in tri-calcium silicate, and the question arises what are *alite* and *celite*, the essential constituents of clinker, what are their components and how they are altered in structure like steel, a solid solution of carbon in iron, at a definite temperature.

Analyses were made from pure silica, alumina, and lime in the proportions found in industrial clinker. From exact analyses of clinker, the relative number of molecules of the different substances was calculated, the molar proportion of iron being added to the alumina, similarly the proportions of the lime and other bases, and the relative amounts of silica, alumina and lime calculated to give a clinker of the same basicity and molar ratio, but with the unessential elements absent, the iron present in combination with sulphuric acid being deducted. From the amounts thus arrived at, it was found in No. 1, that after deducting three molecules of iron for combination with silica as tri-calcium silicate, the amount of lime left for combination with alumina was found closely with the formula  $2\text{Al}_2\text{O}_3 \cdot 3\text{CaO}$ , in No. 2, a quantity insufficient to form even a monomeric salt was left, which necessitates the conclusion that some di-calcium silicate must be present. Sections of clinkers thus prepared showed that No. 1 contained both *alite* and *celite*, and was not therefore a homogeneous solid of the aluminate  $2\text{Al}_2\text{O}_3$  in tri-calcium silicate; No. 2 a larger amount of *celite* was present. Clinkers made in which the different aluminates were present in certain definite molecular ratio to the tri-calcium silicate. That in which the monocalcium aluminate was present contained the most *celite*, while that in which the di-calcium aluminate was present in a tri-calcium form contained *alite*. Hence this constituent is a solid solution of di-calcium aluminate in tri-calcium silicate, and *celite* di-calcium aluminate in di-calcium silicate, since tri-calcium di-calcium aluminate and di-calcium aluminate would react to yield di-calcium aluminate with a corresponding reduction of tri-calcium to di-calcium silicate. In these experi-

ments the ratio of silicate to aluminate was 6 to 1, and taking the ratios 3 to 1, 4 to 1, and 5 to 1, the amount of *alite* and *celite* can be calculated, and are found to depend on the ratio of silicate to aluminate, and on the basicity of the clinker as a whole. The extremes of composition of an industrial cement within the bounds of the above ratios, if the cement is perfectly burned, would be:

Silica	..	..	..	..	18.5	23.2
Alumina ( $\text{R}_2\text{O}_3$ )	..	..	..	..	6.1	11.9
Lime (without magnesia and alkalis)	..	..	..	..	63.1	68.1

When the *celite* is rich in aluminate, the cement was found to be quick-setting, and probably the rate of cooling affects the amount of *celite* formed. An increase of lime in the cement No. 1 would have given an increased amount of *alite*, and the cement was actually found then to be slow-setting. Cement No. 2, containing 1 per cent. less alumina, is a much less concentrated solution of aluminates in silicates, but on the other hand is less basic, and contains a larger amount of dilute *celite*. For the first reason cement No. 1 should be slower setting, but for the second the latter clinker would be less "volume constant," since *celite*, being a di-calcium silicate solution has the characteristic lack of volume constancy. The terms "mild," "medium" and "hard" are suggested for cements with increasing amounts of aluminate, by comparison with steels with increasing amounts of carbon.

To test the concentration of aluminates in silicate within which the clinker exists as a normal Portland cement, series of clinkers were prepared with varying amounts of tri-calcium silicate and tri-calcium aluminate or of tri-calcium silicate and di-calcium aluminate, to determine the effect of a reduction of lime and consequent increased formation of *celite*, and of di-calcium silicate and di-calcium aluminate. The results obtained are complicated, and the mineral entities occurring in the clinkers vary with the concentration towards either silicate or aluminate. In the second or "cement" series the Portland cement ratio was found to extend from—

	$\text{SiO}_2$	$\text{Al}_2\text{O}_3$	$\text{CaO}$
Pure tricalcium silicate	26.4	0.0	73.6
To 7 ( $\text{SiO}_2, 3\text{CaO}$ ), 3 ( $\text{Al}_2\text{O}_3, 2\text{CaO}$ )	18.9	13.6	67.5

Beyond this concentration, the clinkers lose the characteristic structure of Portland cement, although they are hydraulic.

It is evident that basic silicates and aluminates are miscible in all proportions in the fused condition, but not so in a state of solid solution. *Alite* and *celite* are solid solutions—but not saturated—of aluminates in silicates, and the question arises how these solutions are formed during the conversion of raw materials into clinker, at temperatures below the fusion point. From the fact that diffusion occurs not only in gases and liquids, but also in solids, it is not difficult to understand that particles of silica, alumina, and lime may diffuse at a temperature below the melting point of the resulting clinker to form a Portland cement, the stability of which depends partly on its composition, and partly on the completeness of the diffusion. The time of exposure of the materials to the high temperature should be longer the lower the temperature. Further, the raw materials must be ground fine enough to provide a sufficient area of intimate contact for diffusion to be complete at the given temperature and in the allotted time; otherwise the resulting clinker will not be homogeneous in constitution, and therefore not in equilibrium, and will lack volume constancy. Again, just as aqueous solutions can be made supersaturated, so silicate of lime may dissolve more aluminate at high temperatures than will remain in solution on cooling, and such a solution would be in a state of tension, and tend to return to equilibrium with a change of volume, and the liberation of some aluminate, which may explain the change of rate of setting, with age, observed in some cements. If raw materials are ground sufficiently fine, a satisfactory clinker may be produced at a lower temperature, and consequently the greatest economy will depend upon a proper balance between fineness of grinding and fuel expenditure, the balance depending upon the cost of

fuel. The longer time of burning required in the dome kiln, is probably due to the fact, that diffusion occurs more slowly than in the rotary kiln. The higher the percentage of lime, the higher the temperature required for complete diffusion with silica, and the greater the necessity for fine grinding.—W. C. H.

#### ENGLISH PATENTS.

*Kaolinic Stone, and the like; Process and Apparatus for Disintegrating —*, and for Separating the Constituents thereof. R. Frugier, Limoges, France. Eng. Pat. 24,199, Nov. 8, 1904. Under Int. Conv., Nov. 9, 1903.

SEE Fr. Pat. 336,490 of 1903; this J., 1901, 372. T. F. B.

*Coverings, Blocks and Slabs; Manufacture of Non-Conducting —* for Covering Steam Pipes, Boilers and the like and for other Purposes. H. C. Michell, London. Eng. Pat. 25,787, Nov. 26, 1904. Under Int. Conv., Nov. 27, 1903.

A MIXTURE of flake mica and a silicious binding agent, e.g., sodium silicate solution, with or without the addition of asbestos or other refractory fibre, is moulded, dried, heated to about 1000° C., and cooled slowly. The flakes of mica should be arranged, as far as possible, parallel to one another and at right angles to the direction in which heat is passing from the article to be protected.—A. G. L.

*Coverings, Blocks and Slabs; Manufacture of Non-Conducting —* suitable for Covering Steam Pipes, Boilers and the like and for other Purposes. H. C. Michell, London. Eng. Pat. 25,788, Nov. 26, 1904. Under Int. Conv., Nov. 27, 1903.

A MIXTURE of asbestos and a silicious binding agent, such as sodium silicate, is moulded, dried, and heated to a high temperature, say about 1000° C., in order to effect combination between the asbestos and the binding agent. Mica or other light filling material may be added to the mixture according to Eng. Pat. 4970 of 1901.—A. G. L.

#### UNITED STATES PATENT.

*Brick or Artificial Stone; Process of Making —*. L. F. Kwiatkowski, New York, N.Y. U.S. Pat. 790,901, May 30, 1905.

INGREDIENTS including lime and sand are mixed and the lime is hydrated. The mixed material is placed in a V-shaped receptacle in "layers of different ages," and after a certain time, portions of each layer are removed from the bottom and moulded together.—A. G. L.

#### FRENCH PATENTS.

*Pumice; Process for the Agglomeration of Natural and Artificial —*. Soc. Geofray, Jacquet et Guillermin. Fr. Pat. 349,618, Dec. 27, 1904.

THE pumice to be agglomerated is mixed with silicates or fluosilicates, or both, either in the form of solutions or of powders, with the addition of enough water to give a plastic mass. This is moulded, dried in the air, or by a gentle heat and burnt at a dark red heat.—A. G. L.

*Wood-Composition; Manufacture of —*. F. Matas y Rodés. Fr. Pat. 349,782, Dec. 31, 1904.

THE composition consists of wood sawdust or shavings, with a solution of nitrocellulose in methyl alcohol as binding agent. The mass is agglomerated in heated moulds under pressure; the heat causes the individual particles of wood to distend, so that they are forced against each other not only by pressure from the outside,

but also by pressure from the inside of each piece. The moulds consist of perforated metal sheet or gauze; pressure is preferably exerted simultaneously in two directions at right angles to each other in order to ensure a uniform product. Ether or acetone may be added to the methyl alcohol solution in order to increase its rate of evaporation, if desired. Gum arabic may be added to the mass to retard evaporation and to the product more coherent. The nitrocellulose solution may be altogether replaced by a solution of animal vegetable glue or similar material.—A. G. L.

*Wood; Process of Impregnating —*. F. B. Fr. Pat. 350,758, Jan. 14, 1905.

SEE Eng. Pat. 28,729 of 1904; this J., 1905, 517.—T

*Agglutinant Suitable for use in the Manufacture of Moulded Objects, and also for other Purposes*. L. and E. Perry. Fr. Pat. 349,839, Dec. 31, 1904.

SEE Eng. Pat. 21,842 of 1903; this J., 1905, 198.—T

#### GERMAN PATENTS.

*Tiles [for Decorative Purposes]; Manufacture of*. A. Biberfeld. Ger. Pats. 157,383, Dec. 6, 1903, and 158,612, Sept. 23, 1903; and 158,613, Jan. 13, 1904.

THE tiles are prepared by forming crystals of (sugar-candy) on a backing of textile material of a size and shape. According to Pat. 158,612, other suitable substances, such as alum, rock salt, copper sulphate, ferrous sulphate, &c., are substituted for the sugar in Pat. 157,383, and the tiles so prepared are coated with celluloid, collodion, lacquer, varnish, or the like. According to Pat. 158,613, tiles prepared according to Pat. 157,383, are also coated with celluloid, lacquer or the like.—A. S.

*Solid Articles, Pipes, or the like from Moist Peat; Process for the Manufacture of —*. F. Stötzl. Ger. Pat. 159,651, March 19, 1903.

PEAT, either in its natural moist condition or in which a portion of the water has been removed by pressing, is mixed with cement in such proportions that the hardening of the mass is effected by the moisture contained in the peat. For the manufacture of drain-pipes, a small quantity of tar or asphaltum is added to the mass.—A. S.

*Stone; Process for the Manufacture of Artificial from the Residues of Paper Manufacture*. O. Weiser. Ger. Pat. 159,615, Aug. 14, 1903.

THE residue obtained as a by-product from paper-making machines, containing chloride of lime, alum, caustic residues of vegetable glue, and various colouring materials, is ground, mixed with organic substances such as sawdust, sawdust, &c., and a refractory binding agent such as clay, moulded into the desired forms, dried and burnt.—A. S.

*Tiles, &c.; Process for the Manufacture of — from Slate or Slate Waste*. Aktieselskabet Ardoise. Dan. Pat. 158,364, Oct. 25, 1903.

THE slate powder is mixed with from 5 to 8 per cent powdered chalk and formed into tiles with the aid of a binding agent consisting of rosin soap and water (alkali silicate solution) with or without the addition of kaolin. The binding agent is prepared by boiling three parts by volume of powdered caustic soda and 16 parts by volume of powdered rosin with 30 parts of water, and adding to the mixture one part by volume of kaolin, 10 parts of powdered chalk and 30 parts of sodium silicate. The tiles are formed by the aid of a pressure of 15–40 kilos. per sq. cm. and allowed to stand for some days at the ordinary temperature, dried for about three days at 60°–100° C., glazed and baked at 800°–1000° C.—A. S.



## X.—METALLURGY.

*ness*; Effect of — in Low-Silicon Cast Iron. H. Londenbeck. Trans. Amer. Foundrymen's Assoc., 1905, 17—19.

NESE can be used to advantage in low-silicon and iron (a) where the percentage of scrap is large and plumb high; (b) when plates having hard chilled and soft backs are desired; (c) when the amount of iron in the iron employed exceeds 0.07 per cent.

The manufacture of large hydraulic cylinders, the case should be kept low, otherwise the casting may have a coarse graphitic structure which is very unsatisfactory. The following analyses are given of cylinders of nickel:—

	(Satisfactory) No. 1.	(Unsatisfactory) No. 2.
	Per cent.	Per cent.
Iron .....	0.90	0.71
Carbon .....	0.25	0.49
Silicon .....	3.34	2.98
Al carbon .....	1.44	0.65
Phosphorus .....	0.136	0.12
Sulphur .....	0.39	0.31

—J. H. C.

*Melting — with Cast Iron.* R. P. Cunningham. Trans. Amer. Foundrymen's Assoc., June, 1905, 8—10.

Author states that by a judicious use of steel scrap, castings can be produced of any required strength, but that close attention is required in charging the properties of materials, fuel, and fluxes. For thin castings little steel can be used; for thick, heavy castings more is permissible. It is an advantage to use a ferro-silicon and ferro-manganese unless the iron used is manganese and silicon in fair proportions. The results of 18 casts with different percentages showed that more than 33 per cent. of steel could be used with advantage, as above this proportion there was excessive shrinkage and only a slight gain in strength. For ordinary work 25 per cent. of steel is recommended. The results in the middle of each heat were always the best.

—J. H. C.

*and Cobalt; Alloys of —, with Iron.* W. Guertler G. Tammann. Z. anorg. Chem., 1905, 45, 205—224.

Iron used in making the nickel- and cobalt-steels needed was very pure; that for the nickel-steels contained 0.06 per cent., and that for the cobalt-steels 0.24 per cent. of carbon. The *nickel-steel melting point curve* consists of two branches, with a discontinuity at 35 per cent. of nickel (1510° C.); the curve for alloys higher in nickel descends from this to a minimum at 66 per cent. of nickel and gradually rises thence to the melting-point of nickel (1485°), whilst the curve for alloys lower in nickel remains at about 1500° down to 20 per cent., and gradually rises to the melting-point of iron (1550°). A 66 per cent. alloy corresponds to  $\text{Ni}_3\text{Fe}$ , and, being an intermetallic compound, ought to crystallise out leaving a liquid of the same composition; but this property is not characteristic of the whole of the nickel-iron alloys, but only of the  $\text{Ni}_3\text{Fe}$  alloy. The solid solubility of nickel in  $\gamma$ -iron where it falls below that percentage. The limit divides the reversible steels containing nickel from the irreversible containing less. In the former, the temperature at which magnetisation occurs on cooling is identical with that at which it disappears on heating; in the latter, supercooling occurs, and magnetisation does not appear till far below the temperature at

which it is lost on heating. The authors' determinations of these critical temperatures agree very closely with those of Osmond, the differences being no doubt caused by the different amounts of minor constituents present in Osmond's steels and in the authors'. Apparently both nickel and  $\text{Ni}_3\text{Fe}$  undergo on cooling a transformation from a  $\beta$ - to an  $\alpha$ -condition. The *cobalt-steel melting-point curve* is practically a horizontal line at 1500° C. from 100 per cent. to 5 per cent. of cobalt, and below that rises to the melting-point of iron. Like the nickel steels, the cobalt-steels of every composition show no separation of constituents on solidifying. In regard to transformation on cooling (as shown by change of magnetic permeability) they group themselves into four classes:—1. From 100 to 75 per cent. of cobalt, reversible, changes on heating and on cooling occurring at the same temperature. 2. From 75 to 60 per cent., the change occurs not suddenly but over an interval of about 100°, which interval is between the same temperatures whether the temperature is rising or falling. 3. From 60 to 5 per cent., irreversible, a supercooling of 20°—30° making that difference between the transformation-temperatures on heating and on cooling. 4. Below 5 per cent., the transformation-temperatures on heating and on cooling are on first heating almost identical, 760°—752° C., but on repeated heating the former gradually rises to 820°, while the latter remains constant.

All these alloys exhibit when polished and etched a polygonal structure, varying greatly in distinctness and in the size of the polygons; the authors have not yet, however, been able to draw from the micrographic examination of these alloys any conclusions as to their constitution.—J. T. D.

*Silver; Cyanidation of —.* A. Chidley. Eng. and Mining J., 1905, 79, 1053.

THE ore treated contains argentite, chalcopyrite and, occasionally, specks of tetrahedrite; a small quantity of copper is also present, but has no injurious effect on the extraction of gold and silver. The ground ore is passed over amalgamated plates and then separated roughly into sand and slime by settling. The sand is mixed with lime in the proportion of 25 lb. per ton and treated for 12 hours with nearly one-half of its weight of a 0.4 per cent. solution of cyanide. After draining off the solution, the charge is raked and levelled, allowed to stand exposed to the air for six days, then leached continuously for four days with a 0.2 per cent. solution of cyanide, and washed with water. The sand contains from 13 to 15 oz. of silver and from 3 to 5 dols. of gold per ton, and the average extraction is 85—90 per cent. of the silver and 90—92 per cent. of the gold.—A. S.

*Aluminium; Alloys of —, with Tin, Bismuth, and Magnesium.* H. Pécheux. Comptes rend., 1905, 140, 1535—1536.

THE action of water on these alloys (see this J., 1904, 609 and 716) has already been noticed by the author, and he has recently demonstrated it on a larger scale, having obtained in 20 minutes, from 2 c.c. of the filed tin alloy, 5—6 c.c. of hydrogen. The bismuth alloy yielded more hydrogen than the tin alloy, and the magnesium alloy more than the bismuth alloy. The oxygen of the decomposed water combines with the aluminium. Larger quantities of hydrogen are obtained from copper sulphate solution, apart from the decomposition of this solution by precipitation of copper at the expense of the metal alloyed with the aluminium. The alloys of aluminium with zinc and lead do not decompose pure water, but do decompose the water of copper sulphate solution, and, more slowly, that of zinc sulphate solution.—J. T. D.

*Copper; Corrosion of — in Sea-Water.* Uthemann. Engineer, 1905, 99, 442—443.

IN the following table the results of some tests of the author's method of protecting copper by means of a spiral of iron wire from corrosion by sea-water (see Eng. Pat. 21,661 of 1904; this J., 1905, 623), are given:—

## I. In Flowing Water.

Material.	Time of Immersion.	Composition of Bath.	Temperature.	With or Without Protection.
	Days.		° C.	
Cylinder from molten copper .....	94	water + 3.5% of NaCl	13	with
" " " " .....	94	" " "	"	without
" " " " .....	52	" " "	16	with
" " " " .....	52	" " "	"	without
Cylinder of pure electrolytic copper .....	30	" " "	"	without
" " " " .....	30	" " "	"	without
" " " " .....	187	water + 3% of NaCl & 0.5% of MgCl <sub>2</sub>	18	with
" " " " .....	"	" " "	"	with
" " " " .....	"	" " "	"	without
" " " " .....	"	" " "	"	without

## II. In Still Water.

	Days.		° C.	
Cylinder of pure electrolytic copper .....	59	water + 3.5% of NaCl & 0.8% of HCl	+5 to -20	with spiral outside
" half of electrolytic copper and half of brass .....	"	" " "	"	with spiral outside
" of pure electrolytic copper .....	33	" " "	"	without
" half of electrolytic copper and half of brass .....	"	" " "	"	with spiral outside
" of pure electrolytic copper .....	198	sea water containing 3.5% of NaCl	18	with spiral outside
" " " " .....	"	" " "	"	electrolytic coating
" half of electrolytic copper and half of brass .....	"	" " "	"	without
" " " " .....	"	" " "	"	with spiral outside
" from molten copper .....	74	" " "	22	electrolytic coating
" half of copper and half of brass .....	"	" " "	"	without
" " " " .....	"	" " "	"	with spiral outside
Condenser tube of Heckmann bronze .....	"	" " "	"	without
" tube of brass .....	"	" " "	"	with spiral outside
" tube of Heckmann bronze .....	"	" " "	"	inside
" tube of brass .....	"	" " "	"	without

*Pyritic Smelting; Amount of Air required in —.*

L. T. Wright. Eng. & Mining J., 1905, 79, 957.  
THE maintenance of the desired temperature in pyritic smelting depends upon the rate of oxidation of the sulphide ore, and the supply of air. The equation:— $\text{FeS}_2 + 5\text{O} = \text{FeO} + 2\text{SO}_2$ , shows that 1 lb. of iron disulphide requires 0.66 lb. of oxygen, a quantity which is contained in 36.3 cb. ft. of air at 72° F. (22° C.). The author has observed that, in practice, the efficiency of the air in pyritic smelting is 70 per cent., so that to furnish the 0.66 lb. of oxygen required for the oxidation of each 1 lb. of

pyrites in the charge,  $36.3 \times \frac{10}{7} = 52$  cb. ft. of air will be needed. The author cites a case in actual practice where good results were obtained. The furnace had an area of 437.6 sq. ft. at the level of the tuyères, and the charge was smelted at the rate of 683.3 lb. (containing 343 lb. of pyrites) per minute. The degree of oxidation attained was 90 per cent., and the furnace gases immediately above the charge contained 12 per cent. of sulphur dioxide. On the basis given above, the amount of air required in this case would be  $343 \times 0.9 \times 52 = 16,052$  cb. ft. per minute; the volume of air actually supplied was 16,985 cb. ft. per minute.—A. S.

## ENGLISH PATENTS.

*Armour Plates and other Articles of Steel; Manufacture or Treatment of —.* R. A. Hadfield, Sheffield. Eng. Pat. 15,220, July 7, 1904.

ARMOUR plates and other articles of nickel-chromium or of nickel-chromium-tungsten-steel, are heated from about 950° C. to 1100° C., cooled, reheated to 700° C. to 720° C., cooled slowly (preferably in the reheating furnace),

and again reheated to the same temperature, cooled to 640° C., to 655° C., suddenly cooled, reheated to 620° C., and again suddenly cooled. Under the claim, the process is modified by omission of the reheating to 700° C. to 720° C. Either process is used in treating a cast nickel-chromium-steel plate containing from about 0.3 to 0.4 per cent. of carbon, about 0.25 per cent. of manganese, about 1.8 per cent. of chromium, and about 3.3 per cent. of nickel. Ref. is made to Eng. Pat. 16,132 of 1901 (this J., 1902, 1).

*Metals [Precious]; Apparatus for the Extraction of from their Ores.* D. S. S. Stuart, London. Eng. Pat. 12,347, May 31, 1904.

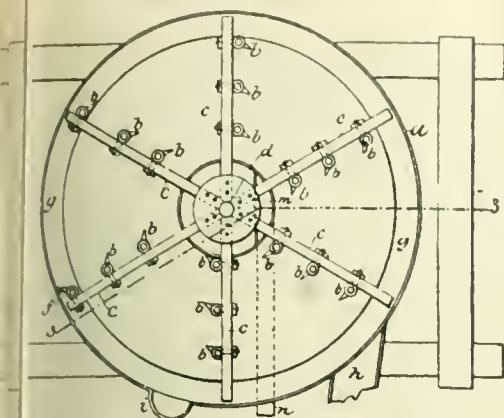
THE apparatus is adapted for the dry crushing of shattering blows from rapidly rotating hammers, enclosed within a casing forming a disintegrating chamber provided with a hopper and automatic feed, and suspended within it a stepped "curtain grizzly," with holes. The draught produced by the hammer carries the powdered ore into a screening chamber terminating in a passage leading to a dust chamber. "grizzly" in the screening chamber returns the fragments back to the disintegrator. In the screening chamber there is also a fixed and a vibrating screen, a jiggling device, and an automatic water-seal discharger. (Compare Eng. Pat. 5208, of 1902; this J., 1902, 1).

*Metals; Apparatus for Treating and Amalgamating.* G. P. Tyars, Cape Town, Cape Colony. Eng. Pat. 16,754, July 29, 1904.

THE apparatus includes a shaft carrying arms, on



b, are secured at the points at which a spiral drawn  
the centre of the vessel intersects those arms, and  
des of the paddles are set at one and the same angle



ward to their radii, and so arranged that the leading  
of any blade traces out the same path as the outer  
edge of the preceding one, except the blade of the  
last paddle *f*, which is turned towards the outer wall  
of the vessel. The two outermost blades project into  
the vessel, extending round the edge of the bottom of the  
vessel. Mercury and the crushed ore-pulp are delivered  
by the revolving paddles, and the metallic particles  
thrown towards the outer wall, gravitate into the  
space in which amalgamation is effected. The amalgam  
concentrates are drawn off through a tap, whilst the  
residue is led to a shoot.—E. S.

*Process for use in the Manufacture of Soda, for the  
Refining of Metals, and for like purposes; Impts. in—*  
J. and N. Wrinkle. Eng. Pat. 15,792, July 15, 1904.  
U.S. Pat. 791,170, May 30, 1905. page 731.

*Process for Ore; Method of —*. J. Gayley, New York.  
U.S. Pat. 411, Jan. 9, 1905. Under Int. Conv., Oct.  
1904.

U.S. Pat. 779,037 of 1905; this J., 1905, 138.—T.F.B.

# UNITED STATES PATENTS.

*Manufacture of —*. J. Vernon, Newton Stewart,  
Scotland. U.S. Pat. 791,170, May 30, 1905.

Eng. Pat. 1966 of 1903; this J., 1904, 609.—T.F.B.

*Process for the Manufacture of —*.  
A. Hadfield, Sheffield, England. U.S. Pat. 791,189,  
May 30, 1905.

Billets or blanks are heated gradually to about 880° C.,  
and afterwards rapidly to about 950° C. They are then  
immediately worked to the desired section, reheated as  
necessary, and quickly quenched.

In casting the ingots, the upper ends are cast with larger  
diameters than the lower ends and with large feeding heads.  
The feeding heads are then removed and the billets are  
drawn to the required section from the lower solid and  
sound portions of the ingot.—J. H. C.

*Process of Treating Ferruginous Ore  
for the Manufacture of — therefrom.* M. Moore,  
Bourne, and T. Heskett, Brunswick, Australia.  
U.S. Pat. 791,928, June 6, 1905.

U.S. Pat. 341,169 of 1904; this J., 1904, 827.—T.F.B.

*Process of Treating Ferruginous  
Ore for the Manufacture of — therefrom.* M. Moore,  
Bourne, and T. Heskett, Brunswick, Australia. U.S.  
Pat. 792,440, June 13, 1905.

U.S. Pat. 345,599 of 1904; this J., 1905, 32.—T.F.B.

*Nickel; Extraction of —*. H. A. French, New York.  
U.S. Pat. 791,090, May 30, 1905.

THE mattes or other nickel-bearing substances are re-  
duced to powder, mixed with sulphuric acid and sulphur,  
and heated.—J. H. C.

*Ore; Process of Smelting —*. E. Riveroll, Los Angeles,  
Cal. U.S. Pat. 791,577, June 6, 1905.

THE ore is delivered down an inclined covered passage  
leading from the base of the stack to a vessel into which  
the reduced molten metal flows. At intervals in the arched  
cover of the channel, jets of burning fluid fuel are injected,  
the supply of air being so controlled that the ore in the  
upper part of the inclined channel is decalcified by exposure  
to a flame depositing carbon on it, and also to the action  
of carbon monoxide gas, produced from the ore in the  
lower part of the passage, where it is exposed to a smelting  
heat by means of a "perfect combustion flame."—E. S.

*Ore-Briquette.* W. A. Kōneman, Chicago, Ill. U.S. Pat.  
791,799, June 6, 1905.

THE claim is for briquettes composed of a mixture of  
"ore-fines," finely divided, bituminous coal and anthracite  
to which a binding agent is added. The mixture is formed  
into briquettes and dried without allowing the coal to  
become coked. The dried briquettes are charged into a  
blast-furnace, where they are coked during the initial  
heating, the ore particles, which were formerly held  
together mechanically by the binding agent, being now  
bound together by the coked coal.—W. H. C.

*Furnace; Roasting —*. F. Klepetko, New York.  
U.S. Pat. 792,053, June 13, 1905.

IN a furnace having one or more hearths, claim is made  
for a vertical, hollow rabble-shaft, having horizontal  
hollow rabble-arms projecting from it. On the inner  
surface of each rabble-arm, parallel to the longitudinal  
axis, is a series of ribs, by means of which the cooling  
medium, (air), drawn into the arms from the hollow shaft,  
is split up into a number of individual currents.—A. S.

*Furnace; Rotary [Ore] —*. W. S. Rockwell, Assignor  
to Rockwell Engineering Co., New York. U.S. Pat.  
792,169, June 13, 1905.

SEE Eng. Pat. 1503 of 1904; this J., 1904, 443.—T. F. B.

*Furnace; Metallurgical —*. J. W. Lansing, San  
Francisco, Cal. U.S. Pat. 792,223, June 13, 1905.

THE plant consists of a combination of a number of up-  
right furnaces, each having an ore-chamber with a fire-  
box beneath, a closed receptacle containing water, and a  
stack, together with the necessary connections. In the  
upper portion of the closed receptacle, above the level of  
the water therein, is an exhaustor, which draws the gases  
evolved in the ore-chambers into the receptacle, beneath  
the surface of the water. A continuous flow of water  
into and out of the receptacle is maintained. The exit  
passages from the fire-boxes lead to the stack, and  
dampers are provided by means of which the fire-gases  
may be diverted from any one of the ore-chambers at  
will.—A. S.

*Copper [and Copper Alloys]; Process of Hardening and  
Tempering —*. C. R. Plumer, Seattle, Wash.  
U.S. Pat. 792,070, June 13, 1905.

COPPER or a copper alloy is heated to a high temperature,  
treated while hot with copper sulphate, and poured into  
moulds. After partial cooling, the metal is subjected  
to the action of sulphur until it is coated with "sulphur-  
oil," and then allowed to harden.—A. S.

# FRENCH PATENTS.

*Steel; Process for Refining and Tempering —, and  
Toughening Cast Iron.* T. H. Gannon, W. H. Phillips  
and J. Eastwood. Fr. Pat. 350,520, Jan. 4, 1905.

SEE Eng. Pat. 28,736 of 1903; this J., 1905, 138.—T. F. B.

*Alloy; Antifriction Composition or — and Process for its Manufacture.* L. Boudreaux. Fr. Pat. 349,459, March 26, 1904.

THE invention (as to its main features) consists in the agglomeration of finely-divided metals, with in most cases a lubricating material, into blocks under pressure. Such metallic powders are obtained by a variety of methods, adapted to special cases; such as by reduction of the oxides or salts (of copper for example) by heating with carbon; by precipitation from solution, by for instance zinc powder, (for copper, antimony, tin and lead); by electro-chemical means; or by condensation of the vapours, as with zinc; always with precautions to ensure that the powders obtained be extremely finely-divided, constituting a "sponge" having a "molecular porous or crystalline structure," suitable to enter into combination, of the kind above indicated, with lubricating substances, which may be in the form of powders, pastes or liquids. Graphite may be so used, being added before or during the compression of the powdered metals into blocks. Also, during compression of the powdered metals, substances may be added, capable of subsequent removal as vapour by heat, or by solution in a suitable medium, leaving the block with a porous structure, analogous to that of platinum sponge. Numerous applications of such antifriction powders or alloys to mechanism in movement are specified and claimed.—E. S.

*Ores; Process and Apparatus for the Separation of — on Shaking Tables by the aid of Water.* Maschinenbau-Anstalt Humboldt. Fr. Pat. 349,689, Dec. 9, 1904.

IT is proposed by varying the inclination of the washing tables according to different methods, to regulate the force of the currents of washwater.—J. H. C.

*Amalgamator for Gold and Silver Ores.* B. A. Langridge. Fr. Pat. 349,832, Dec. 31, 1904.

SEE Eng. Pat. 28,490 of 1904; this J., 1905, 335.—T. F. B.

*Gold from Water Containing it; Process and Apparatus for Extracting —.* H. C. and U. Ciantar. Fr. Pat. 350,668, Jan. 10, 1905. Under Int. Conv., Jan. 11, 1905.

SEE Eng. Pat. 689 of 1904; this J., 1905, 445.—T. F. B.

*Zinc; Process for Extracting and Purifying —.* A. V. Cunningham. Fr. Pat. 350,580, Jan. 7, 1905.

SEE Eng. Pat. 4706 of 1904; this J., 1904, 1220.—T. F. B.

#### GERMAN PATENTS.

*Steel and Steel-Alloys; Process for the Manufacture of Mild — in the form of Castings.* F. Siewert and A. Thomas. Ger. Pat. 159,474, Sept. 19, 1903.

THE mild steel or steel heated considerably above its melting point is poured into the moulds, in which are suspended rods or plates of the substance which it is desired to alloy with the steel. The alloying substance is melted by the heat of the molten steel, and the ebullition which takes place causes a thorough mixing of the metal.—A. S.

*Metals; Process for the Manufacture of Alkali, Alkaline-earth, Earth and Heavy — or of Alloys of these Metals.* J. Malovich and Co. Ger. Pat. 159,632, Aug. 14, 1902.

OXIDES or salts of the metal or metals are mixed with the sulphate or sulphite of another metal, a reducing agent and sulphur, and the mixture is heated to a temperature above the melting point, but below the volatilisation point of the metal or alloy it is desired to obtain. For example, a mixture of 100 parts of aluminium silicate (brick dust), 33 parts of sodium sulphite and 11 parts of sulphur is heated in a crucible for 5–7 hours at 800°–900° C., whereby metallic aluminium and a vitreous slag are stated to be obtained.—A. S.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A.)—ELECTRO-CHEMISTRY.

*Cell for Industrial Laboratories; Standard —.* Rosset. L'Eclair. Electr., Paris, 1904, 40, 44. Proc. Inst. Civil Eng., 1905, 159, 71.

THE Daniell cell is the most suitable one for industrial laboratories, but its E.M.F., which is dependent upon degree of concentration of the solutions of zinc and sulphates, is subject to variations, owing to changes in these concentrations caused by diffusion, evaporation, chemical action of the zinc, and electro-deposition of copper. In order to overcome this defect, the inventor proposes the employment of equimolecular solutions of zinc and copper sulphates, separated by a semi-permeable membrane of copper ferrocyanide formed in the interior of an ordinary porous pot. By the use of the method the strengths of the two solutions are maintained equimolecular, and in these circumstances, the E.M.F. of the cell and the thermal co-efficient remain constant, independent of the absolute concentrations of the solutions.—

*Combustion of Organic Compounds; Electrical — for the —.* H. N. Morse and L. S. Taylor. N. Y. Eng. Pat. 753.

#### ENGLISH PATENT.

*Insulating Material and Process of Manufacture — same; Electric —.* J. Billwiller, Goldach, Karrer, Moriken, Switzerland. Eng. Pat. 27,1904.

SEE Fr. Pat. 349,850 of 1904; following this.—T. F. B.

#### UNITED STATES PATENTS.

*Furnace; Electric —.* E. Haagen, Assignor to W. C. Heracus, both of Hanau, Germany. U.S. Pat. 792,022, June 13, 1905.

ONE terminal of the source of electric current is connected to a conductor leading to the heating or melting chamber of the furnace, the second terminal being connected to another conductor, which enters a recess in the side of the furnace and reaches nearly to the inner surface of the melting chamber. A second conductor leads from the heating chamber also to the recess, and the two terminals in the recess are joined by a rod made of a metal, the melting point of which is a little above a red heat; the rod is observed from the outside of the furnace, and in this way "by its commencing red heat" the correct strength of the current.—B. N.

*Furnace; Electric —.* F. A. J. FitzGerald and J. Bennie, Niagara Falls, N.Y. U.S. Pat. 792,251, June 13, 1905.

THE furnace comprises a base, with apertures in which heat-insulating material is disposed, and a number of independent compartments on the base. The compartments are separated by hollow walls of refractory material, within which are placed resistances, connected electrically in series and also connected with an alternating current terminal.—B. N.

*Oxides of Alkaline Metals; Apparatus for Obtaining —.* G. W. Roepper, Philadelphia, Pa., and W. E. Brown, Mechanic Falls, Me., Assignors to American Electric Co., Delaware. U.S. Pat. 790,922, May 30, 1905.

AN apparatus for mercurial alkaline processes consisting of a transferring wheel (for effecting circulation of mercury) mounted transversely in the de-amalgamating compartment, and dipping below both the water and the amalgam. The wheel is fitted with peripheral pockets containing loose pieces of electrically-conductive material held in position by wire gauze round the periphery of the wheel. Perforated plates forming circumferential compartments are also provided to divide the pockets into small compartments and facilitate the discharge of the alkaline amalgam.—G. W. McD.



a; [Electrical] Process of Manufacturing ——. Cooper. U.S. Pat. 791,194, May 30, 1905. VII., 731.

## FRENCH PATENTS.

ing Material [Electrical] and Process of Manufacturing the same. J. Billwiller and Schweizerische (Steinholz) Fabrik Dr. P. Karrer vormals t and Karrer. Fr. Pat. 349,850, Dec. 23, 1904.

and slabs are made of a mixture of 5 parts of sawdust, 13 parts of powdered mica, and 13 parts of magnesium. The mixture is moistened with about 70 per cent. of water and moulded for from 12 to 16 hours at a pressure of about 400 kilos. per sq. cm. The mass is dried and impregnated at a temperature of 170° C. with vegetable, or, preferably, mineral oil, which 5 to 10 per cent. of aluminium soap has dissolved.

Use, a mixture of 5 parts of sawdust, 5 parts of powdered mica, 13 parts of magnesium oxide and 3 parts of flowers of sulphur is treated as above. In case, however, the mass obtained is impregnated with a solution of sulphur in carbon bisulphide instead of oil.—A. G. L.

ing Material [Electrical]; Manufacture of ——. Müller. Fr. Pat. 349,781, Dec. 31, 1904.

Use, with or without the addition of other substances, is intimately mixed with a solution of pitch in an organic solvent. The mixture is compressed in the cold, and is then allowed to stand in the air, when it hardens. The mass is then removed from the solvent by means of the solvent evaporates; or else it is dried in a vacuum to remove the solvent more completely.—A. G. L.

ator Based on the Formation of Oxides of Lead or Oxides within a Porous and Inert Material. C. H. B. Fr. Pat. 349,654, Dec. 29, 1904.

Oxides of lead, or other oxides, are formed chemically in a porous and inert body, the latter being in fragments in a compact block. The active material, thus obtained, is placed in a rectangular perforated ebonite case, is provided with a central rod and side pieces connected to the rod for making good contact with the material. The lower end of the case is closed by means of a plate, the latter supporting the central rod, so that the material may be easily and rapidly withdrawn from the case.—B. N.

re; Electric ——. Soc. Anon. Électrometallurgique (Géraldes Paul Girod). Fr. Pat. 350,524, Jan. 4, 1905.

Use of the furnace consists of one or more movable electrodes of graphite, the other pole being formed of a desiccant sunk in the stonework of the furnace, sufficiently deep in the hearth or cooled artificially, so that a quantity of fused metal is cooled, forming a solid protective bed between the electrodes. The movable electrode merely dips into the slag covering the fused metal, and contact between the metal and the electrodes is thus avoided.—B. N.

and Other Malting Grains; [Electrical] Process of Steeping and Germinating. Deichmann and Co. Fr. Pat. 349,478, Dec. 12, 1904. XVII., page 746.

; [Electrical] Apparatus for the Industrial Manufacture of —, by means of Liquid Air. P. M. Oudin. Addition, dated Dec. 23, 1904, to Fr. Pat. 348,018 of Oct. 17, 1904 (this J., 1905, 282 and 446).

Addition relates to a method of using two spirals of wire in conjunction with the central rod described in the patent, or one spiral may be used to replace the central rod. Various modes of connecting the spirals with the terminals of the source of current are described.—B. N.

; Electro-catalytic Process for Obtaining Fixed — in any Carburetted Body. A. A. Eveno. Fr. Pat. 352,838, June 4, 1905. II., page 721.

## GERMAN PATENTS.

Carbon Electrodes of Arc Lamps; Process for the Utilization of Waste ——. R. Peters. Ger. Pat. 158,151, Jan. 19, 1904. XIII., page 742.

Electrolysing Salt Solutions with the Use of a Liquid Cathode; Method of ——. R. F. Anderson. Ger. Pat. 158,590, Dec. 2, 1902.

THE mercury cathode is kept in motion by applying to the outside of the electrolytic cell the poles of a powerful electro-magnet.—T. F. B.

Electrode; Nickel —, for Use with Alkaline Electrolytes. M. Roloff and H. Wehrlin. Ger. Pat. 159,393, June 7, 1903.

A PASTE, suitable for coating nickel electrodes for use in processes in which alkaline electrolytes are used, is prepared by precipitating with alkali a solution containing 5 mols. of a nickel salt and 1 mol. or less of a silver salt. These electrodes are said to have a higher specific capacity than those containing more silver than is indicated above.—T. F. B.

Oxides or Hydroxides of Metals mixed with Graphite in the form of Granules; Product obtained from — for Electrolytic Processes with Invariable Electrolytes. Kölner Accumulatorenwerke Gottfried Hagen. Ger. Pat. 158,800, Oct. 17, 1903.

THE granules of graphite are electrolytically coated with a thin shell of some easily conducting metal, which is not attacked by the electrolyte, and are then worked up into a paste with metallic oxides or hydroxides for plates of electric apparatus in which an invariable electrolyte is employed, the object being to increase the conductivity of the resulting paste.—T. F. B.

Chlorates of the Alkalies or Alkaline Earths; Process of Preparing — by Electrolysis. H. Landolt. Ger. Pat. 159,747, May 31, 1904.

By the addition of a small quantity of bleaching powder solution to the chloride solution in the electrolytic production of chlorates, the cathode becomes covered with a film of lime, which prevents reduction of the chlorate at the cathode, whilst the hypochlorous acid generated at the anode assists in the oxidation of the chloride. Two litres of a clear solution of bleaching powder, containing 50 grms. of available chlorine per litre, are added to 100 litres of saturated sodium chloride solution, and the mixture is electrolysed, at a temperature of 80°—100° C., by means of a current of 1000 amperes per sq. m. of cathode surface. Further addition of bleaching powder solution (300—500 c.c. per 100 litres of electrolyte) is necessary every 24 hours or so. By this method, it is stated that solutions containing 600—700 grms. of sodium chlorate per litre are ultimately obtained.—T. F. B.

## (B).—ELECTRO-METALLURGY.

Copper and Zinc and their Cyanide Solutions; E.M.F. between —; and their Behaviour on Electrolysis. F. Spitzer. Z. Elektrochem. 1905, 11, 345—368.

THE E.M.F. which copper and zinc exhibit in cyanide solutions is dependent on the concentration of the solution and its content in free potassium cyanide. In both cases, higher concentration of the metal cyanide and greater excess of free potassium cyanide give rise to a larger potential difference, but with copper the effect is much more marked than with zinc. As a result, zinc, which in dilute alkali cyanide solutions is a less noble metal than copper, just as it is in most other salt solutions, in very concentrated potassium cyanide shows a smaller P.D. than copper.

That copper and zinc mutually precipitate each other from the corresponding cyanide solution, is ascribed to the formation of alloys, since the results are not in accordance with the above potential measurements.

The yield in the electrolytic deposition of zinc and copper from cyanide solutions is greatly influenced by the current density and content in free cyanide, which must both be

kept very low, as otherwise hydrogen is evolved at the cathode, and very little metal is deposited. In the electro-deposition of brass, the alloy is obtained at a potential which is far below that at which pure zinc could be deposited.—R. S. H.

*Copper: Effect of Impurities on the Electrical Conductivity of —.* L. Addicks. Bull. Amer. Inst. Mining Eng., May, 1905, 559–568.

THE author's experiments were made with a view of determining the amounts of various elements which would lower the electrical conductivity of copper by 3 or 4 per cent. The results obtained are shown in the following table:—

Element Added.	First Sample.			Second Sample.			Third Sample.			Fourth Sample.	
	Added Element.	Cu.	Cond.	Added Element.	Cu.	Cond.	Added Element.	Cu.	Cond.	Added Element.	Cu.
Aluminium .....	0.0	99.96	99.6	0.006	99.90	98.6	0.109	99.65	66.8	0.739	99.03
Antimony .....	0.007	99.96	99.6	0.022	99.94	97.2	0.047	99.86	95.4	—	—
Arsenic .....	0.004	99.96	99.6	0.007	99.95	96.8	0.013	99.94	93.2	0.140	99.82
Bismuth .....	0.0	99.96	99.6	0.028	99.93	99.6	0.045	99.91	99.3	—	—
Cadmium .....	0.0	99.96	99.6	0.062	99.90	99.5	0.113	99.87	99.1	0.427	99.55
Gold .....	0.0	99.96	99.6	0.089	99.86	98.9	0.149	99.84	98.4	0.317	99.64
Iron .....	0.0	99.96	100.5	0.042	99.93	96.8	0.046	99.90	92.9	0.068	99.89
Lead .....	0.0	99.96	99.6	0.083	99.82	99.1	0.052	99.86	98.7	0.347	99.56
Oxygen .....	0.020	99.98	100.7	0.050	99.95	101.4	0.100	99.90	100.5	0.200	99.80
Phosphorus .....	0.0	99.96	99.6	0.080	—	52.3	—	—	—	—	—
Silicon .....	0.0	99.96	99.6	0.007	99.89	99.4	0.007	99.89	99.1	0.042	99.89
Silver .....	0.003	99.89	100.5	0.137	99.81	100.0	0.340	99.60	98.3	0.503	99.49
Sulphur .....	0.0	99.89	100.5	0.053	99.93	100.0	0.135	99.83	99.0	0.236	99.75
Tellurium .....	0.0	99.89	109.5	0.065	99.82	100.4	0.181	99.74	100.2	0.405	99.65
Tin .....	0.0	99.96	99.6	0.052	99.85	97.6	0.097	99.85	92.7	0.295	99.61
Zinc .....	0.0	99.96	99.6	0.048	99.91	98.3	0.095	99.79	96.3	—	—

Curve-diagrams are also given. By means of tangents to the curves, factors expressing the ratio of the lowering of the conductivity to the amount of the added impurity, were deduced, the values obtained for this factor being:—Aluminium, 500; antimony, 190; arsenic, 720; bismuth, 4; cadmium, 9; gold, 10; iron, 140; lead, 3; oxygen, 25; phosphorus, 3000; silicon, 70; silver, 6; sulphur, 8; tellurium, 4; tin, 67; and zinc, 30.—A. S.

#### ENGLISH PATENT.

*Metals: Solutions for the Electro-deposition of —.* L. Potthoff, New York. Eng. Pat. 14,058, June 21, 1904.

THIS invention relates to an electrolytic bath for the deposition of metals, and is composed of a mixture of equal parts of an aluminium salt and a salt of the coating metal, dissolved in water to form a solution having a density of from 11° to 18° B. When a double salt of aluminium is not used, about 2 per cent. of an organic acid or 4 per cent. of a carbohydrate is added. The bath may also be made from a mixture of 5 to 8 per cent. by weight of an aluminium salt, with from 25 to 50 per cent. of a salt of the coating metal, dissolved in about 100 parts of water.—B. N.

#### UNITED STATES PATENTS.

*Gold or other Diamagnetic Metals: Art of Separating [Electrically] —.* L. T. Weiss, New York. U.S. Pat. 791,305, May 30, 1905.

THE diamagnetic particles are first electrolytically coated with a magnetic metal, and the coated metallic particles are then separated from the accompanying matter by magnetic means.—E. S.

*Metals: Electrolytic Deposition of —.* H. C. Harrison, London, and J. Day, Weston-super-Mare. U.S. Pat. 791,341, May 30, 1905.

SEE Eng. Pat. 23,647 of 1900; this J., 1902, 354.—T. F. B.

*Zinc: [Electrolytic] Process of Extracting —, from its Ores.* A. G. Betts, Troy, N.Y. U.S. Pat. 791,401, May 30, 1905.

THIS invention relates to a process of extracting zinc from its ores, and consists in first obtaining the metal as a soluble salt, such as zinc sulphate, in solution, the latter

being then electrolysed, using a liquid-metal cathode as mercury, in order to produce a zinc-mercury alloy. The zinc is extracted from the alloy and deposited on a suitable cathode by electrolysis, using a solution of chloride as the electrolyte.—B. N.

*Tin [from Tin Scrap]: [Electrolytic] Process of Stripping —.* H. W. Hemingway, Walthamstow, U.S. Pat. 791,555, June 6, 1905.

SEE Eng. Pat. 8759 of 1902; this J., 1903, 561.—T. F. B.

*Antimony: Process of Electrodepositing —.* Betts, Troy, N.Y. U.S. Pat. 792,307, June 13, 1905.

SEE Eng. Pat. 15,294 of 1904; this J., 1905, 626.—T. F. B.

#### FRENCH PATENTS.

*Furnace: Electric —.* P. Girod, Second Add. dated Dec. 24, 1904, to Fr. Pat. 329,822 of Feb. 1903 (this J., 1903, 1054 and 1904, 1225).

THE modification, described in this addition, relates to the form of furnace containing a number of independent crucibles; the base of the furnace is either in one piece or lattice-like in character, and the top is covered by several removable refractory plates. The heating is effected as described in the main patent and in the first add.—L. N.

*Galvanising, Tinning and Coating Wire and other Bodies: Process of —.* G. A. Goodson, Fr. Pat. 349,664, Dec. 29, 1904. Under Int. Conv., Jan. 1904.

SEE Eng. Pat. 3798 of 1905; this J., 1905, 550.—T. F. B.

*Sulphides, Antimonides and Arsenides: Treatment of —.* N. H. M. Dekker. Fr. Pat. 349,730, Dec. 30, 1904.

THE powdered minerals are suspended in acidulated water and treated with nascent hydrogen and oxygen produced by the electrolysis of water. The hydrogen unites with a portion or the whole of the sulphur, antimony, or tin, whilst by the action of the oxygen, sulphates (or antimonates or arsenates) or oxides are produced. The apparatus employed consists of a rectangular cell containing fixed and revolving electrodes.—J. H. C.

*Electrostatic Separation [of Ores]: Method and Apparatus for —.* C. H. Huff. Fr. Pat. 350,601, Jan. 7, 1905.

SEE Eng. Pat. 27,449 of 1904; this J., 1905, 282.—T. F. B.

*Copper: [Electrical] Process for Colouring —.* M. J. Fr. Pat. 350,508, Jan. 3, 1905.

THE copper article is made the cathode in a bath containing a potassium cyanide solution of an arsenic antimony salt and iron chloride, the anode being a copper plate, and the current is passed until a film of arsenic antimony is formed upon the copper. The coated article is then removed and heated to redness. It is stated that the copper article thus treated acquires a brilliant enamel-like resistant coating of a red or orange tint.—E. S.



## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*Test [Fatty Acids]; Co-operative Work on the — of the Assoc. of Official Agric. Chemists.* 1904. U.S. pt. of Agric., Bureau of Chem., Circular No. 22, 1905.

The result of experiments by a number of chemists working independently on the titer test, the following conclusions are drawn:—(1) The method of preparing the acids has no influence on the results. (2) The fatty acids should be dry; filtering, and heating for 20 minutes at 60° C. is recommended. (3) The varying results obtained are chiefly due to differences in the method of filtering the fatty acids during the test. (4) The Wolfbauer method of stirring gives the best results (see this J., 1894, 1895). (5) A standard thermometer should be used.—A. S.

*Oenocarpus Wightiana and Hydnocarpus Anthelmintica; Constituents of the Seeds of —. Isolation of a Homologue of Chaulmoogric Acid.* F. B. Power and M. Barrowcliff. Chem. Soc. Proc., 1905. 21, 175–176.

Seeds of *H. Wightiana* yielded 32.4 per cent. of a fatty acid on expression, and 41.2 per cent. by extraction with ether. The expressed oil had the following characters:—*n*<sub>D</sub> 22–23° C.; sp. gr. at 25° C., 0.958; [*a*]<sub>D</sub> in chloroform, +57.7°; acid value, 3.8; saponification value, 207; iodine value, 101.3. From the seeds of *anthelmintica* 16.3 per cent. of oil was obtained by expression, and 17.6 per cent. by extraction with ether. The expressed oil had the following characters:—*n*<sub>D</sub> 25° C.; sp. gr. at 25° C., 0.953; [*a*]<sub>D</sub> in chloroform, +2.5°; acid value, 7.5; saponification value, 212; iodine value, 86.4.

The two oils resemble very closely chaulmoogra oil (*Taraktognos Kurzii* (this J., 1904, 669) both in physical characters and in composition. They consist chiefly of the glyceryl esters of chaulmoogric acid,  $C_{26}H_{52}O_2$ , and a new acid, *hydnocarpic acid*,  $C_{16}H_{32}O_2$ , or homologue of the same series, which has also been isolated from chaulmoogra oil. Hydnocarpic acid crystallized from alcohol in glistening leaflets, melting at 60° C., having [*a*]<sub>D</sub> = +68° in chloroform. It is an unsaturated acid, but contains only one ethylenic linkage, therefore possesses a closed carbon ring. Besides the constituents mentioned, the oil of *H. Wightiana* contains a small proportion of an acid or acids of the linolic series, whilst the oil of *H. anthelmintica*, on the other hand, contains small quantities of oleic and palmitic acids.—A. S.

*Gynocardia Odorata; Constituents of the Seeds of —.* F. B. Power and M. Barrowcliff. Chem. Soc. Proc., 1905. 21, 176–177.

Power and Gornall (this J., 1904, 669) have previously shown that the oil from *Taraktognos* seeds is identical in physical character and chemical composition with the chaulmoogra oil of commerce. The results of the present investigation now show conclusively that the oil known in Indian commerce as "chaulmoogra oil" and sometimes "gynocardia oil" could not have been obtained from seeds of *Gynocardia odorata*, as was generally believed to the year 1900. Chaulmoogra oil is a solid at the ordinary temperature (*m. pt.*, 22°–23° C.), is optically inactive, and consists chiefly of the glyceryl esters of acids of the chaulmoogric series, whereas the oil from *Gynocardia* seeds is a liquid at the ordinary temperature, is optically inactive, and contains neither chaulmoogric acid nor its homologues.

*Gynocardia* seeds yielded, on expression, 19.5 per cent., by extraction with ether, 27.2 per cent. of an oil having a light yellow colour, and an odour resembling that of linseed oil. The expressed oil had the following characters:—Sp. gr. at 25° C., 0.925; acid value, 4.9; saponification value, 197; iodine value, 152.8. It consists of the glyceryl esters of the following acids:—Linolic acid, or isomerides of the same series, constituting the largest proportion of the oil; (2) palmitic acid in considerable amount; (3) linolenic and *iso*-linolenic

acids, the latter preponderating; and (4) oleic acid in relatively small amount. (See also this J., 1905, 558.)

—A. S.

*Cod Liver Oil and other Fish Liver Oils; Examination of —.* R. T. Thomson and H. Dunlop. Paper read before Assoc. Pub. Analysts of Scotland, June, 1905, 1–18.

THERE is a close correspondence between the iodine value and refractive index in fish liver oils, and the latter is, therefore, regarded by the authors as only affording corroborative evidence. The saponification value is not of much use as a differentiating test with the exception that dog-fish oil has a very low value (*e.g.*, 169.7), corresponding with its high proportion of unsaponifiable matter, whilst porpoise blubber oil has an exceptionally high value (256.6), indicative of the presence of volatile fatty acids. The amount of unsaponifiable matter in seven different fish-liver oils, including cod-liver oil was low (1.0 to 1.38 per cent.), whereas dog-fish oil contained 8.4 per cent., and shark liver oil 15.28 per cent. In the authors' opinion it is at present impossible to differentiate between cod, ling, coal-fish, hake, whiting, haddock and skate liver oils, whilst the detection of small proportions of seal or whale oil or even of dog-fish or shark liver oils in cod liver oil is very difficult, though probably less than 5 per cent. of porpoise oil could be detected. As regards the Pharmacopoeia tests for cod liver oil, the authors consider that the range of the iodine value should be extended to 181, and that the sp. gr. should range from 0.923 to 0.931, whilst the unsaponifiable matter should not exceed 1.5 per cent.—C. A. M.

### UNITED STATES PATENT.

*Oil; [Paint—], and Paint, and Process of Making same.* W. N. Blakeman, jun. U.S. Pats. 792,113 and 792,114, June 13, 1905. XIII.A., page 742.

### FRENCH PATENT.

*Castor Oil Product Miscible with Mineral Oil; Preparation of a —.* Soc. Anon. Française Stern-Sonneborn pour la Fabrication des Vaseline, Huiles et Graisses Industrielles. Fr. Pat. 350,511, Jan. 3, 1905.

CASTOR oil is heated for six hours in an autoclave at a temperature of 260–300° C., and under a pressure of 4–6 atmospheres. When cold, the resulting product mixes in all proportions with mineral oil.—W. P. S.

### GERMAN PATENTS.

*Fatty Acids; Process for the Recovery of Fat from Sewage, Effluents and the like, in the form of —.* F. Kaepfel. Ger. Pat. 159,170, Jan. 20, 1903.

THE fat contained in the material is saponified, the soap is extracted by hot water, and the fatty acids are precipitated from the hot soap solution in the usual manner, and extracted by a suitable solvent in order to separate them from albuminoid substances.—A. S.

*Fatty Acids and Resins; Process for the Saponification of — by means of Alkali Carbonates.* W. Heckhausen. Ger. Pat. 158,929, April 27, 1904.

FATTY acids and resins are saponified by means of alkali carbonates in a closed vessel under pressure, the gases evolved being led first into an air-chamber, and then to the purifying apparatus. It is claimed that by the aid of the air-chamber, which acts as a pressure-regulating device, the saponification can be effected under pressure, without risk of danger from the sudden evolution of considerable quantities of carbon dioxide.—A. S.

*Soap.* R. A. Jones. Ger. Pat. 159,098, Oct. 1, 1903.

CLAIM is made for a tablet of soap, a portion of which is covered with a protective coating, *e.g.*, paraffin wax. A mark or label may be impressed on the soap before it is coated with the paraffin.—A. S.

*Soap: Process for Preparing Tablets, &c., of — enclosed in Casings.* W. Rödiger i. F. Kluge und Co. Ger. Pat. 158,572, Oct. 2, 1903.

The process is intended for the preparation of tablets, &c., from soap which is liquid when hot, but becomes solid on cooling. The soap whilst still in a liquid or pasty condition is filled into casings, such as cardboard boxes, paper bags, &c. Thus, the usual cooling process before packing the soap is dispensed with.—A. S.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

#### (A.)—PIGMENTS, PAINTS.

*Paints and Colours containing Lead; Report on the Manufacture of — as affecting the Health of the Operatives employed.* T. M. Legge, H.M. Medical Inspector of Factories. 1905. [Cd. 2466.] Price 11d.

IN consequence of the severe incidence of lead poisoning (as coming under section 73 of the Factory and Workshops Act, 1901), to persons employed in paint works, nearly 100 such factories, in London, Liverpool, Glasgow, Hull, Manchester and Birmingham, have been inspected. An analysis of 225 cases of "plumbism," from January 1, 1899, to June 30, 1904, brings out very prominently the injurious effect of the inhalation of dust containing lead, for whilst operations which can be generally classed as "wet processes" are responsible for only 18.2 per cent. of the cases, no less than 72.9 per cent. are traceable to dust. From returns furnished by District Inspectors of 148 paint works in which the grinding of white lead is carried on, it appears that in only 16 has any attempt been made to control the dust arising during the transference of the white lead from the casks to the grinding machinery, and the remarks made by the Certifying Surgeons show that the dust arising in that operation affects men at work in the immediate neighbourhood not themselves handling lead products. Dust containing lead also arises from the operations of sifting and packing red-lead, vermilionettes, chrome greens and yellows, though the risk of poisoning from these colours seems to be far less than that from white lead. The wet processes produce but few cases, though some severe ones have occurred in carrying out a process involving prolonged boiling of the materials, there being evidence that the spray projected into the air during ebullition has an injurious effect similar to that of dust. The wearing of respirators is open to many objections, and the whole investigation points to the necessity of employing exhaust draught to draw away the dust from the worker. An Appendix to the Report embodies the definite suggestions as to the lines on which the existing Code of Regulations should be amended, as well as those in force in Germany, whilst photographs and diagrams are appended to show methods of applying exhaust draught, actually in use.—M. J. S.

*Zinc Cement for Steam-Joints.* A. Livache. Bull. Soc. d'Encour., 1905, 107, 568—570.

A CEMENT for steam-joints is described which is composed of "zinc-gray," a metallic powder obtained in the manufacture of zinc-white, made into a paste with wood oil. It contains no lead compounds, and is, consequently, harmless to handle; it does not harden on keeping, and hardens more quickly when exposed to heat than the ordinary red-lead mastic.—W. H. C.

#### UNITED STATES PATENTS.

*White Lead; [Electrolytic] Process of Making —.* C. P. Townsend, Washington. U.S. Pat. 791,956, June 6, 1905.

SEE Fr. Pat. 349,001 of 1904; this J., 1905, 627.—T.F.B.

*Dyestuff adapted to form Lakes; Azo —.* P. Julius and E. Fussenegger, Assignors to Badische Anilin und Soda Fabrik. U.S. Pat. 792,421, June 13, 1905. IV., page 726.

*Paint; Luminous —.* H. Lieber, New York. U.S. Pat. 791,631, June 6, 1905.

THE composition contains a luminescent compound, radio-active excitant, and an adhesive and quick-drying substance; for example, a composition of zinc sulphide, radium-barium carbonate, and a quick-drying adhesive.—E. S.

*Oil; [Paint —] and Process of Making same.* W. N. Blakeman, Jr., New York. U.S. Pat. 792,113, June 13, 1905.

A NON-DRYING fatty oil such as cottonseed oil is oxidized and then "claidinised" by treating it with an oxidizing agent. After this treatment it is mixed with a drying oil, such as tung oil, with or without the addition of a non-drying fatty oil or an oil which has been only partially "claidinised."—A. S.

*Paint, and Process of Making same.* W. N. Blakeman, Jr., New York. U.S. Pat. 792,114, June 13, 1905.

THE paint is prepared by mixing an oxidized and "claidinised" non-drying fatty oil such as cottonseed oil (see preceding abstract) with a drying oil such as tung oil, with or without the addition of a non-drying fatty oil or an oil which has been only partially "claidinised," and then grinding an anhydrous pigment with the mixture.—A.

#### FRENCH PATENT.

*Lakes; Process for Preparing —.* Farbenfabr. F. Bayer und Co. Fr. Pat. 349,587, Dec. 21, 1904. Under Int. Conv., June 16, 1904.

RED lakes, fast to light, are obtained by precipitating a suitable substratum, in the usual manner, the dyestuff produced by combining the diazo derivative of *o*-toluidine or *o*-anisidine with 1.5-naphtholsulphonic acid.—T. F. B.

#### GERMAN PATENTS.

*White Lead; Process for the Manufacture of —.* Peska. Ger. Pat. 158,309, June 5, 1903.

LEAD oxide suspended in a solution of a suitable lead salt (acetate, nitrate, &c.), is subjected to the action of carbon dioxide or gases containing carbon dioxide. It is found that the product obtained in this way is of a good colour, and also, is amorphous, which is of importance as crystalline white lead has not such a good covering power.—A. S.

*Carbon Electrodes of Arc Lamps; Process for the Production of Waste — [Pigment].* R. Peters. Ger. Pat. 158,151, Jan. 19, 1904. Addition to Ger. Pat. 149,900, Feb. 14, 1903. (See Fr. Pat. 335,795 of 1903; this J., 1904, 260.)

THE waste carbons are heated to 1200°—1400° C., and then allowed to cool very slowly, whereby they become friable, and can be ground to a soot-like powder suitable for the preparation of paint. In the present patent the waste carbons are quenched in oil prescribed in the main patent (loc. cit.) and dispensed with.—A. S.

#### (B.)—RESINS, VARNISHES.

*Shellac; Decomposition of — by Distillation.* A. Etard and E. Wallée. Comptes rend., 1905, 40, 1603—1606.

SHELLAC was mixed with sand and distilled from a retort. There was obtained: about 22 per cent. of an almost free from ash, about 6 per cent. of gas and about 72 per cent. of distillate. The distillate consisted of an aqueous and an oily layer, the latter representing about 52 per cent. of the original oil, when dried. It contained very little basic matter, but about 40 per cent. of oil of character, and 60 per cent. of essential oil. The former consisted essentially of oleic acid, the latter mainly of various hydrocarbons of the terpene and polyterpene classes. The authors conclude that shellac consists essentially of a mixture of not very stable oleates of a continuous series of polyterpenes, and that such compounds are



of all industrial varnishes. They point out that resins seem to be constituted in an analogous manner, consisting of bornyl acetate and similar terpenic and esters of higher acids with polyterpenes.—E.F.

#### ENGLISH PATENT.

*Use of Fluid [Solvent for Resins] and Process of Drying same.* W. Oppenheimer and T. O. Kent. Eng. Pat. 4271, Feb. 20, 1904. III., page 722.

#### FRENCH PATENTS.

*Use of Products; Apparatus for Distilling—and for Condensing the Distillation Products.* H. Ropats. Pat. 349,543, Dec. 24, 1904.

The apparatus is characterised by the combination of a distilling still with internal steam pipes communicating with the jacket space, and a condensing chamber. The bottom of the still is inclined towards a side outlet for the distillation residue, with a draw-off below by means of which the residue is removed. Heating steam is admitted to the jacket-space and passes through the tubes mentioned above. The purity of the product during the distillation can be tested by means of a helical steam pipe passing down through the centre of the still. The distillation process takes place through an outlet-pipe in the head of the still and passes to the condensing chamber, in which they are led to follow a zig-zag course by means of partitions or baffles.—A.S.

*Use of Substitute for Varnishing Furniture, &c.; Process of Preparing a —.* C. Ludwig. Fr. Pat. 350,733, Dec. 13, 1905.

Eng. Pat. 760,541 of 1904; this J., 1904, 670.—T.F.B.

#### (C.)—INDIA-RUBBER, ETC.

*Use of Rubber from North-eastern Rhodesia; "Muteke" —.* Bull. of the Imp. Inst., 1905, 3, 14—16.

The "Muteke" rubber, obtained from the branches of the "muteke" or "mutecha" plant from North-eastern Rhodesia, was quite dry and free from stickiness; it possessed good tenacity and elasticity, and was completely soluble in benzene, carbon bisulphide, and chloroform, and insoluble in ether. It had the following composition:—Caoutchouc 4.6 per cent., resin 12.0 per cent., caoutchouc 79.7 per cent., dirt and insoluble matter 3.7 per cent. (including 0.4 per cent.). The percentage of caoutchouc in the material was thus 83.6. Its value was computed at 3s. 6d. per lb.—T.F.B.

*Use of Rubber from Rhodesia; "Dande" —.* Bull. of the Imp. Inst., 1905, 3, 16—19.

The "Dande" rubber, weighing 155 grms., was obtained from the Natal district of Rhodesia; it had been collected from the plant known as "Dande," which proved to be closely allied to *Landolphia petersiana*. The rubber possessed good physical properties, and showed the following composition:—Moisture, 15.5 per cent.; resin, 10.7 per cent.; caoutchouc, 68.1 per cent. (=80.7 per cent. of dry material); dirt and insoluble, 5.7 per cent. (including ash, 1.6 per cent.). The sample was valued at 3s. 6d. per lb. in London.—T.F.B.

#### ENGLISH PATENT.

*Use of Fluid [Rubber Solvent] and Process for Obtaining same.* W. Oppenheimer and T. O. Kent. Eng. Pat. 4271, Feb. 20, 1904. III., page 722.

#### FRENCH PATENT.

*Use of Guttapercha and Gutta-Percha; Process and Apparatus for the Extraction of Vegetable Juices and Latexes, especially of those which yield —.* C. E. Giovetti, R. Grundler and H. Haberer. Fr. Pat. 349,527, Dec. 31, 1904.

The apparatus consists of two parts: (1) a shield which is fixed firmly to the tree against the incision; and (2) a

reservoir from which the air can be exhausted. The shield has a short, projecting tube which is connected to the reservoir. It is claimed that by means of this apparatus, better yields of latex are obtained from fewer incisions than by the ordinary method, and that no coagulation of the latex takes place, owing to the exclusion of air.—A.S.

#### XIV.—TANNING, LEATHER, GLUE, SIZE.

*Use of Mallet Bark; a New Australian Tanning Material.* Bull. of the Imp. Inst., 1905, 3, 69—70.

MALLET bark, which is the name given to the bark of *Eucalyptus occidentalis*, has recently been imported into Europe from Queensland. 12l. 10s. to 13l. 10s. per ton being obtained for it. About 500 tons were used locally in 1903, and 4000 to 5000 tons were collected during 1904; this year's production is expected to be much greater. The bark is of medium thickness, and is cinnamon coloured, containing from 35—45 per cent., and occasionally up to 50 per cent. of a readily soluble tannin, which yields a firm, tough, light brown leather, free from the pink colour of leather tanned with wattle bark. At present it is chiefly used alone or in conjunction with valonia for medium weight leather.—T.F.B.

*Use of Maletto (Mallet) Bark.* J. Paessler. D. Gerber Zeit., 1905, 48 [53—58]; Chem.-Zeit., 1905, 29, Rep. 171.

THE average composition of maletto bark (from *Eucalyptus occidentalis* Endl.) is: tanning substances 42 per cent. (35—52), non-tannin 7.0 per cent., insoluble matter 36.5 per cent., moisture 14.5 per cent. It forms a very cheap tanning material and can be easily extracted with water, for the most part without heat, the liquor having a density of 8—10 B. The use of steam under high pressure, on the other hand, causes decomposition of the tanning principles and deteriorated colour, the latter defect being imparted to the leather. The usual colour resembles that imparted by oak tan, but prolonged exposure to light turns it a decided reddish tinge, like mangrove tan. Owing to the small proportion of sugars (9 parts per 100 of tanning principles) the liquor does not become very acid. So far as can be ascertained, the bark is free from substances injurious to leather, but it should not be used in any large proportion when light shades are desired. The commercial extract has the density 22—24 B. and contains 30—36 per cent. of tanning substance.—C.S.

*Pickling Process; Study of the —.* W. Eitner and Stiazy. Der Gerber, 1905, 31, 125—127, 139—141, 155—156.

THE authors have made a systematic series of experiments with mixtures of salt and various acids for pickling skins preparatory to tanning. Experiments with hydrochloric, acetic and lactic acids showed that these offer no advantages over sulphuric acid for use in pickling: the pickled pelts and the leather produced from them being similar in appearance and quality. By varying the concentration of the pickle liquors, it was found (1) that the amount of salt absorbed by the pelt from the pickle liquor was controlled by the concentration of the solution; 23 to 25 per cent. of the total amount used being taken up by the pelt; (2) the absorption capacity of the pelt for acid was limited.

The goods pickled with the largest amount of acid possessed a more leathery feel and after drying were fuller and stretched much better than those in which smaller amounts of acid were employed. Dried pickled pieces, containing as much as 3 per cent. of sulphuric acid, showed no deterioration or tendering of fibre. The pickled skins after chrome tanning still retained these characteristics. An analysis of the leather produced by tanning with sumach showed that no free acid was retained in the finished leather. An Australian pickled pelt was found to contain 19.2 per cent. of salt and 2.8 per cent. of sulphuric acid.

From a very large number of experiments the authors draw the following conclusions:—

(1) That sulphuric acid is quite equal in efficiency to other acids for the purpose. (2) To a certain limit increasing softness is produced by increasing the quantity of acid used. (3) For naturally soft skins and when a leather not very soft is required the best results are obtained by using 10 kilos. of salt, 1 kilo. of sulphuric acid and 100 litres of water for 50 kilos. of pelt in the drum. (4) For material which is naturally hard and when a soft leather is required, the amount of acid should be increased to 2 kilos., using similar amounts as those given above of pelt, salt and water.—M. C. L.

#### ENGLISH PATENTS.

*Leather; Tanning of Hides into* —. N. L. Tullis, Linlithgow, Scotland. Eng. Pat. 12,388, June 1, 1904.

THE hides after unhairing and fleshing are placed in a solution of ferrous salts in conjunction with alkali sulphites, bisulphites or thiosulphates; equal amounts of the ferrous salt and the alkali salt being generally used. The tannage with the iron salts may be preceded by a preliminary tannage with alum, chrome or formaldehyde.—M.C.L.

*Bating, De-Acidifying and Oxidising Hides and Skins.* O. P. Amend, New York. Eng. Pat. 18,514A, Aug. 26, 1904.

SEE U.S. Pats. 763,347 and 768,259 of 1904; this J., 1904, 756 and 906.—T. F. B.

#### FRENCH PATENT.

*Depilating Skins; Composition for* —. Schoellkopf, Hartford and Hanna Co. Fr. Pat. 350,632, Jan. 9, 1905.

SEE U.S. Pat. 781,714 of 1905; this J., 1905, 245.—T.F.B.

#### GERMAN PATENT.

*Fertiliser; Process for the Manufacture of* — from Shells. Kölner Ceresinfabrik Gebrüder Maus, G. m. b. H. Ger. Pat. 157,276, Dec. 21, 1902. XV. (see below).

### XV.—MANURES, &c.

#### UNITED STATES PATENT.

*Fertiliser, and Process of Making same.* W. B. Chisolm, Charleston, S.C. U.S. Pat. 792,314, June 13, 1905.

SULPHUR and lime are boiled together, to produce a homogeneous liquid, and this solution of calcium sulphides is mixed and thickened with phosphate, and the mass is then ground, to constitute a fertiliser.—E. S.

#### FRENCH PATENT.

*Sewage and other Refuse; Treatment of* —. J. L. F. Garrigon. Second Addition, dated Dec. 22, 1904 and Fr. Pat. 340,740, Feb. 26, 1904. XVIII.B., page 747.

#### GERMAN PATENT.

*Fertiliser; Process for the Manufacture of a* — from Shells. Kölner Ceresinfabrik Gebrüder Maus, G. m. b. H. Ger. Pat. 157,276, Dec. 21, 1902.

THE shells are treated with acetic acid and the solution separated. The residue contains nitrogenous substances and calcium phosphate and forms a useful fertiliser, whilst from the solution, glue and calcium acetate are obtained as by-products.—A. S.

### XVI.—SUGAR, STARCH, GUM, Etc.

*Sucrose in presence of Levulose and Dextrose; Determination of* —. H. Pellet. Bull. Assoc. Chim. Sucr. Dist., 1905, 22, 1041–1048.

THE rotatory power of pure levulose in aqueous solution is increased by the action of strong acids, but not by

acetic or sulphurous acid, and only slightly by sulphuric. Exposure to prolonged heat (105° to 107° C.) produce notable diminution in the rotation of levulose, whether pure or in presence of salts, and the rotation is now longer modified by the addition of strong acids. It is therefore useless to acidify the liquids obtained from cane sugar works for polarisation before the Clerget invers. In cane molasses, the rotatory power of levulose is variable according to the conditions under which the juice is obtained, the products obtained from it, have been heated, more these products have been subjected to a high temperature, and the more will the levulose have suffered diminution of its rotatory power. The rotatory power of levulose being thus variable and unknown, it is not possible to calculate the proportions of levulose and dextrose in cane molasses with certainty. This is probably an explanation of the very variable results obtained by different observers with cane molasses.—L. J. DE W.

*Starch; coagulated by Amylocoagulase, Analogy between and the Natural Starch of Peas.* A. Fernbach and Wolff. Comptes rend., 1905, 140, 1547–1549.

THE starch separated from green peas differs from other natural starches in containing a high percentage of amylose, which is cellulose unsaccharifiable by malt. In fact, there is a very close analogy between pea starch in its natural condition and potato starch which has been coagulated by amylocoagulase. When pea starch is boiled with a relatively small proportion of water, it forms an opaque jelly on cooling; when boiled with a larger quantity of water, it gives a solution which can be filtered clear and hot. The filtrate deposits, on cooling, a pulverulent gelatinous precipitate (amylocellulose), unsaccharifiable by malt, but if the hot filtrate be received directly in alcohol, its saccharification is complete. The insoluble residue has the appearance of the skeletons of the granules; it gives a blue coloration with iodine; after saccharification the residue is morphologically unchanged, but the iodine reaction is reddish-brown. Pea starch yields 82 per cent. of starch soluble in boiling water, and completely saccharifiable. The residue, amounting to 17–18 per cent., is amylocellulose, soluble in water only on heating at 150° C. When the starch is boiled with water allowed to cool completely, the unsaccharifiable residue is increased to about 22 per cent., the extra 4 per cent. of amylocellulose having been formed during cooling.—J. F.

*Sugars; Volumetric Determination of Reducing Sugars.* A. R. Ling and T. Rendle. XXIII., page 753.

*Sugar; Determination of* — with Fehling's Solution. F. P. Lavalle. XXIII., page 753.

#### ENGLISH PATENTS

*Sugar [Levulose]; Manufacture of* —. S. Stein and M. Loewenthal, both of Liverpool. Eng. Pat. 16,546A, July 27, 1904.

LEVULOSE is prepared by pulping dahlia bulbs or chicory roots with water, heating, defecating and clarifying the liquid by means of suitable reagents, and saccharifying the extract either by means of its own acidity or by acetic acid. The solution of levulose is then purified and concentrated to a thick syrup or solid mass.—J. F. B.

*Inulin; Manufacture of* —. S. Stein and M. Loewenthal, both of Liverpool. Eng. Pat. 16546A, July 27, 1904.

THE bulbs or roots of dahlia or chicory are ground to a pulp, with or without the addition of water. Magnesia is then added to the pulp in order to neutralise the acidity and facilitate the filtration. After filtration in the warm state, the liquid is defecated by the addition of tan, aluminium salts or other suitable precipitating agents and again filtered. The inulin is deposited from the filtrate by cooling, the deposition being accelerated by freezing and subsequently thawing the solution.—J. F. B.



UNITED STATES PATENTS.

*and Waste Molasses; Process of Making First — Operation.* H. Winter, Charlottenburg, Germany. Pat. 791,971, June 6, 1905.

ig. Pat. 26,570 of 1902; this J., 1904, 29.—T. F. B.

*er; Bagasse-Burning —.* H. G. Ginaca and A. W. Sch. U.S. Pat. 791,023, May 30, 1905. H., page 721.

FRENCH PATENTS.

*cautes and Granulated Sugar; Continuous Apparatus for Cleansing —.* A. Landrin and M. Moullier. Pat. 349,418, March 24, 1904.

massecuite is fed upon an endless band of wire gauze carries it over a series of separate suction boxes, in which the layer of massecuite is subjected simultaneously to the pressure of the cleansing syrups sprayed above and to the action of an exhaustor sucking below. The thickness of the layer of massecuite is regulated by a valve at the feed-discharge, and the suction in the box can be regulated independently.—J. F. B.

*Masseccuites; Vertical Mixing Device for —.* Anon. de Constructions Mechaniques de St. Quentin. Pat. 349,803, Dec. 31, 1904.

mixer, especially suitable for crystallising vessels in refineries, possesses a set of agitating arms fixed to a central rotary hollow shaft, inside which is a rotary screw which raises the mass from the bottom of the vessel and distributes it by means of a channel over the whole surface of the massecuite as the shaft rotates.—J. F. B.

GERMAN PATENTS.

*for [Beet] Slices with a Continuous Screw on a Cylindrical Spindle.* A. Eitner. Ger. Pat. 157,907, June 13, 1903.

spindle of the press is preferably constructed in two parts, of which the upper one carries the pressing-screw, the lower one is rotated, whilst the lower one carries a conical casing or mantle, which does not rotate, and is provided with openings through which the expressed water passes into the hollow spindle. The spindle carrying the screw is disposed inside an outer chamber, so that the space between the conical casing and the walls of the outer chamber becomes narrower as it approaches the outlet of the pressed material. It is claimed that by this press, the expressed water is caused owing to reduction of the beet-slices to a smaller size as in the case in the usual presses in which the spindle is a number of wings or blades arranged in the form of a spiral, and with screens interposed between them.—A. S.

*for [Beet] Slices.* A. W. Maekensen. Ger. Pat. 158,614, July 11, 1903.

object of the invention is to prevent the loosening of the compressed material in the interval between the successive press-blades. For this purpose, the individual, central or nearly horizontal covering-blades are provided with cover-blades, which cover the spaces between the individual press-blades. These covering blades may be connected to the press-blades or to the spindle of the press.—A. S.

*Centrifugal Machines for Syrups and other Liquids; Process for Collecting Separately the Discharge-Liquors —.* A. Fesca und Co. Ger. Pat. 158,275, May 14, 1903.

the drum of the centrifugal machine is arranged with an annular collecting channel consisting of a series of funnel-shaped vessels or pockets, each with an outlet at the bottom. Below this collecting channel are arranged a series of distributing channels disposed in sets, the corresponding channels in each set communicating with a common discharge-channel. When the centrifugal machine is rotated, the outlets of the funnel-shaped vessels are immediately above the distributing-channels communicating with one of the discharge-channels, whilst by

rotating the collecting channel, the distributing-channels connected with any other discharge-channel, can be brought at will, under the outlets.—A. S.

XVII.—BREWING, WINES, SPIRITS, Etc.

*Fermenting Liquids; Influence of Metals on —.* H. L. Nathan. Centralbl. Bakt., 1905, 14, 289; Chem.-Zeit., 1905, 29, Rep. 154.

In continuation of his previous studies (this J., 1904, 876), the author placed cylinders of various metals and alloys in fermenting fruit musts and beer worts. The course of the fermentation was more profoundly affected by the metals in the case of the fruit musts, but in the case of the beer worts the alterations in the organic composition of the liquid were the more serious, since the slightest quantity of dissolved metal caused the destruction of the beer by albuminoid turbidities. The conclusion is drawn that the fermentation of fruit musts should be carried out only in glass, glazed, enamelled or nickel-plated vessels with fittings of aluminium, whilst the same recommendation applies for beer with the exception that aluminium is to be avoided, and the fittings should be made of copper. All metallic surfaces should be highly polished so as to reduce the danger of attack.—J. F. B.

*Disinfectants in the Brewery; Comparative Investigations on Certain —.* H. Will. Z. ges. Brauw., 1905, 28, 330—333, 347—349. (See this J., 1904, 125.)

According to their relative germ-destroying powers, the author arranges the various antiseptics available for brewery use in the following order from the weakest to the strongest:—Antinonin, microsol, montanin, antigermin, ammonium fluoride, formalin, hydrofluoric acid, antiformin.

Arranged according to their relative powers of preventing the development of micro-organisms, the order from the weakest to the strongest is:—Antiformin, ammonium fluoride, montanin, antinonin, microsol, antigermin, hydrofluoric acid, formalin.

Formalin therefore takes a very high place amongst the brewery antiseptics; it is more powerful against bacteria (e.g., *sarcina* and acetifying organisms) than against yeasts and mould fungi. The following limiting concentrations of formaldehyde are recorded as preventing development:—*Sarcina* and bacteria, 0.003—0.031 per cent.; yeasts, 0.007—0.062 per cent.; mould fungi, 0.031—0.125 per cent.

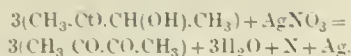
For the destruction of micro-organisms by fumigation, formalin gave somewhat disappointing results.—J. F. B.

*Acetyl-methylcarbinol; Presence [and Determination] of — in Certain Commercial Vinegars.* Pastureau. J. Pharm. Chim., 1905, 21, 593—595.

*Detection of Acetyl-methylcarbinol.*—On adding 95 per cent. alcohol to the vinegars, a more or less copious precipitate was formed, and they were also found to exert a powerful reducing action on alkaline cupric tartrate, in the cold. On neutralising and distilling, the distillate, which was free from furfural, gave a copious precipitate of iodoform when treated with iodine; it had a powerful reducing action on alkaline cupric tartrate, and gave with phenylhydrazine a lemon-yellow crystalline osazone, m. pt. 243° C. The ether-alcohol solution of this osazone afforded, with ferric chloride, a characteristic blood-red colour, and, on evaporation of the solvent, red needles of the corresponding osotetrazone. The reducing body was thus identified as acetyl-methylcarbinol or methylacetol  $\text{CH}_3\text{CO}\cdot\text{CH}(\text{OH})\cdot\text{CH}_3$ .

*Determination of Acetyl-methylcarbinol.*—Fifty c.c. of the vinegar, neutralised with sodium carbonate, were distilled to dryness, avoiding overheating. The distillate was rendered alkaline with sodium carbonate and ammonia, and treated with 10 c.c. of N/10 silver nitrate solution. After standing for 24 hours, the liquid was made up to 100 c.c., filtered, and the unreacted silver nitrate remaining in the liquid determined by the cyanometric method. Each molecular equivalent of reduced silver is equivalent

to three molecules of methylacetol, according to the equation:—



In the vinegar examined the amount of methylacetol present was equivalent to 3.256 grms. per litre.—J. O. B.

*Starch Coagulated by Amylocoagulase. Analogy Between —, and the Natural Starch of Peas.* A. Fernbach and J. Wolff. XVI., page 744.

*Spirits; Determination of Higher Alcohols in —.* P. Schidrowitz and F. Kaye. XXIII., page 753.

#### ENGLISH PATENTS.

*Hops, Malt, &c.; Sulphuring —, so as to Avoid Contamination with Arsenic.* J. L. Baker and A. R. Ling. Eng. Pat. 16,992, Aug. 3, 1904.

WHEN sulphur is thrown upon fuel for sulphuring hops, malt, &c., any arsenic in the fuel, which might otherwise be fixed by the mineral matter of the latter, is rendered volatile. The kiln is therefore so arranged that the sulphur dioxide is generated separately from the kilning furnace, in a special stove provided with a chamber into which the sulphur is introduced upon a tray, dampers being arranged in front for the admission of air and an outlet pipe at the back for the escape of the gas into the kilning chamber, where it mixes with the heated air from the furnace.—J. F. B.

*Beers and Stouts for Bottling; Production of Non-deposit —.* W. G. Storrier, Alloa. Eng. Pat. 12,417, June 1, 1904.

THE apparatus for cooling and carbonating beer previous to filtration and bottling, consists of a horizontal cylindrical vessel fitted with a central rotary shaft. The end portions of this shaft are hollow and perforated, and act as inlet and outlet respectively for a cooling liquid. Inside the vessel the shaft is surrounded by a cylindrical jacket through which the cooling liquid circulates. The space between the cooling cylinder and the walls of the container is filled with the beer to be treated, the beer being kept in motion by stirring paddles attached to the rotary cooling cylinder.—J. F. B.

#### FRENCH PATENTS.

*Barley and Other Malting Grains; [Electrical] Process for Steeping and Germinating —.* Deichmann and Co. Fr. Pat. 349,478, Dec. 12, 1904.

THE grain is exposed, during the operations of steeping and germination, to the undulatory motion of high-tension currents, at a tension exceeding 1000 volts, but not attaining the tension of Tesla currents. The undulatory motion is defined as the effect of radiations transmitted by the agency of the air. This electrical treatment is stated to increase the percentage of extract and mellow corns and to decrease the percentage of protein of the malt, at the same time increasing the yield of malt dry substance obtained.—J. F. B.

*Yeast from Dates; Manufacture of —.* L. van den Hoff. Fr. Pat. 349,844, Nov. 10, 1904.

A YEAST possessing special properties, very resistant to high temperatures, is prepared from the fruits of the date palm (*Phoenix dactylifera*). A must is prepared by steeping the dates, expressing the juice, and defecating the latter at a temperature of 105° C. This must is fermented at a temperature of 25° C. by a special yeast isolated by selection from the date fruits themselves. Fermentation lasts for six days, the temperature being reduced at the rate of 2° C. per day. The fermented juice is heated to 65° C. for three hours, cooled, bottled and pasteurised at 70° C. This liquor serves as a medium for the revivification of cultures of the special yeast isolated from the dates, which cultures are preserved in tubes in a thick sugar syrup.—J. F. B.

## XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

### (A).—FOODS.

*Butter; The Proteids of Cream, Butter and Butter in Relation to "Mottled" —.* L. L. van Slyke and E. B. Hart. J. Amer. Chem. Soc., 1903, 27, 679.

WHEN the amount of lactic acid in cream exceeds 0.1 per cent., neither calcium casein nor free casein is present but only casein lactate, the butter and butter-milk the cream also containing only casein lactate. In butter and butter-milk made from "sweet" cream, calcium casein and some free casein are found.

The light spots or streaks in butter, known as "mottles" are due, first, to the presence and uneven distribution of butter-milk adhering to the outer surface of the granules; and, secondly, to the hardening and local effect of brine upon the proteid thus retained in the butter. The light portions of mottled butter are, therefore, caused by the presence of a proteid, usually casein lactate, while the yellow or clear portions occur where the spaces between the butter granules are filled with clear brine, and contain comparatively little proteid. Several hours are required to complete the hardening action of the brine on the proteid.

Mottles in butter can be prevented by washing butter granules twice with water at a temperature 35° to 45° F., to remove the butter-milk before salting. The churning should be so managed that the butter granules are about the size of rice grains. (For nomenclature of casein compounds see this J., 1905, 27, 100.) —W. P.

*Starch coagulated by Amylocoagulase; Analogy between — and the Natural Starch of Peas.* A. Fernbach and J. Wolff. XVI., page 744.

*Milk; Detection of Formalin in —.* Utz. XXIII., page 752.

#### ENGLISH PATENTS.

*Alimentary Substances; Apparatus for Eliminating Moisture from —.* A. Witschi-Studer, Hindelshausen, Switzerland. Eng. Pat. 11,466, May 18, 1904. U.S. Pat. 800,000, May 19, 1903.

IN a chamber or oven—heated by suitable means—arranged a number of trays, one above the other. The front and back of the oven are closed by doors made of pivoted plates which can be opened or closed at will to any extent. The bottom of each tray, except the lowermost one, is made of over-lapping pivoted plates which can be opened so that the contents of the tray fall into the next lower tray. The material, such as meal, &c., is placed in the upper tray. After partial drying, it is allowed to fall to the next tray, and so on, the perfectly dry material being withdrawn from the bottom tray. As the dried material is withdrawn, the material is placed in the top tray. The trays are mounted on rollers running on ledges fixed to the sides of the chamber to facilitate moving them in and out of the latter. For drying fruit, &c., the bottoms of the trays may be formed of fine or coarse wire-netting.—W. P. S.

*Alimentary Product [Dried Yolk of Egg]; Manufacture of an —.* J. Poumay, Brussels. Eng. Pat. 6,500, March 24, 1905.

YOLKS of eggs separated from the whites are thoroughly mixed with one-third of their weight of water. The resulting emulsion is strained and evaporated under reduced pressure at a temperature of 40–50° C. to a paste. The latter is further dried over quick-lime or the like at a temperature of 25°–30° C. and ground to a fine powder.—W. P. S.

*Centrifugal [Milk] Separators; Feeding Arrangement for —.* S. C. Hauberg, Copenhagen. Eng. Pat. 19,565, Sept. 10, 1904.

To cause the milk entering the drum to impinge upon



readily separated "cream column" instead of directly at the edges of the skimming plates, the apertures of the central feed pipe are arranged at or near the middle of the interstices between the projecting edges of the tubes, and within the inner contour of the "cream column."—C. S.

## UNITED STATES PATENT.

*Cream, &c. : Process of Treating* — [Condensing]. R. Kennedy, Assignor to the American Dairy Products and Manufacturing Co., Philadelphia, Pa. U.S. Pat. 791,270, May 30, 1905.

Milk, cream, or mixtures thereof, are evaporated and dried until a large portion of the lactose and salts crystallize out. The latter are filtered off, and the resulting milk further concentrated by evaporation. (See also Pat. 787,044, 1905; this J., 1905, 510.)—W. P. S.

## 3. —SANITATION: WATER PURIFICATION.

## ENGLISH PATENTS.

*Filter and Contact-Beds for the Bacterial Treatment of* — R. Middleton, Leeds. Eng. Pat. 15,829, July 16, 1904.

Filter-beds are built up from special forms of glazed earthenware, either piled up geometrically or thrown together on the bed. The forms of earthenware particularly described are oblate spheroids, spheres, and double pyramids. Where these are built up symmetrically, some of the smaller forms may be regularly intersticed, thus forming holes for flushing purposes, which may be kept open by the insertion of wooden rods. The filter-beds may be of different sizes and shapes in the same locality.—W. P. S.

*Clarification*. E. Vial, Brussels. Eng. Pat. 14,366, June 14, 1904.

Fr. Pat. 344,174 of 1904; this J., 1904, 1109.—T. F. B.

*Apparatus for Purifying or Softening* — G. Guttmann, London. Eng. Pat. 5200, March 13, 1905.

A filter-tank, acting as a storage vessel, is surrounded by a water jacket, the latter being divided by diaphragms into compartments, one serving as a mixing tank for the water and chemical reagents, and the second as a filter-apparatus. The filtering compartment is again subdivided by diaphragms, and the various compartments are so arranged as to communicate with each other on the same level. The filtering tanks, superimposed baskets of iron or wirework are placed, and the loose filtering material is packed in such a way that it protrudes through the wide ends of the baskets. The material thus forms porous walls between adjacent baskets and between the baskets and the sides of the tank, and prevents the water from passing through the apparatus without passing through the filtering material.—B. N.

## FRENCH PATENTS.

*Recovery of Vapours produced in Certain Industries; Method of* — by Refrigeration. J. E. A. Aurenque. Fr. Pat. 349,843, Nov. 4, 1904.

In the case of vapours which are heavier than air, openings are arranged in the floor of the workshop where they are produced. The vapours pass through and are conducted into conduits placed beneath to suitable apparatus where they are cooled and condensed.—W. H. C.

*Purification of* — M. M. Neilson. Fr. Pat. 349,467, Nov. 22, 1904.

Raw sewage is led into a closed ventilated tank, where it is acted on by aerobic bacteria, cultures of the latter being added to hasten the action. The liquid is then pumped into a tank where it passes upwards through a filter. Slimes are provided at the bottom of the tanks for removing solid mineral matters.—W. P. S.

*Sewage and other Refuse: Treatment of* — J. L. F. Garrigou. Second Addition, dated Dec. 22, 1904 to Fr. Pat. 340,740, Feb. 26, 1904 (this J., 1904, 833 and 1109).

The sewage is separated into two portions—liquid and solid—as described in the original patent. The liquid portion is then heated after the addition of chalk or dolomite, the ammonia evolved being collected. The liquid is now sterilised by heat, allowed to settle, and passed through a filter-press when cold. The chalky precipitate obtained may be used as a manure, and the filtrate for irrigation purposes, &c. Powdered charcoal may be added to the filtrate in case the latter is not completely de-odorised when it leaves the filter-press. The more solid portion of the sewage is mixed with "plaster" and powdered charcoal in sufficient quantity to form a hard cake on drying at a temperature below 120° C. under pressure. Before drying, phosphates, ammonium salts, brewery wastes and the like, may be added, to increase the manurial value of the cakes.

—W. P. S.

## GERMAN PATENTS.

*Fatty Acids: Process for the Recovery of Fat from Sewage, Effluents and the like, in the Form of* — F. Kaepfel. Ger. Pat. 159,170, Jan. 20, 1903. XII., page 741.

*Water: Apparatus for the Softening of* — L. Ilwass and F. Heimberg. Ger. Pat. 159,378, Aug. 26, 1903.

The water is treated with alkalis or lime, and then flows into a chamber, wherein it is treated with an acid, e.g., oxalic acid, for the neutralisation of the last traces of lime or alkali. The water after the treatment with lime flows down through a pipe, enlarged at its lower end in the form of an inverted funnel and then rises in the chamber surrounding the pipe, the calcium carbonate being deposited on the bottom of the chamber. The addition of oxalic acid is made in a chamber made in the form of an inverted cone, which surrounds the water-inlet pipe above the funnel-shaped portion.—A. S.

## (C).—DISINFECTANTS.

*Disinfectants in the Brewery; Comparative Investigations on Certain*. H. Will, XVII., page 745.

## UNITED STATES PATENT.

*Fumigation [Disinfecting]: Process and Compound for* — H. V. Walker, Brooklyn. U.S. Pats. 790,468 and 790,469, May 23, 1905.

The process consists in adding to a solution of some gaseous disinfectant, such as formaldehyde, aluminium sulphate and a substance which will unite with water, e.g., quicklime. The "compound" claimed in the second patent is an aqueous solution of formaldehyde containing aluminium sulphate; lime is added to this in sufficient quantity to absorb all the water, thus liberating formaldehyde.—T. F. B.

## GERMAN PATENTS.

*Iodophenol-formaldehyde Compounds [Disinfectants]: Method of Preparing* — F. Henschke. Ger. Pat. 157,554, Oct. 6, 1903.

A COMPOUND of iodophenol with formaldehyde, possessing antiseptic properties, is obtained by the action of iodine in alkaline solution on the product of condensation of phenol and formaldehyde (see Fr. Pat. 345,398 of 1904; this J., 1904, 1233).—T. F. B.

*Mercury Preparations [Disinfectants] which will not Attack Metals: Process for Preparing Easily Soluble* — M. Emmel. Ger. Pat. 157,663, Oct. 31, 1903. Addition to Ger. Pat. 121,656, Nov. 22, 1898.

PREPARATIONS of mercury, of use as disinfectant coatings, and which do not attack metals, are obtained by adding to the mercury salt (e.g., the cyanide, "oxycyanide,"

or *p*-phenolsulphonate) an alkali oxide or hydroxide, instead of an alkali carbonate or bicarbonate as in the principal patent.—T. F. B.

### XIX.—PAPER, PASTEBOARD, Etc.

*Straw Cellulose: Manufacture of — by the Sulphite Process.* L. Gottstein. Z. angew. Chem. 1905, 18, 983—984.

REFERRING to the article by Dietz on the above subject (this J., 1905, 557), the author states that in 1885 he prepared large quantities of straw cellulose by the sulphite process in Sweden, in the same boilers as were employed for wood pulp. These boilers were of the rotary type, 30—40 cb. m. in capacity, lined with lead plates. Whereas with the soda process it is necessary to remove the knots of the straw before boiling, this was not so with the sulphite process, since the knots were so slightly attacked that they were easily separated when the pulp was strained. The straw cellulose thus prepared, bleached to a good white, and was employed without comment by the manufacturers of writing papers. The preliminary extraction of the silica by hydrofluoric acid, as recommended by Dietz, was not practised. In the author's opinion the necessity for such an extraction has not been fully demonstrated, but it may possibly prove to be a technical advantage.—J. F. B.

*Lignocelluloses: Methoxyl Determinations in Certain —.* A. S. Wheeler. Ber. 1905, 38, 2168—2169.

THE results of the determination of the methoxyl group in the woods of certain trees, occurring in the Southern States of North America and the West Indies, are recorded:—

Botanical Name.	Local Name.	Methyl (as CH <sub>3</sub> )
		Per cent.
<i>Diospyros Virginiana</i> , L. ....	Persimmon	1.95
<i>Magnolia tripetala</i> , L. ....	Umbrella tree	2.57
<i>Sassafras sassafras</i> (L.), Kaat. ....	Sassafras	2.44
<i>Castanea pumila</i> (L.), Mill. ....	Chinquapia	2.16
<i>Platanus occidentalis</i> , L. ....	Buttewood	2.23
<i>Hamamelis Virginiana</i> , L. ....	Witch hazel	2.67
<i>Hicoria glabra</i> (Mill.) Britton ....	Pig nut hickory	2.32
<i>Liquidambar styraciflua</i> , L. ....	Sweet gum	2.24
<i>Cornus florida</i> , L. ....	Dogwood	2.37
<i>Gleditsia triacanthos</i> , L. ....	Honey locust	2.47
<i>Ailanthus glandulosa</i> , Desf. ....	Tree of Heaven	2.52
<i>Melia Azederach</i> , L. ....	China tree	2.35
<i>Paulownia tomentosa</i> (Thunb.) ....	Paulownia	2.40
<i>Gymnanthes lucida</i> ....	Crab wood	2.95
<i>Fagara flava</i> ....	Wild lime	2.19

—J. F. B.

*Acetylcellulose.* C. Haenssermann. Chem.-Zeit., 1905, 29, 667.

ACETYLHYDROCELLULOSE was dissolved in 15 times its weight of fuming nitric acid, and the solution was allowed to remain for 14 days, at the end of which time it had become clear and less viscous. On pouring into water, a product was obtained which dried to a fine white powder soluble in acetone, ethyl acetate and amyl acetate. This product is regarded as a nitrate of hydrocellulose, derived from the acetate by the displacement of the acetyl groups and their partial substitution by nitric acid. The substance was explosive, and contained 11.5 per cent. of nitrogen. On denitration by sodium hydrosulphide the corresponding hydrocellulose was obtained as a white powder, completely soluble in cold 10 per cent. caustic soda and capable of reducing Fehling's solution.—J. F. B.

### UNITED STATES PATENTS.

*Fibres: Process of Manufacturing Viscose-coated —.* C. N. Waite, Assignor to S. W. Pettit. U.S. Pat. 791,385, May 30, 1905. V., page 727.

*Fibres: Waterproof, Viscose-coated — and Process of Manufacturing same —.* C. N. Waite, Assignor to S. W. Pettit. U.S. Pat. 791,386, May 30, 1905. V., page 727.

*Printing upon Pyroxylin Materials: Process of* R. E. Rochm. Assignor to The Whitehead and Hoe U.S. Pat. 791,503, June 6, 1905. VI., page 728.

### FRENCH PATENTS.

*Textile Fibres and Threads: Coating — with Cellulose.* J. M. de Sauverzac. Fr. Pat. 349,636, Dec. 27, 1904. V., page 727.

*Paper: Process and Apparatus for Producing coloured, Marbled, or Unequally Mixed —.* Werke vorm. Meister, Lucius und Brüning. Fr. Pat. 349,636, April 5, 1904.

SEE Eng. Pat. 6849 of 1904; this J., 1905, 248.—T.

### XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Aldehydes: Synthesis of — by means of Formic Acid.* J. Houben. Chem.-Zeit., 1905, 29, 667—668.

MAGNESIUM-ALKYL chlorides react with formic acid in ethereal solution, with the production of aldehydes. The author's experiments relate to the synthesis of phenyl aldehyde by the action of benzylmagnesium chloride and formic acid. Copper formate may be employed in place of formic acid. The yields are only small, to dibenzyl and dibenzylcarbinol having been identified amongst the by-products of the reaction.

In a similar manner *n*-propylmagnesium chloride reacts with butyric aldehyde on treatment with formic acid, low yields are ascribed to the unsuitability of ether as a solvent medium.—J. F. B.

*Alkaloids of certain Mydriatic Solanaceous Plants.* Schmidt. Arch. Pharm., 1905, 243, 303—309.

*Datura metel.*—Further experiments with this plant, cultivated at Cassel, confirm the author's previous statement that scopolamine is the only base produced. He also found that this is the case with the entire plant, the organs examined having yielded scopolamine. In an important respect, *Datura metel* differs from *D. albiflora*, flowers of which have been shown by Browne and by others to yield scopolamine, whereas the leaves and seeds, according to Shimoyama and Koshima, contain hyoscyamine and a little atropine. Hitherto the only available commercial source of scopolamine (the hyoscyamine of O. 1) has been the root of *Scopolia*, where it is accompanied by much hyoscyamine. Small quantities only of scopolamine have been isolated from *Hyoscyamus* seeds; Solanaceous plants have been stated to contain scopolamine as to be worthless as a practical source of the alkaloid. The dried leaves of *Datura metel* gave 0.55 per cent. of the seeds 0.5 per cent. of the base, which was proved to be pure *lævo*-scopolamine, and to be identical with *lævo*-hyoscyamine.

Since certain commercial specimens of scopolamine (hyoscyamine) hydrobromide, obtained from the *Scopolia* base, consisting of a mixture of *lævo*- and *dextro*-scopolamine, have been found to give rise to unpleasant secondary reactions, probably due to some undetected impurity, it is suggested that only *lævo*-scopolamine of high purity of which could be determined by its optical rotation should be employed for medicinal purposes.

*Datura arborea* yielded, in all parts, scopolamine accompanied by hyoscyamine.

*Datura quercifolia* gave from the leaves, 0.4 per cent. and from the seeds, 0.28 per cent. of total alkaloid. In quality, the mydriatic bases stand between those of *D. metel* and *D. stramonium*, consisting of about equal parts of scopolamine and hyoscyamine.

*Datura stramonium* yielded only hyoscyamine and scopolamine.

*Atropa belladonna.*—The author has examined the fruit from wild plants, and has been able to isolate hyoscyamine from both ripe and unripe fruits, and further examination of all parts of the plant he finds that hyoscyamine is the only mydriatic alkaloid present.—J. O.



me; *Action of Methyl Iodide on* — C. Mourou A. Valeur. *Comptes rend.*, 1905, **140**, 1601—1603.

Previous communication (this J., 1903, 961, 1305, 1365), authors showed that sparteine was a bitertiary base  $C_{15}H_{26}N_2$ , saturated in character, not methyl- in either amino-group, and identical with the "ro-sparteine" formerly described. They now find on boiling sparteine with excess of methyl iodide in alcoholic solution, a mixture of two iodomethyl sparteine is obtained. One of these, *a*, is relatively soluble in water, has rotatory power  $[\alpha]_D = -22.75^\circ$ , has already been described. The other, *a'*, is much less soluble in water, has not been obtained in quite a state, but has a much higher rotatory power,  $r$  than  $-36.9^\circ$ . Both have the empirical formula  $C_{15}H_{24}N_2I$ . The authors consider them to be stereoisomers. — E. F.

nes and Essential Oils, 72nd Communication.  $\beta$ -phellandrene, O. Wallach. *Annalen*, 1905, **340**, 1—16. (this J., 1904, 997.)

ating the hydrocarbon,  $\beta$ -phellandrene, with nitrous in petroleum spirit, only a small yield of the nitrite is red, some of the hydrocarbon remaining unchanged. A portion of the nitrite formed at first, is converted into  $\alpha$ - $\beta$ -phellandrene and other products. The nitrite in chloroform solution has  $[\alpha]_D = -156.8^\circ$ . If the nitro- compound (nitro- $\beta$ -phellandrene) is reduced with zinc acetic acid, dihydrocinnamic aldehyde,  $C_{10}H_{14}O$ , is obtained, boiling at  $111^\circ$ — $112^\circ$  C. at 13 mm. On oxidation with hypobromite, this passes into cuminic acid. If the  $\beta$ -phellandrene nitrite is reduced with sodium in alcohol, alcohol is produced. Amongst the basic products of reduction of the nitro-compound, are a hydro- xylamine, and cumylamine. The author proposes structural formulae for  $\beta$ -phellandrene, and its nitrite nitro-compound. If  $\beta$ -phellandrene is cautiously oxidized with permanganate, a liquid glycol is produced, boiling at  $150^\circ$  under 10 mm. pressure. On steam-distilling dilute sulphuric acid, it is converted into tetrahydro- cinnamic aldehyde,  $C_{10}H_{16}O$ . This boils between  $220^\circ$ — $230^\circ$  C.: sp. gr., 0.93;  $n_D$ , 1.4903 at  $20^\circ$ . The semi- ozonide (m. pt.  $204$ — $205^\circ$ ) and oxime (m. pt.  $87^\circ$ ) were obtained. On oxidation with silver oxide, tetrahydro- cinnamic acid,  $C_{10}H_{16}O_2$ , m. pt.  $143$ — $144^\circ$  C. is produced. The aldehyde is identical with the "phellandral" described by Schimmel and Co., occurring in the oil of *Andrium aquaticum*. (See this J., 1904, 1236.) — F. S.

lyptus Oils of New South Wales containing the Pepper- mint Ketone. Bull. of the Imp. Inst., 1905, **3**, 4—6.

Following descriptions are given of eucalyptol oils of New South Wales containing the "peppermint ketone." The leaves of *E. piperita* yielded 0.627 per cent. oil, containing phellandrene, pinene, eucalyptol and peppermint constituent. Nearly 3.4 per cent. of oil obtained from *E. amygdalina*, containing phellandrene, eucalyptol, and the peppermint ketone as chief constituents. The oil from *E. nitrea* (1.48 per cent.) contains a large amount of phellandrene, some eucalyptol, the peppermint constituent and (probably) citral. The oils from *E. ammanniana* and *E. coriacea*, consist principally of phellandrene, and the yields average 0.29 per cent., and 0.1 per cent. respectively. *E. Siberiana* yields an oil containing much phellandrene and a fairly large amount of peppermint ketone, but no eucalyptol nor eudesmol. 1 per cent. of colourless oil was obtained from *E. oreades*, consisting largely of phellandrene. *E. dives* yielded 1 per cent. of oil consisting largely of phellandrene, and possessing an odour of peppermint; eucalyptol appeared to be absent. The oil from *Radiata* is similar to the last; the yield averaged 1 per cent. *E. delegatensis* yielded 1.76 per cent. of oil consisting principally of phellandrene. The oil from *E. obliqua*, which is yellowish in tint, contains phellandrene as its chief constituent, but differs from the oil from *E. dives*, &c., in having apparently aromadendral place of the peppermint constituent. — T. F. B.

thousia Citriodora; Composition and Uses of the Volatile Oil of — from Queensland. Bull. of the Imp. Inst., 1905, **3**, 11—13.

The sample of the oil of *Buckhousia citriodora*, which had been distilled in Queensland from the native plant, consisted of a greenish-yellow, optically inactive liquid, of sp. gr. 0.8903 at  $21^\circ$  C., and refractive index of 1.494 at  $22^\circ$  C. On distillation, 100 c.c. yielded 10 c.c. (containing 1 c.c. of water) boiling between  $212^\circ$  and  $219^\circ$  C., and 80 c.c. (consisting principally of citral) boiling between  $219^\circ$  and  $231^\circ$  C. The amount of citral in the oil, as determined by the bisulphite process, was 93.5 per cent. The oil is similar to lemon-grass oil, and is valued at 7d. to 9d. per oz. in London. — T. F. B.

Mercury; Volumetric Method for the Determination of —. E. Rupp. *XXIII.*, page 752.

Formaldehyde; Gasometric Determination of —. G. B. Frankforter and R. West. *XXIII.*, page 754.

Pyridine; Purification of — [also Preparation of Ammonium Magnesium Phosphate and its Substitution Derivatives.]. L. Barthe. *III.*, page 722.

Aconitine; New Reagent for the Detection of —. E. P. Alvarez. *XXIII.*, page 752.

Cod Liver and other Fish Liver Oils; Examination of —. R. T. Thomson and H. Dunlop. *XII.*, page 741.

ERRATA.—This J., 1904, 1160, col. 1, l. 21 from top, for "Zachovers" read "Zachoder." This J., 1904, 1160, in Table, l. 35 from bottom, for "9 C." read "59 C."

#### ENGLISH PATENTS.

Barbituric Acids and Intermediate Products; Manufacture of —. F. Boehm, London. From E. Merck, Darmstadt, Germany. Eng. Pat. 14,014, June 21, 1904.

SEE Fr. Pat. 344,980 of 1904; this J., 1904, 1237. — T. F. B.

Diethylmalonylurea [Diethylbarbituric Acid]; Method of Preparing —. F. Mayer, Mainz, Germany. Eng. Pat. 2787, Feb. 10, 1905. Under Int. Conv., June 17, 1904.

DIETHYLMALONYLUREA (diethylbarbituric acid) is obtained by heating together, at about  $100^\circ$  C., equimolecular proportions of biuret and diethylmalonyl chloride; an amide of a carboxylic acid of diethylmalonylurea appears to be formed as an intermediate product. — T. F. B.

#### UNITED STATES PATENTS.

Dialkylbarbituric Acid; Process of Making —. M. Engelmann, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 789,902, May 16, 1905.

NEUTRAL carbonic esters are condensed with dialkylmalonic acid diamides by means of alkaline condensing agents (e.g., alkali alcoholates), 5-dialkyl-2,4,6-trioxy pyrimidines being produced. Thus the 5-diethyl compound may be obtained by condensing diethyl carbonate with diethylmalonic acid diamide in presence of sodium ethylate. — T. F. B.

Diethylbarbituric Acids; Process of Making —. A. Einhorn, Munich, Assignor to Farbwerke vorm. Meister, Lucius and Brünig, Höchst on the Main, Germany. U.S. Pat. 790,116, May 16, 1905.

DIALKYLTHIOBARBITURIC acids are converted into dialkylbarbituric acids by heating with mineral acids (e.g., by boiling with 33 per cent. sulphuric acid for a considerable time). — T. F. B.

C-C-Dialkylbarbituric Acids; Process of Making —. E. Preiswerk, Assignor to Soc. Chem. Industry in Basle, Basle, Switzerland. U.S. Pat. 790,263, May 16, 1905.

On condensing the alkyl esters of carbonic acid with dialkylmalonic acid diamides in presence of sodium ethylate, C-C-dialkylbarbituric acids (pyrimidines) are obtained (see also U.S. Pat. 789,902, preceding). — T. F. B.

Nicotine; Process of Obtaining —. A. Koelliker, Benel, Germany. U.S. Pat. 790,138, May 16, 1905.

NICOTINE may be obtained from "tobacco extracts

containing sulphuric acid " by neutralising with sodium hydroxide, distilling, adding sulphuric acid to the distillate, evaporating it until crystallisation commences, and then adding sodium hydroxide until the solution is just alkaline. —T. F. B.

#### FRENCH PATENTS.

*Aldehydes  $R_2CH.CHO$  and  $RR'CH.CHO$ : Process for Preparing* —. A. Behal and M. Sommelet. Addition dated April 9, 1904, to Fr. Pat. 347,399, Jan. 6, 1904.

By condensing acid amides or nitriles with halogenated ethers of the general formula  $X.CH_2OR$  (where X represents a halogen atom) in presence of magnesium (or zinc) and a zinc-copper couple, ethers of hydroxyketones are obtainable; on reduction, these compounds are converted into monoalkyl ethers of substituted glycols, viz.,  $R'.CH(OH)CH_2OR$ . These latter compounds may also be produced by the direct condensation of the above halogenated ethers with many aldehydes and ketones, in presence of magnesium and a zinc-copper couple. The glycol derivatives are converted into aldehydes by treatment with acid as described in the main patent (this J., 1905, 345). The following are among the new aldehydes obtained by this method:—Methyl-2-decanal, methyl-2-undecanal, methyl-2-dodecanal, dimethyl-2,5-hexanal, dimethyl-2,3-nonanal, dimethyl-2,4-decanal, methyl-2-dodecene-11-al. —T. F. B.

*Dialkylbarbituric Acids: Process for Making* —. Akt.-Ges. f. Anilinfabr. Fr. Pat. 349,814, April 12, 1904.

SEE Eng. Pat. 8302 of 1904: this J., 1905, 289.—T.F.B.

*Camphene: Production of* — by the use of Nicotine. Soc. Gen. pour la Fabrication des Matières Plastiques. Fr. Pat. 349,815, April 12, 1904.

The process is for the production of camphene by heating pinene hydrochloride with a little more than the theoretical amount of nicotine for several hours in an autoclave at 210° C.—F. S.

*Pinene Hydrochloride: Continuous Production of* —. Soc. Gen. pour la Fabrication des Matières Plastiques. Fr. Pat. 349,816, April 12, 1904.

A SERIES of lead chambers are connected by pipes, which can be surrounded by refrigerants. The oil of turpentine gravitates downwards, the outlets of the chambers being so arranged that the chambers are always partly filled. Hydrochloric acid gas circulates from below upwards, bubbling through the liquid in each chamber. —F. S.

*Ureas (or Pyrimidines): Process for Producing Cyclic* —. E. Merck. First, Second and Third Additions dated Nov. 8, 1904, to Fr. Pat. 349,353, Nov. 8, 1904. Under Int. Conv., Nov. 14, 1903, Jan. 28, 1904 and Jan. 28, 1904, respectively.

SEE Eng. Pats. 22,128, 22,126 and 22,127 of 1904: this J., 1905, 689.—T. F. B.

*Camphor: Process for Preparing* — from the Esters of Isoborneol. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 349,398, Dec. 8, 1904. Under Int. Conv., Dec. 21, 1903.

SEE U.S. Pat. 790,601 of 1905, preceding these.—T. F. B.

*Alcohol: Recovery of Vapours of* — either Pure or Mixed with other Gases or Volatile Solvents. Soc. J. Jean et Cie and G. Raverat. First Addition, dated Dec. 31, 1904, to Fr. Pat. 345,138, July 25, 1904.

THE process for absorbing alcoholic vapours by means of concentrated sulphuric acid (see this J., 1904, 1231) can be extended to the recovery of other bodies mixed with the alcohol, especially camphor and turpentine. These bodies are absorbed by the acid simultaneously with the alcohol and can be precipitated by diluting with water, the recovered alcohol remaining in solution. —J. F. B.

*Hydrocarbons: Process of Obtaining Sulphurised* —. Cie Morana. Fr. Pat. 349,833, Dec. 31, 1904.

SULPHURISED hydrocarbons are prepared by the action of ketones and aldehydes in the presence of metallic sulphide, or polysulphide, or ammonium sulphide or hydrosulphide. The oxygen of the ketone is replaced by sulphur and at the same time condensation with aldehyde grouping takes place with the elimination of water.—F. S.

*Castor Oil Product Miscible with Mineral Oil: Production of a* —. Soc. anon. Française Stern-Sonne pour la Fabrication des Vaseline, Huiles et Graisses Industrielles. Fr. Pat. 350,511, Jan. 3, 1905, 2 page 741.

*Dialkylmalonic Amides: Process of Producing Compounds of* —. E. Merck. Fr. Pat. 350,600, Jan. 3, 1905. Under Int. Conv., Jan. 8, 1904.

DIALKYLMALEONIC amides have hitherto been prepared by the action of ammonia on dialkylmalonyl chloride. It is now found that the cyanogen group of diacyanoacetamides, dialkylcyanacetylureas, and diacyanoacetic esters may be converted into the CO group by gently heating with fairly strong sulphuric acid or hydrochloric acid. One part of diethylexycetamide is heated with 5–10 parts of concentrated sulphuric acid (preferably diluted with a little water to 100° C. for 1 hour; the product is poured into water and the diethylmalonic amide is filtered off.—T. F.

*Methylene Salicylacetate and Process of Preparing* —. Valentiner and Schwarz. Fr. Pat. 350,623, Jan. 3, 1905.

SALICYLACETIC acid (m. pt. 135° C.) is dissolved in heating in half its weight of 40 per cent. formaldehyde solution. The solution sets on cooling to a solid which is broken up and recrystallised from water. The product consists of methylene salicylacetate  $HOOC.C_6H_4.OCH_2OCOCH_3$  of m. pt. 108° C.; it possesses the power of reducing ammoniacal silver nitrate.—T. F. B.

#### GERMAN PATENTS.

*Perfumes Having the Odour of Violets from Pseudoionones and its Derivatives: Method of Preparing* —. P. Alexander. Ger. Pat. 157,647, Feb. 9, 1902.

THE so-called pseudo compounds obtained by condensing citral or lemon-grass oil with acetone or its homologues or with acetoacetic ester or similar derivatives of acetone by means of acids or alkalis, are converted into compounds possessing the odour of violets, by heating them in water, or with some indifferent solvent, to temperatures considerably above 100° C. (e.g., 170°–190° C.).—T. F. B.

*Alkylapomorphinium Salts: Process for Producing Easily Soluble, Stable* —. R. Pschorr. Ger. Pat. 158,900, July 30, 1903.

STABLE, easily soluble alkylapomorphinium salts may be obtained either by the action of the heavy metal salts on the corresponding acid on apomorphine-iodo-alkylate, or by treating the free quaternary base with acids, or by the action of alkyl halides or alkyl esters of oxy acids on apomorphine. The chloromethylate, bromomethylate and methyl nitrate are described.—T. F. B.

### XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*Emulsions of Mercury Salts [Oxalate].* L. Castelli. Soc. Fotograf. Ital., 1905, 2. Through Phot. Arch. 1905, 42, 169–170.

STABLE mercury oxalate emulsions may be obtained by adding 200 c.c. of a hot, 1 per cent. solution of oxalic acid to a solution of 8 grms. of mercuric nitrate in 50 c.c. of water, washing the precipitate till free from acid, and incorporating it, at a temperature of about 40° C., with a solution of gelatin, 10 grms., and sodium chloride, 5 grms.



r, 50 c.c. Ammonium oxalate may be used in place of oxalic acid. Emulsions of fine grain are best obtained by using a 10 per cent. mercuric nitrate solution and a 1 per cent. oxalic acid solution, mixing them at 80° C., and adding the washed precipitate to the above gelatin solution, diluted to 350 c.c. The mixture is allowed to stand for several days, when the emulsion is passed through muslin and washed in the usual manner.—T. F. B.

*Bromide Plates and Papers; Action of Stannous Chloride on —.* R. Namias. Phot. Korr., 1905, 42, 176. (Chem.-Zeit., 1905, 29, Rep. 176.)

A solution of 1 part of stannous chloride in 200,000 of water will reduce the silver in a bromide emulsion in a few minutes, like an ordinary developer, whilst stronger solutions, allowed to act for a sufficient time, fog the plate and destroy definition like over-exposure to light. This behaviour is held to militate against the old theory, since not more than 0.1 per cent. silver bromide can be reduced to sub-bromide by any quantity of stannous chloride present. Bromide plates and papers immersed in a 3 per cent. solution of the stannous chloride and exposed to light, will furnish a direct negative which resists the action of sodium thiosulphate. It is possible to obtain direct positives with plates and papers. The resulting pictures being better than those obtained with oxalic acid, the author believes that in the latter case causes the formation of silver chloride, but that metallic silver is deposited when the stannous chloride is used.—C. S.

*Plates; Sensitising Properties of some New —.* Kieser. Z. wissen. Phot. Through Phot. Mitt., 1905, 42, 188—190.

Series of dyestuffs obtained by König by treating with amines the reaction products of pyridine and silver halides were examined as to their colour sensitising properties. The best concentration for the solutions found in all cases to be about 1 in 25,000. Most dyestuffs caused considerable increase of sensitiveness towards the blue end of the spectrum; the sensitising effect of each was found to be destroyed by addition of quantities of ammonia. The dyestuff from bromopyridine and *p*-phenetidine exhibited the best sensitising properties, the sensitiveness having "maxima" at about 570, 630, and 700. It is considered equal in sensitiveness to the isocyanine class of dyestuff. The dyestuffs from bromopyridine and  $\beta$ -naphthylamine, and from bromopyridine and *o*-anisidine, showed a maximum at wave 600; the sensitiveness towards the red end of the spectrum was fairly well marked. The other dyestuffs showed a most increase in sensitiveness to blue rays, with decrease of red sensitiveness.—T. F. B.

*Plates; Coloured —.* G. Lippmann. Comptes Rend., 1905, 140, 1508—1509.

Plates taken by the author's method on a sensitive emulsion, developed by a mirror of mercury show colours whatever the nature of the film. If the film be cellulose acetate sensitised by bichromate, the image can be developed by washing with water; but the colours, which come out during the washing, disappear when the film dries, and they are brought back at will by again wetting the film. If the film be wetted with a solution of potassium iodide, the colours remain after the solution has dried, and they are then very feeble; but if the film be developed with 20 per cent. silver nitrate solution, the colours reappear in a particularly brilliant form, and the film can now be washed and dried without any fading of the colours. No doubt the uneven distribution in the film of silver iodide is the cause of this; the colours seen in the film are now changed into the complementary colours seen by reflexion. If a similar treatment could be applied to gelatin-bromide films, coloured prints could then be produced from negatives in an ordinary photographic frame. (See also this J., 1891, 483; 1893, 464; 1895, 400; 1900, 273; 1901, 1238.)—J. T. D.

## ENGLISH PATENTS.

*Chromic-Gelatin Processes in Photography; Impts. in —.* L. Strasser, Charlottenburg, Germany. Eng. Pat. 17,192, Aug. 5, 1904.

PAPER, coated with gelatin hardened by alum, and containing some substance which is visibly reduced by light (e.g., iron ammonium citrate), is exposed under a negative until the detail is just visible in the light parts of the print. A paper coated with bichromated, pigmented gelatin is then pressed on the above print, and the paper is developed in hot water as in the usual pigment process. After a short time the pigment paper can be removed from the original paper, leaving the coloured image on the latter; this may now be transferred to glass, wood, &c. In a modification of the above method, the sensitive salt may be applied to a temporary support coated with dextrin or similar substance; in this case the print will finally be obtained on the pigment paper, whence it may be transferred to its permanent support. The image may be strengthened by impregnating with the bichromated pigmented gelatin such substances as sodium acetate or potassium thiocyanate.—T. F. B.

*Reducing Agents or Compositions for use in Photography.* H. E. Smith, London. Eng. Pat. 6276, March 24, 1905.

COBALTAMINES or double salts of cobalt nitrite with alkali nitrites are employed in sulphuric acid solution for reducing the density of the photographic image; the action of these compounds is said to be selective to the required degree. For further details, see this J., 1905, 635.

—T. F. B.

## FRENCH PATENT.

*Photographic Paper.* E. C. Morgan. Fr. Pat. 349,731, Dec. 30, 1904. Under Int. Conv., Dec. 2, 1904.

SEE Eng. Pat. 26,247 of 1904; this J., 1905, 152.—T.F.B.

## XXII.—EXPLOSIVES, MATCHES, Etc.

*Explosion of Dynamite; Effects of the Explosion of — at a Distance.* L. Thomas. La Nature, Paris, 1904, 180—181. Proc. Inst. Civil Eng., 1905, 159, 53—54.

FROM the results of experimental explosions of large charges of dynamite in the open air, it is concluded that no dangerous and destructive effects are produced beyond a radius varying from 328 to 1640 ft., according to the weight of the charge. In the experiments, the dynamite was enclosed in packing cases, each holding 55 lb. of the explosive, and charges of 55, 110, 551 and 2204 lb. respectively were exploded. The direct destructive effects of the different charges were limited to distances of 57.4, 131.2, 180.4 and 410.1 ft. respectively; beyond these limits were small neutral zones, and beyond the latter, zones in which the effects of the counter-shocks only were manifested. The results indicate that the distance within which the destructive action of the explosion is felt, increases in proportion to the square root of the weight of the charge.—A. S.

*Acetylcellulose.* C. Haussermann. XIX., page 748.

## UNITED STATES PATENTS.

*Explosive Powder; Apparatus for the Manufacture of Strips of —.* F. J. du Pont, Wilmington, Del. U.S. Pat. 790,918, May 30, 1905.

THE paste is placed in a cylinder and is forced by a plunger through a nozzle which feeds it between two rollers travelling at the same rate of speed and from which it issues as a sheet.—G. W. McD.

*Explosive Composition.* A. Frank, Charlottenburg, Germany. U.S. Pats. 792,511 and 792,512, June 13, 1905.

SEE Eng. Pat. 27,515 of 1903; this J., 1905, 44.—T.F.B.

## FRENCH PATENTS.

*Explosives; Impts. relating to* —, C. Girard.  
Fr. Pat., 349,635, April 5, 1904.

FOR the purpose of obtaining increased safety in manufacture and dispensing with the use of oil, advantage is taken of the lowering of the melting point of molecular mixtures of azo and nitro bodies of the aromatic series to produce, in conjunction with oxidising bodies, a series of explosives. If azobenzene (m.pt. 66.5° C.) is added to dinitrotoluene (m.pt. 71° C.), the mixture has a melting point of only 34.5° C. The following are given as examples:—Potassium chlorate (72 parts), azobenzene and dinitrotoluene (28 parts). Ammonium nitrate (63 parts), azobenzene and dinitrotoluene (37 parts). Potassium chlorate (65 parts), azobenzene and picric acid (35 parts). By the addition of similar mixtures to nitroglycerin explosives they can be worked up at lower temperatures and are less susceptible to freezing at low temperatures. A molecular mixture of trinitro-cresol and picric acid, melting at 70° C., can advantageously be used for filling shells.—G. W. McD.

*Self-Combustible Compound and its Applications.* H. Maxim. Fr. Pat. 349,604, Dec. 27, 1904.

SEE Eng. Pat. 28,376 of 1904; this J., 1905, 457.—T.F.B.

## XXIII.—ANALYTICAL CHEMISTRY.

## APPARATUS, Etc.

## FRENCH PATENT.

*Carbon Monoxide; Apparatus for the Detection and Determination of* —, A. Lévy and A. Pecoul. Fr. Pat. 349,714, Dec. 29, 1904.

THE process depends upon the liberation of iodine from iodic acid by carbon monoxide, and the absorption of the iodine in a solvent with which it forms a coloured solution. The gas containing the carbon monoxide is led first through a filter of glass wool and then through a heated U-tube containing pure iodic anhydride. The iodine set free is carried forward by the gas and is led through an absorption-tube containing some chloroform, carbon bisulphide or other suitable liquid, covered with a column of distilled water, about 8 cm. high, to prevent evaporation. The chloroform or carbon bisulphide acquires a depth of tint proportional to the amount of iodine set free by the carbon monoxide, and the amount of the latter can be readily determined by comparing the colour with that of a standard solution.—A. S.

## INORGANIC—QUANTITATIVE.

*Gold; Quantitative Separation of* — from other Metals by Salts of Hydrazine and Hydroxylamine. P. Jannasch and O. von Mayer. Ber. 1905, 38, 2129—2130. (See this J., 1904, 685, 729, 760.)

GOLD is precipitated quantitatively from neutral, acid or alkaline solutions by hydrazine hydrochloride; the precipitation takes place at the ordinary temperature, and the precipitate is usually reddish-brown. Hydroxylamine may be used instead of hydrazine; the precipitation is in this case carried out in a solution of hydrochloric acid and is only complete after long heating on the water-bath. By using hydrazine or hydroxylamine, gold may be separated from potassium, sodium, barium, strontium, calcium, magnesium, aluminium, chromium, zinc, manganese, iron, uranium, nickel, cobalt, cadmium, mercury, lead and copper.—C. E. F.

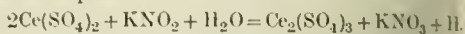
*Metals of the Platinum Group; Action of Hydrazine and Hydroxylamine Salts on* —, and the Quantitative Separation of these Metals from Gold. P. Jannasch and O. von Mayer. Ber. 1905, 38, 2130—2131. (See preceding abstract).

PLATINUM is not precipitated from its solutions by hydroxylamine hydrochloride, and can be separated from gold, which, in solution of hydrochloric acid is

precipitated. Platinum is precipitated when worked with hydrazine hydrochloride and sodium hydroxide. Palladium is similar to platinum in these reactions. Iridium, rhodium, osmium and ruthenium are separated from gold by hydroxylamine hydrochloride, which does not give any precipitate. Hydrazine hydrochloride precipitates rhodium completely, but not iridium, osmium and ruthenium.—C. E. F.

*Nitrous Acid; Volumetric Determination of* — Tetravalent Cerium Salts. G. Barbieri. Chem. 1905, 29, 668—669.

THE orange-yellow solutions of ceric salts are decolourised by alkali nitrites without evolution of gas, according to the equation:



The reaction is quantitative and takes place rapidly at the ordinary temperature. The best results are obtained by oxidising the nitrites with excess of ceric salt and by determining the excess of the latter by potassium iodide and titrating the iodine liberated. The presence of nitrates and of salts of earths other than ceria has no influence on the results.—J. F.

*Hydrogen Peroxide; Determination of* — in the Presence of Potassium Persulphate. J. A. N. Friend. Soc. Proc., 1905, 21, 185.

THE author has previously shown (Chem. Soc. Trans. 1904, 85, 597) that hydrogen peroxide cannot be accurately determined in the presence of potassium persulphate by titration with permanganate in the ordinary way; however, a slight excess of permanganate is rapidly reduced to the mixture of hydrogen peroxide and potassium persulphate, and the excess determined iodometrically with thiosulphate, very accurate results can be obtained in the presence of not more than 0.08 grm. of potassium persulphate. (Compare also this J. 1905, 561.)

*Mercury; Volumetric Method for the Determination of* —, E. Rupp. Arch. Pharm. 1905, 243, 300.

THE following method is specially suitable for the determination of mercuric chloride in pharmaceutical and surgical preparations.

Ten c.c. of N/1 sodium hydroxide solution are mixed with about 5 c.c. of formaldehyde solution, approximately 35 per cent. in strength, the mercuric chloride solution to be determined is added, and the mixture is allowed to warm for 10 to 15 minutes on the water-bath. After cooling, it is acidified with excess of acetic acid, a known volume, in excess, of N/10 iodine solution is run in, the flask stoppered, and well rotated for 5 minutes, so as to bring the precipitated mercuric iodide into intimate contact with the iodine solution. When the combination is complete, the excess of iodine is titrated in the usual manner, with thiosulphate solution.—J. F.

## ORGANIC—QUALITATIVE.

*Aconitine; New Reagent for the Detection of* —, Alvarez. Comptes rend. 1905, 140, 1540—1541.

THE substance (0.5 to 2.0 mgrms.) is placed in a porcelain crucible, 5—10 drops of bromine are added, and the mixture is gently warmed. Then 1—2 c.c. of nitric acid are added, and the whole is evaporated to dryness on the water-bath, adding a drop of bromine now and then as the liquid becomes decolorised. The residue 0.5—1 c.c. of a saturated alcoholic solution of potassium hydroxide is added, and the whole is evaporated to dryness, giving a red or brown residue if aconitine be present. After cooling, 5 or 6 drops of a 1 per cent. aqueous solution of copper sulphate are added, the residue is well moistened with it, when an intense green colour is struck.—J. T. D.

*Milk; Detection of Formalin in* —, Utz. Chem. 1905, 29, 669.

THE author has established that the addition of formaldehyde to milk vitiates the tests used to distinguish between raw and boiled milk only when the prop-



aldehyde is considerably in excess of that employed for derivative purposes.

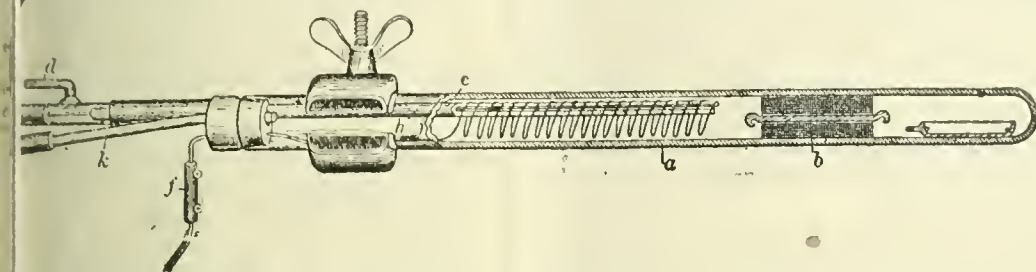
A reagent is proposed for the detection of formaldehyde in milk; this is the same as that used by Winkel as ferments, viz.: vanillin and hydrochloric acid. Equal parts of milk and hydrochloric acid, sp. gr. 1.18, warmed with a few crystals of vanillin, a fine or raspberry-red coloration is developed. If, however, a mere trace of formaldehyde be present, the coloration becomes yellow.

It is stated to be a most distinct and delicate test; colorations can be obtained by means of piperonal roxybenzaldehyde, but the vanillin test is the best. The colorations are not applicable for the detection of aldehyde in liquids other than milk.—J. F. B.

#### ORGANIC—QUANTITATIVE.

*Analysis of Organic Compounds; Electrical Method* ——. H. N. Morse and L. S. Taylor. *Amer. J.* 1905, **33**, 591–603.

The apparatus is represented in the adjoining figure. The



ion tube, which is closed at one end, has a length of 15 mm., and an internal diameter of 15 mm. At the other end is a rubber stopper, and through this pass: a glass tube *c*, 250 mm. long and 6 mm. in diameter; a glass tube *k* through which the products of combustion pass to the absorption apparatus; (3) a stout platinum wire (No. 18, B & S gauge), which extends from

the porcelain tube *c* is joined outside the combustion chamber by means of rubber tubing to a branched glass tube. One branch *d* of the oxygen or air for the combustion and through *g* a piece of stout platinum wire passes ends to *h*. A thinner platinum wire (No. 29, 1.75 m. and weighing about 2.5 grms., is joined to the other platinum wire at *j*; it passes through the tube and returns on the outside of this as a coil.

A roll of copper wire gauze 60 mm. long, and the tube placed next the closed end as shown. During a combustion, the boat with substance is placed in the tube, and the absorption apparatus fixed on. The current of oxygen is admitted, and the electric current through the platinum coil is closed. The current is first, but is gradually increased until the coil is heated to red heat; *b* is then heated by a gas flame, and the substance also. One half of the copper wire is kept oxidized throughout the combustion. The substance is driven out by air after the combustion is complete, and the electric current is gradually decreased. The apparatus occupied in carrying out the combustion need not be occupied for half an hour. When nitrogen or halogens are present, a roll of copper gauze or silver foil is introduced next to the oxidized copper spiral.

The advantages claimed for this method over the ordinary method are the following: (1) the small dimensions of the apparatus, (2) less waste of heat energy, (3) short time occupied by the combustion.—C. E. F.

*Volumetric Determination of Reducing* ——. Ling and T. Rendle. *Analyst*, 1905, **30**, 182–188.

The authors recommend a new indicator—ferrous thiocyanate—which they have employed with great success for the determination of the end-point of the titration of

Fehling's solution with solutions of reducing sugars. This indicator is prepared in the most sensitive form in the following manner:—1 gm. of ferrous ammonium sulphate and 1 gm. of ammonium thiocyanate are dissolved in 10 c.c. of water at a temperature of 45°–50° C., and the solution is immediately cooled; \*5 c.c. of concentrated hydrochloric acid are added, and the slight reddish colour due to the presence of ferric salts is discharged by the addition of a trace of zinc dust; the indicator becomes red after a few hours by absorption of air; it can be decolorised again by more zinc dust, but its delicacy becomes impaired after it has been decolorised several times.

For the determination of sugars the authors prefer to use the Fehling's solution in the undiluted form. Ten c.c. of freshly-mixed Fehling's solution are raised to the boiling point in a flask and the sugar solution, the concentration of which should be so adjusted that 20–30 c.c. correspond to 10 c.c. of Fehling's, is run into the boiling liquid in small amounts, the mixture being boiled after each addition. Towards the end of the titration, drops of the liquid are withdrawn by means of a glass rod and rapidly brought in

contact with drops of the indicator previously "spotted" on a porcelain tile; when all the cupric salt is reduced, the mixture of the two drops ceases to produce a red stain. This method has the advantage of obviating the necessity of filtration, but the titration and the "spot" tests must be made very rapidly in order to avoid oxidation.

It is claimed that by this method more accurate results are obtainable with commercial sugars than by the gravimetric method.—J. F. B.

*Sugar; Determination of* ——. with Fehling's Solution. F. P. Lavalle. *Ber.*, 1905, **38**, 2170.

In the volumetric determination of reducing sugars with Fehling's solution, the author recommends the addition of an excess of caustic alkali to the latter to prevent the precipitation of the cuprous oxide. By this means, a completely colourless solution is obtained when the titration is completed, and the end point is rendered much more distinct. The actual details are as follows:—Ten c.c. of ordinary Fehling's solution, 30 c.c. of sodium hydroxide solution (1:3) and 50 c.c. of water are mixed, boiled, and titrated as usual with the sugar solution. The titration is finished when the last drop of sugar solution added causes the faint blue coloration of the Fehling's solution to disappear. The method is stated to be quick and accurate.—W. P. S.

*Spirits; Determination of Higher Alcohols in* ——. I. P. Schidrowitz and F. Kaye. *Analyst*, 1905, **30**, 190–194.

The paper deals with the Beckmann nitrite method of determining higher alcohols (this *J.*, 1900, 383; 1902, 193). Working according to Beckmann's directions upon a selected alcohol, the authors obtained an obviously impossible result corresponding to 0.8 per cent. of amyl alcohol. This error was recognised as being due to the extraction of a portion of the ethyl alcohol by the carbon tetrachloride. By making the conditions of extraction identical with those of the Allen-Marquardt method, i.e., extracting a mixture of alcohol and brine of a sp. gr. of 1.10 with carbon tetrachloride, the authors succeeded in

\* In the original paper "50 c.c." should read "5 c.c."

reducing the error, so that the apparent proportion of amyl alcohol was 0.7 grm. per litre; but a simultaneous determination by the Allen method gave a result of only 0.12 grm. per litre. Hence it is concluded that, owing to the extraction of some of the ethyl alcohol and to its determination as apparent amyl alcohol in the form of nitrite, the Beckmann method in its present condition is unworkable.—J. F. B.

*Formaldehyde; Gasometric Determination of* — G. B. Frankforter and R. West. *J. Amer. Chem. Soc.*, 1905, 27, 714—719.

The following method of carrying out the determination of formaldehyde by Blank and Finkenbeiner's process (this *J.*, 1899, 79) is described. A Scheibler-Finkner calcimeter, with a graduated tube of 300 c.c. capacity, was employed. One c.c. of the formaldehyde solution of known specific gravity was placed in the side tube of the generator, 10 c.c. of hydrogen peroxide and 20 c.c. of N/1 potassium hydroxide solution being placed in the body of the generator. After bringing the water in the measuring tube to the zero mark and allowing the temperature to become constant, the solutions were gradually mixed. The volume of the liberated hydrogen was read off when the temperature of the generator vessel had again become constant. The results obtained agreed well with those yielded by other methods. Satisfactory results were also obtained by substituting freshly-prepared sodium peroxide solution for the hydrogen peroxide. The presence of a little alcohol in the formaldehyde solution tends to give low results unless larger quantities of hydrogen peroxide and potassium hydroxide be used. It is shown that the evolved gas consists of pure hydrogen. —W. P. S.

*Pyridine; Purification of* — [also, *Determination of Ammonia in* —]. L. Barthe. *III.*, page 722.

*Acetyl-methylcarbinol; Presence [and Determination] of* — in certain Commercial Vinegars. Pastureau. *XVII.*, page 745.

#### XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Radium; Production of* — from Uranium. F. Soddy. *Phil. Mag.*, 1905, 9, 768—779.

EXPERIMENTS were made with a solution of 1 kilo. of uranium nitrate, from which radium had been practically completely removed by repeated precipitation of small quantities of barium sulphate in the solution. The solution was kept in a closed bottle, and observations were made over a period of about eighteen months. It was found that the uranium, under these conditions, gradually developed the power of producing an emanation identical in properties with that obtained from radium, and the author states that there can be no doubt that the emanation results from radium produced from the uranium. The quantity of radium produced was very minute, being equivalent to about 1 atom per  $3 \times 10^{11}$  atoms of uranium. —A. S.

*Mineral Springs; Radioactivity of Bohemian* —. H. Mache and S. Meyer. *Monatsh. f. Chem.*, 1905, 26, 595—625.

The authors made a detailed examination of the various springs in the Karlsbad, Marienbad, Teplitz-Schönan-Dux, and Franzensbad groups, and also waters from the mines at St. Joachimsthal. The results were as follows:—1. The amount of emanation in a given locality varies enormously from spring to spring; the comparative figures vary at Karlsbad from 38.4 to 0.99, at Marienbad from 6.78 to 0.66, at Teplitz-Schönan-Dux from 8.73 to 3.13, and at Franzensbad from 0.96 to 0.13. At Karlsbad, the "Eisenquellen," which are cold springs in a hot spring district, show more emanation than the surrounding hot springs. 2. In the case of the St. Joachimsthal waters the quantity of emanation increases with the depth from which the water is taken; the deepest of these shows the highest content yet found in a spring ( $6 \times 10^3 = 185$  electrostatic units). 3. The gas evolved from those springs

which contain it in small quantity has a higher coefficient of emanation than the water; but in the case of springs rich in gas this is not the case. The authors conclude that the gas derives its emanation from the water, and that in the very gaseous waters equilibrium in this respect is not reached when the gas escapes. 4. The diminution of amount of emanation follows an exponential law, with constants practically identical to those of the radium-emanation. This, and the behaviour of the induced radioactivity leaves no doubt that the emanation is identical with that of radium.—J. T. D.

#### New Books.

*Forty-First Annual Report on Alkali, &c.* BY THE CHIEF INSPECTOR. Proceedings during year 1904. Presented to the Local Government and to the Secretary for Scotland. Eyre and Spence, East Harding Street, Fetter Lane, E.C. 1905. Wyman and Sons, Ltd., Fetter Lane, E.C., and 32, Abingdon Street, Westminster, Oliver and Boyd, Edinburgh; E. Ponsonby Grafton Street, Dublin. Price 8d. (See page 722.)

*Report on the Manufacture of Paints and Colours Containing Lead, as Affecting the Health of Operatives Employed.* By T. M. Legge, H.M. Medical Inspector of Factories. Darling Street, S.W., 34—40, Bacon Street, E.; Wyman and Sons, Ltd., Fetter Lane, E.C., and 32, Abingdon Street, Westminster, S.W.; Oliver and Boyd, Edinburgh; E. Ponsonby, 116, Grafton Street, Dublin. Price, 11½d. (See page 742.)

*Mines and Quarries; General Report and Statistics for 1904. Part I. District Statistics.* [Vol. 1.] Wyman and Sons, Ltd., Fetter Lane, E.C. Price 1s. 7d.

This report, just issued by the Home Office, contains 48 pages of statistics of the persons employed, and accidents at mines and quarries in the United Kingdom in 1904, arranged according to the Inspection Districts to which are added "Comparative Tables" showing the number of persons employed, output and accidents in mines for each year from 1873 to 1904.

*Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions. 1904. Vol. I. [Vol. 2497.]* Price 7s. 7d.

This is the first volume of the statement of the trade of the United Kingdom for the year 1904, and contains abstract tables showing the total imports and exports of every article which is separately enumerated in the official classification, as well as detailed tables showing the quantity and value of the imports and exports of each article from and to each country; and are given in each case not only for the year 1904, but for each of the four preceding years. A new feature in the present issue of this return is an introductory statement explaining the bases on which the tables are compiled, and giving an outline of their scope and arrangement.

Several alterations have been made in the classification of imports and exports; amongst the more important of these it may be noted that in the import table headings for "chemical products," "musical instruments," "seed oil," "chinaware or porcelain and earthenware," "hardware," "iron and steel," have been divided in greater detail than was formerly the case. The statements of the exports of the following classes of goods are also shown in greater detail, viz., coal,



oil-seed cake, chemicals, chinaware or porcelain thenware, hollow-ware and musical instruments. urns of the shipments of certain classes of iron goods and of wool have been re-classified. ne II. of this statement will include tables of and exports of the United Kingdom, arranged he countries from and to which they were shipped, as the imports and exports at each port, &c.

ORE DEPOSITS IN FOREIGN COUNTRIES. Reports. [Cl. 2553.] Price, 2s. 4d.

turn has been prepared in the Commercial Intelligence Branch of the Board of Trade; it contains a digest of information which has been received from H.M. Representatives in foreign countries as the result of inquiries made by the Board of Trade, through the Foreign Office at the suggestion of the British Iron Trade Association. The data comprise particulars as to the geographical position and extent of iron ore deposits in various countries, the means of transport, cost of labour, analyses, &c., together with other particulars likely to be of interest to those interested in the iron trade in this country. A number of samples, maps and miscellaneous reports forwarded by H.M. Representatives in illustration of their reports may be seen at the office of the Commercial Intelligence Branch.

ANNUAL REPORT OF THE CHIEF INSPECTOR OF FACTORIES AND WORKSHOPS FOR THE YEAR 1904. Part I. Reports. Presented to both Houses of Parliament by Command of His Majesty.] Darling and Son, Ltd., 34—40, Abchurch Lane, London, E.; Wyman and Sons, Ltd., 15, Abchurch Lane, E.C., and 32, Abingdon Street, Westminster, S.W.; Oliver and Boyd, Edinburgh; E. Sonby, 116, Grafton Street, Dublin. 1905. Price 3s.

TO THE CLASSIFICATIONS OF THE PATENT SPECIFICATIONS OF FRANCE, GERMANY, AUSTRIA, NORWAY, SWEDEN, AND SWITZERLAND IN THE LIBRARY OF THE PATENT OFFICE. Second Edition. [Patent Office Library Series, No. 1.] Darling and Son, Ltd., 34—40, Abchurch Lane, London, E.; Patent Office, 25, Southampton Buildings, Chancery Lane, London, W.C. 1905. Price, 6d.

present handbook is an enlarged edition of the French Nos. 1 (Key to the Classifications of the French Patent Specifications) and No. 5 (Key to the Classification of Patent Specifications of Germany, Austria, Denmark, and Norway) of the Patent Office Library Series.

DELLA SOSTANZE COLORANTI. TEORIA ED APPLICAZIONE ALLA TINTURA DELLE FIBRE TESSILI. ARTURO PELLIZZA. Ulrico Hoepli. Editore Librai a Real Casa. Milan. 1905. Price L.5.50.

volume, pocket book size, containing 472 pages of subject matter, and alphabetical index of subjects. In treatment of the subject, that of the dyestuffs first, and finally that of the textile fibres. A. Mineral coloring matters. B. Organic coloring matters. C. Nitrophenolic dyestuffs. II. Quinone-oxime (Nitroso) Group. III. Azoxy-group. IV. Azo-group. V. Hydrazo Group and Derivatives. VI. Thio-azo Group. VII. Imino Group. VIII. Triphenylmethane dyestuffs. IX. Quinonoid Group. X. Unclassified Group: unknown constitution, &c., as Murexide, Canarin, &c. Continuation of X. Then follow Kostanecki's classification, and a Scheme for the Qualitative Identification of Organic Dyestuffs.

NOUVEAUTES CHIMIQUES POUR 1905. Nouveaux produits de Laboratoires. Méthodes Nouvelles de recherches Appliquées à la Science et à l'Industrie. MILLE POULENC, D.és Sc. J. B. Baillière et Fils, 19, rue Hautefeuille. Paris. 1905. Price, Fr.4.

volume, containing 326 pages of subject matter, 150 illustrations, and an alphabetical index of subjects.

The contents are classified as follows: I. General applications of Physics and Chemistry. II. Various items of Laboratory Apparatus. III. Electricity. IV. Chemical Analysis. V. Bacteriology.

SPECTROSCOPY. By E. C. C. BALY, F.R.C.S., Lecturer on Spectroscopy and Assist.-Prof. of Chemistry, University College, London. Longmans, Green and Co., 39, Paternoster Row, London. 1905. Price, 10s. 6d. New York and Bombay.

8vo volume, containing 550 pages of subject matter, with 158 illustrations in the text, and four large plates at the end, and also an Appendix. The volume terminates with an alphabetical Index of subjects and authors. The subjects treated of may be classified as follows:—I. and II. Historical. III. The Slit, Prisms, and Lenses. IV. The Complete Prism Spectroscope. V. Prism Spectroscope in Practice. VI. The Diffraction Grating. VII. The Ruled Grating in Practice. VIII. The Infra-red and Ultra-violet Regions. IX. The Application of Interference Methods to Spectroscopy. X. Efficiency of the Spectroscope. XI. The Photography of the Spectrum. XII. The Production of Spectra. XIII. Nature of Spectra. XIV. The Zeeman Effect. XV. Series of Lines in Spectra. XVI. Change of Wavelength. XVII. Rowland's Grating Ruling Engines. APPENDIX. Recipes for Solutions for Silvering Glass Mirrors.

THE SYNTHETIC DYESTUFFS AND THE INTERMEDIATE PRODUCTS FROM WHICH THEY ARE DERIVED. By J. C. CAIN, D.Sc., and J. F. THORPE, Ph.D., Lecturer on Colouring Matters in the Victoria University of Manchester. Chas. Griffin and Co., Ltd., Exeter Street, Strand, London, W.C. 1905. Price, 16s. nett.

LARGE 8vo volume containing 361 pages of subject matter, 17 additional pages of Tables of Synthetic Dyestuffs, 12 additional pages of Tables of Atomic Weights, Specific Gravities and Strengths of Acids, Alkali Hydroxides, Tannic Acid, and various Saline Solutions, &c. List of Errata and Addenda, and the Alphabetical Index of subjects. There are 13 illustrations.

The Work consists of three parts. I. *Theoretical*. Description of the Intermediate Products and Dyestuffs. II. *Practical*. Methods of Preparation of the more Important Intermediate Products and Dyestuffs, on the Laboratory Scale. III. *Analytical*. The Analysis and Identification of Intermediate Products and Dyestuffs, together with Methods for Detecting Dyestuffs on the Fibre.

I. (i) Coal Tar: Its Occurrence and Purification. (ii) Nitration (iii) Sulphonation. (iv) Amino Compounds. (v) Hydroxyl Compounds. (vi) Carboxyl Compounds and Aldehydes. (vii) Application of the Dyestuffs. (viii) Classification. (ix) Nitroso-Dyestuffs (Quinone-oximes). (x) Nitro-dyestuffs. (xi) Azo-Dyestuffs. (xii) Hydrazone-Dyestuffs. (xiii) Auramine. (xiv) Triphenylmethane Dyestuffs. (xv) Pyronine Dyestuffs. (xvi) Acridine Dyestuffs. (xvii) Oxyketone Dyestuffs. (xviii) Diphenylamine Dyestuffs. (xix) Quinoxaline Dyestuffs. (xx) Thiazol Dyestuffs. (xxi) Quinoline Dyestuffs. (xxii) Indigo. (xxiii) Sulphur or Sulphide Colours. (xxiv) Xanthone Dyestuffs. (xxv) Short History of the Synthetic Colouring Matters. II. *Practical*. (xxvi) The Technical Laboratory. (xxvii) and (xxviii) Preparation of Intermediate Products. (xxix) Preparation of Dyestuffs, &c. III. *Analytical*. (xxx) Intermediate Products. (xxxi) Application of the Colouring Matters. (xxxii) Valuation of a Colouring Matter. (xxxiii) Quantitative and Qualitative Analysis of Dyestuffs. (xxxiv) Investigation of Dyestuffs on the Fibre.

## Trade Report.

### I.—GENERAL.

#### AUSTRIA-HUNGARY: TRADE OF—

For Off. Ann. Series, No. 3399.

The following return shows the value of certain articles of import during the years 1903-04:—

Articles.	Value.	
	1903.	1904.
	£	£
Hides and skins, raw . . . . .	2,074,000	2,645,000
Coal . . . . .	3,620,000	3,729,000
Metals . . . . .	2,362,000	2,733,000
Hogs' grease . . . . .	91,000	250,000
Paper and paper goods . . . . .	1,200,000	1,350,000
Chemical products . . . . .	1,460,000	1,720,000

Copper and zinc are chiefly responsible for the increased importation of metals. Paper (chiefly fine German stationery) and chemical products (especially colours), all showed increased importation in 1904.

The subjoined return shows the value of some articles of export during the years 1903-04:—

Articles.	Value.	
	1903.	1904.
	£	£
Hides and skins, raw . . . . .	1,966,000	2,012,000
Brown coal . . . . .	2,799,000	2,570,000
Paper and paper goods . . . . .	1,458,000	1,466,000
Leather goods . . . . .	2,250,000	1,980,000
Mineral oil . . . . .	380,000	560,000
Chemical products . . . . .	995,000	987,000
Ironware . . . . .	1,410,000	1,930,000
Metals and metalware . . . . .	958,000	1,000,000
Glassware . . . . .	2,254,000	2,379,000
Earthenware and pottery . . . . .	929,000	1,029,000

The decreased exportation of coal—to Germany—is accounted for by the interruption during the drought of the navigation of the Elbe.

The export of sugar, which reached its zenith in 1903 with about 710,000 tons, fell in 1904 to 510,000 tons, the decrease being principally in raw and refined sugar to the United Kingdom and raw sugar to America. The rise in price, however, partially covered the loss to the Monarchy.

The leather industry has also suffered, the export of gloves having decreased 187,000*l.* and that of shoes 66,000*l.*

The exports of petroleum and glass have increased.

#### NORWAY: CUSTOMS TARIFF OF —.

A reprint of the new Customs Tariff of Norway, embodying the proposals of the Customs Committee, which have been provisionally put into force, can be found in the issues of the *Board of Trade Journal* for May 25th to June 22nd, inclusive (pages 355–360, 407–412, 455–457, 499–501, and 547–550). The above copies

of the *Board of Trade Journal* may be obtained of Messrs. Wyman and Sons, Fetter Lane, E.C., price 1*s.* each.

### II.—FUEL, GAS, AND LIGHT.

#### NATURAL GAS AT YAMACHICHE, QUEBEC.

U.S. Cons. Rep. No. 2284, June 15, 1905.

The discovery is reported of a remarkable gas well at Yamachiche. Two companies are at work boring. The work of one of them has been stopped by a 100 ft. gas, salt water, sand and rock that is beyond control. The flow started when the drill had been driven about 280 ft., and was so strong that it forced derrieks, and trappings out of the well and threw a 200 ft into the air. The flow was preceded by an explosion that shook the ground for a great distance. Work on this well is stopped temporarily. Natural gas is already used for fuel at St. Genevieve, in this district.

### IV.—COLOURING MATTERS, Etc.

#### INDIGO IN JAVA.

For. Off. Ann. Series, No. 3403.

In view of the difficulties experienced during the few years in finding markets for Java indigo, it is feared that the acreage under cultivation will have largely curtailed.

Exports during the past five years have been as follows:—

Year.	Quantity.
	Lb.
1900 . . . . .	1,537,000
1901 . . . . .	1,411,000
1902 . . . . .	1,128,000
1903 . . . . .	1,297,000
1904 . . . . .	1,070,000

### IX.—BUILDING MATERIALS, Etc.

#### MAGNESITE BRICKS; U.S. CUSTOMS DECISION.

June 7, 1905.

Bricks made of magnesite obtained from magnesite are dutiable at 1 dol. 25 c. per ton as "fire brick without more than 10 lb. each, not glazed, enamelled, painted or decorated in any manner," under paragraph 87 of the tariff. The merchandise had been assessed duty under the same paragraph at 25 per cent. ad valorem as "brick other than fire brick." The Government sought to establish as a fact that fire brick applied to brick made of fire clay. This contention was sustained by the Board, who sustained the claim of the importer.—R. W. M.

### X.—METALLURGY.

#### MINERAL OUTPUT OF THE UNITED KINGDOM.

*Mines and Quarries; General Report and Statistics for 1904. Part I., District Statistics [Cd. 2540]. Price 1*s.**

The above report contains statistics, where available, of the output of the principal mineral products of all mines, from quarries and from certain other workings during the years 1873–1904; the following details are extracted therefrom:—

Year.	Alum. Shale.	Arsenic.	Arsenical Pyrites.	Barytes.	Bauxite.	Chalk.	Chert and Flint.	Clay and Shale.	Coal.	Copper Ore.	Other Precious Metals.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Average 1873–82 . . . . .	—	5,566	—	18,970	—	—	—	2,807,285	138,086,800	64,724	—
1883–92 . . . . .	3,914	6,112	4,197	24,408	9,193	—	—	2,811,754	169,921,705	20,267	—
1893–1902 . . . . .	3,912	4,093	6,886	23,819	9,312	4,051,926	94,370	11,349,108	203,322,846	7,286	—
1903 . . . . .	3,284	902	57	24,271	6,128	4,469,974	73,181	16,198,021	230,334,469	6,428	—
1904 . . . . .	6,532	976	46	26,289	8,700	4,438,728	65,256	15,948,915	232,428,272	5,276	—



Year.	Fluor- spar.	Auri- ferous Quartz.	Gravel and Sand.	Gypsum.	Igneous Rocks	Iron Ore.	Iron Pyrites.	Lead Ore.	Limestone.	Mang- nese Ore.	Nickel and Cobalt Ore.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1873-82	—	—	—	72,243	—	16,338,805	40,680	73,357	—	3,316	—
1883-92	267	—	—	126,316	—	14,315,492	22,322	49,651	—	7,162	87
1893-1902	1,386	10,252	1,612,552	189,159	4,497,702	13,204,273	11,793	34,480	11,385,286	1,093	30
1903	11,911	28,600	2,245,757	219,897	5,425,538	13,715,645	9,639	26,567	12,222,971	818	—
1904	18,160	23,203	2,239,593	234,005	5,988,821	13,774,282	10,287	26,374	12,043,135	8,756	—

Year.	Ochre and Umber	Oil Shale.	Phosphate of Lime.	Salt.	Sandstone.	Slate.	Sulphate of Strontia.	Tin Ores (dressed).	Uranium Ore.	Wolfram.	Zinc Ore.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1873-82	5,904	712,928	—	2,373,648	—	—	—	14,114	—	36	24,805
1883-92	12,324	1,835,174	24,404	2,160,129	—	457,107	—	14,429	—	117	24,931
1893-1902	13,362	2,192,597	1,528	1,959,089	4,971,975	557,925	14,156	8,741	35	65	22,182
1903	14,150	2,009,602	70	1,886,992	5,409,502	531,612	22,842	7,381	6	272	24,888
1904	16,050	2,333,062	58	1,891,633	5,303,260	566,273	18,169	6,471	—	161	27,655

## MINERAL INDUSTRY OF NEW SOUTH WALES.

Bd. of Trade J., June 15, 1905.

quantity of gold won in New South Wales during the three months of the year 1905 was 84,376 oz., equivalent to 69,906 oz. fine, valued at 296,945*l.*, compared with 103,448 oz. crude (87,048 oz. fine), at 369,755*l.*, during the same period of 1904.

quantity and value of the silver, copper, tin and exported from New South Wales during the first

of this year were as follows:—

Product.	Quantity.	Value.
		£
Ingots, and matte .....	149,336 oz.	17,038
and concentrates, &c. ....	101,690 tons	536,820
Ingots and ore .....	1,636 "	102,019
Ingots, and ore .....	563 "	67,358
at Australasian and other ports	676,100 "	278,342
Total value .....	—	£1,001,577

se figures indicate a net increase for the quarter of *l.*, as compared with the corresponding period last year. The exports of silver, silver-lead, &c., show an increase in value of 129,561*l.*, but the value of the coal is less by 39,565*l.*. In copper and tin a decrease of 151*l.* and 5,700*l.* respectively, in value is also shown.

## BOLIVIA; MINERAL WEALTH OF —.

For. Off. Ann. Series, No. 3388.

M. Consul at La Paz gives in his report for 1904 a list of the minerals found in Bolivia, together with particulars of the districts in which deposits occur.

## TIN EXPORT OF JAVA.

For. Off. Ann. Series, No. 3403.

Shipments of Government tin from Java amounted to 9 tons, as against 15,381 tons in 1903 and 10,339 in 1902; while the quantity of private tin shipped was 3,077 tons, as compared with 3,436 tons in 1903 and 10 tons in 1902.

## I.—TANNING; LEATHER; GLUE, Etc.

## QUEBRACHO EXPORTS FROM ARGENTINA.

U.S. Cons. Rep. No. 2280, June 10, 1905.

The exports of quebracho logs from Argentina for a series of years were, in tons, as follows:—1894, 74,358; 1895, 239,836; 1902, 254,723; 1903, 200,201; 1904, 723. Of the exports of 1903, the quantity consigned to Germany was only 4,322 tons, or 15,877 less than in 1902, while the United States received 23,511 tons,

Portugal 30,893, and the United Kingdom 139,747 (11,332 less than in 1902) on British account "for orders." A large portion of this last-mentioned quantity went to Germany. The exports of quebracho extract were as follows during the years given, in tons:—1895, 402; 1900, 5957; 1903, 12,040; 1904, 20,111. In 1903, Germany received 2812 tons (409 more than in 1902), the United States 6352 tons, and the United Kingdom only 1214 tons, besides 200 tons on British account "for orders."

According to the statistical department, the value of quebracho extract in Buenos Aires is 80 *dols.* per ton, and 86 *dols.* per ton on board in a German port, while the value of quebracho in logs is 15.84 *dols.* in Buenos Aires, and 21 *dols.* on board in Germany.

## XVI.—SUGAR, STARCH, GUM, Etc.

## SUGAR PRODUCTION OF JAVA.

For. Off. Ann. Series, No. 3403.

The following table gives the sugar production of Java in each of the past six years:—

Year.	Quantity.
	Tons.
1899 .....	730,842
1900 .....	710,150
1901 .....	766,342
1902 .....	848,021
1903 .....	883,020
1904 .....	1,064,935

During the year prices steadily advanced from the equivalent of 7*s.* to 9*s.* 4½*d.* per cwt.

Up to the end of 1904 an all round increase of the export to most countries took place. This is specially noticeable as regards shipments to the United Kingdom, India and the United States. On account of the large sugar crops in Queensland and New South Wales proving sufficient for local requirements, Australia has only taken 14,000 tons of Java sugar as against 72,000 tons in 1903. Although the exports to Singapore amount to 28,000 tons, there is reason to believe that a large portion of this is ultimately transhipped to Indian ports. The sugar chiefly exported to India is what is known as superior sugar. It has there to a certain extent supplanted the Austro-Hungarian and German beet sugars. Prospects for the 1905 crop are good, the young cane, according to reports, looking very well, but naturally much depends on the weather.

XVII.—*BREWING, WINES, SPIRITS, Etc.*

SPIRIT: DUTY-FREE — IN GERMANY DURING THE PERIOD OCT. 1, 1903, TO SEPT. 1, 1904.

*Z. Spiritusind.*, 1905, 28, 229.

The amounts of denatured spirit used in the different chemical industries during the period Oct. 1, 1903, to Sept. 1, 1904, are shown in the following table, the increase or decrease compared with the corresponding figures for the preceding year, being given in brackets:—

	Hectolitres.
For the manufacture of vinegar .....	162,509 (— 2,246)
.. .. celluloid .....	25,007 (+ 2,569)
.. .. ether .....	67,077 (+ 15,468)
.. .. acetic ester .....	1,907 (+ 1,443)
.. .. chemical products ..	48,978 (+ 10,341)
.. .. colour lakes .....	8,447 (— 1,950)
.. .. varnishes and polishes	69,097 (— 1,511)

The total amount of partially denatured spirit used in the chemical industries and for industrial purposes amounted to 385,946 hectolitres, an increase of about 22,700 hl. over the figures for the preceding year.—A. S.

XIX.—*PAPER, PASTEBOARD, Etc.*

WOOD PULP IN SWEDEN.

*For. Off. Ann. Series*, No. 3412.

During the latter part of 1903 endeavours were made to raise the prices of wood pulp by limiting the production. At first the results obtained were small, but afterwards prices improved considerably, and in the spring sellers became very hopeful. Their expectations, however, were not realised, for early in the summer wet pulp had frequently to be sold at almost any price obtainable. Ruinous low offers were accepted by exporters until, owing to the drought that prevailed in Scandinavia and elsewhere, the demands increased at the very time that supplies were diminishing. The latter half of the year therefore was characterised by brisk sales and rising prices. The following are the figures quoted per English ton f.o.b. Gothenburg:—Dry mechanical pulp, from 3*l.* 4*s.* 5*d.* up to 4*l.* 14*s.* 5*d.* Wet mechanical pulp, from 1*l.* 12*s.* 2*d.* up to 2*l.* 4*s.* 5*d.*

In the manufacture of sulphite cellulose, imported sulphur was at one time exclusively employed. Since 1903, however, it has been largely replaced by pyrites, which is now mined in considerable quantities and used for the above-mentioned purpose. The mines at Falun supply the principal works in Central Sweden. The season was a good one and prices steadily increased. It is stated that at the beginning of the present year much of the produce was already sold and that contracts have in some instances been entered into for the delivery of the output not only of 1905, but also of the next two years. Hopes are therefore entertained here that the market for chemical wood pulp will continue to be favourable for some time to come. The prices quoted by the exporters per ton f.o.b. Gothenburg was stated to have been:—For slightly bleached "lättblekt" sulphite, 7*l.* 4*s.* 5*d.* up to 8*l.* 6*s.* 8*d.*, and for strongly bleached "lättblekt" sulphite, 6*l.* 13*s.* 4*d.* up to 7*l.* 15*s.* 6*d.*

The export of wood-pulp from Sweden during 1903 and 1904 was as follows:—

	1903.	1904.
	Tons.	Tons.
Chemically prepared, dry .....	224,573	251,427
Chemically prepared, undried ..	18,016	20,524
Machine pressed, dry .....	48,585	58,321
Machine pressed, undried .....	67,139	82,291

## WOOD PULP IN NORWAY.

*Bd. of Trade J.*, June 22, 1905.

H.M. Consul-General at Christiania reports that the stocks of both mechanical and chemical wood pulp in Norway are at present very low.

Norway's production of wood pulp in the last three years is estimated to have been as follows:—

1. Chemical wood pulp, calculated dry. —

	1902.	1903.	1904.
	Tons.	Tons.	Tons.
Cellulose sulphite .....	93,000	96,000	105,000
Cellulose sulphate .....	9,000	9,500	16,000

2. Mechanical wood pulp (for sale), calculated wet

	1902.	1903.	1904.
	Tons.	Tons.	Tons.
	326,000	313,000	290,000

The anticipated production in 1905 of mechanical pulp is estimated at 290,000 tons. Figures showing anticipated production of cellulose in 1905 are available.

Stocks on the 1st January of the three last years are as follows:—

1st January, 1903 ..	24,055 tons, calculated
1st January, 1904 ..	25,178 tons, calculated
1st January, 1905 ..	10,504 tons, calculated

Of the stock left on 1st January this year 78.3 tons sold, thus leaving unsold on that date only 2681 tons.

XX.—*FINE CHEMICALS, Etc.*

QUININE IN JAVA.

*For. Off. Ann. Series*, No. 3403.

The large quantities of Java cinchona bark offered for sale at the Amsterdam auctions caused a decline in the average result of the auctions being 6.50 c per (5 c = 1*d.*) as against 7.06 c in 1903, while the 1*st* auctions also showed a similar decline, viz., 1, compared with 1½*d.* in the preceding year.\*

The following figures show the quantities of sulphate of quinine disposed of in Batavia by the Bandoeng quinine factory during the past three years:—

Year.	Quantity.	Average price per c.
	oz.	d.
1902 .....	821,608	11
1903 .....	741,053	9½
1904 .....	821,608	9½

NOTE.—The Dutch unit is calculated on half kilos., the one on 1 lb.; thus 6.5 cents equals an English unit of 1*sd.*

ACETIC ANHYDRIDE: U.S. CUSTOMS DECISION  
June 1, 1905.

The United States Circuit Court, June 1, 1905, decided that "acetic acid anhydrous" (acetic anhydride) which is not chemically an acid nor is it technically designated as such, is nevertheless dutiable "acetic acid" under paragraph 1 of the tariff. The Court held that, while an article may be bought and sold by a specific name indicating a particular article, a group of such articles may be known in trade and commerce by a term which includes them all in a general group. Thus acetic acid is held to include acetic anhydrous, and of various strengths. This decision reverses one by the Board of General Appraisers, which held it to be dutiable as a chemical compound at 1 cent. *ad valorem* under paragraph 3.—R. W. M.



## Patent List.

S. -In these lists, [A.] means "Application for Patent," and  
C.S. "Complete Specification Accepted."

When a Complete Specification accompanies an Application, an  
is affixed. The dates given are (i) in the case of Applica-  
tion Patents, the dates of application, and (ii) in the case of  
Complete Specifications Accepted, those of the Official Journals  
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### I. PLANT, APPARATUS, AND MACHINERY.

- 13,247. Lieberich. Filter.\* June 27.
- 13,263. Harder. Furnaces for burning producer gas.\* June 27.
- 13,355. Pearsall. Hydraulic Apparatus for raising or forcing liquids, or for compressing gases.\* June 28.
- 13,492. Brewtnall. Apparatus for cooling and heating liquids, fluids, vapours and the like. July 1.
- 13,603. Soc. Jules Jean et Cie., and Raverat. Process for recovering vapours of volatile solvents. [Fr. Appl., Sept. 1, 1904.]\* July 1.
- 14,067 (1904). Kaebl. Centrifugal separating apparatus. June 28.
- 14,238 (1904). Burdth. Apparatus for heating, cooling, and similar purposes. June 28.
- 17,854 (1904). Sharratt and Sharratt. Kilns and the like. July 5.
- 21,067 (1904). Macfarlane. Centrifugal machines. July 5.
- 1586 (1905). Hager. Indicator for receivers of distilling apparatus. July 5.
- 5147 (1905). Palau, Sibis, and Navarro. Apparatus for raising liquids. July 5.

### II.—FUEL, GAS, AND LIGHT.

- 12,666. Lake, Deutsche Gasglühlicht-Akt.-Ges. (Auerges.). Mantles for use in incandescent lighting. June 19.
- 12,828. Moeller. Incandescent mantles. June 21.
- 13,129. Nield. Method of extracting water from peat, and making peat into briquettes for fuel. June 26.
- 13,263. Harder. See under I.
- 13,290. Syms. Gas producing apparatus for use with fuel of a bituminous nature. June 25.

- [A.] 13,301. Scott. Process for producing vapour oil and rendering it non-explosive. June 28.
- .. 13,495. Hall-Brown. Gas producers. July 1.
- [C.S.] 6959 (1904). Levis (Gen. Electric Co.). Filament for electric incandescent lamps and methods of manufacturing the same. June 28.
- .. 14,757 (1904). Thwaite. Method and apparatus for rendering iron blast furnace gases available for working gas motor engines. July 5.
- .. 14,947 (1904). Bayles. Fuel. July 5.
- .. 16,125 (1904). Electric Equipment and Securities, Ltd., and Kuzicka. Manufacture of electric incandescent bodies. July 5.
- .. 18,214 (1904). Hatton. Gas Producers. June 28.
- .. 6158 (1905). Bouchard-Braceiq. Automatic apparatus for carburetting air and other gases. June 28.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [A.] 13,151. Spaltholz. Emulsions of tar oils, phenols, and similar products, crude mineral oils, and mineral oil residues. June 26.

### IV.—COLOURING MATTERS AND DYESTUFFS.

- [A.] 12,756. Newton (Bayer und Co.). Manufacture of new anthracene dyestuffs and intermediate products. June 20.
- .. 12,757. Newton (Bayer und Co.). Manufacture of a new anthracene derivative. June 20.
- .. 12,854. Johnson (Badische Anilin und Soda Fabrik). Production of indigo.\* June 21.
- [C.S.] 20,527 (1904). Newton (Bayer und Co.). Manufacture of anthracene dyestuffs and their application in dyeing and printing. July 5.
- .. 11,205 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters. June 28.

### V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 12,650. Knopf, and The Bremen Baumwollwerke (C. Knopf & Co.). Processes and apparatus for treating cotton seed hulls or other fibrous materials containing waste products. June 19.
- .. 12,956. Abel (Act. Ges. f. Anilinfabr). See under XVIII. A.
- .. 13,053. Ainley. Machines for washing and scouring textile fabrics. June 24.
- .. 13,356. Hardeastle. Method and machinery for treating fabrics, felts, yarns, slivers and the like with liquids, emulsions, gases, vapours, or dusts and the like. June 28.

- [A.] 13,580. Fell (Koendörfer). Process for oiling cotton and other vegetable fibres. July 1.
- [C.S.] 15,729 (1904). Roberts and Crossley. Method of and means for removing vegetable impurities from woollen rags, wool, and other animal fibres. July 5.
- .. 16,542 (1904). Mellor and Villy. Working or dressing textile fibres, especially silk or the like. June 28.
- .. 17,822 (1904). Carstanjen. Mordanting and loading silk and other textile fibres. June 28.
- .. 26,005 (1904). Smith. Apparatus for treating tubular fabrics with liquid or semi-liquid compositions. July 5.
- .. 28,003 (1904). Ollagnier. Treatment of cocoanut fibre and its application to the manufacture of brushes. June 28.

#### VI.—COLOURING WOOD, PAPER, LEATHER, ETC.

- [A.] 13,507. Wood. Wall-paper printing machines. July 1.
- [C.S.] 2013 (1905). Lafitte. Impregnation and colouration of timber. July 5.

#### VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 13,127. Hargreaves. Manufacture of salt. June 26.
- .. 13,447. Swayze. Process of making potassium salts. [U.S. Appl., July 5, 1904.]\* June 29.
- [C.S.] 13,565 (1904). Castiglioni and Calastretti. Process for reducing sulphates of the alkaline earths and of the alkalis to sulphides, and for reducing metallic oxides to metals. June 28.
- .. 13,981 (1904). Behrens and Behrens. Process and apparatus for manufacturing carbonic acid. June 28.
- .. 23,515 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable hydrosulphites. July 5.
- .. 7034 (1905). Paramore. Art of treating and utilising chlorine gas. June 28.

#### VIII.—GLASS, POTTERY, AND ENAMELS.

- [C.S.] 18,437 (1904). Bottomley and Paget. Working of fused silica. July 5.

#### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 12,998. Schuijt, Kunze and Overman. Process of preparing whitewash. June 28.
- .. 13,135. Brabänder and Koch. Process and apparatus for manufacturing artificial marble. June 26.
- [C.S.] 17,563 (1904). Wilkes. Separators and grinding mills used in the treatment of marl, clay, or like material. June 28.

- [C.S.] 18,376 (1904). Walton. Manufacture of floor-plate wall coverings and the like, and apparatus therefor. June 28.
- .. 18,920 (1904). Lake (Matthey and Co.). Manufacture of electrical insulating or non-conducting compositions. July 5.
- .. 25,385 (1904). Wilkinson. Material for the paving of roadways, &c. June 28.
- .. 8024 (1905). Lainé. Manufacture of composition for building and other purposes. July 5.

#### X.—METALLURGY.

- [A.] 12,652. Campbell. Treatment of chromium-iron.\* June 19.
- .. 12,868. Goldschmidt and Weber. The detinning of tinned plates. June 21.
- .. 12,869. Goldschmidt and Weber. The detinning of tinned plates. June 21.
- .. 12,870. Goldschmidt and Weber. The detinning of tinned plates. June 21.
- .. 13,141. Hoffmann. Manufacture of a substance to be used for the improvement of inferior steel. June 26.
- .. 13,242. Hobson and James. Gold alloys. June 26.
- .. 13,350. Langer. Apparatus for obtaining nickel from nickel carbonyl.\* June 28.
- .. 13,351. Langer. Treating with carbonyl nickel ores or other material containing nickel and apparatus therefor.\* June 25.
- .. 13,433. MacIvor and Fradd. Treatment of complex ores containing gold. June 29.
- [C.S.] 14,479 (1904). Krautschneider. Process for annealing and tempering metals and metallic products. July 5.
- .. 14,757 (1904). Thwaite. *See under II.*
- .. 16,517 (1904). Broadbent. Galvanisation of metals. June 28.

#### XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- [A.] 12,852. Roxby. Electroplating. June 21.
- .. 12,853. Roxby. Electroplating aluminium. June 21.
- .. 13,427. Kitsee. Secondary batteries.\* June 22.
- [C.S.] 18,920 (1904). Lake (Matthey and Co.). *See under IX.*

#### XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

- [A.] 12,784. Perez y Garcia. Apparatus for heating oils and fats.\* June 20.
- .. 12,907. Hatmaker. Process of mixing oils, fats and other substances in fluid or comminuted form with liquids. June 22.
- [C.S.] 13,983 (1904). Stockhausen. Compounds of sulphated oils and fats and method of producing the same. June 28.



### III. PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

#### (A.)—PIGMENTS; PAINTS.

[A.] 1,455. Alberti. Process for the preparation of lithopones.\* June 29.

#### (B.)—RESINS, VARNISHES.

[A.] 3,180. Thiemann. Process of utilising waste amber. [Ger. Appl., June 25, 1904.]\* June 26.

#### (C.)—INDIA-RUBBER.

2,859. Von Stechow. Method of extracting pure raw rubber from rubber plants.\* June 21.

### TANNING, LEATHER, GLUE, SIZE, Etc.

6,383 (1904). Loebell. Process for purifying crude viscino obtained from plants of the ilex class. July 5.

### IV.—BREWING, WINES, SPIRITS, Etc.

0,480A (1904). Williamson. *See under XVIII. A.*  
2,988. Connell. Evaporation and utilisation of potale or liquid distillery refuse and the like. June 23.

3,022. Petersen-Schepelern and Schwanenflügel. Preliminary treatment and ageing of spirits.\* June 23.

3,186. Hunt. Treating or maturing spirits such as whiskey or brandy. June 26.

3,602. Soc. Jules Jean and Cie, and Raverat. Process for the recovery of vapours of alcohol pure, or mixed with air, gases, moisture or other volatile solvents. [Fr. Appl., July 25, 1904.]\* July 1.

4,382 (1904). Hunt. Maturing and improving the aroma of raw whiskey and other spirits. June 28.

4,827 (1904). Hunt. Treatment of whiskey and other spirits. July 5.

8,619 (1901). Schrottky. Manufacture of beer. June 28.

### VIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

#### (A.)—FOODS.

20,480A (1904). Williamson. Meat or malt extracts and preparations, aerated and other beverages or alimentary substances. June 22.

12,816. Evenden and Daw. Coffee preparations. June 21.

12,956. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of silk fibroin peptone. June 22.

13,435. Davenport. Extract of fish. June 29.

[C.S.] 14,588 (1901). Beadle and Stevens. Manufacture of food-stuffs for cattle and other live stock. July 5.

#### (B.)—SANITATION; WATER PURIFICATION.

[A.] 13,596. Venning and Lawrence. Process of purifying and softening water. July 1.

[C.S.] 17,994 (1904). Mather and Platt, Ltd., and Hopkinson. Methods of and means for purifying, softening and treating water. July 5.

#### (C.)—DISINFECTANTS.

[A.] 13,034. Corbyn, Stacey and Co., Ltd., and Bell. Method of generating or evolving formaldehyde for disinfecting purposes.\* June 23.

### XIX.—PAPER, PASTEBOARD, Etc.

[A.] 12,805. Bayley. Process of treating paper to expedite ink drying. June 21.

„ 13,184. Trotman. The watermarking of paper. June 26.

[C.S.] 22,245 (1904). Didier. Manufacture and application of celluloid paste in imitation of white horn, buffalo horn, tortoiseshell, ivory, &c. June 28.

„ 9998 (1905). Fab. Prod. Chim. Flora. Process for directly converting cotton or cellulose into cellulose acetates. June 28.

„ 11,512 (1905). Béhal. Manufacture of celluloid. June 28.

### XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 10,758A. Béhal. Manufacture of bornyl acetates.\* June 24.

„ 10,758B. Béhal. Manufacture of camphors from bornyl acetates.\* June 24.

„ 12,843. Newton (Bayer und Co.). Manufacture of new esters of aminoalcohols and of salts thereof. June 21.

„ 12,934. Wellcome, Jowett and Hann. Manufacture of a tropine derivative. June 22.

„ 13,347. Maschmeijer. Manufacture of substances with the odour of violets. [Ger. Appl., July 22, 1904.]\* June 28.

„ 13,601. Soc. Jules Jean and Cie, and Raverat. Process for the recovery of ether vapours. [Fr. Appl., July 13, 1904.]\* July 1.

[C.S.] 18,147 (1904). Wetter (Hoffmann-Laroche & Co.) Pharmaceutical compound and process for the manufacture of the same. July 5.

„ 20,195 (1904). Inrray (Meister, Lucius und Brüning). Manufacture of iodine compounds of phenol ethers. June 28.

„ 8297 (1905). Chem. Fabr. auf Actien, vorm. E. Schering. Manufacture of camphor. July 5.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 12,867. Buhler. Pigment printing process. [Ger. Appl., July 9, 1904.]\* June 21.
- „ 13,032. Mallabar. Printing and developing photographs on silver chloride paper. June 23.

## XXII.—EXPLOSIVES, MATCHES, Etc.

- [A.] 12,720. Cocking, and Kynoch, Ltd. Smokeless powders. June 20.
- „ 12,892. Cocking and Kynoch, Ltd. Smokeless powders. June 21.

- [A.] 12,893. Cocking, and Kynoch, Ltd. Smokeless powders. June 21.
- „ 12,894. Cocking, and Kynoch, Ltd. Smokeless powders. June 21.
- „ 13,061. Cocking, and Kynoch, Ltd. Smokeless powders. June 24.
- „ 13,340. Claessen. Manufacture of priming compositions, charges for shells and torpedoes. June 28.
- „ 13,359. Bartz and Hirsch. Matches and process for manufacturing the same.\* June 28.

## XXIII.—ANALYTICAL CHEMISTRY.

- [C.S.] 15,885 (1904). Milne and O'Connor. Apparatus for testing gas, air, and like fluids. June 2



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## Official Notices.

### COMMUNICATIONS

Members of communications read before the Society, or its Local Sections, are requested to take notice that Rule 43 of the Bye-laws the Society has the right of publication for three months of all such papers. Payment of this Bye-law renders papers liable to be used by the Publication Committee, or ordered to be printed for the Journal, in which case no reprints can be furnished to the author.

### SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

The Sixth International Congress of Applied Chemistry was held in Rome in April, 1906, during Easter week. Communications should be addressed to the President, Prof. E. Paternò, Via Panisperna, 89 Rome.

## Changes of Address.

When notifying new addresses, members are requested to state them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is to be avoided as tending to create confusion. When giving subscriptions, the use of the form attached to this publication helps in the verification of addresses, on the safe delivery of the Journal depends.

Mr. Harrison E., 1/o Columbus; Station A., East Liverpool, Ohio, U.S.A.

Mr. Theodore, 1/o Pompton Lakes; Box 44, Haskell, N.J., U.S.A.

Mr. Alex. H., 1/o London; c/o G. H. Ogston and Co., Messina, Sicily.

Mr. Harry, 1/o Blackley; Staveley, Broomfield Road, Heaton Moor, Stockport.

Dr. Frankland, 1/o Leeds; Medical Department, Singapore, Straits Settlements.

Mr. Wm., 1/o Hampstead; 14, Sleningford Road, Nab Wood, Shipley, Yorks.

Mr. W. S., 1/o Bradford Street; The Cottage, Bocking, Braintree, Essex.

Mr. Andrew, 1/o Heaton Moor; Dalmonach Works, Bonhill, Dumbartonshire.

Mr. J. W., 1/o New England Building; 164, Kenilworth Street, Cleveland, Ohio, U.S.A.

Hunt, Bertram, 1/o Costa Rica; retain Journal.

Mr. Jno. P., 1/o West 38th Street; 373, West 35th Street, New York City, U.S.A.

Jollyman, W. H.; all communications to P.O. Box 3782, Johannesburg, Transvaal.

Korte, Dr. R. F., 1/o London; Schwarzenstein, Altena i/Westfalen, Germany.

Lett, Stephen J., 1/o Morland; Hall o' th' Gate, Crosby Ravensworth, *via* Shap, Westmorland.

Lichtenthailer, R. A., 1/o Lake City; 303, South Main Street, Winston-Salem, N.C., U.S.A.

Mitsugi, R.; all communications to Military Powder Works, Oji-mura, Tokyo-fu, Japan.

Petrie, Dr. Jas. M., 1/o Sydney; retain Journals.

Richmond, Jno. R., 1/o Preseot; 14, North Road, West Kirby, Cheshire.

Rushby, Wm., 1/o Surrey Street; Broomfield House, Batley, Yorks.

Statham, Noel, 1/o Spain; The Redings, Totteridge, London, N. (temporary).

Thomas, Wm. H., jun., 1/o Passaic; R.F.D. No. 37, South Norwalk, Conn., U.S.A.

Towse, Walter, 1/o Normanton Terrace, 31, Malvern Street, Newcastle-on-Tyne.

True, Percival E., 1/o Elizabeth; c/o Elgin National Watch Co., Elgin, Ill., U.S.A.

Vernon, R. H.; Journals (temporarily), c/o W. Vernon, Bath Club, 34, Dover Street, W.





an American ambassador, the late Mr. Phelps, to a assembly of Englishmen, that he knew he made mistakes, but he was comforted by the reflection that a man who never made mistakes never made any. He did not suggest that no mistakes had been would not be made either by English or by rulers; but he might venture to say that Roosevelt had shown that he brought to the of the day strong and vigorous opinions, which he hesitated to express; and which, whether they were right or wrong, carried with them the conviction were the opinions of an honest man striving to do the best for his people and the best for the civilised world, amongst the many bold and noble steps that Roosevelt had taken, even during his first office, he had called the attention of the civilised world to the causes of peace; and his aspirations for general peace were set out in marked relief by his invitation given some time ago, and accepted almost universally by the world, to again meet at The Hague to consult on the peace of the world could be further promoted. He also referred to the action the President of the United States had just taken in recognising that, owing to his dependent position, it was in his power to take such a crowned head in Europe could possibly do. He had not hesitated to take steps to put an end to a terrible war which was causing so much misery and death in the eastern part of the world. He felt that King Edward VII. and President Roosevelt during the last three years, more for the peace of the civilised world than any other two men. He asked them to drink the toast of the President of the United States with the hope that the remainder of his office would be as successful as its commencement.

THE PRESIDENT then announced that the following would be sent to President Roosevelt: "At the request of the Society of Chemical Industry, attended by British and American Members, your health was cordially proposed by the Lord Chief Justice of England and enthusiastically received. We send respectful regards and sympathy with you and your people in the name of Mr. Hay."

GORDON SALAMON then announced that he had received congratulatory telegrams from Dr. Hart and Dr. Messel, from the Chemists' Club, Dr. Zabriskie, Dr. Messel.

C. F. CHANDLER said he had been selected to give the toast of "The Houses of Parliament" because, although there was no person present who knew less about the Houses of Parliament. He had had occasion to visit either House of Parliament, and had a dim recollection of having read that Guy de Maupassant had tried to "toast" the Houses of Parliament, and that he was to grief; and he had also read about the Great Exhibition of 1883 having come into conflict with the House of Commons; but his personal knowledge was extremely limited. He first began to learn something with regard to the practical work of the Houses of Parliament when he had occasion to provide himself with those wonderful books. Nearly 40 years ago, when he was studying the history of water, he found it necessary to consult the Reports issued by the Rivers Pollution Commission, and that they were full of the most valuable information—in fact, he got better and more useful information from those Reports than from anything he found either in the English language or the French. After this experience he felt it a rule ever afterwards when discussing any matter relating to the public welfare and requiring any knowledge of chemistry or physics, to look at the Blue Books. He had studied amongst others those published with regard to food, drainage, gas manufacture, and those on electricity; and he always obtained from them information which he could not obtain from any other source. Thus he came to admire the system of the Houses of Parliament. When any new subject came up, they did not sit still and allow interested people to come and press their views; but they sent for the most distinguished men in the kingdom and questioned them in a simple straightforward manner, and thus

obtained from them the best knowledge the world possessed on the particular subject before the Committee. On one occasion he came into personal contact with one of these Committees, having appeared some years ago before the Committee dealing with the subject of petroleum. He had previously been before a Committee of the United States Senate on oleomargarine, and he remembered saying to the Chairman of that Committee, one of his own pupils, that the legislation which resulted was absolutely contrary to the advice he had given them; and the manufacture of that eminently nutritious and satisfactory form of food was put under a ban in the United States. The State of New York, which had never spent one cent for Chemical Education, once spent 70,000 dollars a year in preventing people eating oleomargarine. On the particular occasion when he came before the Committee of Parliament he was very deeply impressed; he thought it was the most dignified session he had ever attended. The question was one as to raising the flash-point of petroleum as required by law, and in which the interests of the American oil producers and Scotch oil refiners were in antagonism. He was much struck with the impartial character of all the remarks that were made before that Committee; there did not seem to be any partisanship or any bias on the part of any member; and he carried away with him a deep feeling of the dignity and fair-mindedness of that Parliamentary Committee. Speaking broadly, the Houses of Parliament represented to his mind the ideal of taxation coupled with representation. Taxation without representation was the cause of the breach between the American Colonies and the Mother country. In England they had almost universal suffrage. Unfortunately, in America they had complete universal suffrage. When the subject of suffrage came up in the Constitutional Convention it was proposed that there should be a property qualification, and there was a strong feeling in favour of such a provision. Benjamin Franklin suggested that it would be eminently proper to permit it, but there would be some difficulty in carrying it out in detail. It seemed to him that the Houses of Parliament represented Government for the people by the people; they had developed by the publicity of their discussions and the wisdom of their deliberations the most perfect system of civil government, a system which gave justice and equity before the law to all the citizens of the British Dominions. Without making any invidious comparisons between the Government of his own country and that of Great Britain he could not say that there was any country in the world which had a fairer or more just system of government than that which had been secured by the deliberations of the Houses of Parliament. He coupled with the toast the names of Lord Allerton and Mr. Rufus Isaacs, M.P.

LORD ALLESTON, in responding for the House of Lords, said that he had listened with great interest to the speech of Prof. Chandler, and he was much gratified to learn the good impression which had been made upon his mind by his experience of the Houses of Parliament. Englishmen were proud of their Houses of Parliament and of the power which lay behind them; and he hoped he might be allowed to claim with becoming modesty for the House of Lords that they never showed themselves unwilling to take their fair share of the work of the nation, not only in their own House but in work outside in the field, if they were called upon; and in many positions of distinction both in Commerce and, he was going to say, in Chemistry, there might be found distinguished members of the House of Lords. That House took just as much interest in all that concerned the welfare of the Empire and the nation at large as did the House of Commons; their objects were the same; they might strive a little differently in detail, but their object was the welfare of the people and the country to which they belonged. He was himself a Member of the Society of Chemical Industry, and he read their proceedings with great interest. He doubted whether one could find the same number of members in any society or profession of men upon whom so largely depended the progress of commerce and manufactures as one would find in this Society. It was because he felt the great importance of it, apart from those questions upon which

the Lord Chief Justice had touched, that he felt it was of the greatest possible good to this country that they had had visits from men so distinguished as those who constituted the Society; and he hoped such reciprocal visits might tend to make for progress in the department in which they were specially interested, because that department was one which made for the progress and welfare of the commerce of the world at large.

Mr. RUFUS ISAACS, K.C., M.P., said he should like to add his humble tribute to what had fallen so well from Lord Allerton in response to what Prof. Chandler had said, that no one who was a member of either House of Parliament or who cherished the traditions of those Houses could have heard unmoved the high testimony by Prof. Chandler to the work of those Houses. The work, the result of which was collected in the Blue Books, was work which was quietly done, and of which the public heard little. Prof. Chandler had told them how valuable he had found them, and had given thereby great encouragement to those who sat on Committees and did their duty, having before them undoubtedly the testimony of the highest in the land, and being thus able to pass a judicial opinion upon the subjects brought before them and upon which they had practically to decide.

Dr. E. DIVERS said the Society of Chemical Industry needed no words at the annual dinner of its members and their friends in support of the toast of its prosperity. That toast would that evening and at many annual dinners to come be welcomed with enthusiasm, whatever might be the brevity with which it was brought forward. During the past Session the prosperity of the Society had been satisfactory to those who did not expect too much. There had been evidence that there was much more to be done, but this was no reproach to the action of the Society during the past Session, but rather evidence of the progress that had been made which had brought about its awakening to the fact that so much remained to be done. At the present time the Society numbered some 4326 members, and there was every promise that at the end of the next year there would be a much larger number. In the United States, the Society had added a New England Section; and in England it had revived the Birmingham Section under most favourable auspices. It had taken part, indirectly through some of its members, in bringing about legislation favourable to Chemical Industries; and, as evidence of the power which it had over its members, he need only point to that meeting, which had drawn about a hundred of its members across the Atlantic to take part in its celebration. During the Session its numerous Sections had brought together large bodies of members to take part in the proceedings, and to arouse in them, as he hoped, a common and united interest in Chemical Industries in general, rather than in their own particular subjects only. Their Journal, published fortnightly, had given them a great number of papers, many of them of particular value in technology and even in pure science. One other point not to be overlooked was that the affairs of the Society had been carried on in such a way that their expenditure had not exceeded their revenue. That account of the Society might seem a very bald one after the splendid examples of oratory they had heard from previous speakers; but, after all, the Society was always with them and he found it very difficult to speak in any special terms about it, because they all knew about it, heartily appreciated it, and were deeply interested in its welfare. He had the supreme satisfaction of inviting their President to respond to that toast. Eminently successful in chemical technology as an electro-metallurgist, Dr. Nichols had carried out the business of the Society during his Presidentship with remarkable success; he had been for nearly the whole of that period separated from headquarters by the broad Atlantic, yet he had by active correspondence made his opinions strongly felt, and the advice which he so frequently gave had received the hearty concurrence of the Council and those who had to work with him and under his directions. His address on Monday last was fraught, not only with great advantage to the Society, but to chemical technology all over the world; it was a remarkable address, and he thought he

might say it would greatly add to the benefits Dr. Nichols had conferred upon them if he would, on his return, some time to the expansion of that address into a paper on the subject of the management and organisation of chemical works. He was quite sure that such a paper would be received with very great approval, would have a very wide circulation, and would add greatly to the development of manufacturing interests both in Britain and in America. On behalf of the Society he took upon himself to thank the President most cordially for the services he had rendered during his year of office.

The PRESIDENT said that he could hardly express the singular sensations which he had experienced in sitting in that distinguished company in that magnificent hall. He was the President of one of the many Societies, for they were less than a quarter of a century old, and what was a quarter of a century in a century which reckoned by almost milleniums? He was proud to be their President if only for a little while longer. The Society was one which had a great deal to be proud of. In the first place, they were proud of being in that magnificent hall of the old Goldsmiths', where they were proud of their distinguished guests, to whom he had addressed them, but many of whom he had the opportunity to do so; they were proud of their Presidents (he would say nothing about the past President). The other evening, at a somewhat less formal gathering, more than twelve of them sat together at one table, he thought, than had ever been gathered together in one room. They were proud of what they had done for the Society, and still more proud of what they had done for the public; they were proud of their work, though he would not say much about that because he was one of the number; they were proud of their Education Committee. He had had the good fortune to attend for the first time the other day a meeting of the Committee, and he was astonished to see the amount of work done, done freely and gladly, by that magnificent body of men; and in consequence of their work a great number of members who contributed articles, the work of the Journal, which he might safely say was the best Journal on the subject of Chemistry and Chemical Industry which was published in the world. They were proud of all those things, but he would not dilate upon them, as he had had his innings last Monday, and would not inflict another speech upon them. He would, however, say that he was sure the Society was proud of its New York Section; the name was somewhat of a misnomer, as that Section included a very large number of the United States, almost, in fact, the City of New York. It numbered more than 1400 members, or nearly one-third of the total membership. He mentioned this because the great success of that section was due, usually the case, to a very few gentlemen. He had heard that one of them, Dr. Love, had sent a cable message last night. Dr. Love was a gentleman who was present at the birth of the Society; and had been one of the active members in the New York Section. They were with them that evening Mr. Parker, who had done good service, and Dr. Chandler himself, who did not spend his time reading Blue Books and delivering lectures, but found time for other work which he thought was just as useful. Without mentioning too many names, the New York Section owed a great deal to two gentlemen who were with them that evening and whom the New York Section desired at that time to especially thank. He referred in the first place to the genial gentleman who had for so long conducted the séances of the *Deutscher Chemiker*, which met at the conclusion of the business of the New York Section, and which did noble scientific work in the consumption of large quantities of time. It was not, of course, in that capacity that he thanked Dr. Hugo Schweitzer, but because without his help he did not know what that Section would have been. He certainly would not have been what it was to-day, and what it promised to be in the future. But, as a token of the appreciation of many hundreds of workers and members, he had the honour of presenting him that evening, on behalf of the New York Section, a beautiful gold medal, appropriate to that hall, and



ription, "Presented to Dr. Hugo Schweitzer by her members of the New York Section of the of Chemical Industry, as a token of their high and appreciation of his long and faithful services tary of the Section. July, 1905." The other similar if not exactly like the first, having on the pen of the scribe, and the other having a cornith money rolling out of it, not a shilling of which ted, with a similar inscription of the same loving as for Mr. R. C. Woodcock, who all through the life Section had been its honoured and efficient er. There was one more thing they had to be for and to be proud of, and that was the glorious which it was theirs to follow and uphold. Might ways be true to it, and proud of it! To be a was to be in almost the highest position, in his at, to which a man could attain.

OVERTON REDWOOD, in proposing "The Learned e," said he had noticed that their American brothers ay of making themselves better acquainted with institutions than they were themselves, and he d to think that that accounted for the shade of resignation which he observed to pass momen- ver the habitually cheerful countenance of the it when he rose to propose this toast. No doubt ols had learnt that there were in Great Britain an 1000 of these societies to which he was expected when proposing that toast, and that a carefully ed record of the proceedings of those societies y filled a volume of some 300 pages. He must ted, with the labours, largely unselfish and unseen, of army of workers in the limitless field covered by ned societies, was a fruitful and inspiring theme. must hasten to reassure Dr. Nichols by telling him was far from his intention to attempt to deal ensively with so great a subject. He would, r, crave indulgence for reminding them that in of antiquity as well as in regard to distinguished of work done, the United States could claim much own learned societies. So far back as 1743 Dr. n issued a proposal for the promotion of useful ge among the British plantations, and in the g year the American Philosophical Society was in Philadelphia, with Dr. Franklin as Secretary. ocity, of which, thanks to the support of Dr. r, he had had the privilege of being an honorary r for many years, was the first society to be l in America for the pursuit of philosophical gation in its broadest sense; and it was also well known that the Smithsonian Institution, as established by Act of Congress in 1838, though society in the strict sense of the term, ranked as the most important and most useful of scientific That institution was founded by Hugh Smithson, of a Duke of Northumberland. So that the had something to do with the inception and istory of these societies in the United States. But rather of British societies that he had to speak, and, se, first in antiquity and dignity came the Royal of London. It was, therefore, with peculiar pride e alluded to the circumstance that they were ex- ally honoured that evening by the presence of the ous and revered President of that Society, Sir W. Huggins. They were also very fortunate to ith them Prof. Joseph Larmor and Sir Archibald . Secretaries of that Society: and they had also ntatives of other learned societies, including the ent of the Chemical Society. The work done by and other societies was well known to all. The ed Societies had mainly come into existence dping ateenth century, to meet the need of organisation ystematisation of science, and for the provision f a common ground where the various workers meet to discuss results. They played, undoubtedly, y important part in facilitating the interchange as, and stimulating by example and competitive to renewed effort in probing the secrets of Nature, enerally promoting the advancement of knowledge. ed to couple with the toast the name of Sir William ns.

Sir WM. HUGGINS said that in the name of Science and as the representative of the Royal Society, the oldest chartered scientific society in this country, and now the venerable, but still young, mother of many fair and distinguished daughter societies, he begged to thank them for the cordiality with which this toast had been honoured. In speaking for Science, he was under some disadvantage as compared with those who represented Commerce, Politics, and Fiscal Policies, for he could not appeal to one of the strongest of human passions—party feeling. Science, above all things, was the harbinger of unity, peace and goodwill amongst all men; it recognised no territorial limits; it knew nothing of language or race; it was equally at home in every country, and the fatherland of Science was as wide as the earth itself. The scientific societies in the past had done not a little towards unity by electing colonial and foreign members, and bringing together men who dwelt in all parts of the earth, whether as inhabiting the British Dominions across the seas or belonging to other nations. But it had been left for the Society of Chemical Industry to take another and a great step forward towards the realisation of the brotherhood of Science, by opening its doors to men of every country and every race. While still a British Society, its membership included the English-speaking peoples of the earth. Amongst those sitting at the table that evening they had not only their brethren from Canada but their other brothers, only once removed and quite as dear to them, from the United States. Truly, such a meeting as that might be taken as some advance towards that federation of the world, which was the cherished dream of the poet and of the man of Science. That Society might be said to have thrown a bridge across the Atlantic, over which their friends of the other hemisphere had come to feast with them that night, when, for the second time, an American presided over the Society. The Royal Society welcomed this manifestation of the brotherhood of Science; and marked its appreciation of the great importance of such international exchanges of courtesy and friendship and of scientific opinion by the new departure of a reception to those and their friends who had come across the seas, which would be held on the following evening. In industrial production, in competitive ownership of parts of the earth, and in the rival ruling of the seas, the pre-eminence of one country, or of one race, meant necessarily more or less the subjection of other countries or races—the gain of one nation was the loss of another; but the victories of Science stood alone in that there was no enemy, no one was defeated and the conquests of Science were pure gain and enriched the whole human race. The increased power over Nature secured by the work of Faraday, or of Edison, or of Rutherford, did not give exclusive advantage respectively to Great Britain, to the United States or to Canada, but to all three equally alike—it enriched mankind. Any cheque for discovery, drawn with the pen of experiment, by any man, rich or poor, free or bond, Greek or Barbarian, on the Bank of Nature, would be honoured in full without the impoverishment of any other man. Like the widow's cruse of oil and barrel of meal, the stores of Nature were not diminished by what was taken from them. The forecast of the present century was not doubtful. It needed not the skill of the Augur to determine from the signs of the heavens or from the flight of birds to forecast that man's progress would be in direct proportion to his increased power of dominion over the forces of Nature. The scientific societies had, in common with the Royal Society, the object of improving natural knowledge; and it was only by the increase of such knowledge that man could hope to supply all his needs, his increasing needs, from the unlimited stores of Nature. It was surely unnecessary for him in that assembly to say how completely the future condition of mankind, in its intellectual composition as well as in its material resources, depended upon the growth and activity of the scientific societies.

Mr. GORDON SALAMON, in proposing the toast of "The Guests," said it was unnecessary to speak at any length in its favour, at least with regard to that portion of it which referred to the welcome they had sought to give

to their guests from across the Atlantic. They had already been formally greeted, and he trusted that since they had been in London they had found that their welcome was true and sincere, and that they would go back knowing that they were regarded as essential to the continued prosperity of the Society. He could only say, on behalf of the Society, that their American and Canadian friends were not only welcome, but he was happy to think there was no feeling of rivalry between them. They were all possessed of one spirit, namely, to promote the good of the Society throughout the world, and, further, to promote the continuance of that feeling of kinship which united them to-day. With regard to the other guests present, they greatly appreciated their coming amongst them and giving their support to the President. Finally, in the name of the Society, he must express their most grateful thanks to the Prime Warden and Court and Sir Walter Prideaux and the Goldsmiths' Company for permitting them to use that most beautiful and historic hall for their annual dinner. In giving that toast he could not refer to all the guests in detail, but he would ask two gentlemen to respond—one who had received the Victoria Cross of that Society that evening, Dr. Hugo Schweitzer, and also Dr. Wiley.

Dr. HUGO SCHWEITZER said before replying to the toast it was only proper that he should refer to the great and unexpected honour which had been bestowed on himself and his esteemed friend, Mr. Woodcock. He was so surprised and touched by it that he could not find words in which to express his gratitude. They had done nothing but what they considered to be their duty to their fellow chemists, and if they thought it just to reward them so very highly, they could only, of course, accept their gift with great gratitude. In one respect, his selection to respond to the toast had been a most excellent one, for it was not within the power of any orator to express gratitude for the limitless hospitality which had been accorded them—it took heart and sentiment to do that, and in those respects he yielded to none. He thanked them from the bottom of his heart for all the pleasures they had enjoyed, and also for all they were going to enjoy; and he thanked them especially for the American members, whom they seemed to insist on spoiling as a loving mother spoils her only child. His selection was probably due to the fact that he had been connected actively with the first over-sea Section, and also to the fact that in his career he represented the internationality of the Society perhaps better than a great many others. He was a German by birth and an American by selection, and he had been closely attached in his life work to the interests and the members of that Society. Dr. Nichols had told them a few of the things of which they had reason to boast; but he had left out a few things to which he might now refer. England had developed the gentleman. That word had to be introduced into the languages of all nations, for none were conscious of its lack until they met that perfect type, the English gentleman. England had given them their beloved profession, and it had also given them healthy recreation. The sons of Great Britain were the first to recognise the truth of the adage that, "All work and no play makes Jack a dull boy"; they had given them such healthy sports as lawn tennis, football, cricket, yachting, hunting and that more strenuous game which was played according to rules formulated by the Marquess of Queensberry. This great country was the mother of chemical industries; here the manufacture of acids, alkalis and the coal tar colours had been developed; it was also here that the Bessemer process had been discovered. England had produced Faraday, Humphry Davy and Dalton, and he knew not how many more, and there still lived here to-day Perkin, Thorpe, Muspratt, Mond and Ramsay. Americans were happy to be connected with England, not only by the close ties of international science, but they were proud to be connected with it by a common language and a common Teutonic origin. In conclusion, he would ask them all to drink to their hosts, and to those gentlemen who had planned and arranged that wonderful feast.

Dr. H. W. WILEY said it was difficult to say anything further in response to this toast, but it was pleasant to

even attempt to give some voice to the feelings of countrymen with regard to the way they had been received in England. It had been said that "Gratitude is a lively expectation of favours to come," and the present gathering was happily inserted in between the immense amount of favours already received and those to which they were still looking forward. Every American thought it was his privilege to have the chance of making a speech, and were it not for its bad reputation, he could help wishing to be a Hydra, because it would take heads, each one furnished with a silver tongue, to all that should be said on such an occasion as this. What was the secret of this bond of amity of the peoples? He did not believe that the spirit of it was entirely or even very much due to kinship, but some of the keenest quarrels he had ever known occurred in the domestic circle. He thought it was because two peoples were inspired by the same spirit, they the same love of freedom and the same desire for justice should be meted out to every man. He believed the science of chemistry played no mean part in bringing them together; the free development of commerce and the open door were what they both fought for with perhaps a preference in their own favour. He loved the English because they were a strong and vigorous race, having the stamina and ability to carry out what they undertook; that was because they were a fed nation. A great friend of his at Yale confessed that people ate three times too much, but it was well-fed nations that came to the front, and those who wrote on dietetics and said that people ate too much generally did so after having a good meal, sitting in an easy chair, and smoking a good cigar. It was said that during the great Civil War, a deputation waited on President Lincoln and asked him to resign General Grant from the Army of Tennessee, which had just won a great battle, because he drank whisky. President Lincoln paid great attention to what was said, and then asked if the deputation could tell him the quality of the whisky which General Grant used, because he should like to send some to the other generals. He was the spirit that animated them which led to the great victory. As long as they had the same spirit and loved liberty and justice, they would be drawn nearer and nearer together, though there was no separation between them so far as he could see.

Sir JOSEPH SWAN then proposed "The Health of the President," which the latter briefly acknowledged.

A "Ladies Dinner" was also held on Wednesday evening, at the Café Royal, Regent Street, attended by about one hundred and twenty; Sir Wm. Ramsay, K.C.B., F.R.S., presiding. After the toasts of the King, Queen, and Royal Family, and the President of the United States had been duly honoured, Mr. A. Gordon Salomon proposed "Our Lady Grace," which was most cordially received, and was responded to by Mrs. Wm. H. Nichols. "Applied Chemistry" was given by Mrs. Lewkowitch, and responded to by William Ramsay. Dr. M. O. Forster, F.R.S., proposed the health of the Chairman.

## London Section.

Meeting held at Burlington House, on Monday, July 31, 1905.

MR. A. GORDON SALOMON IN THE CHAIR.

### THE MANUFACTURE AND USE OF ART PAPER.

BY R. W. SINDALL.

These special papers are now made in large quantities to supply the demand for a paper having a smooth surface suitable for the printing of half-tone blocks. The demand





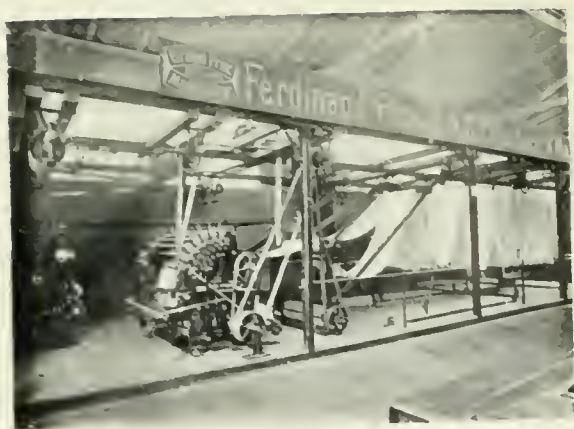


FIG. I. GENERAL VIEW OF A "COATING" MACHINE.



FIG. III.—THE EFFECT OF THE RATIO OF GLUE IN A COATING MIXTURE.

As the percentage of glue increases, the tendency of coating to "lift" is reduced.

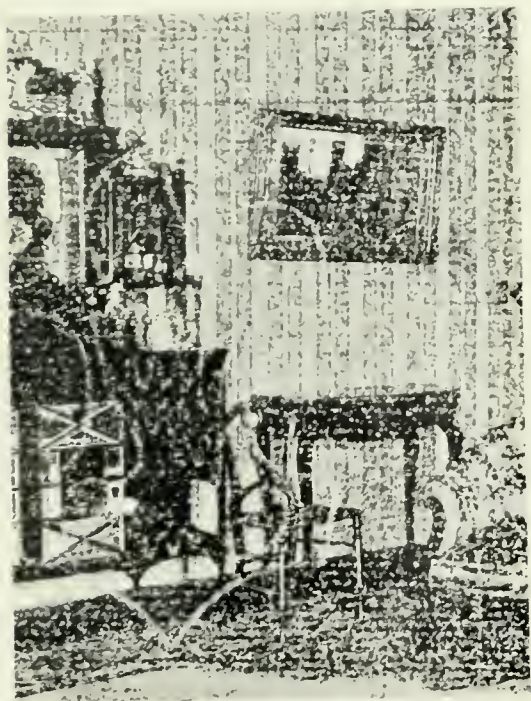


FIG. IV.—PHOTOGRAPH OF A PRINT MADE ON HAND-MADE RAG PAPER.

The Ink does not come into contact with the depressions caused by the watermark, so that the latter appears very prominent.



FIG. II.—FIRRES OF A TYPICAL MAGAZINE'S ESPARTO, WITH TRACES OF CHEMICAL WOODP

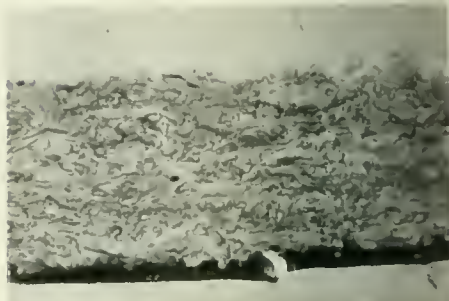


FIG. VI.—SECTION OF "ART" PAPER COATED ONE SIDE ONLY  $\times 90$ .

The crack in the coating is probably due to the roll the paper.



FIG. V.—PHOTOGRAPH OF A PRINT ON A GOOD PAPER SHOWING ALL NECESSARY DETAIL.



il, and the sharpness of outline required in an action produced by process printing cannot be obtained on ordinary paper, however highly glazed and polished, since the surface is not sufficiently smooth, but the application of a mineral coating an enamelled surface is obtained which is perfectly even and level, capable of taking an extremely high polish. The process employed in the production of these papers is complicated, and the operation appears to be quite simple, though, as a matter of fact, the difficulties connected with the manufacture and use of "Art" papers are numerous.

The coating applied to the surface of the paper varies in position according to the quality of the work, the coating consisting of some inert mineral substance such as china clay, blanc fixe, or enamel, mixed with the quantity of an adhesive-like glue or casein. For the best papers in which good colour and extra finish are desired qualities, blanc fixe and satin white are used in conjunction with glue, commoner qualities being made with china clay.

The machine for the manufacture of coated papers consists of three parts. The first is the coating section, the second is the drying apparatus, and the third is the machine for reeling up the paper.

The reel of paper to be coated is placed in any convenient manner upon a shaft at the back of the coating machine, which is a large drum about 4 ft. diameter, and the paper is led round under the drum and over the top, and as it passes over it is brought into contact with a short endless felt, which transfers the coating mixture to the paper. The mixture is constantly fed into a narrow copper trough fixed to the front of the machine, and this is maintained at a suitable temperature. A copper roll rotating in the trough brings a steady stream of the liquid on to the felt, and the quantity of coating transferred to the paper is regulated by means of regulating rolls. The thorough adhesion of the enamel is secured by an even distribution over the surface of the paper is effected by a series of brushes, usually seven in number, which operate on the top of the drum and brush the enamel well into the paper. Some of these brushes are while the others, actuated by small cranks, move alternately from side to side. The last two or three brushes are fitted with soft bristles to ensure an even surface free from brush "marks." The wet-coated paper is then carried over to the drying apparatus, which consists of two parallel rails fixed 8 or 9 ft. above the floor, upon which slowly travel endless chains carrying a series of festoons at regular intervals. By an ingenious device the paper is caught on the sticks, taken up a sloping incline until it reaches the rails, and then it falls into a series of festoons or loops, the whole of which are moved forward upon the rails. The drying is hastened by the use of a current of air heated to about 85° F. If the festoon is not long enough, a turntable is provided which rotates the festoons to describe a semi-circle at the end of the run, bringing the paper along a second set of rails to any required distance. This device has the great advantage of bringing the finished paper directly under the observation of the man in charge of the coating machine. The dried paper is reeled up by a special reeling machine.

On the opposite side of the paper is coated in a similar manner, the reel from the first operation being passed over the machine a second time. The machines have recently been introduced for coating both sides of the paper at one operation, but the results are not altogether satisfactory for high-class work.

When coated the paper has a dull surface, and a high gloss is then given to it by means of the super-calender, in which process the paper is cut to any required shape and dimensions.

#### MATERIALS USED.

For ordinary art papers the proportions of enamel and glue are 100 lb. of mineral to 18 to 25 lb. of glue. These proportions are mixed with water to give a solution of the materials. The glue is soaked in cold water for 24 hours, and then gently heated in a copper steam jacketed pan in which mineral is worked up into a creamy paste with water

and thoroughly mixed with the glue. Aniline dyes are added to the mixture for the production of coloured or tinted papers.

Of recent years casein has been largely employed as a substitute for glue. About 18 to 20 lb. of casein are required for 100 lb. of mineral, and, since it is insoluble in water, borax or ammonium is necessary as a solvent. The casein is stirred into cold water and gently heated to about 100° F., and after the addition of 1½ lb. of borax, still further heated to 140° F. Casein sometimes imparts an unpleasant smell to the paper, if it has been dissolved any length of time, but the addition of a little formalin is usually sufficient to remove defects of this kind.

The decomposition of casein in solution, even to a slight extent, diminishes its adhesive properties, and as a matter of common experience, a coating mixture prepared from casein which stands over from a Saturday to the Monday following is frequently rendered foul and useless. Inattention to details of this kind is a fruitful source of trouble, which only appears at the printing office, when it is then impossible to trace back the primary offender. The manufacturers of art papers are frequently puzzled to explain defects for which there does not appear to be any adequate cause, and this question of the alteration of adhesive properties in the prepared coating mixture is one of them. The alteration may be traced in some instances to comparatively simple causes, of which I venture to illustrate one.

When ordinary glue and moist satin white are the ingredients for a mixing, it is evident that the ratio of dry glue to dry mineral can only remain constant when the raw materials are of uniform and constant composition. If the moist enamel contains a lower percentage of water than some accepted standard, then the amount of glue must be varied to meet it. But the manufacturer does not always test the mixture, and we may, therefore, have variations of a greater or lesser degree.

The explanation of the differences, which may occur with the printing on successive deliveries of art paper to the printer from the paper-maker, may appear almost too simple, but it is a matter of common experience to the consulting chemist, that simple causes are those which come to be frequently overlooked by manufacturers. It is only by specific instances of this kind that we indicate the possibility of arriving at a satisfactory solution of the difficulties encountered in every commercial industry.

#### QUALITIES OF ART PAPER.

The finished art paper presents many different physical qualities to those found in the body paper. The weight and bulk are greatly increased by the additional mineral matter added, the increase being determined by the amount of finish necessary. For heavy art papers the extra weight is generally 10 to 12 lb. per ream of 480 sheets, and the thickness is increased 12 to 15 per cent., so that books made from such papers are very heavy to handle, and are also extremely bulky.

The unpleasantness and fatigue caused by the reflection of light from the surface of high-glazed art papers is a matter of common experience, and the use of art paper for ordinary letterpress work cannot be too strongly condemned. The use of poor paper, closely printed letterpress, unsuitable surface, outrageous colours, and other defects in relation to paper generally, are fruitful sources of injury to the eyes and brains of readers, perhaps more so than most people are aware. A close investigation into this subject would amply repay attention.

#### THE "BODY" PAPER.

It is clear from these descriptions of the methods used for coating paper, and the reasons given for the necessity of such a coating in the production of a purely artificial surface, that the composition and quality of the "body" paper is not a matter of very great importance. To a large extent this is quite true, but in the better qualities of art papers the nature of the "body" must be studied. Flexibility and resistance to the frequent turning over of the leaves of a book can only be ensured by the use of suitable material as the constituent of the body paper. Hence esparto is found to be preeminently suitable for

the purpose, and when mixed with chemical wood-pulp in varying proportions gives results which are satisfactory.

Esparto is a grass found in Spain and Algeria, having the following composition:—

(Müller.)	Spanish.	African.
Cellulose .....	48.25	45.80
Fat and wax .....	2.07	2.62
Aqueous extract .....	10.19	9.81
Pectous matter .....	26.39	29.30
Water .....	9.38	8.80
Ash .....	3.72	3.67

It is imported into this country in huge bales which on arrival at the mill are opened, freed from dust by special winnowing machinery, and the esparto thus cleaned. The grass is loaded into stationary digesters and boiled for six to seven hours with 15 to 20 per cent. of its weight of caustic soda at a pressure of about 60 lb. The boiled pulp is then thoroughly washed and bleached with chloride of lime solution, the yield of bleached cellulose being between 45 and 50 per cent.

Esparto fibre when examined under the microscope has many characteristic features which render the identification of the particular form of cellulose an easy matter. Fibres of the fibro-vascular bundles are slender, short, needle pointed fibres, whilst the presence of certain pear-shaped vessels determines the esparto with ease.

The wood pulp which forms one of the constituents of ordinary magazine papers is prepared chiefly by the "sulphite" process. The logs of wood having been thoroughly freed from the outer bark, and dirt, are chipped up into small flakes, which are thrown into huge steel digesters 50 ft. high, and 15 ft. internal diameter, lined with acid-resisting brick or cement, capable of holding 20 tons of wood at one charge. A solution of bisulphite of lime (prepared by passing the fumes of burning sulphur into towers containing blocks of limestone moistened with water) is run into the digester, which is then closed, and its contents heated by steam.

The wood is boiled for eight or nine hours at a pressure of 80 lb. and thereby reduced to a pulpy mass which can be washed and thoroughly cleansed from the soluble by-products. A yield of 50 per cent. of cellulose is obtained.

#### PREPARED PULP.

It may be noted in passing that the primary action of the bisulphite process in the digester is one of hydrolysis, with subsequent formation of sulphonated products, and may be briefly stated thus:—

Just as sugar is inverted by the hydrolytic action of water, and to a far greater extent by a mineral acid, so the cellulose compounds, and even to a more or less degree the normal cellulose itself are hydrolysed when treated with sulphurous acid.

The use of alkaline sulphites with sulphurous acid is preferable to that of sulphurous acid alone, inasmuch as, though the action of the latter upon the organic residues, as compared with sulphuric or hydrochloric acids for example, is greatly modified (perhaps, owing to its reducing action), nevertheless degradation does take place, resulting in the formation of tarry products which permeate the whole fibre substance and thus consumes a much larger quantity of bleach than would be required for the same wood using bisulphite of lime.

Another advantage in the use of the latter method as compared with the soda process for resolving the wood is, that the phenolic colouring matters in the cellulose compounds produce soluble colourless derivatives by reduction, and hence cause the fibre to be of a better colour.

With cheap art papers, the materials used for the "body" are of greatly inferior quality, and "mechanical" wood pulp, as it is called, often forms a large proportion of the paper. In the entire absence of any standards of quality, it is not surprising to find that many high class illustrations of considerable value, even if only of a temporary character, are printed on papers of very low quality.

It is necessary that the body paper should be carefully made, its surface being fairly even, yet not too smooth. The marks of the machine wire should not be too pronounced, since irregularities on the surface of the paper due to these marks cannot be completely obliterated if the coating subsequently put on the paper is thin.

Another important feature in the body paper is the extent of the sizing. The papers are treated with size, and the conditions for proper coating require uniformly sized body paper in order that the rat glue to enamel on the surface may remain constant.

The irregularity in printing results may sometimes be traced to uneven sizing of the body paper, so that during the coating operation, the glue of the coating mixture tends to soak more readily into the body paper a time than another, thereby disturbing the composition of the artificial surface.

In cases where the ratio of glue to enamel is already barely sufficient to resist the pulling or lifting of the printer's ink, any slight alteration of this kind gives rise to serious trouble.

It must not be forgotten that there are many conditions which affect the final results. The influences are cumulative, or, on the other hand, they may neutralise one another, so that the figures which analysis may give as representing the percentages of certain ingredients cannot always afford conclusive evidence. The following is an illustration of a simple case of "cumulative influence." A coating mixture of definite composition, which experience has proved to be suitable for a given paper, may be applied to a soft-sized body paper. The paper, however, may be insufficiently calendered. The ink for printing may be a trifle more tacky or tenacious than usual. All these conditions tend to lower the resistance power of the coating, and the printing results will be poor owing to what we term for want of a better name "cumulative influences."

#### DEFECTS IN "ART" PAPER.

The chief quality in a coated paper is a good surface which must be hard enough to resist any tendency to "lift" and yet soft enough to allow the ink to be absorbed sufficiently without spreading in order that the effect of "setting off" may be avoided.

The hardness of surface depends on the proportion of glue in the mineral coating. If the amount is too small then the enamel comes away from the paper and as a result the process block so that the picture is spoiled, is technically known as "lifting." If however the amount of glue is too great, the ink is not absorbed quickly and it comes off on to the back of the next sheet of paper leaving the printing machine. This "setting off" is a serious drawback to rapid printing, in which a production of 1500 copies per hour is by no means an uncommon occurrence.

In colour work the presence of too much glue in the coating is a defect since the colour will not lie flat and the result produced is very poor. A good surface gives a uniform flat colour, but a surface which is too hard gives a mottled, washy and unsatisfactory result.

It may be noted that the super-calendering of a paper is something to do with the hardness of the surface. The main object of the polishing is to finally smooth down the slight irregularities on the paper, and to give a surface that will reproduce every detail in the block with accuracy. A little extra rolling to sheets which show a tendency to "lift" will sometimes improve the surface sufficiently for the work because the glazing slightly increases the resistance power of the coating to resist the ink. The resistance obtained is only momentary, but before the coating time to become detached, the pressure of the rollers against the paper is removed, and the desired result is obtained.

The importance of these two factors, one of which is chemical, represented by the glue, and the other purely mechanical one, namely, the glazing or super-calendering, may be judged by a careful comparison of pictures printed on "art" papers containing varying proportions of glue and varying degrees of surface.

The conditions shown in Fig. 111. are those of extreme cases, created in order to bring out clearly the influence



adhesive matter. Naturally the papermaker aims to obtain a good coating with a minimum of glue, but slight variations in the direction of glue from a standard which experience has proved for a certain class of work are found to be risky. In consequence of this, a paper coated for use with light blocks may pick off when employed with blocks of heavy dark shades. The production of a dense print is always a severe test on an art paper.

#### INFLUENCE OF MINERAL MATTER ON PRINTING RESULTS.

Hand-made paper containing little or no mineral matter has the picture blurred and indistinct, the depression watermark being brought into prominence by the deposit of ink along the lines of the mark itself. Cheap printing paper with a small proportion of mineral matter, of loading, there is a slight improvement in result.

A machine finished paper containing about 16 to 18 per cent. of loading or mineral matter a marked improvement is obtained.

An imitation art paper containing about 30 per cent. of mineral matter, much of which lies on the surface of the sheet, the picture shows more detail.

Generally in the art paper giving a smooth surface completely free of mineral matter, the clearness of the leaves nothing to be desired. But it must not be looked that the surface is artificial and the paper is quite a secondary part, being sandwiched in, between two layers of mineral coating. In consequence of this the quality of the "body" paper is considered a matter of no importance, and many papers are merely composed of ingredients in which conditions essential for durability are chiefly remarked by their absence.

The rationale of the process is therefore perfectly clear. In a high-class writing paper, the absence of any mineral matter absolutely precludes an even surface, the glazing or polishing of these surfaces as produced by processes perfectly familiar to the papermaker, viz., the use of the super-calender, the plate-glazing rolls, etc., is not sufficient to give the desired effect. Usually, the print is blurred, indistinct, and lacking detail and the curious outlining of the watermark is an indication of unevenness of surface. The examination of the surface of a high class linen paper reveals the presence of numerous fibres crossing and recrossing in other in every conceivable direction. It is obvious that even minute fibres occupy a certain volume, and the face of the paper at all such points of intersection is slightly above the spaces between them, and a certain amount of pressure will bring them into one plane.

The addition of a small amount of mineral matter to fill up the interstices of the paper. The particles of mineral matter such as china clay, which is the usual filler for cheap papers, distribute themselves around the fibres and fill up, more or less, the air spaces, and reduce the irregularity of surface. The pressure of the action of the rolls in the super-calender reduces minute undulations on the surface of the sheet as in the case of a high-class rag paper, but the fibres are not so pronounced. As the percentage of mineral matter is increased the improvement in the paper from the printing standpoint is noticeable, and is forced to the conclusion that the particular characteristic necessary in an "art" paper is only to be achieved by a complete degradation of the actual paper mineral substance which has nothing in common with the fibrous constituents.

The "imitation art" paper, which is a compromise between an ordinary cheap printing paper and the so-called high-class "art paper," contains a very high percentage of mineral matter which is brought up to the surface by a peculiar process of treatment, so that the surface of paper is rendered more suitable for half-tone printing. To use the word "paper" in connection with a material which consists of 35 per cent. china clay held together by a few low class vegetable fibres is an abuse of terms, but it is one which has some commercial value.

#### SUGGESTIONS AS TO SURFACE.

With such a purely artificial surface upon a sheet of paper, which can easily be removed by friction with the moistened finger, it is evident that durability of the pictures is scarcely to be expected.

The resistance of the art paper to the ravages of time is a matter which should not be difficult to determine, since all the elements for rapid depreciation are present in the shape of a large percentage of a cheap glue mixed with a common clay lying on the surface of a more or less inferior body paper, so that the moisture and damp of an ordinary atmosphere find books of this class an easy prey in course of time. The preservation of books containing the fine art illustrations obtained by the process of printing can be prolonged by careful storage in a properly dried room, but having regard to the large number of books expensively got up being continually published, this question is of the utmost importance.

In this case, as in many similar instances, the rule that "prevention is better than cure" holds good, but so far, the introduction of a fine art paper in which the smoothness of surface shall be an inherent quality of the actual paper, and not a mere artificial characteristic, has not been successfully accomplished.

There is a big field open for a systematic research into this question, which would afford considerable scope for chemical and mechanical ingenuity. No doubt the discovery of some method for obtaining a smooth surface without the employment of such adventitious substances as those which obtain at present would be extremely profitable to the inventor. Attempts have been made by the writer to obtain a coating by means of some form of dissolved cellulose, but without success. Investigation should probably proceed along the lines of the "Willesden process." In the manufacture of water-proof Willesden paper and similar goods, the body paper is passed through a bath containing cellulose dissolved in Schweitzer's reagent, an ammoniacal solution of cupric oxide. When this solution evaporates, a greenish mass of cellulose and copper oxide coats the whole surface, and the coating becomes intimately associated with the body paper by reason of the partial dissolution of the surface cellulose which takes place as the ammonia evaporates.

The colour of the final product is greenish, but the substitution of the copper by zinc brought about by treating the Schweitzer's reagent with metallic zinc, produces a colourless solution of the corresponding zinc salt, which has somewhat similar properties.

Other soluble forms of cellulose offer considerable attractions for research in this new field. The work of Messrs. Cross and Bevan, with the thiocarbonates and acetates of cellulose, are well-known in this connection, but the application of these soluble derivatives as a coating pure and simple has not yet met with any wide measure of success.

The attempt to produce a glossy surface on paper by the reprecipitation of a soluble cellulose seems to be a correct and scientific procedure, eliminating to a large extent the conditions which favour disintegration and the dissolution of three irreconcilable elements, the body paper, the mineral coating and the printers' ink.

Many of the difficulties experienced by printers using art papers may be overcome by careful attention to the conditions of working. The most important condition for successful work is that of an equable temperature. It is a matter of common experience that printing with art papers on Monday gives far more trouble than the work later on in the week, and that in the winter this difficulty is more pronounced. The general principle to be observed is the desirability of having the art paper, the ink and printing presses all at the same temperature and not only during the process of printing, but for some time before use. The regulation of the heat of the room to some fixed standard would do away with many troubles which are at present ascribed to the "paper" in some vague manner. Thus, for example, a given sample of ink may give satisfactory results one week because the supply has been kept in the printing room, while the next

week, being brought direct from a cold store room, it may give rise to endless trouble.

With regard to the ink which is used for printing on art paper, no systematic work has been done, and it is evident that a proper investigation into this question would result in some definite information. As the enamel on the art paper in its natural condition has a dull surface the ink must be of good quality. In general terms, the ink should have sufficient consistency to be tacky, the rollers should be hard and well seasoned, with a proper distribution of the ink by the inkers. In addition to the property of consistency, the ink should be manufactured in such a way as to dry quickly when placed on the surface of the paper. The consistency is determined by grinding down the colouring matter with as much strong varnishing as possible, the ink being thinned down if necessary afterwards, though the addition of too much medium varnish for this purpose tends to make the ink when dry flake away from the surface of the paper. The addition of driers is not always essential as the constituents of the ink pigment possess in themselves the necessary qualities for this purpose. It is hard to say whether the chemist can undertake the task of making up the ink varnish to the required consistency and with the required tackiness and drying properties, because so many factors enter into consideration, many of which are of a mechanical nature, as already intimated.

Probably, just as important a factor is the nature of the paper itself. Successful printing can only be accomplished by practical experiment, and this seems to lie in the hands of the printers as much as in that of the ink manufacturer or paper maker.

*Imitation Art Paper* is largely used for catalogues and cheaper printings where clearness of detail is not so essential as in the best art papers. It is a very efficient substitute in many respects, but it lacks strength and durability. It is usually made by adding large quantities of china clay to a mixture of wood pulp and esparto, and producing a heavy loaded paper in which only a small proportion of rosin size is used. The paper is made on the machine in the ordinary way, and treated as it passes on to the calenders of the machine by means of the water doctor. This is a device which causes the surface of the paper to come into contact with water just before it is drawn through the rolls of the calender. The somewhat bulky sheet wetted superficially in this manner is suddenly compressed by the pressure of the rolls and flattened down so that the surface has the appearance of a coating. The proportion of clay in an imitation art paper is often as great as 35 per cent., and this, coupled with the "soft sizing," is the cause of the somewhat limp feel and handle of this class of paper. It is, however, produced cheaply and answers its purpose.

*Duplex coated papers* may be produced by colouring a suitable coating mixture with one aniline dye for one side, and adding another to a coating mixture for the other side of the paper.

#### THE PRINTING PROCESS.

The production of a half-tone block from any photograph or picture is an interesting process, which may be described very briefly here. The picture is mounted on a board in front of a camera and brilliantly illuminated by means of two powerful arc lights placed on either side, and a photograph of the picture taken in the ordinary way except that a screen grating is put in front of the sensitive plate.

The screen grating is an important feature of the process, and is prepared in the following manner:—A sheet of plate glass of good quality is coated with an asphalt varnish. Lines are ruled diagonally at 45° across the varnished surface by an automatic ruling machine, which is capable of ruling parallel lines up to any degree of fineness. The number of lines per inch depends on the work for which the screen is to be used. For coarse, rapid work such as newspaper printing the lines are 50 to an inch; for book illustrations, the lines are 170–200 to an inch. The lines are etched on the glass by means of hydrofluoric acid, which eats away the glass along the lines ruled by the machine. A white enamel is rubbed into the etched lines, baked in by heat, and the glass

carefully polished. Two such glasses placed together with the lines crossing at right angles are cemented with Canada Balsam to form a screen grating.

The effect produced by the interposition of such a grating is to give a picture formed entirely of a very number of small dots, shadows being represented by closeness of the dots, and the lighter tones by divaricious sizes. The gradation of the light and dark depends greatly on the experience and skill of the operator in adjusting the screen at a correct distance.

The *screen negative* is developed in the usual way used for the production of a print on a copper plate. The plate is carefully washed and coated with a sensitive solution, made by mixing fish glue, albumen, bichloride of ammonia, and dilute chromic acid in certain proportions. The plate, brought into contact with the screen negative is exposed to an arc light, for a period of 6–8 minutes and then thoroughly washed in order to remove the portions of the coating not rendered insoluble by the light.

The washed plate is then immersed in a bath of aniline dye, usually methyl violet, which stains the plate and renders all the detail clear and distinct. When the plate is enameled by the heat of a Bunsen flame the colour of the picture changing from blue to green, finally to a deep brown tone. When this point is reached the plate is cooled down, and the coating resembles hard enamel.

The "etching" process requires a good deal of skill and technical experience, as well as a knowledge of the effect. The process is a simple one, involving the immersion of the plate, the back of which has been previously coated with black varnish, in a bath of weak nitric acid, the dots being protected by the enamel remaining on the plate and the spaces between are eaten out by the acid.

From this plate a rough proof is taken, which enables the operator the opportunity of determining how further the etching process must be taken, and the time to which it may be necessary to etch some portions of the plate deeper than others in order to give good results in the final picture. The finished block is mounted on a slip of wood, and in that condition is ready for the press.

#### DISCUSSION.

Mr. CLAYTON BEADLE said there was no doubt the introduction of the so-called "art papers" had given a further stimulus to the use of china clay. He was one class of paper which he did not think the public had referred to, that was the paper made by what is called the "water finish." It was not a coated paper, but was treated in a peculiar way. The paper was treated with a thin film of water before it passed over the calender and this treatment imparted to the surface a character which rendered it capable of receiving impressions from process blocks. So far, this paper had not been as successful as the coated paper. Undoubtedly, the effect of the art paper was a very unfortunate one. The cellulose was absolutely transparent. It was due to the peculiar structure of the fibres which caused the light which falls upon their surface to be reflected and reflected in every conceivable direction that the pure white surface was produced. When such a substance as clay was introduced, either on the surface or into the body of the paper, a truly opaque surface was produced, and no amount of crushing would render the paper transparent. He thought that the proportions given by Mr. Simonds for the amount of casein and glue were greater than frequently employed in practice, either in this country or on the Continent. On the Continent they were ahead of this British with regard to coating paper. They were a body paper containing the very cheapest material, sometimes 50 or 60 per cent. of mechanical wood, while in this country 50 per cent. of esparto grass was used with 50 per cent. of chemical wood to produce the same effect. They were more skilled in the actual coating of the paper, and a cheaper and commoner body paper could be employed to get a similar result as to external appearance went.

Mr. WALTER F. REID said the two materials mentioned were generally used for enamelling paper.



nd casein, and it would be difficult to choose two als which were more readily decomposed in the of time, especially if they got damp. As Mr. had said in the closing remarks of his paper, there great opening for other materials, but there was considerable difficulty in using materials allied to se or which contained a solvent of cellulose. He sed experiments with nitro-cellulose solutions, and und that when the fibres were cemented too closely er the paper invariably became brittle. If the g were only on the surface of the fibres it was apt arate with frequent bending of the paper. He had ted thick cardboard of a spongy nature until it ed like wood; and he had extracted the coating ial, and the cardboard became as supple as it was . That was one of the great difficulties that were ith, but he thought that up to a certain percentage ing was a necessary adjunct, the paper itself being too . By coating with a mixture of mineral matter and , paper was produced which could not stand the ay wear and tear. A great deal of the literature of esent day was read and thrown away at once, and as great danger in printing works of scientific and al importance on paper which, as Mr. Sindall had y pointed out, was not durable. He thought those ers of the Society who had the opportunity could o better than devote themselves to this question, was one that contained great industrial possi-

H. P. STEVENS said that the diagrams which showed lect of printing on paper containing various pro-ns of mineral matter and glue or gelatin was very sting. Mr. Sindall also referred to the calendering e paper as also producing that effect, but surely ight be other factors which affected the way ich the paper took the print; for instance one be the variety of glue employed, and he should o have heard Mr. Sindall's opinion as to some he more important qualities which he would or in a suitable glue. Glue was used for a number roposes, not only for coating paper, but for sizing, on, and naturally the quality of glue which would per for sizing purposes would be different from or coating. Mr. Sindall had spoken of satin white isisting of barium sulphate and alumina; the common white was, however, prepared from slaked lime and r aluminium sulphate. He believed that the whites frequently consisted of nothing more than oitated calcium sulphate, and they did not usually in barium, or, at any rate, very little.

R. W. SINDALL said that imitation art paper was eed by what was termed "water finish." In the ss a very large percentage, perhaps 30 per cent., of clay was mixed with the pulp in the beaters, the paper passed through the calenders, and the water was ght into contact with it by means of a roller which kept wet, the result being that as the paper came gh the rollers the clay was brought up to the surface. regard to the proportions of the glue and casein, h he had quoted, many of the figures were derived his own practical knowledge and experience, and of them had been given to him. He had no doubt uch of the ordinary art work they could do with as as 15 per cent., but with normal everyday printing, had to produce a paper which would stand the rest conditions. With regard to the use of lved cellulose as a coating material, the unfortunate g was they could not easily get rid of the by-ucts of the chemicals used as the solvents. That one of the drawbacks of attempting to produce an paper from dissolved cellulose. e had not gone into the question of the influence of quality and varieties of glue, but the subject was one h needed investigation. It was necessary as far as ble to connect the analytical results obtained in the oratory with the practical results obtained in the ing offices or in the mill. That was an investi-on which the paper makers did not carry out them-: they expected it to be done in the laboratory, re it was not always possible.

*Meeting held at Burlington House, on Monday, June 5th, 1905.*

MR. A. GORDON SALAMAN IN THE CHAIR.

## THE INFLUENCE OF GELATIN SIZING ON THE STRENGTH OF PAPER.

BY CLAYTON BEADLE AND H. P. STEVENS.

As far as we are aware no systematic attempt has been made to determine the influence of different percentages of gelatin on the physical constants of a waterleaf paper. It is generally known, of course, that gelatin increases the strength of a paper, and that the increase is in some way connected with the percentage of gelatin added, but, so far, no tables or diagrams have been published showing the effect of different proportions of gelatin on the strength and stretch of paper.

Before describing our work we will briefly refer to two communications bearing on the subject which have appeared in German trade journals since the completion of our work. Both these papers, however, cover a different ground to our own as in neither of them is any attempt made to trace the effects of different proportions of gelatin.

The first of these papers is by E. L. Selleger, and appeared in the "Papierfabrikant." For these experiments the strength and stretch of the papers were measured before and after treatment with animal size. As most of the experiments were performed on previously, rosin-sized papers they are hardly comparable with our own. The only experiment on a waterleaf paper containing no rosin gave to following results:—

A. *Unsize Paper* (weight per sq. m., 55 grms.); mean breaking length, 6,300 m.; mean elongation, 5.4 per cent.

B. *Paper Sized with Animal Size* (weight per sq. m., 60 grms.):—Mean breaking length, 7,260 m.; mean elongation, 7.4 per cent.; increase on breaking length, 960 m. = 15 per cent.; increase in elongation, 2 m. = 37 per cent.; increase in weight per sq. m., 5 grms. = 9.04 per cent.

Unfortunately the author gives no information as to the quantity of the gelatin used.

The second paper appeared in the "Wochenblatt fur Papier-Fabrication" in connection with the choice of suitable materials for bank note papers. As no information is given either in respect to the strength of the sizing bath or the amount of gelatin taken up by the paper, it is not possible to compare these results with our own.

The effects of rosin size upon strength of waterleaf papers have in a small measure been investigated. For many years it was supposed that the addition of rosin size in all cases diminished the strength of the paper. By conducting a number of sizing trials with known quantities of rosin size in papers of known composition one of us was able to show that in many instances the reverse is the case, namely, the rosin size increasing the strength of the paper. Within certain limits this increase was found to be in proportion to the amount of rosin fixed by the fibres.<sup>(1)</sup> Thus, when papers contain a very large proportion of mechanical wood, and in their waterleaf state show very low tensile strength, this strength is increased by the addition of rosin, whereas, if the waterleaf strength is high, the addition of rosin tends to diminish the same. It appears, therefore, that the addition of rosin is such that under normal conditions it increases the strength of very weak papers and decreases the strength of very strong ones, whilst papers of intermediate strength are little affected. In the original communication an attempt was made to represent this numerically, and it would appear possible to calculate the strength of a rosin-sized paper if the waterleaf strength, percentage of rosin, and rosin strength factors were known. Under abnormal conditions, however, but under conditions that not infrequently occur in ordinary practice, such as in a very damp atmosphere, or when the paper is artificially damped, the rosin affords some protection to the fibres. In such

cases it appears that under all circumstances of composition the rosin-sized paper is stronger than its water-leaf, provided the amount of rosin present be not too small. At any rate this has been our experience so far. It will be readily seen, therefore, that the influence of rosin upon the strength of paper is one of extreme complexity and dependent upon many factors. It is therefore a difficult subject to investigate, and it is hardly surprising that the work of different observers has led to conflicting conclusions.

In many commercial papers the subject is still further complicated, from the fact that the paper is first rosin sized and then tubsized with gelatin. We mention these facts because they may assist in some measure in a better grasp of the subject with which we are about to deal.

Many papers of the highest class, such as drawings, loans, banks, high-class writings, &c., are still sized with gelatin alone. We propose to simplify matters by dealing only with these.

We will now briefly review the earlier work which has led up to the researches undertaken on behalf of this communication. One of us undertook, at the request of Messrs. George Newnes, Ltd., a series of researches, among the chief objects of which was to investigate the influence of sizing paper with gelatin.<sup>(2)</sup> Samples of paper of different fibrous composition were cut in transverse section, both in the machine and cross direction, from which photomicrographs were produced. These sections if focussed critically can be made to show the section of the individual fibres, transverse and longitudinal, which assist in determining the direction in which these fibres are placed, but what perhaps is more interesting is that they can be made to reveal the nature of the interstices of the paper, from which we can form some conception of the manner in which gelatin should be distributed. It must be remembered that these interstices as revealed by magnification of the sections have to be bridged over by microscopic films of gelatin to give the paper the necessary ink-proof qualities.<sup>(3)</sup> The general distribution of the fibres has furthermore been investigated by splitting paper into laminae sufficiently thin to permit the light to penetrate freely; such laminae should not for such purposes consist of more than one layer of fibres.<sup>(4)</sup> Such laminae made it evident that on the top surface of the paper the distribution and direction of the fibres is different from that of the middle or of the underneath layers, and it affords further proof of the statement of Schuberth that papers are disposed in natural laminae.<sup>(5)</sup> The reason for this has been traced to the peculiar action of the wet end of the paper machine whilst the wet web is in process of formation. These researches led to the determination of what we call the direction of "least expansion when wetted," which was proved ultimately to coincide with the mean direction of the fibres.<sup>(6)</sup> By aid of the above-mentioned laminae note was taken of the direction of different fibres. Tables were constructed showing the direction of each individual fibre, from which the mean direction in each case was calculated.<sup>(7)</sup> With machine-made papers the mean direction of the fibres corresponds within a degree with the "machine" direction, i.e., the direction in which the paper travels on the machine. As the greatest strength would naturally be in the predominating direction of the fibres, it had for years been argued that the fibres pointed in the machine direction. The above measurements proved this supposition. These laminae have furthermore shown that the watermarking of paper is rendered visible to the naked eye, not so much from the difference in the thickness of the design as compared with that of the background, but from the fact that the fibres are disposed in opposite directions, running (in ordinary laid papers) at right angles to the line of the wire marks in the thinner places; and parallel to them in the thicker places.<sup>(8)</sup> The reason for this appears to be that the fine wires of the "dandy" at the moment of contact with the soft stuff on the machine wire push aside all those fibres parallel with themselves, whereas these wires are unable to influence those fibres at right angles.

For the purpose of investigating the strength of papers in different directions, papers were tested by the "fan method."<sup>(9)</sup> In machine-made papers the cross direction of the web, i.e., that at right angles to the direction in

which the paper travels on the machine is described as 0° or 180°, thus forming a base line for measurement machine direction being 90°. Strips of paper 3 in. by 1 in. wide were cut at every 10° from 0° to 90° at some cases at every 5°. These were tested for tensile strength, which is expressed in pounds, and for elongation, the time of fracture, which is expressed in percentage, the distance between the clips which hold the paper in the testing machine. Diagrams plotted, showing the fluctuation of strength at these different angles, were found instructive. The strength is always greatest when paper is pulled in the machine direction, and least when pulled in the cross direction or near to it. When tested every 5° it is generally found that the strength is a minimum a few degrees from the cross direction, although always at its maximum in the machine direction. I tested every 10° the divergence of minimum strength from the "cross" direction is naturally lost sight of. The reason for this slight divergence can be traced to the action of the paper machine.<sup>(10)</sup>

As a general rule with machine-made papers the direction (or "stretch," as it is usually called) is in the order to the strength; thus the "stretch" is greatest when pulled in the "cross" direction and least when pulled in the "machine" direction.

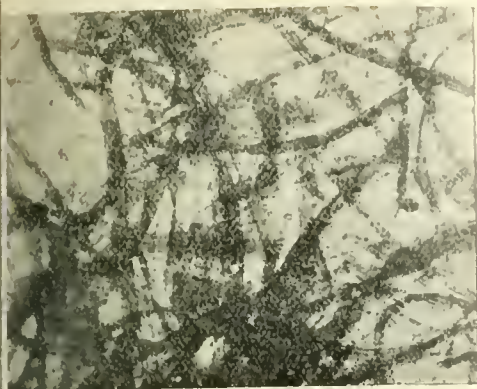
Hand-made papers are generally supposed to have uniform strength, or nearly so, but unfortunately far from being the case with a great deal of the hand-made paper. With a view of investigating this point a number of well-known hand-made papers were tested by the "fan" method for strength and for stretch. For particular make of hand-made papers it will be found there is one spot or position on the sheet which gives the greatest strength when pulled at a particular angle, another in another position of the sheet and at a different angle which gives the least strength. That which gives the greatest strength gives the least stretch and *versa*.<sup>(11)</sup> There are far greater complexities in the properties of hand-made than with machine-made. These complexities partially arise from the "personal equation" of the vatman who makes the sheet, but also very largely from the manner in which the mould is dipped into the vat, which is common to all hand-made papers.

With machine-made paper, if prepared with ordinary care and uniformity, all strips cut parallel to one another, no matter at what particular angle or part of web, have approximately the same tensile strength.<sup>(12)</sup> In hand-made papers this is not the case. Thus, if a sheet of hand-made be divided up into numerous parallel strips, the strength will be found to depend upon their position in the sheet.

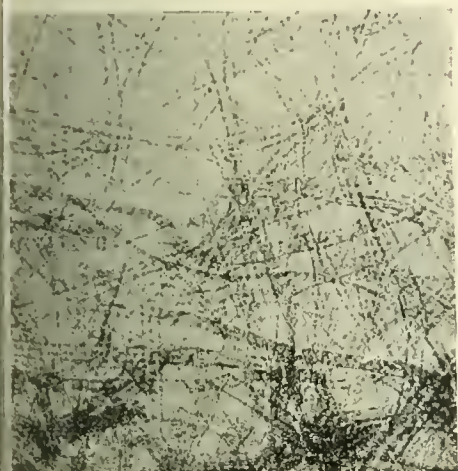
The fact that the near deckle edge (i.e., that edge directly underneath the letters on the watermark running parallel to same) is dipped first into the vat and the edge parallel to it is the last to receive the water, results in the production of paper, which has quite a different "tear" on the near deckle edge to that on the far deckle edge. This difference is noticed whether the paper be made parallel to or at right angles to the respective deckle edges. An experienced paper-maker can tell by his eyes shut by tearing the paper which of these two deckle edges the tear is close to, and with the naked eye the difference of tear is apparent even to the casual observer. By a series of tests on strips cut in different directions near these two deckle edges, the probable cause of this difference has been revealed, and on closely following the motions of the mould, the reasons for these differences can be grasped. These physical tests show a marked difference of strength and stretch at different angles, which difference is not popularly supposed to exist.

As to the strength of hand-made paper when pulled at right angles to these "near" and "far" deckle edges, the matter is different, that on the right of the vat running to and from him is in every way similar to that on his left running parallel to same, but it differs entirely both in tear, strength, elasticity, and other qualities from the condition of the paper along the near and far deckle edges. The middle of the sheet is affected by four deckle edges, and in a square sheet where the corners are equi-distant, the effects of these respective influences

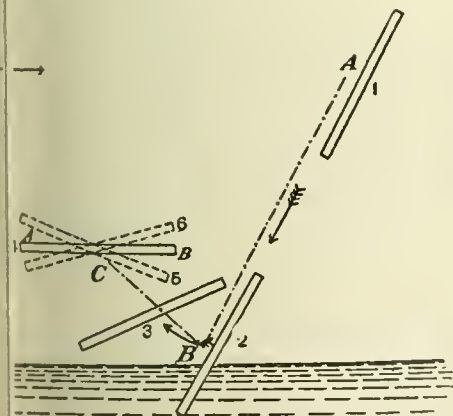




1.—SPLIT SECTION OF CIGARETTE PAPER, SHOWING ARRANGEMENT OF FIBRES DUE TO WATER-MARK. Direction of small laid lines indicated by arrows. (Magnification, 100 diameters.)



2.—PHOTO-MICROGRAPH SHOWING INFLUENCE OF WAVE, BY LIFTING MOULD OUT OF VAT, ON DIRECTION OF FIBRES. (Magnification, 110 diameters.)



3.—SIDE VIEW, SHOWING MODE OF DIPPING DECKLE INTO VAT.

A B C, path of vatman's thumb.  
A, front deckle edge. B, back deckle edge.

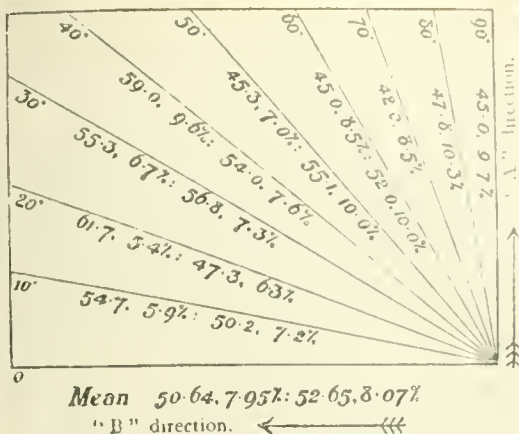
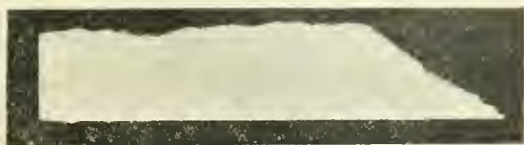


FIG. 4.—SHOWING THE BREAKING STRESS, IN LBS., AND PERCENTAGE STRETCH OF PURE LINEN HAND-MADE PAPER WHEN TESTED AT DIFFERENT ANGLES.

(This is one of the few papers nearly equal in strength in all directions and in all parts of sheet.)



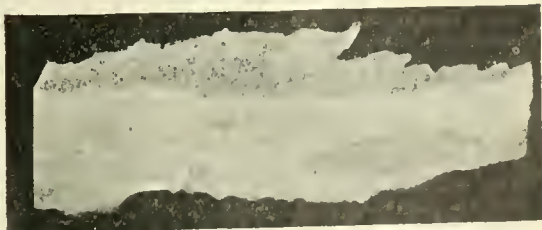
Paper "Y." Torn close to far deckle edge B. (Fig. 2.)



Paper "X." Torn close to far deckle edge B.



Paper "Y." Torn close to near deckle edge A.



Paper "X." Torn close to near deckle edge A.

FIG. 5.—TO ILLUSTRATE NATURE OF TEAR CLOSE TO NEAR AND FAR DECKLE EDGES.

might almost be calculated for any angle. The material contained in the corner, is, of course, brought under the influence of the two edges enclosing the angle. The forces which these two edges exert are at right angles to one another, but one edge very much preponderates in its influence over the other.

Speaking generally, hand-made paper is strongest at or near the direction in which the vatman looks when making the sheet, and is weakest at right angles to this direction. The reason of this is, that in process of lifting the mould out of the vat a wave is produced, which traverses from the vatman to the opposite side of the deckle. This wave tends to set the fibres in the direction in which the wave traverses, and so gives the greatest strength to the paper in this direction. Although the vatman shakes the mould in the opposite direction to overcome this influence, the first wave is so great in its effect as to preponderate over all subsequent influences.<sup>(13)</sup> Hence, the difficulty in making hand-made papers absolutely uniform in strength. We do not wish it to be supposed that hand-made papers are inferior to machine-made. The reverse is undoubtedly the case. We are dealing here with small differences. Hand-made and machine-made papers may be compared to ivory and ivory substitutes respectively. The former is much superior apart from its sentimental value in spite of the fact that its physical qualities are somewhat unequal or irregular. We have given numerous foot-note references in order that those desirous of sifting the evidence on which these conclusions are based can refer to the original publications.

This concluding reference to the researches undertaken on behalf of Messrs. Newnes, we will now proceed with our joint work.

In passing, we must briefly refer to a series of comparative trials on the strength-giving qualities of different gelatins abstracted in this Journal.<sup>(14)</sup> That gelatin, marked P in the list, was the one chosen for trials, about to be described. By studying the original communication it can easily be seen how this sample compared in its various qualities with the other samples which it was matched against. The waterleaf paper was also of the same make as that used in the following investigation.

It is obvious from what is said above that, it would be an extremely difficult thing to investigate the exact influences of different proportions of gelatin upon a hand-made paper. We made numerous tests with this object, but without success. Although much useful information was obtained, it was not of such an order as to admit of representation in a diagrammatic form. We found it necessary therefore to select a machine-made paper for the purpose.

The paper selected for our experiments was a typical machine-made cream laid waterleaf; containing about two-thirds cotton and one-third linen; substance about 27 lb. large post. It was cut into convenient strips, each sheet being carefully weighed. Some of these strips were tested for strength and elongation in both machine and cross directions, the results of which are given in Table 1. The first three horizontal columns of the table give the average of eight tests and the fourth gives the average of the first three. It will be noticed that the paper selected was wonderfully constant and uniform in its physical qualities, this being essential in trials where slight differences have to be observed as the result of small additions of gelatin. To obtain this uniformity as above explained, a machine-made paper had to be selected. The strips of waterleaf were treated with gelatin solution at 130° F., containing no alum or soap. The strips were first laid on the surface, and when the gelatin had soaked through on to the top surface they were immersed and immediately afterwards passed through rubber squeezing rolls, again weighed, and hung up to loft dry in air at 60–65° F. After drying, they were again weighed. They were then put together and kept about a week in air at the same temperature and tested for tensile strength and elongation, in the same manner as the waterleaf (Table 1.)

Table 2 shows how the percentage of gelatin taken up by the waterleaf in each case was arrived at. The quantity of gelatin is proportional to the strength of the bath.

The description at the head of each column is sufficiently explanatory.

Table 3 gives an individual test in detail of a waterleaf sheet.

Table 4 gives full details in regard to the whole of the tests.

The curves as shown on Figs. 9 and 10 when taken in conjunction with table 4, speak for themselves.

A curve can be drawn, as shown in Fig. 9 through various mean figures of machine and cross directions. A quite unexpected result was produced by the addition of 0.43 per cent. of gelatin. Instead of a slight increase in strength a decrease took place. On repeating the experiment, with a solution of gelatin of the same strength as before, a similar result was obtained. The effect of the addition of a very small percentage of gelatin is therefore to decrease the strength, particularly in the machine direction. On increasing the proportion of gelatin the strength again rises so that with the addition of 0.7 per cent., the sized paper has the same mean strength as the waterleaf, after which there is a rapid increase. The approximate increase at different stages are tabulated in Table 5. The ratio of machine to cross direction in respect to strength, shows a greater difference with the waterleaf than with the sized papers, but this ratio remains fairly constant with proportions of 1 per cent. to 5 per cent. of gelatin. With larger quantities of gelatin, the difference is less marked.

By reference to Figs. 9 and 10, a papermaker can get some idea of what increase in strength will be produced by the addition of different percentages of gelatin in sizing. As the quality of the gelatin may influence the results somewhat, it is well to note that the gelatin used was of good quality, such as might have been the case with papermakers for the sizing of rag papers. We can, however, anticipate that the general character of the paper would be affected by the quality or properties of the gelatin, although we have good reason to believe that the extent of the increase in strength would be influenced by the character both of the gelatin and of the paper used.

Fig. 11 shows the character of the curves of elongation at time of fracture, which should also prove of value to papermakers for the purposes of reference, particularly in cases where it is desired to produce a paper of high elongation, or where the latter must lie within certain limits as is often the case for H.M.'s Stationery Co.

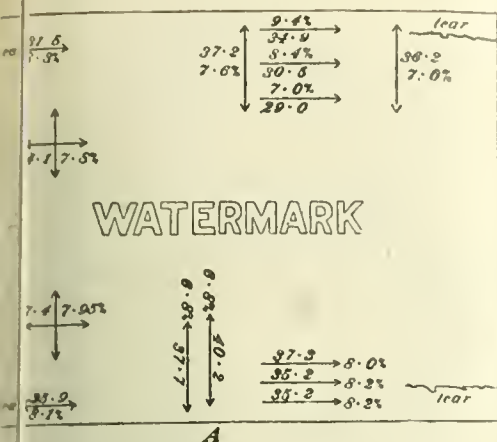
We attach considerable commercial importance to the description of work which we have endeavoured to put before your notice in this paper.

For the great majority of purposes, unsized waterleaf is of no service. For the purpose of printing and writing, upon, to impart to the sheet its necessary hardness, enable it to be used for multifarious purposes, the paper must either be rosin-sized or tub-sized.

The addition of sizing materials profoundly influences the physical qualities of the paper. A waterleaf made of strong materials frequently has little strength until it has been sized with gelatin, but the influence that the sizing will have upon the paper is entirely dependant upon the character of the fibres of which it is composed. The waterleaf has latent properties, which, in a large measure, make themselves manifest after the addition of gelatin. A more exact knowledge of these changes is much to be desired. Although we have extended our tests to a large range of papers and made them as exhaustive as possible, we do not feel justified as yet in dogmatizing much, but our results, such as they are, may, we hope, be of service to papermakers and users of papers. Knowledge of the methods we have employed will, we trust, stimulate others to give the subject closer investigation.

In conclusion, we beg to thank Mr. John Christy for his kindness in permitting us to use lantern slides and photomicrographs, many of which were prepared by him to assist our researches, and to Messrs. George N. Ltd., for permission to reproduce lantern slides and diagrams, both of which have been of material service in illustration of this paper.





6.—SHOWING RESULTS OF PHYSICAL TESTS OF PAPER, PERFORMED CLOSE TO FAR (B) AND NEAR (A) DECKLE EDGES.

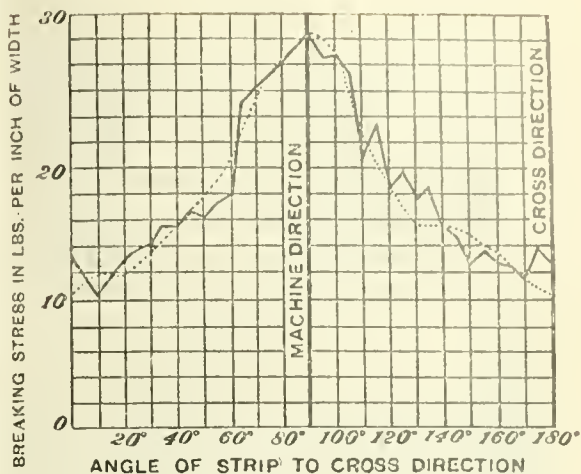


FIG. 7.—CURVES SHOWING BREAKING STRESS OF PAPER IN DIFFERENT DIRECTIONS.

Machine-made tub sized cream-wool extra superfine note paper, made from cotton and linen rags.

The line . . . . shows the results of tests taken for each 10°, and the line ——— for each 5°. Cross direction 0° or 180°; machine direction 90°.

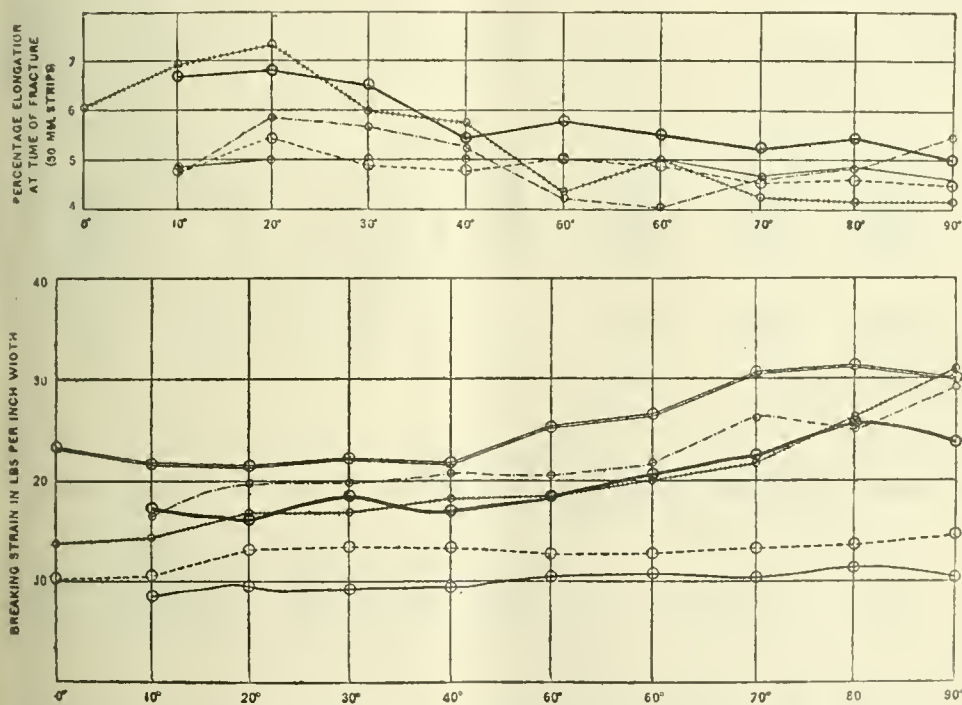


FIG. 8.—TO SHOW THE STRENGTH AND ELONGATION OF HAND-MADE AND MACHINE-MADE PAPERS, TESTED AT DIFFERENT ANGLES.

- Hand-made shakes both ways. Half linen, half cotton. 25 lbs. L.P., gelatine, 7.8 per cent.
- Cream wool (linen) machine-made bank. 10 lbs. L.P., gelatine sized.
- Backward and forward shake waterleaf. Sized with 8.3 per cent. gelatine.
- Backward and forward shake waterleaf. Unsized.
- Hand-made "side to side shake" waterleaf. Sized with 6.8 per cent. gelatine.
- Hand-made "side to side shake" waterleaf. Unsized.

FIG. 9.

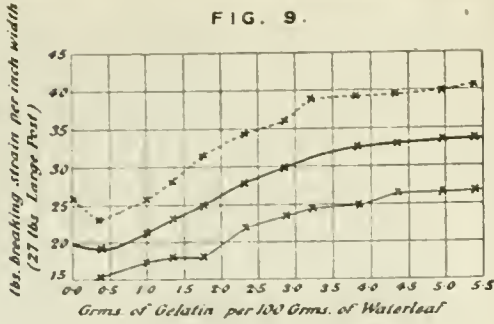


FIG. 10.

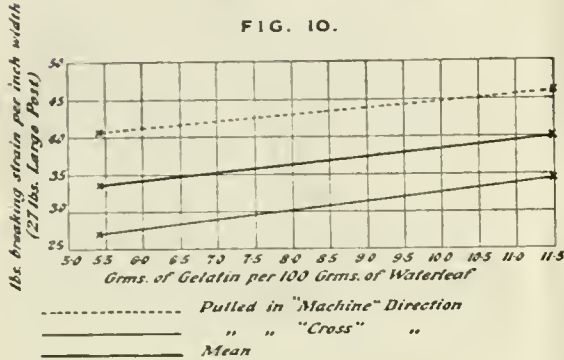


FIG. II.

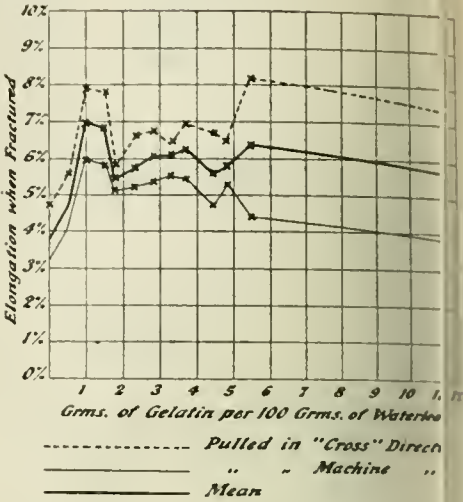


TABLE 1.

Tensile strength and percentage elongation of Waterleaf as used for Trials with different concentrations of Gelatin :—

Breaking Strain in lbs. per inch width.					Elongation at time of fracture.			
	Machine Direction mean of 3 tests.	Cross Direction mean of 5 tests.	Mean of Machine and Cross Direction 8 tests.	Ratio when Machine = 100.	Machine Direction on 50 mm. strips 3 tests.	Cross Direction do. 5 tests.	Mean of Machine and Cross 8 tests.	Ratio when Machine = 100.
Mean of all tests	25.63	13.80	19.73	54.0	Per cent. 3.43	Per cent. 4.08	Per cent. 4.20	1
	25.77	15.48	20.62	60.0	3.20	4.76	3.98	1
	26.13	15.42	20.77	59.0	2.80	4.16	3.48	1
	25.84	14.90	20.35	57.3	3.14	4.63	3.89	1

TABLE 2.

Table showing the amount of Gelatin taken up by paper from Gelatin Solution of different concentrations as used for Trials :—

No. of Trial.	A Weight of Waterleaf. (Air dry.)	B Weight of Wet Paper after sizing.	C Weight of size solution absorbed by Waterleaf (by difference).	D [Strength of size solution in vat (Per cent. Gelatin).	E Weight of air dry Gelatin absorbed by Waterleaf (by calculation).	F Percentage Gelatin in finished tub-sized Paper.
1	3.50	6.57	3.07	Per cent. 0.5	0.015	Per cent. 0.43
2	—	—	—	—	—	1.00
3	3.22	6.32	3.10	1.5	0.046	1.43
3A	3.57	7.22	3.65	1.5	0.054	1.51
4	3.55	6.70	3.45	2.0	0.063	1.78
5	3.60	7.02	3.42	2.5	0.085	2.36
6	3.55	7.00	3.45	3.0	0.103	2.90
7	3.60	6.90	3.30	3.5	0.115	3.20
7A	3.25	6.32	3.07	3.5	0.107	3.29
8	3.50	6.75	3.25	4.0	0.130	3.72
9	3.32	6.60	3.28	4.5	0.147	4.41
9	3.70	6.75	3.05	4.5	0.137	3.90
10	3.55	7.07	3.52	5.0	0.176	4.96
10	3.15	6.60	3.45	5.0	0.172	5.46
20	3.51	7.56	4.04	10.0	0.404	11.51



TABLE 3.

Table giving details of an individual test with one of the Waterleaf sheets of same make as in Table 1, but somewhat thinner:—

Machine.			Cross.		
Strength.	Elongation.		Strength.	Elongation.	
lbs.	Per cent.		lbs.	Per cent.	
21.4	3.2		15.2	5.2	
21.4	3.2		15.2	5.6	
21.0	3.2		15.2	5.6	
			15.2	5.8	
			15.2	5.6	
Mean	21.26	3.2	15.2	5.56	

TABLE 4.

Table showing the effects of Tub-sizing a machine-made paper (Cream Laid Superfine 27 lbs. L.P. made of Rag) with different percentages of medium quality Gelatin:—

1.	2	3	4	5	6	7	8	9	10	11	12	13
Air-dry Gelatin per 100 parts by weight of air-dry Waterleaf.	Mean Strength of Machine Direction in lbs. per inch width (3 tests).	Do. do. Cross Direction do. do. (5 tests).	Mean of Machine and Cross do. do. (8 tests).	Ratio of Machine to Cross Direction when Machine = 100.	Actual total gain in lbs. at each 1 per cent. added Gelatin.	Rate of gain at each 1 per cent. added Gelatin.	Actual gain from 1 per cent. to 2 per cent., 2 per cent. to 3 per cent., &c.	Mean of Machine Direction on 50 mm. strips (3 tests).	Do. do. Cross Direction do. do. (5 tests).	Mean of Machine and Cross (8 tests).	Ratio of Machine to Cross Direction when Machine = 100.	
0.0	25.84	14.90	20.35	57.3	—	—	—	Per cent.	Per cent.	Per cent.		147
0.43	22.53	15.20	18.86	67.6	—	—	—	3.14	4.63	3.89		139
1.00	25.77	17.14	21.45	66.4	1.10	1.10	1.10	4.00	5.56	4.78		131
1.43	28.83	17.58	23.20	60.9	—	—	—	5.86	7.92	6.99		132
1.78	31.70	17.62	24.66	55.6	4.77	2.38	3.67	5.10	5.80	5.45		114
2.36	34.55	21.82	28.18	63.1	—	—	—	5.20	6.54	5.87		126
2.90	35.66	23.24	29.45	65.1	9.42	3.15	4.65	5.40	6.75	6.07		125
3.24	39.10	24.54	31.82	62.8	—	—	—	5.60	6.48	6.04		116
3.72	36.66	23.38	30.02	63.7	—	—	—	5.54	7.00	6.27		127
3.80	38.87	24.82	31.84	63.8	12.10	3.02	2.68	5.26	6.68	5.94		127
4.41	39.37	25.16	32.26	63.9	—	—	—	4.74	6.64	5.69		140
4.96	39.73	25.12	32.47	62.8	12.14	2.43	—	5.20	6.48	5.87		123
5.46	40.50	26.90	33.70	66.4	—	—	—	4.66	8.20	6.43		175
11.51	45.93	34.20	40.06	74.5	19.71	1.97	—	3.86	7.44	5.65		193

TABLE 5.

Table showing the approximate gain in mean tensile strength at different stages due to tub-sizing with different % of gelatin:—

of sizing with gelatin.	Mean breaking strain.
leaf = 100.)	
cent.	About
gelatin.	1 1/2 lb. per inch of width.
"	5 "
"	4 "
"	2 1/2 "
"	1 1/2 "
ch 1 be-	
n 5 and	
elatin	1 " "

## DISCUSSION.

STEVENS wished to point out that the experiments strength of tub-sized papers prepared in this way be followed more closely by laboratory experiments many others. It was possible to closely imitate the s of treatment with gelatin that was actually l out in the mill, and consequently the results ed were of practical value.

Clayton Beadle. "The Paper Maker." Clayton Beadle. Fibrous Constituents of Paper. "Technics." pp. 427, 564. Vol. 2, pp. 60, 138, 251, 345, 586. Vol. 3, 116, 273.

- Technics. Vol. 2, pp. 63, 255.
- Technics. Vol. 2, pp. 251, 254.
- Technics. Vol. 3, p. 26 and Vol. 2, p. 590.
- Technics. Vol. 2, p. 349.
- Technics. Vol. 2, p. 64.
- Technics. Vol. 2, p. 252.
- Technics. Vol. 2, p. 254.
- Technics. Vol. 2, p. 590 to 592.
- Technics. Vol. 2, p. 348.
- Technics. Vol. 2, pp. 586 to 589.
- Technics. Vol. 2, p. 248.
- This J., 1905, 248.

## New York Section.

Meeting held at Chemists' Club, on Friday, May 19th, 1905.

DR. RUSSELL W. MOORE IN THE CHAIR.

DESCRIPTION OF METHODS EMPLOYED IN PREPARING THE TABLES OF SPECIFIC GRAVITY OF SULPHURIC ACID, NITRIC ACID, HYDROCHLORIC ACID AND AMMONIA, ADOPTED BY THE MANUFACTURING CHEMISTS' ASSOCIATION OF THE UNITED STATES.

BY W. C. FERGUSON.

## INTRODUCTORY.

The General Chemical Company, finding that many different methods of analysis were being used in their various works, and realising the advantages of uniform methods, submitted the task of unification to the writer. After careful investigation, the methods best adapted were selected, and by the constant examination of new methods described in the literature as well as by original research, these methods are from time to time substituted or modified. The need soon became apparent for uniform specific gravity tables, no two authorities agreeing; not only was there disagreement between specific gravities and corresponding percentage composition when reduced to the same standard, but different moduli, temperatures, &c., were used as standards.

The preparation of standard tables of the specific gravity

and corresponding composition, with other useful data, was undertaken for nitric acid, hydrochloric acid, ammonia and sulphuric acid. "The Manufacturing Chemists' Association of the United States," hearing of our efforts while the work was in progress, after investigation, accepted the tables as they were completed as standard tables of the association. In the case of the sulphuric acid table, they employed Prof. H. P. Talbot of the Massachusetts Institute of Technology of Boston, as expert, whose name appears with that of the writer as authority.

These tables are designed primarily as a basis for sales which are largely governed by the degree Baumé; they are also useful for controlling processes, taking account of stock, &c.

The acids and ammonia used were the purest obtainable C.P. and were carefully examined for impurities and purified when necessary. The impurities in commercial products are such a variable quantity and, as their purity is becoming more pronounced as manufacturing processes improve, many substances made on a large scale being nearly C.P., it was deemed that the tables would have more practical value if they were based upon C.P. compounds. As to any scientific merit they may possess, it is needless to say that such a positive basis to which they can always be referred is an essential.

All of the analytical and sp. gr. determinations, determinations of the co-efficient of expansion (or allowance for temperature), determination of boiling points, as well as all calculations and clerical work, were performed by two experienced men working independently.

#### SPECIFIC GRAVITY DETERMINATIONS.

All specific gravity determinations were taken at 60° F., compared with water at 60° F. The work was done in winter and no account was taken of differences of atmospheric pressure or temperature, which averaged about 760 mm. and 65° F.

The apparatus used in this work was a 50 c.c. Geissler pycnometer having a capillary side arm tube fitted with a glass cap, in the top of which was a small hole which allowed the liquid to expand without loosening the thermometer or cap, at the same time preventing loss while weighing. The thermometer, which was ground to fit the neck of the bottle, was graduated to 1/9° F. and readable to 1/18° F., and was frequently checked against a standard thermometer.

Before making a determination the water content of the bottle was first accurately determined and checked from time to time during a series of determinations. To obtain the water content, the bottle together with the thermometer and glass cap were carefully cleaned, dried and weighed. (The accuracy of the balance and weights were systematically checked against a standard set of weights.) The bottle was then filled with freshly distilled water at 55°–57° F., and the thermometer tightly inserted. As the temperature slowly rose, the water expanded through the capillary side-arm. When the thermometer registered 60° F., the last drop was removed from the top of the capillary, the tube capped and the whole weighed. This weight, less the tare obtained above, was taken as the water content of the bottle at 60° F. Check determinations agreed within 0.002 grms., or less than 0.00005 sp. gr. Distilled water freed from carbon dioxide by boiling, and cooling in a closed vessel, gave the same water content as the ordinary distilled water which was used throughout the work. This water was free from chloride and residue upon evaporation.

In determining the sp. gr. of liquids, the weight of the liquid contained by the bottle at 60° F. was obtained as above. This weight, divided by the water content, equals the sp. gr.

It was thought that the temperature of the liquid in the bottle might vary in different parts and the whole not have the same temperature as registered by the thermometer in the centre of the bottle. To ascertain the facts in the case a beaker was filled with water below the temperature of the room, and a thermometer placed in the centre of the beaker showed the same temperature as those placed near the sides, the temperature rising uniformly throughout the liquid.

#### COEFFICIENT OF EXPANSION.

The correction for temperature was found by allowing the liquid to slowly expand, and when the temperature had risen 8°–10° F., the tube was wiped off and the apparatus again weighed. Another weight taken at a still higher temperature, and from these the difference in sp. gr. for 1° F. and the number of degrees corresponding to 1 B. were calculated. To determine how much the expansion of the pycnometer affects sp. gr. determinations at different temperatures, the bottle was filled with distilled water and weighed at 50°, 60° and 80° F. From Kopp's table of the volume of water at different temperatures, the increase in volume of 5 for each 10° F. was calculated. If the bottle had expanded, the successive differences in weight should corresponded with the differences in volume, but in case the differences in weight were less than the calculated expansion of water, the amount less being due to expansion of the glass bottle. The results showed 1° F. = 0.00062 grms. = effect of expansion of 50 c.c. 100 c.c. = 0.0012 grms. which would make a difference of 0.000012 sp. gr., which is less than the accuracy of determinations, and no correction has been made for.

*Analytical Determinations.*—All calculations are upon F. W. Clarke's Table of Atomic Weights, 1906 = 16.

*Preparation of Standards.*—The following standards were prepared by the methods to be described:—Sodium carbonate (a) ignited at low red heat to constant weight; sodium bicarbonate (b) heated at 572° F. to constant weight; ammonium sulphate; 100 per cent. sulphuric acid; sulphuric anhydride; sulphanilic acid.

*Sodium Carbonate (a).*—This standard was prepared from the purest obtainable sodium bicarbonate by the ammonia process and specially selected for use by a prominent manufacturer. Our analysis showed it to contain in addition to some sodium chloride—

	Per cent.	Per cent.
SiO <sub>2</sub> . . . . .	0.001	equivalent Na <sub>2</sub> CO <sub>3</sub> = 0.00
Fe <sub>2</sub> O <sub>3</sub> .Al <sub>2</sub> O <sub>3</sub> . . . . .	0.002	" = 0.00
CaCO <sub>3</sub> . . . . .	0.010	" = 0.0106
MgCO <sub>3</sub> . . . . .	0.009	" = 0.0113
	0.022	0.0219

The impurities that are titratable by an acid, calcium and magnesium carbonates, are exactly equivalent to sodium carbonate displaced.

About 200 grms. of sodium bicarbonate were washed with a funnel having a porcelain plate until entirely free from chloride. It was then dried at 100° C., protected from acid gases, finely ground, and kept in a sealed bottle until used. About 20 grms. of bicarbonate thus prepared was heated in a platinum dish at a moderate red heat until the weight was constant, and then 5 grms. was accurately weighed for analysis. Our attention was directed to the method of heating sodium carbonate in standardising, various results were obtained depending on the temperature of ignition, the highest temperature giving the greatest alkalinity, or about 0.09 per cent greater than the lowest. It remained to be determined whether the high or low result was correct, and whether in heating to the higher temperature (red heat or Bunsen flame) water was given off, or whether the weight was due to a decomposition of sodium carbonate into sodium oxide and carbon dioxide.

In referring to the literature several references were found upon the ignition of sodium carbonate. Menzies, Vol. I., p. 525, in quoting the work of Pickering, says "When sodium carbonate is fused about 1 per cent. carbon dioxide is disengaged." In Lunge's "Untersuchungsmethoden," Vol. I., p. 83, reference is made to an article in Zeitschr. f. Angew. Chem., 1897, p. 5, in which he says that soda intended for standardisation of acids must not be heated higher than 300° C. (572° F.), and if the heating is carried on at this temperature for a sufficient length of time, one is assured that neither bicarbonate nor water is left behind, yet no sodium oxide has been formed as may happen when the heating is carried to a low red heat.

*Sodium Carbonate (b).*—A portion of the washed



carbonate was carefully heated in a platinum dish with occasional stirring at 572° F. to constant weight and immediately analysed.

**Ammonium Sulphate.**—10 grms. of the standard acid hereinafter described) were quickly and accurately weighed in a small glass weighing tube, avoiding absorption of moisture from the atmosphere. After rinsing the sample in a large platinum dish, it was made slightly ammoniacal with ammonia that had been freshly distilled to free it from lime. During evaporation on the steam bath, the dish was kept covered by a large funnel and protected from acid fumes. Ammonia was added from time to time until it was found that the salt became acid on evaporation. After evaporation the dish was dried in an air bath to constant weight at 230° F.

**Sulphuric Acid** (100 per cent.  $\text{H}_2\text{SO}_4$ ).—In reviewing the work of Pickering (J. Chem. Soc., 1890) it occurred to me that it would be possible to make some pure 100 per cent. sulphuric acid, and that the analysis of this would be a suitable check on our other methods. Pickering has shown that the curve of the melting point of sulphuric acid near 100 per cent. reaches a maximum at 99.8 per cent. Therefore, by starting with an acid slightly above 100 per cent., and another slightly more than 100 per cent., a point should be reached in recrystallising the successive crops of crystals obtained from both which should show the same per cent. sulphuric acid, as actually the case.

Beginning with two litres of chemically pure sulphuric acid, distilled sulphuric anhydride was added until, on analysis, the strength was 99.8 per cent. The bottle was then during crystallisation so as to obtain small crystals, the bottle was half full of crystals the mother liquor was drained off through a porcelain plate fitted to the mouth of the bottle and having a glass tube passing through its centre to the bottom of the bottle by which air dried with strong sulphuric acid was passed, when the bottle was inverted. By draining the crystals for several hours at a temperature slightly above the melting point, the mother liquor was entirely removed. These crystals were then melted and recrystallised and drained as described above. The crystals thus obtained were melted, recrystallised and drained, the final crystals being melted and kept in a sealed bottle until used. Two litres of acid were prepared, analysing 99.8 per cent. sulphuric acid. From this the standard acid was prepared in exactly the same manner as in the case of analysing 99.8 per cent. sulphuric acid.

**Sulphuric Anhydride.**—Another method used as a check standard was the titration of sulphuric acid formed by the addition of water to 100 per cent. sulphuric acid. To do this required especial care—first, to take a sample of sulphuric anhydride free from water, after obtaining it, to mix it with water without loss of anhydride. The plan adopted was as follows:—

100 per cent. sulphuric acid containing 40 per cent. free  $\text{SO}_3$  was distilled at a low temperature into a long-necked flask fitted tightly over the delivery tube of the retort. Crystals of potassium permanganate were added to the flask to destroy any sulphur dioxide present. The first 25 c.c. of the distillate were rejected. About 200 c.c. were collected over. Then this 200 c.c. was redistilled, rejecting the first few c.c. and collecting about 100 c.c. in an ordinary delivery flask, to the delivery tube of which was sealed the end of a test tube, which had been drawn out in the middle, and bent at the constricted part, almost to a right angle, thus forming a receiver. As soon as the distillation into the flask was completed the neck was sealed, thus making the whole apparatus air-tight. By heating the flask to 140° F. and cooling the receiver, about 20 grms. of sulphuric anhydride were distilled into the latter, which was then sealed at the constricted part having a slight vacuum.

**Sulphanilic Acid.**—In looking through the list of organic acids for one that would be suitable, sulphanilic acid was selected upon account of its being a monobasic acid of a high molecular weight, crystallising without water and drying without decomposition. The so-called C.P. was recrystallised three times, finely ground, and dried in an air bath at 230° F. to constant weight.

## ANALYSIS OF STANDARDS.

For the comparison of the above carefully-prepared compounds as standards two litres of C.P. sulphuric acid were used. This acid was tested for impurities, found to be practically free, and was kept sealed when not in use, its percentage composition being determined as follows:—

**Sodium Carbonate (a).**—5 grms. of freshly-ignited sodium carbonate, prepared as above, were quickly weighed out, and an amount of standard acid, slightly in excess of the amount required for neutralisation was weighed in a small weighing tube and washed into a flask containing the sodium carbonate. After boiling for 15 minutes to expel carbon dioxide, the excess of sulphuric acid was titrated with N/2 sodium hydroxide, using phenolphthalein as indicator. A short stem funnel was placed in the neck of the flask to prevent loss while boiling. Duplicate analyses of the standard acid by this method gave 97.33–97.35 per cent. of sulphuric acid.

**Sodium Carbonate (b).**—5 grms. sodium carbonate, prepared as above by heating at 572° F. to constant weight, were used in determining the strength of our standard acid. Observing exactly the same conditions described above, we obtained 97.41–97.42 per cent. sulphuric acid.

**Ammonium Sulphate.**—The ammonium sulphate dried to constant weight at 230° F., as described above, was cooled in a desiccator and quickly weighed.

The salt was then dissolved in water and the small amount of free acid present, as indicated by Methyl Orange, was titrated with N/3 sodium hydroxide. Adding an equivalent weight of ammonia to the weight above, gave 97.41 per cent. as the strength of the sulphuric acid. The amount of acid titrated was less than 0.10 per cent. (with Methyl Orange a sharp end point is obtained). A duplicate analysis gave 97.41 per cent. of sulphuric acid.

**Sulphuric Acid** (100 per cent.  $\text{H}_2\text{SO}_4$ ).—About six grms. of acid, crystallised from 99.8 per cent. sulphuric acid, as described above, were introduced into the bottom of a small weighed tube by means of a long-stemmed dropping tube manipulated with a rubber bulb. The glass stopper was then inserted in the tube, the whole weighed, after which the acid was carefully washed into a casserole containing cold water, and titrated with sodium hydroxide solution, using phenolphthalein as indicator, according to the method to be described.

Assuming this acid to be 100 per cent. sulphuric acid, and using the NaOH solution standardised on this basis to determine the composition of the standard acid, duplicate determinations gave 97.39–97.41 per cent. sulphuric acid. Acid crystallised from 100.1 per cent. sulphuric acid. Using this standard exactly as in the preceding our standard acid analysed 97.40 per cent. sulphuric acid.

**Sulphuric Anhydride.**—The tube containing the sulphuric anhydride was weighed and placed in a glass-stoppered bottle containing about 100 c.c. of water. The tip was broken off above the level of the water and the bottle sealed. After standing in a warm place for three days, the sulphuric anhydride had distilled out of the tube and was absorbed by the water, thus mixing without any loss of sulphuric anhydride. The glass tube was dried and weighed, and, deducting this weight from the weight above, we have the weight of sulphuric anhydride. The resulting acid was diluted to one litre and 300 c.c. measured with the dividing burette were titrated with sodium hydroxide solution, using phenolphthalein as indicator, boiling out carbon dioxide and observing the same conditions as in standardising.

Assuming the sulphuric anhydride to be absolute, and using the sodium hydroxide solution, standardised on this basis, to determine the strength of the standard acid, it was found to be 97.40 and 97.43 per cent. of sulphuric acid.

**Sulphanilic Acid.**—20 grms. of this acid, prepared as described above, were titrated, using about 95 c.c. of sodium hydroxide solution, phenolphthalein as indicator, and observing all conditions as in standardising with sulphuric acid. Assuming the acid to be 100 per cent. pure, and using the sodium hydroxide solution standardised

on this basis to determine the strength of our standard acid, it was found to be 97.41 per cent. of sulphuric acid.

Recapitulation of composition of standard sulphuric acid referred to all the standards employed:—

	Per cent.	Average
Sodium carbonate—		
(A) Ignited at low red heat to constant weight	97.33 97.35 97.41 97.42	97.34
(B) Heated at 572° F. to constant weight		97.415
Ammonium sulphate method	97.41 97.41	97.41
100 per cent. sulphuric acid prepared from acid slightly under 100 per cent.	97.39 97.41	97.40
100 per cent. sulphuric acid prepared from acid slightly over 100 per cent.	97.40	97.40
Sulphuric anhydride	97.40 97.43	97.415
Sulphanilic acid	97.41	97.41

The close agreement between the above standards, with one exception, is only what the writer and his assistants expected, provided the standards themselves were pure. The analytical methods employed and to be described yield results in experienced hands that are entirely in accordance with the above figures.

The abnormal result in the case of sodium carbonate ignited at a low red heat was investigated as follows:—

About 20 grms. of sodium carbonate were heated to constant weight at 572° F., and 10 grms. used for analysis of the standard acid showed it to contain 97.416 per cent. sulphuric acid. Ten grms. were placed in a platinum boat in a combustion tube, where it was heated to moderate red heat in a combustion furnace. A slow stream of dry air, free from carbon dioxide, was aspirated through the tube, and the carbon dioxide, disengaged by heating the sodium carbonate, was absorbed in a saturated solution of barium hydroxide, contained in a bottle. A Mohr bulb containing barium hydroxide was connected with the bottle and proved the complete absorption of carbon dioxide therein. After aspirating for several hours, the bulb was connected directly to the tube and the aspiration continued, which showed that no more carbon dioxide was evolved, no precipitate being formed.

The excess of barium hydroxide was neutralised with strong HCl, and finally carefully titrated with N/300 hydrochloric acid, using phenolphthalein as indicator; the barium carbonate was then titrated with N/300 hydrochloric acid, using Methyl Orange as indicator.

A blank titration was made using the same reagents, and the difference between the two Methyl Orange titrations represented the alkalinity due to barium carbonate. In this way 0.0060 grms. carbon dioxide were determined by a titration of about 35 c.c. of hydrochloric acid, thus making a simple and accurate determination.\* The carbonate of soda that had been heated in the combustion tube was removed, accurately weighed, and used to analyse the standard acid. About 10 grms. were used, and the result obtained was 97.358 per cent., which is 0.058 per cent. lower than the result obtained above.

0.0060 grms. of carbon dioxide formed by decomposition of sodium carbonate would leave 0.0084 grms. Na<sub>2</sub>O, which, when weighed and calculated as Na<sub>2</sub>CO<sub>3</sub>, would make a difference in the per cent. of sulphuric acid of 0.056 per cent., which agrees within 0.002 per cent. with the result found.

After heating to redness:—

9.9916 grms. Na <sub>2</sub> CO <sub>3</sub> are equivalent to	9.2369 grms. H <sub>2</sub> SO <sub>4</sub> .
0.0084 grms. Na <sub>2</sub> CO <sub>3</sub> are equivalent to	0.0134 " "
	9.2503 " "

Before heating to redness:—

10.0000 grms. Na <sub>2</sub> CO <sub>3</sub> are equivalent to	9.2447 " "
Increased alkalinity due to Na <sub>2</sub> O formed	0.0056 " "

Equivalent to ..... 0.056 percent. of ..

If the CO<sub>2</sub> found had been the result of decomposition of sodium bicarbonate, the increased alkalinity would have been 0.078 per cent. instead of 0.058 per cent. as found.

By heat:—

2NaHCO<sub>3</sub> = Na<sub>2</sub>CO<sub>3</sub> + CO<sub>2</sub> + H<sub>2</sub>O.  
168.116      106.1      44      18.016  
0.0060 grms. CO<sub>2</sub> found are equivalent to 0.0223 grms. Na<sub>2</sub>CO<sub>3</sub>

After heating to redness:—

10.0 grms. Na<sub>2</sub>CO<sub>3</sub> are equivalent to ... 9.2447 grms. H<sub>2</sub>SO<sub>4</sub>

Before heating to redness:—

9.9772 grms. Na<sub>2</sub>CO<sub>3</sub> are equivalent to ..... 9.2236 grms.  
0.0228 grms. NaHCO<sub>3</sub> are equivalent to ..... 0.0133 "  
9.2369 " 9.2369 "

Increased alkalinity due to formation ... 0.0078 "  
of Na<sub>2</sub>CO<sub>3</sub> from NaHCO<sub>3</sub> equivalent to 0.078 percent. of

It is thus indicated by this experiment that the carbon dioxide formed is the result of decomposition of Na<sub>2</sub>CO<sub>3</sub> into Na<sub>2</sub>O + CO<sub>2</sub>.

A sample of sodium carbonate, prepared by dry constant weight at 572° F., was heated until it had completely fused, and analysis showed an increased alkalinity equivalent to 0.30 per cent. of carbon dioxide disengaged.

If the calcium and magnesium carbonates present in the purified carbonate were entirely converted into calcium carbonate when ignited at low red heat only 0.018 per cent. increased alkalinity would be accounted for.

These results, considered together with the close agreement between the other standards and sodium carbonate ignited at 572° F., are very convincing arguments in favour of preparing standard sodium carbonate in this manner.

**Standard Acid.**—Averaging the results obtained from the different standards enumerated above, except sodium carbonate ignited to redness, its percentage composition was found to be 97.41 per cent. sulphuric acid.

This acid or its equivalent was used for standardising the caustic soda that was employed for all analytical determinations embraced in these tables.

The burette used was a 100 c.c. chamber burette graduated from 95—100 c.c. in 1/10 c.c., and reduced to 1/100 c.c. The burette was standardised by weighing 95 and 100 by weighing mercury delivered every 1/10 c.c. and for 1 c.c. the mercury was weighed every 1/10 c.c. The readings and graduations were found to be accurate to 1/100 c.c. The burette was frequently cleaned with strong sulphuric acid, so that it drained perfectly for each determination.

**Standard Sodium Hydroxide Solution.**—This solution was prepared from C.P. caustic soda, purified by boiling and was made of such strength that six grms. of standard acid required 95—98 c.c. Caustic soda purified by boiling in alcohol is not suitable for this purpose, as it does not drain properly in the burette, but produces a milky appearance. To standardise this solution, using Methyl Orange as indicator, about 6 grms. of the standard acid were quickly and accurately weighed out, diluted with about 400 c.c. cold distilled water and 1 c.c. of a 1 per cent. solution of Methyl Orange added. The caustic soda solution was then run in from the 100 c.c. chamber burette until a few tenths of a c.c. excess had been added, and after three minutes' draining the burette was washed with Standard sulphuric acid of strength about equivalent to the soda solution was added from a burette until a trace changed the colour of the solution from yellow to orange. The end point is sharper in titrating caustic alkaline to acid than *vice versa*.

H<sub>2</sub>SO<sub>4</sub> taken — H<sub>2</sub>SO<sub>4</sub> 2nd titration = grms. of sulphuric acid  
c.c. NaOH

acid equivalent to 1 c.c. sodium hydroxide solution

A thermometer was kept in the standard solution, the temperature at which the solution was standardised was recorded, and in making a subsequent titration any other temperature the necessary correction was applied to the reading. The correction for temperature was determined with the pycnometer, as described by

\* This method was subsequently published in the "Analyst," May, 1904, vol. 29, pp. 152—153. Thos. Macara.



100 c.c. of solution was found to be 0.015 c.c. = 0.015 to be subtracted when the temperature was above 60° F. and below 50° F. The temperature of standardising, and added when below, the temperature of the titration agreed within 0.03 c.c. Methyl orange was used in titrating nitric acid, hydrochloric acid and ammonia.

Standardise with phenolphthalein, about six grms. standard acid were accurately weighed out and into a casserole containing about 25 c.c. of cold dilute acid being rinsed from a small weighing beaker into the casserole. One c.c. of phenolphthalein solution (per litre) was added, and the sodium hydroxide solution run in from the 100 c.c. chamber burette until about 0.5 c.c. of the end point. The solution was boiled for five minutes to remove carbon dioxide, the titration finished by cutting the drops from the chamber burette until a fraction of a drop produced a pink colour. This tint was carefully noted, and analyses run to the same end point. By boiling for five minutes, provision was made for uniform use of the burette. Duplicate titrations agreed within 0.02 c.c. The limits of burette reading were placed at 0.01 when Methyl Orange was used, and 0.02 c.c. for phenolphthalein, yet, as will be shown, the actual duplicate obtained by two men working independently agreed much closer.

**Dividing Burette.**—The dividing burette referred to in standardising with sulphuric anhydride is designed for dividing a solution. It consists of a burette of which is drawn to a capillary and bent down, the stopcock of the burette is a three-way cock, the passage being connected to a vertical tube at the top of which is a funnel for filling the burette. One and two flasks with small necks were graduated by running the burette a sufficient number of times to fill the flask to a point in the neck. This point was carefully marked, and in subsequent use, it was always filled to mark.

The amount of water delivered by the burette was 1.0, and the weights checked within 0.004 grms., or 0.004 of the weight of one burette full. In measuring the equivalent of 5 grms. of a liquid made up to volume, or would be 0.0002 grms. The tables are described in the order in which they were used during a period of nearly three years.

#### NITRIC ACID TABLE.

C.P. nitric acid employed was free from nitrous acid, hydrochloric acids, and the residue upon evaporation at 212° F. was too small to affect the determinations. It was used for all samples up to 43° B., and for stronger samples this acid was concentrated by distilling with pure glacial phosphoric acid and potassium permanganate, the latter to prevent the formation of nitrous acid. 95-80 per cent. nitric acid was the strongest obtainable, for above this point the acid contained amounts of nitrous acid.

Sp. gr. determinations were made as described and at the same time the pycnometer was filled, 8 grm. sample was weighed in a small weighing bottle having a ground glass stopper, which prevented loss by weighing and diluting. The sample was diluted with water by removing the stopper of the tube with a fork while immersed in a casserole containing approximately 400 c.c. of water. The titration was then using Methyl Orange as indicator, observing the colour changes described in standardising.

Allowance for temperature.—After determining the sp. gr. of the different strengths employed at 60° F., the temperature was raised to 70° F., and the pycnometer filled; likewise at 80° F. from this data the allowance for temperature was calculated, and was found to be 0.0001 for a given strength of acid. At 43° B. the determinations were made from 50° to 90° F.

The following determinations were made, and from the table was calculated by interpolation, the percentage composition being calculated to correspond with each 0.25° B.

From the Baumé the corresponding sp. gr. was calculated by the formula:— $B. = 145 - \frac{145}{\text{sp. gr.}}$

Sp. gr.	Per cent. HNO <sub>3</sub> *	Sp. gr.	Per cent. HNO <sub>3</sub> .
*1.0844	14.40	1.4506	77.15
*1.1005	18.45	1.4507	77.16
*1.1659	27.15	1.4563	78.78
*1.2109	33.80	1.4563	78.80
1.2641	41.77	1.4707	82.84
1.2643	41.81	1.4707	82.91
1.3144	49.69	1.4873	88.33
1.3144	49.70	1.4871	88.31
1.3761	60.45	1.4951	91.42
1.3760	60.44	1.4950	91.39
1.4469	76.57	1.4963	91.92
1.4471	76.57	1.4961	91.91
1.4405	74.84	1.5014	94.59
1.4404	74.80	1.5014	94.58
		1.5037	95.64
		1.5044	95.80

\* These determinations are the average of results that checked within 0.0001 sp. gr. and 0.02 per cent., the record of which has been lost.

The instability of 96 per cent. nitric acid is so great that agreeing determinations were difficult to obtain, and those selected corresponded with the differential of the table at this point.

The following will show the comparative sensitiveness of the analytical determinations, sp. gr. determinations and reading of a delicate Baumé hydrometer and thermometer graduated to 1° F., in terms of sp. gr. :—

B.	Anal. Det.	Sp. gr. Det.	B. Reading 1/20*
15°	0.00013 sp.gr.	0.0001 sp. gr.	0.00044 sp. gr.
30°	0.00013 "	0.0001 "	0.00056 "
45°	0.00008 "	0.0001 "	0.00072 "

[Nitric Acid. See Table, p. 788.]

#### HYDROCHLORIC ACID TABLE.

The purest C.P. hydrochloric acid obtainable was tested for free chlorine, sulphuric acid and residue upon evaporation at 212° F. There were only traces of impurities, which would affect the determinations less than the errors of manipulation.

For the samples above 22° B. this acid was concentrated by distilling it into a portion cooled in ice water.

42.61 per cent. hydrochloric acid was the strongest sample upon which a sp. gr. determination could be obtained at 60° F. Above this point bubbles of gas were formed in the pycnometer when warmed to 60° F.

The sp. gr. and allowance for temperature were determined as in the case of nitric acid. The allowance for temperature was found to be uniform for each strength of acid; 22° B. determinations were made from 50° to 90° F.

After making the above determinations the thermometer of the pycnometer was withdrawn while the bottle was immersed in about 700 c.c. of water in a large casserole, thus avoiding loss while diluting. The bottle was carefully washed out and the dilute acid made up to two litres in a flask standardised against the 100 c.c., dividing burette and portions of this solution were taken with the burette for titration with sodium hydroxide. Methyl Orange was used as indicator, the same conditions used in standardising being closely followed, about 98 c.c. of sodium hydroxide solution being used for each determination. A sample of hydrochloric acid was analysed by precipitating with silver nitrate and the silver chloride

calculated to hydrochloric acid checked the results obtained by titration.

By silver chloride.	By titration.
29.97 per cent. HCl. 29.98 per cent. HCl.	29.97 per cent. HCl. 30.00 per cent. HCl.

The following determinations were made, and from these the table was calculated by interpolation, the sp. gr. and corresponding percentage composition being calculated for each 1° B. from 1°—5°, 0.25° B., from 5°—16° and for the rest of the table for each 0.1° B.

Sp. gr.	Per cent. HCl.	Sp. gr.	Per cent. HCl.
1.02818	6.73	1.13026	27.44
1.02815	6.73	1.13028	27.47
1.05353	10.74	1.15277	30.07
1.05359	10.73	1.15273	30.04
1.07676	15.37	1.16642	32.70
1.07678	15.37	1.16652	32.72
1.09670	19.29	1.19918	39.61
1.09664	19.28	1.19902	39.56
1.11440	22.73	1.20586	41.16
1.11442	22.76	1.20584	41.13
1.12300	24.35	1.21140	42.65
1.12300	24.37	1.21120	42.57

The following will show the comparative sensitiveness of the analytical determinations, sp. gr. determination and reading of a delicate Baumé hydrometer and thermometer graduated to 1° F. in terms of sp. gr. :—

Sp. gr.	Anal. Det.	Sp. gr. Det.	Bé. 1/30°.
10°	0.00004 sp. gr.	0.00005 sp. gr.	0.00027 sp. gr.
18°	0.00015 "	0.00005 "	0.00031 "
24°	0.00012 "	0.00010 "	0.00033 "

[Hydrochloric Acid. See Table, p. 789.]

#### AMMONIA TABLE.

The ammonia was prepared from C.P. ammonia by distilling with lime into distilled water to free it from carbon dioxide and silica dissolved from the glass. 33.22 per cent. ammonia was the strongest sample upon which a sp. gr. determination could be made at 60° F. for above this point bubbles of gas were formed in the sp. gr. bottle when warmed to 60° F.

The sp. gr. and allowance for temperature were determined as in the preceding tables, but, on account of variation of the co-efficient of expansion at different temperatures for a given strength of ammonia, it was found necessary to make a determination for each 10° F. from 40°—100° F., and this was done in each case at 14°, 16°, 18°, 20°, 22° and 26° Baumé. At the same time the picnometer was filled for the sp. gr. determination, a 6 to 8 grm. sample was taken in a weighed glass-stoppered weighing tube, on the stopper of which a little vaseline was placed to facilitate opening. After again weighing, the tube was introduced into a 16 oz. Erlenmeyer flask containing about 400 c.c. of water and an amount of standard sulphuric acid slightly in excess of that required for neutralisation. The flask was then stoppered and heated gently until the stopper of the tube had been expelled. Before removing the stopper from the flask, it was shaken and cooled so as to absorb all the ammonia. The titration was then finished by adding standard sodium hydroxide in slight excess and titrating back with standard sulphuric acid, using Methyl Orange as indicator and observing the same conditions as described in standardising.

The following determinations were made, and from these

the table was calculated by interpolation, the sp. gr. and the corresponding percentage composition being calculated for each 0.25° B. :—

From the Baumé the corresponding sp. gr. was calculated by the formula :  $^{\circ}\text{B.} = \frac{140}{\text{sp.gr.}} - 130$ .

Sp. gr.	Per cent. NH <sub>3</sub>
0.97880	6.97
0.97884	6.96
0.95954	10.12
0.95954	10.12
0.93950	16.68
0.93950	16.67
0.92050	21.77
0.92056	21.70
0.90420	27.11
0.90426	27.13
0.88630	33.22
0.88670	33.10

The following will show the comparative sensitiveness of the analytical determinations, sp. gr. determination and reading of a delicate Baumé hydrometer and thermometer graduated to 1° F. :—

Bé.	Anal. Det.	Sp. gr.	Bé. 1/
15°	0.00004 sp. gr.	0.00001	0.00016
22°	0.00003 "	0.00001	0.00016
29°	0.00006 "	0.00006	0.00014

[Aqua Ammonia. See Table, p. 787.]

#### SULPHURIC ACID TABLE.

The C.P. sulphuric acid used was 1.84 sp. gr., with a trace of residue upon evaporation. The impurities were less than enough to affect either the sp. gr. or analytical determinations.

The sp. gr. determinations were made as described above, except that in bringing the temperature to 60° F. the picnometer was immersed to the neck in a beaker of water a few degrees below 60° F., so that the temperature rose slowly, being the same inside and outside the picnometer.

The allowance for temperature for every 10° F. between 50° and 90° F. was determined at the following Baumé: 66, 63, 57, 51, 44, 36, 29, 21, 12. It was found to be practically uniform for a given strength of acid, and the results are based on a range of 40° F., the corrections at even degrees Baumé being calculated from these results by interpolation. Sp. gr. were taken from the picnometer for analysis, and the amount of acid was weighed out each time which would require between 95 and 100 c.c. of soda solution. For the weakest samples a more dilute standard soda solution was used, but the same conditions as used in standardising with phenolphthalein were closely observed in all cases.

The boiling point determinations were made in a 2 c.c. long-necked flask, using about 100 c.c. of acid in each case. A certified thermometer accurate to 1° F. was suspended in the acid. A small piece of porcelain was placed in the bottom of the flask to facilitate boiling. The flask was gradually heated with a free flame and the temperature recorded when boiling was first perceptible.

The following determinations were made, and from these the table was calculated by interpolation, the sp. gr. and the corresponding percentage composition being calculated for each degree Baumé from 0°—64° and each 1/4° B. from 64°—66° Bé.

From the Baumé the corresponding sp. gr. was calculated by the formula :  $^{\circ}\text{B.} = 145 - \frac{145}{\text{sp.gr.}}$

The degree Twaddell was calculated by dividing the decimal part of the sp. gr. by 0.005.



Sp. gr.	Per cent. H <sub>2</sub> SO <sub>4</sub> .	Sp. gr.	Per cent. H <sub>2</sub> SO <sub>4</sub> .
·00488	0·713	1·52814	62·342
·00468	0·701	1·52803	62·334
·03471	5·145	1·54403	63·702
·03470	5·142	1·54399	63·770
·06488	9·473	1·57481	66·518
·06472	9·469	1·57482	66·516
·00918	14·221	1·62722	70·090
·00912	14·217	1·62723	71·000
·13532	10·042	1·66807	74·480
·13532	19·041	1·66773	74·438
·17362	23·936	1·70438	77·646
·17344	23·920	1·70449	77·555
·21061	28·549	1·72577	79·377
·21045	28·543	1·72576	79·398
·25129	33·488	1·74733	81·322
·25132	33·484	1·74714	81·324
·29513	38·651	1·77002	83·482
·29507	38·631	1·76987	83·467
·34415	44·149	1·79500	86·364
·34403	44·140	1·79003	86·363
·30460	49·521	1·81186	88·534
·30460	49·519	1·81103	88·527
·43084	53·103	1·81939	89·752
·43072	53·175	1·81920	89·732
·46673	56·674	1·82756	91·337
·46678	56·675	1·82750	91·308
·48219	58·143	1·83557	93·219
·48225	58·128	1·83555	93·220

The following will show the comparative sensitiveness of the analytical determinations, the sp. gr. determinations, and the reading of a delicate Baumé hydrometer and thermometer graduated to 1° F., in terms of a sp. gr. :—

Bé.	Anal. Det.	Sp. gr. Det.	Bé. 1/40°.
20°	0·00007 sp. gr.	0·00005 sp. gr.	0·00024 sp. gr.
50°	0·00005 "	0·00005 "	0·00040 "
60°	0·00004 "	0·00006 "	0·00057 "

[Sulphuric Acid. See Table, p. 790.]

The following chemists, my assistants, aided in the preparation of the tables :—

W. P. Kern, B.S.	N. A. Laury, B.S.
J. G. Melendy, B.S.	A. J. Lotka, B.Sc.
Hardee Chambliss, M.S., Ph.D.	C. A. Bigelow, B.S.
H. B. Bishop, B.S.	A. F. Way, B.S.
W. W. Sanders, B.S.	H. F. Merriam, Ph.D.
T. Lynton Briggs, F.I.C., F.C.S.	

Such merit as these tables possess is largely due to these gentlemen, but more especially to Mr. Bishop who had immediate charge of, and participated in most of the determinations, and who shared with the writer the preparation of this paper.

#### *Aqua Ammonia.*

Sp.°	Sp. gr.	NH <sub>3</sub> .	Be.°	Sp. gr.	%NH <sub>3</sub> .	Be.°	Sp. Gr.	%NH <sub>3</sub> .
0·00	1·0000	0·00	16·50	0·9556	11·18	23·00	0·9150	23·62
0·25	0·9982	0·40	16·75	0·9540	11·64	23·25	0·9135	24·01
0·50	0·9964	0·80	17·00	0·9524	12·10	23·50	0·9121	24·50
0·75	0·9947	1·21	17·25	0·9508	12·56	23·75	0·9106	24·99
1·00	0·9929	1·62	17·50	0·9492	13·02	24·00	0·9091	25·48
1·25	0·9912	2·04	17·75	0·9475	13·49	24·25	0·9076	25·97
1·50	0·9894	2·46	18·00	0·9459	13·96	24·50	0·9061	26·46
1·75	0·9876	2·88	18·25	0·9444	14·43	24·75	0·9047	26·95
2·00	0·9859	3·30	18·50	0·9428	14·90	25·00	0·9032	27·44
2·25	0·9842	3·73	18·75	0·9412	15·37	25·25	0·9018	27·93
2·50	0·9825	4·16	19·00	0·9396	15·84	25·50	0·9003	28·42
2·75	0·9807	4·59	19·25	0·9380	16·32	25·75	0·8989	28·91
3·00	0·9790	5·02	19·50	0·9365	16·80	26·00	0·8974	29·40
3·25	0·9773	5·45	19·75	0·9349	17·28	26·25	0·8960	29·89
3·50	0·9756	5·88	20·00	0·9333	17·76	26·50	0·8946	30·38
3·75	0·9739	6·31	20·25	0·9318	18·24	26·75	0·8931	30·87
4·00	0·9722	6·74	20·50	0·9302	18·72	27·00	0·8917	31·36
4·25	0·9705	7·17	20·75	0·9287	19·20	27·25	0·8903	31·85
4·50	0·9689	7·61	21·00	0·9272	19·68	27·50	0·8889	32·34
4·75	0·9672	8·05	21·25	0·9256	20·16	27·75	0·8875	32·83
5·00	0·9655	8·49	21·50	0·9241	20·64	28·00	0·8861	33·32
5·25	0·9639	8·93	21·75	0·9226	21·12	28·25	0·8847	33·81
5·50	0·9622	9·38	22·00	0·9211	21·60	28·50	0·8833	34·30
5·75	0·9605	9·83	22·25	0·9195	22·08	28·75	0·8819	34·79
6·00	0·9589	10·28	22·50	0·9180	22·56	29·00	0·8805	35·28
6·25	0·9573	10·73	22·75	0·9165	23·04			

#### ALLOWANCE FOR TEMPERATURE :

The coefficient of expansion for Ammonia Solutions, varying with the temperature, correction must be applied according to the following table :

Corrections to be added for each degree below 60° F.

Corrections to be subtracted for each degree above 60° F.

Baumé.	40° F.	50° F.	70° F.	80° F.	90° F.	100° F.
14°	0·015° Bé	0·017° Bé	0·020° Bé	0·022° Bé	0·024° Bé	0·026° Bé
16°	0·021 "	0·023 "	0·026 "	0·028 "	0·030 "	0·032 "
18°	0·027 "	0·029 "	0·031 "	0·033 "	0·035 "	0·037 "
20°	0·033 "	0·036 "	0·037 "	0·038 "	0·040 "	0·042 "
22°	0·039 "	0·042 "	0·043 "	0·045 "	0·047 "	
26°	0·053 "	0·057 "	0·057 "	0·059 "		

## Nitric Acid.

Be.°	Sp. gr.	Tw.°	%HNO <sub>3</sub>	Be.°	Sp. gr.	Tw.°	%HNO <sub>3</sub>	Be.°	Sp. gr.	Tw.°	%H
10.00	1.0741	14.82	12.86	23.00	1.1885	37.70	30.49	36.00	1.3303	66.06	52
10.25	1.0761	15.22	13.18	23.25	1.1910	38.20	30.86	36.25	1.3334	66.68	52
10.50	1.0781	15.62	13.49	23.50	1.1934	38.68	31.21	36.50	1.3364	67.28	53
10.75	1.0801	16.02	13.81	23.75	1.1959	39.18	31.58	36.75	1.3395	67.90	53
11.00	1.0821	16.42	14.13	24.00	1.1983	39.66	31.94	37.00	1.3426	68.52	54
11.25	1.0841	16.82	14.44	24.25	1.2008	40.16	32.31	37.25	1.3457	69.14	54
11.50	1.0861	17.22	14.76	24.50	1.2033	40.66	32.68	37.50	1.3488	69.76	55
11.75	1.0881	17.62	15.07	24.75	1.2058	41.16	33.05	37.75	1.3520	70.40	55
12.00	1.0902	18.04	15.41	25.00	1.2083	41.66	33.42	38.00	1.3551	71.02	56
12.25	1.0922	18.44	15.72	25.25	1.2109	42.18	33.80	38.25	1.3583	71.66	57
12.50	1.0943	18.86	16.05	25.50	1.2134	42.68	34.17	38.50	1.3615	72.30	57
12.75	1.0964	19.28	16.39	25.75	1.2160	43.20	34.56	38.75	1.3647	72.94	58
13.00	1.0985	19.70	16.72	26.00	1.2185	43.70	34.94	39.00	1.3679	73.58	58
13.25	1.1006	20.12	17.05	26.25	1.2211	44.22	35.33	39.25	1.3712	74.24	59
13.50	1.1027	20.54	17.38	26.50	1.2236	44.72	35.70	39.50	1.3744	74.88	60
13.75	1.1048	20.96	17.71	26.75	1.2262	45.24	36.09	39.75	1.3777	75.54	60
14.00	1.1069	21.38	18.04	27.00	1.2288	45.76	36.48	40.00	1.3810	76.20	61
14.25	1.1090	21.80	18.37	27.25	1.2314	46.28	36.87	40.25	1.3843	76.86	62
14.50	1.1111	22.22	18.70	27.50	1.2340	46.80	37.26	40.50	1.3876	77.52	62
14.75	1.1132	22.64	19.02	27.75	1.2367	47.34	37.67	40.75	1.3909	78.18	63
15.00	1.1154	23.08	19.36	28.00	1.2393	47.86	38.06	41.00	1.3942	78.84	64
15.25	1.1176	23.52	19.70	28.25	1.2420	48.40	38.46	41.25	1.3976	79.62	64
15.50	1.1197	23.94	20.02	28.50	1.2446	48.92	38.85	41.50	1.4010	80.20	65
15.75	1.1219	24.38	20.36	28.75	1.2473	49.46	39.25	41.75	1.4044	80.88	66
16.00	1.1240	24.80	20.69	29.00	1.2500	50.00	39.66	42.00	1.4078	81.56	67
16.25	1.1262	25.24	21.03	29.25	1.2527	50.54	40.06	42.25	1.4112	82.24	67
16.50	1.1284	25.68	21.36	29.50	1.2554	51.08	40.47	42.50	1.4146	82.92	68
16.75	1.1306	26.12	21.70	29.75	1.2582	51.64	40.89	42.75	1.4181	83.62	69
17.00	1.1328	26.56	22.04	30.00	1.2609	52.18	41.30	43.00	1.4216	84.32	70
17.25	1.1350	27.00	22.38	30.25	1.2637	52.74	41.72	43.25	1.4251	85.02	71
17.50	1.1373	27.46	22.74	30.50	1.2664	53.28	42.14	43.50	1.4286	85.72	71
17.75	1.1395	27.90	23.08	30.75	1.2692	53.84	42.58	43.75	1.4321	86.42	72
18.00	1.1417	28.34	23.42	31.00	1.2719	54.38	43.00	44.00	1.4356	87.12	73
18.25	1.1440	28.80	23.77	31.25	1.2747	54.94	43.44	44.25	1.4392	87.84	74
18.50	1.1462	29.24	24.11	31.50	1.2775	55.50	43.89	44.50	1.4428	88.56	75
18.75	1.1485	29.70	24.47	31.75	1.2804	56.08	44.34	44.75	1.4464	89.28	76
19.00	1.1508	30.16	24.82	32.00	1.2832	56.64	44.78	45.00	1.4500	90.00	77
19.25	1.1531	30.62	25.18	32.25	1.2861	57.22	45.24	45.25	1.4536	90.72	78
19.50	1.1554	31.08	25.53	32.50	1.2889	57.78	45.68	45.50	1.4573	91.46	79
19.75	1.1577	31.54	25.88	32.75	1.2918	58.36	46.14	45.75	1.4610	92.20	80
20.00	1.1600	32.00	26.24	33.00	1.2946	58.92	46.58	46.00	1.4646	92.92	81
20.25	1.1624	32.48	26.61	33.25	1.2975	59.50	47.04	46.25	1.4684	93.68	82
20.50	1.1647	32.94	26.96	33.50	1.3004	60.08	47.49	46.50	1.4721	94.42	83
20.75	1.1671	33.42	27.33	33.75	1.3034	60.68	47.95	46.75	1.4758	95.16	84
21.00	1.1694	33.88	27.67	34.00	1.3063	61.26	48.42	47.00	1.4796	95.92	85
21.25	1.1718	34.36	28.02	34.25	1.3093	61.86	48.90	47.25	1.4834	96.68	86
21.50	1.1741	34.82	28.36	34.50	1.3122	62.44	49.35	47.50	1.4872	97.44	87
21.75	1.1765	35.30	28.72	34.75	1.3152	63.04	49.83	47.75	1.4910	98.20	88
22.00	1.1789	35.78	29.07	35.00	1.3182	63.64	50.32	48.00	1.4948	98.96	89
22.25	1.1813	36.26	29.43	35.25	1.3212	64.24	50.81	48.25	1.4987	99.74	90
22.50	1.1837	36.74	29.78	35.50	1.3242	64.84	51.30	48.50	1.5026	100.52	91
22.75	1.1861	37.22	30.14	35.75	1.3273	65.46	51.80				

## ALLOWANCE FOR TEMPERATURE:

At 10°—20° Be. — 1/30° Be. or 0.00029 Sp. Gr. = 1° F.  
 20°—30° Be. — 1/23° Be. or 0.00044 " " = 1° F.  
 30°—40° Be. — 1/20° Be. or 0.00060 " " = 1° F.  
 40°—48.5° Be. — 1/17° Be. or 0.00084 " " = 1° F.



*Hydrochloric Acid.*

Sp. gr.	Tw.*	%HCl.	Be.°	Sp. gr.	Tw.*	%HCl.	Be.°	Sp. gr.	Tw.*	%HCl.
1-0069	1-38	1-40	16-0	1-1240	24-80	24-57	20-8	1-1675	33-50	32-93
1-0140	2-80	2-82	16-1	1-1248	24-96	24-73	20-9	1-1684	33-68	33-12
1-0211	4-22	4-25	16-2	1-1256	25-12	24-90	21-0	1-1694	33-88	33-31
1-0284	5-68	5-69	16-3	1-1265	25-30	25-06	21-1	1-1703	34-06	33-50
1-0357	7-14	7-15	16-4	1-1274	25-48	25-23	21-2	1-1713	34-26	33-69
1-0376	7-50	7-52	16-5	1-1283	25-66	25-39	21-3	1-1722	34-44	33-88
1-0394	7-88	7-89	16-6	1-1292	25-84	25-56	21-4	1-1732	34-64	34-07
1-0413	8-26	8-26	16-7	1-1301	26-02	25-72	21-5	1-1741	34-82	34-26
1-0432	8-64	8-64	16-8	1-1310	26-20	25-89	21-6	1-1751	35-02	34-45
1-0450	9-00	9-02	16-9	1-1319	26-38	26-05	21-7	1-1760	35-20	34-64
1-0469	9-38	9-40	17-0	1-1328	26-56	26-22	21-8	1-1770	35-40	34-83
1-0488	9-76	9-78	17-1	1-1336	26-72	26-39	21-9	1-1779	35-58	35-02
1-0507	10-14	10-17	17-2	1-1345	26-90	26-56	22-0	1-1789	35-78	35-21
1-0526	10-52	10-55	17-3	1-1354	27-08	26-73	22-1	1-1798	35-96	35-40
1-0645	10-90	10-94	17-4	1-1363	27-26	26-90	22-2	1-1808	36-16	35-59
1-0564	11-28	11-32	17-5	1-1372	27-44	27-07	22-3	1-1817	36-34	35-78
1-0584	11-68	11-71	17-6	1-1381	27-62	27-24	22-4	1-1827	36-54	35-97
1-0603	12-06	12-09	17-7	1-1390	27-80	27-41	22-5	1-1836	36-72	36-16
1-0623	12-46	12-48	17-8	1-1399	27-98	27-58	22-6	1-1846	36-92	36-35
1-0642	12-84	12-87	17-9	1-1408	28-16	27-75	22-7	1-1856	37-12	36-54
1-0662	13-24	13-26	18-0	1-1417	28-34	27-92	22-8	1-1866	37-32	36-73
1-0681	13-62	13-65	18-1	1-1426	28-52	28-09	22-9	1-1875	37-50	36-93
1-0701	14-02	14-04	18-2	1-1435	28-70	28-26	23-0	1-1885	37-70	37-14
1-0721	14-42	14-43	18-3	1-1444	28-88	28-44	23-1	1-1895	37-90	37-36
1-0741	14-82	14-83	18-4	1-1453	29-06	28-61	23-2	1-1904	38-08	37-58
1-0761	15-22	15-22	18-5	1-1462	29-24	28-78	23-3	1-1914	38-28	37-80
1-0781	15-62	15-62	18-6	1-1471	29-42	28-95	23-4	1-1924	38-48	38-03
1-0801	16-02	16-01	18-7	1-1480	29-60	29-13	23-5	1-1934	38-68	38-26
1-0821	16-42	16-41	18-8	1-1489	29-78	29-30	23-6	1-1944	38-88	38-49
1-0841	16-82	16-81	18-9	1-1498	29-96	29-48	23-7	1-1953	39-06	38-72
1-0861	17-22	17-21	19-0	1-1508	30-16	29-65	23-8	1-1963	39-26	38-95
1-0881	17-62	17-61	19-1	1-1517	30-34	29-83	23-9	1-1973	39-46	39-18
1-0902	18-04	18-01	19-2	1-1526	30-52	30-00	24-0	1-1983	39-66	39-41
1-0922	18-44	18-41	19-3	1-1535	30-70	30-18	24-1	1-1993	39-86	39-64
1-0943	18-86	18-82	19-4	1-1544	30-88	30-35	24-2	1-2003	40-06	39-86
1-0964	19-28	19-22	19-5	1-1554	31-08	30-53	24-3	1-2013	40-26	40-09
1-0985	19-70	19-63	19-6	1-1563	31-26	30-71	24-4	1-2023	40-46	40-32
1-1006	20-12	20-04	19-7	1-1571	31-44	30-90	24-5	1-2033	40-66	40-55
1-1027	20-54	20-45	19-8	1-1581	31-62	31-08	24-6	1-2043	40-86	40-78
1-1048	20-96	20-86	19-9	1-1590	31-80	31-27	24-7	1-2053	41-06	41-01
1-1069	21-38	21-27	20-0	1-1600	32-00	31-45	24-8	1-2063	41-26	41-24
1-1090	21-80	21-68	20-1	1-1609	32-18	31-64	24-9	1-2073	41-46	41-48
1-1111	22-22	22-09	20-2	1-1619	32-38	31-82	25-0	1-2083	41-66	41-72
1-1132	22-64	22-60	20-3	1-1628	32-56	32-01	25-1	1-2093	41-86	41-99
1-1154	23-08	22-92	20-4	1-1637	32-74	32-19	25-2	1-2103	42-06	42-30
1-1176	23-52	23-33	20-5	1-1647	32-94	32-38	25-3	1-2114	42-28	42-64
1-1197	23-94	23-75	20-6	1-1656	33-12	32-56	25-4	1-2124	42-48	43-01
1-1219	24-38	24-16	20-7	1-1666	33-32	32-75	25-5	1-2134	42-68	43-40

ALLOWANCE FOR TEMPERATURE :

10—15° Be. — 1/40° Be. or 0-0002 Sp. Gr. for 1° F.  
 15—20° Be. — 1/30° Be. or 0-0003 " " 1° F.  
 22—25° Be. — 1/28° Be. or 0-00035 " " 1° F.

## Sulphuric Acid.

Be.*	Sp. gr.	Tw.*	Per cent. H <sub>2</sub> SO <sub>4</sub> .	Weight of 1 cu. ft. in lbs. Av.	Per cent. O. V.	Pounds O. V. in 1 cu. ft.	* Freezing (Melting) Point.	APPROXIMATE BOILING POINTS			
								50° B <sub>é</sub> , 295° F.			
0	1.0000	0.0	0.00	62.37	0.00	0.00	32.0° F.	60°	"	380°	"
1	1.0069	1.4	1.02	62.80	1.09	0.08	31.2°	61°	"	400°	"
2	1.0140	2.8	2.08	63.24	2.23	1.41	30.5°	62°	"	415°	"
3	1.0211	4.2	3.13	63.00	3.36	2.14	29.8°	63°	"	432°	"
4	1.0284	5.7	4.21	64.14	4.62	2.90	28.9°	64°	"	451°	"
5	1.0357	7.1	5.28	64.00	5.67	3.66	28.1°	65°	"	485°	"
6	1.0432	8.6	6.37	65.06	6.84	4.45	27.2°	66°	"	538°	"
7	1.0507	10.1	7.45	65.53	7.99	5.24	26.3°				
8	1.0584	11.7	8.55	66.01	9.17	6.06	25.1°				
9	1.0662	13.2	9.66	66.50	10.37	6.88	24.0°				
10	1.0741	14.8	10.77	66.99	11.56	7.74	22.8°				
11	1.0821	16.4	11.89	67.49	12.76	8.61	21.5°				
12	1.0902	18.0	13.01	68.00	13.96	9.49	20.0°				
13	1.0985	19.7	14.13	68.51	15.16	10.39	18.3°				
14	1.1069	21.4	15.25	69.04	16.36	11.30	16.0°				
15	1.1154	23.1	16.38	69.57	17.58	12.23	14.7°				
16	1.1240	24.8	17.53	70.10	18.81	13.19	12.6°				
17	1.1328	26.6	18.71	70.65	20.08	14.18	10.2°				
18	1.1417	28.3	19.89	71.21	21.34	15.20	7.7°				
19	1.1508	30.2	21.07	71.76	22.61	16.23	4.8°				
20	1.1600	32.0	22.25	72.35	23.87	17.27	+ 1.6°				
21	1.1694	33.9	23.43	72.94	25.14	18.34	+ 1.8°				
22	1.1789	35.8	24.61	73.53	26.41	19.42	+ 6.0°				
23	1.1885	37.7	25.81	74.13	27.69	20.53	- 11°				
24	1.1983	39.7	27.03	74.74	29.00	21.68	- 16°				
25	1.2083	41.7	28.28	75.30	30.34	22.87	- 23°				
26	1.2185	43.7	29.53	75.90	31.69	24.08	- 30°				
27	1.2288	45.8	30.79	76.64	33.04	25.32	- 39°				
28	1.2393	47.9	32.05	77.30	34.39	26.58	- 40°				
29	1.2500	50.0	33.33	77.96	35.76	27.88	- 01°				
30	1.2609	52.2	34.63	78.64	37.16	29.22	- 74°				
31	1.2710	54.4	35.93	79.33	38.55	30.58	- 82°				
32	1.2832	56.6	37.26	80.03	39.98	32.00	- 06°				
33	1.2940	58.9	38.58	80.74	41.40	33.42	- 07°				
34	1.3063	61.3	39.92	81.47	42.83	34.90	- 01°				
35	1.3182	63.6	41.27	82.22	44.28	36.41	- 81°				
36	1.3303	66.1	42.63	82.97	45.74	37.95	- 70°				
37	1.3426	68.5	43.99	83.74	47.20	39.53	- 60°				
38	1.3551	71.0	45.35	84.52	48.66	41.13	- 53°				
39	1.3679	73.6	46.72	85.32	50.13	42.77	- 47°				
40	1.3810	76.2	48.10	86.13	51.61	44.45	- 41°				
41	1.3942	78.8	49.47	86.96	53.08	46.16	- 35°				
42	1.4078	81.6	50.87	87.80	54.58	47.92	- 31°				
43	1.4216	84.3	52.20	88.67	56.07	49.72	- 27°				
44	1.4356	87.1	53.66	89.54	57.58	51.56	- 23°				
45	1.4500	90.0	55.07	90.44	59.09	53.44	- 20°				
46	1.4646	92.9	56.48	91.35	60.60	55.36	- 14°				
47	1.4796	95.9	57.90	92.28	62.13	57.33	- 15°				
48	1.4948	99.0	59.32	93.23	63.65	59.34	- 18°				
49	1.5104	102.1	60.75	94.20	65.18	61.40	- 22°				
50	1.5263	105.3	62.18	95.20	66.72	63.52	- 27°				
51	1.5426	108.6	63.66	96.21	68.31	65.72	- 33°				
52	1.5591	111.8	65.13	97.24	69.89	67.96	- 39°				
53	1.5761	115.2	66.63	98.30	71.50	70.28	- 49°				
54	1.5934	118.7	68.13	99.38	73.11	72.66	- 59°				
55	1.6111	122.2	69.65	100.48	74.74	75.10	..				
56	1.6292	125.8	71.17	101.61	76.37	77.60	..				
57	1.6477	129.5	72.75	102.77	78.07	80.23	..				
58	1.6667	133.3	74.36	103.95	79.79	82.95	..				
59	1.6860	137.2	75.99	105.16	81.64	85.75	- 7°				
60	1.7059	141.2	77.67	106.40	83.35	88.68	+ 12.6° F.				
61	1.7262	145.2	79.43	107.66	85.23	91.76	27.3°				
62	1.7470	149.4	81.30	108.96	87.24	95.06	39.1°				
63	1.7683	153.7	83.34	110.29	89.43	98.63	46.1°				
64	1.7901	158.0	85.66	111.65	91.92	102.63	46.4°				
64½	1.7957	159.1	86.33	112.00	92.64	103.75	43.6°				
64¾	1.8012	160.2	87.04	112.34	93.40	104.93	41.1°				
65	1.8068	161.4	87.81	112.69	94.23	106.10	37.9°				
65½	1.8125	162.5	88.65	113.05	95.13	107.54	33.1°				
66	1.8182	163.6	89.55	113.40	96.10	108.97	24.6°				
66½	1.8239	164.8	90.60	113.70	97.22	110.60	13.4°				
67	1.8297	165.9	91.80	114.12	98.51	112.42	- 1°				
68	1.8354	167.1	93.19	114.47	100.00	114.47	- 29°				

## FIXED POINTS.

Sp. gr.	Per cent. H <sub>2</sub> SO <sub>4</sub> .	Sp. gr.	Per cent. H <sub>2</sub> SO <sub>4</sub> .
1.0000	0.00	1.5281	100.00
1.0048	0.71	1.6440	100.00
1.0347	5.14	1.6748	100.00
1.0840	9.48	1.6272	100.00
1.0892	14.22	1.6679	100.00
1.1353	19.04	1.7044	100.00
1.1736	23.94	1.7258	100.00
1.2105	28.55	1.7472	100.00
1.2513	33.49	1.7700	100.00
1.2951	38.04	1.7050	100.00
1.3441	44.15	1.8117	100.00
1.3947	49.62	1.8104	100.00
1.4307	53.17	1.8275	100.00
1.4607	56.08	1.8354	100.00
1.4822	58.14		

## ALLOWANCE FOR TEMPERATURE.

At 10° B <sub>é</sub> , 0.0022° B <sub>é</sub> or 0.00023° F.	Sp. gr.
" 20° " 0.036° " "	0.00034
" 30° " 0.035° " "	0.00030
" 40° " 0.031° " "	0.00041
" 50° " 0.028° " "	0.00045
" 60° " 0.020° " "	0.00053
" 65° " 0.026° " "	0.00057
" 66° " 0.0235° " "	0.00054

Per cent. 60°	Pounds 60° in 1 cu. ft.	Per cent. 50°	Pounds 50° in 1 cu. ft.
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61.93	53.34	77.36	100.00
63.69	55.39	79.56	100.00
65.50	57.50	81.81	100.00
67.28	59.66	84.05	100.00
69.09	61.86	86.30	100.00
70.90	64.12	88.56	100.00
72.72	66.43	90.83	100.00
74.55	68.79	93.12	100.00
76.37	71.20	95.40	100.00
78.22	73.68	97.70	100.00

80.06	76.21	100.00	100.00
81.96	78.85	102.38	100.00
83.86	81.64	104.74	100.00
85.79	84.33	107.15	100.00
87.72	87.17	109.67	100.00
89.67	90.10	112.01	100.00
91.63	93.11	114.46	100.00
93.67	96.26	117.00	100.00
95.74	99.52	119.59	100.00
97.84	102.89	122.21	100.00

100.00	106.40	124.91	100.00
102.27	110.10	127.74	100.00
104.07	114.05	130.75	100.00
107.30	118.34	134.03	100.00
110.29	123.14	137.76	100.00
111.15	124.49	138.84	100.00
112.06	125.89	139.98	100.00
113.05	127.40	141.22	100.00
114.14	129.03	142.57	100.00
115.30	130.75	144.02	100.00

116.65	132.70	145.71	100.00
118.19	134.88	147.63	100.00
119.98	137.34	149.87	100.00

O. V.	H <sub>2</sub> SO <sub>4</sub> .	O. V.	60°
60°	93.19	100.00	110.98
50°	77.07	83.35	100.00
	62.18	66.72	80.06

Acids stronger than 66° B<sub>é</sub> should have their percentage compositions determined by chemical analysis.

\* Calculated from Pickering's results, Journal of Chemical Society, vol. 57, p. 363.



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## PLANT, APPARATUS, AND MACHINERY.

### ENGLISH PATENTS.

Generators; Means for Preventing Incrustation —. La Societe C. Bez et ses Fils, Paris. Eng. Pat. 20, June 2, 1904. Under Int. Conv., June 3, 1903.

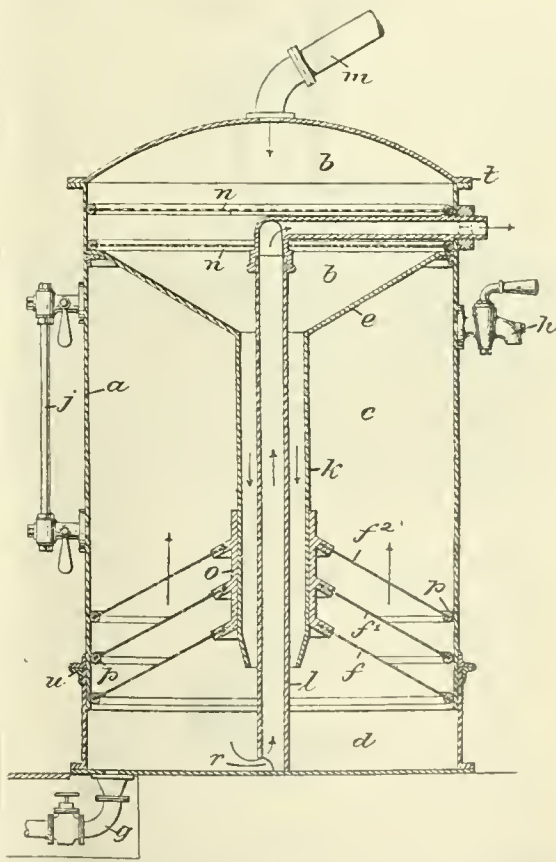
Substances, such as those described in Eng. Pat. 1902 (this J., 1903, 942), are added to the feed so that the latter has a sp. gr. of, at least, 2° Baume. Acting as disincrustants, the added salts increase efficiency of the boiler.—W. P. S.

Impts. in the Removal of Precipitates from —. Sulman and H. F. Kirkpatrick-Picard, London. Pat. 13,481, June 14, 1904.

Rapid collection and filtration of finely divided precipitates is the object of this invention. From 10 per cent. of an alkaline soap is added to the liquid in which the finely divided precipitate is suspended, thoroughly dissolved in and mixed with it. An equal small proportion of a salt of calcium or magnesium, or other metal capable of forming an insoluble soap, is then added. The insoluble soap formed, envelopes the particles of the precipitate into a coagulum, which sinks rapidly to the bottom of the tank and can then be removed for further treatment. The solution already contain a salt capable of forming an insoluble soap, the addition of the salt of calcium or other metal may be omitted.—W. H. C.

Separator and Filter for Mixed Liquids [e.g., Oil and Water]; An Improved —. H. G. Small and The Motionless Engine Packing Co., Ltd., Manchester. Eng. Pat. 17,625, Aug. 13, 1904.

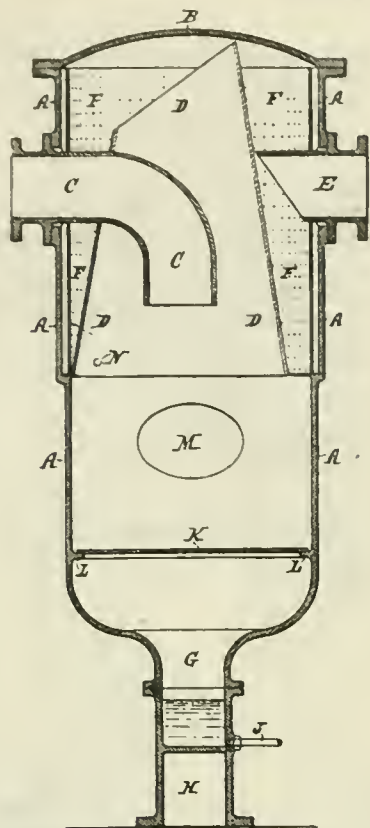
The apparatus consists of a casing *a*, divided into three compartments, *b*, *c*, *d*. The mixture, oil and water, for example, enters by the pipe *m* and passes through the funnel-shaped partition *n*, where any coarse materials are kept back; it then flows down the funnel-shaped partition *e* and the tank into the bottom or "gravity settling compartment" *d*. Here the oil and water separate, the former rising upwards through the sieves *f*, *f*<sub>1</sub>, *f*<sub>2</sub> of progressively increasing fineness of mesh, into the storage compartment *c*, provided with the gauge *j* and the draw-off



tap *h*. The water escapes by the opening *r* into the pipe *l*, through which it flows away in the direction shown by the arrows.—W. H. C.

*Separating Liquids from Vapours; Apparatus for* — J. McNeil, Govan. Eng. Pat. 4332, March 2, 1905.

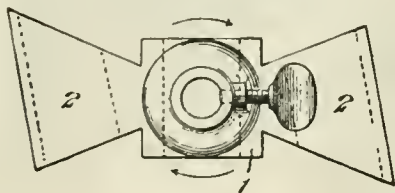
The vapour enters the separator A (see Fig.) by the pipe



C, and owing to its decrease of velocity, deposits much of the liquid carried by it upon the walls of the lower portion of A and upon the perforated plate K, through which the liquid flows into the reservoir G, and escapes by the pipe J through a steam-trap. The vapour travels upwards through the truncated cone D, and passes out of the top with a "swirling motion," depositing the remainder of the liquid upon the perforated screen F and the cover B, and finally escapes through the pipe E, which is placed "diametrically" opposite the lower side of the apex of D. The liquid trickles down the walls and reaches the reservoir G by openings, one of which is shown at N.

—W. H. C.

*Dashers; Impts. in* — M. Murphy, New York. Eng. Pat. 5245, March 13, 1905.



THE claim is for a dasher constructed as shown in the plan (see Fig.) with the object of providing a number of vertical edges and recesses. The wings 2, 2, as well as the central portion 1, are horizontally perforated as indicated by the dotted lines.—W. H. C.

*Cooling or Evaporating Liquids; Apparatus for* — H. E. Newton, London. From H. R. Wertheim, New York. Eng. Pat. 7468, April 8, 1905.

THE invention relates to absorption towers, in which air is forced upwards. Claim is made for a reservoir into which the bottom of the tower is submerged, the level of liquid contained in it, can be varied, when working with forced draught, the bottom of the tower is sealed, whilst when using natural draught it is open to the atmosphere.—W. H. C.

FRENCH PATENT.

*Air [and other Gases]; Process of Drying* — J. C. Fr. Pat. 350,927, Jan. 21, 1905.

SEE Eng. Pat. 25,213 of 1904; this J., 1905, 539.—J.

## II.—FUEL, GAS, AND LIGHT.

*Formaldehyde and Acetaldehyde; Thermal Decomposition of* — W. A. Bone and H. L. Smith. Chem. Trans., 1905, 87, 910—916.

THE vapour of the aldehyde was passed through a glazed porcelain tube heated to the desired temperature, the variation of the pressure during the test being observed by means of a manometer, and the nature of the decomposition-products determined.

*Formaldehyde.*—Experiments were made at 400°, 700°, 900° and 1125° C. In all cases the formaldehyde was decomposed mainly into carbon monoxide and hydrogen, but small quantities of a saturated carbon and carbon dioxide were always formed. The reaction was found not to be reversible to any appreciable extent under the conditions of the experiments. The formaldehyde vapour was heated at 350° C. in borosilicate glass bulbs, or passed slowly over a hot surface of porcelain, more complex reactions took place, and intermediate products were formed. The gases produced consisted mainly of carbon monoxide and hydrogen, the ratio CO/H<sub>2</sub> was high and variable.

*Acetaldehyde.*—Experiments were made at 400° and 800° C. At 400° C. the aldehyde decomposed according to the equation: CH<sub>3</sub>.CHO = CH<sub>4</sub> + CO, but carbon and hydrogen were also produced, and at a small quantity of acetylene. Acetaldehyde heated at 350° C. under atmospheric pressure, in silicate glass bulbs, decomposed into methane and carbon monoxide, without any separation of carbon or liquid of hydrogen. In contact with porous porcelain at 500° C., acetaldehyde decomposed into carbon monoxide and methane, and unsaturated hydrocarbons (ethylene, &c.) and aldehydes (crotonaldehyde).

It is pointed out that in combustion phenomena the aldehyde is always rapidly decomposed or burnt in oxygen, the more complex changes could hardly be a prominent part; the aldehydes would either be completely burnt by the oxygen, or would undergo decomposition, formaldehyde into carbon monoxide and hydrogen, and acetaldehyde into carbon monoxide and methane.—A. S.

*Formaldehyde; Synthesis of* — D. L. Chapman and A. Holt, jun. Chem. Soc. Trans., 1905, 87, 91—92.

THE authors have succeeded in synthesising formaldehyde from mixtures of (a) carbon monoxide and hydrogen; (b) carbon monoxide, hydrogen and steam; (c) carbon monoxide and steam; (d) carbon dioxide and hydrogen. The gaseous mixtures were heated in a large glass globe by means of a platinum wire through which an electric current was passed. Experiments in which the gases were passed through tubes heated at temperatures up to 500° C. gave negative results. Only traces of formaldehyde were produced from a mixture of equal volumes of carbon monoxide and hydrogen, saturated with water vapour at the ordinary temperature, but by suspension in a test-tube containing water in the globe immediately above the heated platinum wire, so that the water



ated slowly during the experiment, a considerably yield of formaldehyde was obtained from a mixture of monoxide and hydrogen.—A. S.

*Alene; India-Rubber as an Absorber of —.* V. Irminger. J. Gas Lighting, 1905, 91, 32.

Author has determined the amount of naphthalene absorbed by india-rubber. (See Colman and Smith, 1900, 813.) Coal-gas containing 5 grs. of alene per 100 cb. ft. was passed through three filled with 14 grms. of india-rubber of good quality giving 2 per cent. of ash) cut in small pieces, and through a solution of picric acid. It was found that rubber absorbed the naphthalene completely from 100 cb. ft. of gas. After passing 50 cb. ft. of air through these and then a further quantity of the coal-gas, naphthalene was completely removed from 139 cb. ft.

In an experiment with a glass cylinder filled with pieces of ordinary rubber waste, containing 28 per cent. of ash, 900 cb. ft. of gas were completely freed from alene, the amount absorbed being about 2 per cent. of the weight of the rubber. After exposing the rubber to the air for a day or two, and then using it again, capable of removing the naphthalene from 750 cb. ft. of gas.—A. S.

*Some Constituents of Manchester and other —.* E. Knecht. XXIV., page 818.

#### ENGLISH PATENTS.

*Process of Treating and Utilising — [as Fuel].* (Clean and W. Paterson. Eng. Pat. 1776, Jan. 30, 1905.) XVIII.B., page 811.

*Artificial —.* H. R. Woltmann, Berkeley, California, U.S.A. Eng. Pat. 3154, Feb. 15, 1905.

SERIAL of low heating value, such as peat, sawdust or waste, is mixed with crude petroleum, asphaltum is added to the mixture, while being heated, is well stirred, cooled down, it is pressed into briquettes. An amount of lime or ground coke may be made, but is not essential. The mixture may have the following composition:—Asphaltum, 25 per cent.; crude petroleum, 25 per cent.; coke, 5 per cent.; and peat, 50 per cent.—R. L.

*Producer Plant; Impts. in —.* C. Whitfield, Kettering. Eng. Pat. 9608, April 27, 1904.

Water part of the scrubber, through which the gas from the gas producer passes on its way to the gas-engine, is kept at a water-seal open to the atmosphere. As the gas is drawn from the scrubber during the charging-stroke of the piston, the water rises to an extent corresponding to the volume of gas withdrawn, whilst during the return stroke of the piston, the water falls again to about its normal level, the flow of gas from the generator to the gas plant and scrubber being, in this way, maintained at a comparatively uniform rate. Extra scrubbers, each with a water-seal, may be provided if desired. The ash-pit of the producer is enclosed, but is provided with a door open to the outer air, which serves for the escape of excess of air and steam not required for working the producer, or for the introduction of an additional quantity of air, in the case of a deficient supply. The return of air and steam enters the ash-pit through a pipe leading directly opposite the end of the pipe communicating with the atmosphere, the supply-pipe leading from the producer, which communicates, on the one hand, with the atmosphere, either directly or through a superheater, and on the other hand, with the upper part of the producer, so that any moisture or vapour evolved when fresh fuel is used, is drawn into the saturator, and used with the return of air and steam for working the producer.—A. S.

*Regenerative Furnaces; Impts. in —.* J. W. Newcer, Newcastle-on-Tyne. Eng. Pat. 15846, July 1, 1904.

Independent valves are employed to control the flow of gas to the furnace, and to convey the waste gases direct to the chimney flue. The passage of the hot and

injurious products of combustion, through the reversing valve, which is the usual arrangement, is thus avoided, and leakages in this valve are prevented. Besides ensuring a longer life of the valves, a saving in the quantity of gas consumed, is claimed.—R. L.

*Gases; Improved Method of Absorbing —, and the Application thereof to the Production of High Vacuum and the Separation of Gases.* J. Dewar, Cambridge. Eng. Pat. 13,638, June 16, 1904.

CHARCOAL cooled to about the temperature at which the gas to be absorbed boils, is exposed to the gas which is contained in a vessel at the ordinary atmospheric pressure, or preferably at a reduced pressure. In this way very complete absorption can be obtained, and the method is used to obtain an almost perfect vacuum in such vessels as incandescent lamp bulbs, Röntgen tubes, and the vacuum vessels in which liquefied gases are stored. The vessel is connected to another containing the charcoal, which is then heated to drive out the gases contained in it. Both vessels are then exhausted by the pump, and the one containing the charcoal is, after cooling, immersed in liquid air or other cooling agent, which will produce the required low temperature. The last traces of air or gas are completely absorbed by the charcoal, and if it is desired to render the vacuum permanent, the vessel containing the charcoal is then removed after sealing the former. The separation of gases is effected by absorbing the mixture in cooled charcoal and then slowly heating the charcoal, when the gases are evolved in the order of their boiling points, or a current of the mixture may be passed over charcoal sufficiently cooled to absorb some of the constituents without affecting others.—W. H. C.

*Mantles; Manufacture of Incandescent —.* E. de Valeriola, E. Sepulchre, Bruxelles and J. Mödler, London. Eng. Pat. 14,288, June 25, 1904.

THE threads used in the manufacture of mantles are impregnated with a solution of "lighting salts," especially nitrates, and, after drying, are exposed during a comparatively short time to the action of ammoniacal vapours. By this operation the nitrates are partially transformed into hydroxides; the threads then consist of a core of soluble salts, covered by a layer of insoluble hydrated oxides. After having been exposed to the air for a few moments, the threads are washed with distilled water to eliminate ammonium nitrate. After being dried again they are made into tissues. It is claimed that this partial transformation into hydrated oxides greatly reduces the quantity of nitrates which have to be decomposed by incineration, and that explosions resulting from the direct contact of the flame with the nitrates are entirely avoided.—R. L.

#### UNITED STATES PATENTS.

*Furnace; Regenerative Retort —.* H. Hegeler and J. W. Hegeler, Lasalle, Ill. U.S. Pat. 792,773, June 20, 1905.

IN a regenerative retort furnace, the retort chamber is separated into two compartments by a central division wall; the two compartments communicating above the wall. Two outer and two inner regenerators are constructed below the retort chamber. The outer ones are provided with short flues communicating with the chamber space below the lower retort tier. Two long flues, extending upwards along the division wall connect the inner regenerators with the spaces below the upper tiers of the retort chamber by means of ports arranged in vertical rows.—R. L.

*Fluids [Gases] for Combustion; Apparatus for Supplying —.* C. Scott-Snell, Assignor to the Scott-Snell Phillips Syndicate, Ltd., London. U.S. Pat. 792,940, June 20, 1905.

SEE Fr. Pat. 344,020 of 1904; this J., 1904, 1080.—T. F. B.

*Gas; Generating Combustible —.* C. Ellis, New York, Assignor to Eldred Process Co., New York. U.S. Pat. 792,011, June 13, 1905.

CURRENTS of cooled products of combustion, and of a

mixture of steam and air, in predetermined proportions, are drawn alternately through a deep layer of incandescent fuel, whereby combustible gas is produced, whilst at the same time the gas producer is cooled below the clinkering point of the fuel.—R. L.

#### FRENCH PATENTS.

*Briquettes: Manufacture of — with a Binding Material Soluble in Water.* B. Wagner. Fr. Pat. 350,579, Jan. 7, 1905.

A MATERIAL suitable for briquette making can be obtained by heating separately the chief constituent, for instance, anthracite, at about 140° C., and the binding material, which may consist of the residues from cellulose manufacture, at about 60° C. The materials are then mixed in a triturating trough at a temperature of about 100° C., and pressed.—R. L.

*Coal: Drying of Small —.* Maschinenbau-Anstalt Humboldt. Fr. Pat. 350,780, Jan. 16, 1905.

THE "small" and impurities delivered from a washing apparatus along with water, are collected in two hoppers by which they are distributed on to a belt conveyer, and are carried to drying towers. By a suitable arrangement of rollers this conveyer keeps the material continually agitated, clogging thus being avoided. The impurities which are not deposited on the conveyer are carried off by the water into a further collecting hopper, where they settle, and are conveyed back to the first hopper-collecting arrangement, whilst the clear water on the top is drawn off by an overflow, and used again in the washing apparatus. It is claimed that a homogeneous material is obtained.—R. L.

*Combustible: Process of Making — from Refuse Sweepings.* E. C. May. Fr. Pat. 350,823, Jan. 17, 1905.

THE sweepings, after being sorted to get rid of pieces of metal and broken earthenware, &c., are mixed with about 3 per cent. of a disinfectant, composed of equal parts of quicklime and ammonium salts. The mixture is ground, dried, and partially carbonised, and then mixed with about 6 per cent. of crude petroleum, and about 5 per cent. of lime, and formed into briquettes.—W. H. C.

*Coke: Method for the Production of — by the Employment of Materials containing Metallic Oxides.* Dr. C. Otto and Co. Fr. Pat. 351,007, Jan. 23, 1905.

IN the method of producing coke, in which the coal, before being carbonised, is mixed with bodies containing metallic oxides, such as the dust from blast-furnace gases, burnt pyrites, &c., the yield of ammonia is low, owing to the action of the oxygen of the metallic oxides. This loss is claimed to be prevented by reducing the oxides to the metallic state before mixing with the coal.—W. H. C.

*Gas from Peat and Analogous Substances: Process and Apparatus for making Combustible —.* C. Whitfield. Fr. Pat. 350,967, Jan. 23, 1905. Under Int. Conv., Jan. 23, 1904.

SEE Eng. Pat. 1738 of 1904; this J., 1905, 490.—T. F. B.

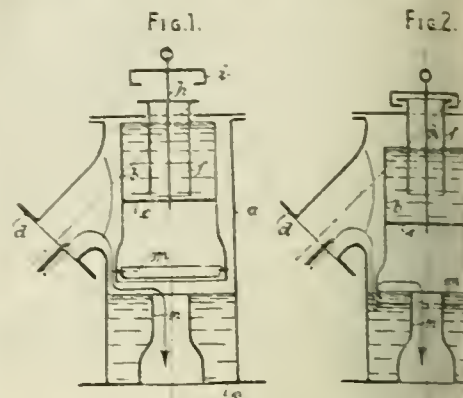
*Gas: Apparatus for the Purification of Blast Furnace —.* L. Schwarz and Co. Fr. Pat. 350,592, Jan. 7, 1905.

THE apparatus consists of a conical shell in which a conical drum revolves horizontally. The gas enters at the narrower end of the apparatus and before arriving in the annular space between the two cones, passes a system of circular discs, which are fitted vertically on the revolving axle, and are constantly kept moist. These discs are fitted close together so that the water forms annular films which have to be penetrated by the gas. The inner drum is provided on the outside with blades which almost touch the conical casing. The drum revolving at high speed acts like a ventilating fan, and whilst causing a centrifugal motion of the gas offers only slight resistance to its passage through the apparatus. The dust contained in the gas being charged with moisture, is deposited on the walls of the apparatus, and can be removed through a manhole. The gas leaving the apparatus is passed through a drying arrangement.—R. L.

#### GERMAN PATENT.

*Gas Retorts: Device for Sealing the Ascension Pipe — against the Hydraulic Main.* M. Hempel. Pat. 158,374, Dec. 16, 1903.

By means of the device claimed, the ascension pipe



sealed against the hydraulic main, without the use of ordinary water-seal, whilst when the retorts are being worked, communication is opened between the ascension pipe and the outer air. A fixed cylinder interposed between the ascension pipe *d* and the hydraulic main, and within this is another cylinder *b*, which is movable vertically, and is divided into two compartments by the partition *c*. When the inner cylinder is in its position, the partition abuts against the raised water-seal *m* in the bottom of the fixed cylinder, and cuts off communication between the ascension pipe and the hydraulic main, whilst at the same time, the pipe *j* in the cover of the fixed cylinder, is opened to the outer air. When the movable cylinder is raised, other hand, communication between the ascension pipe and the hydraulic main is opened, whilst the outlet to the outer air is sealed. Claim is also made for a retecting-ring *m* in the lower end of the movable cylinder which is for the purpose of preventing springing of the water-seal in use (see Fig. 2).—A. S.

### III.—DESTRUCTIVE DISTILLATION OF TAR PRODUCTS, PETROLEUM AND MINERAL WAXES.

*Hydrocarbons of the Benzene Series: Electrolytic Production of —.* II. Ethyl-benzene, Cumene and Camphene. Law and F. M. Perkin. XII., page 805.

#### UNITED STATES PATENT.

*Petroleum: Process of Separating Sulphur and Sulphur-containing Constituents of —, and Hydrogen Carbide.* H. S. Blackmore, M. P. Assignor to Blackmore Ford Utility Oil Co., C. U. S. Pat. 793,026, June 20, 1905.

SEE Fr. Pat. 346,275 of 1904; this J., 1905, 127.

#### FRENCH PATENT.

*Tarcs [from Tar and Mineral Oils]: Manufacture of and Non-Brittle —.* A. Compté and P. Blum. Pat. 350,834, Jan. 18, 1905. IX., page 802.

#### GERMAN PATENT.

*Lubricants which form Stable Emulsions with Water: Process of Preparing —.* V. Urbach. Pat. 159,526, March 3, 1903.

VASELINE oil is treated with air in the usual manner.



ved with about 20 per cent. of wool fat; the mixture is stated to form emulsions with water.—T. F. B.

## —COLOURING MATTERS AND DYESTUFFS.

*Indes and Aminoazo-compounds*. Influence of Substitution on the Formation of —. III. and IV. Morgan, W. O. Wootton and A. Clayton. *Chem. Trans.*, 1903, 87, 935—951.

*Derivatives of Symmetrically Disubstituted Primary Diamines*.—It has been shown previously (*Chem. Trans.*, 1902, 81, 86) that by the action of a diazotised aromatic meta-diamine, in which the two para to the amino-groups are occupied by two groups, by one methyl group and one chlorine by two chlorine atoms, an orthoazo-compound is, although in smaller yield and less readily than condensation is effected with an isomeric base in a free para-position with respect to one of the amino-groups. Also, bases having a free para-position give brown shades on cotton impregnated with di-Primuline, whereas the symmetrical dihalo-bases give yellowish-brown shades. Experiments were carried out with meta-diamines in which the amino-groups were nitro-groups or bromine or iodine groups. 4,6-Dibromo-*m*-phenylenediamine was prepared by heating diacetyl-*m*-phenylenediamine, and hydrolysis by a bromo-compound with alcoholic potassium hydroxide. The di-iodo-compound was obtained by an aqueous solution of *m*-phenylenediamine reacting with an alcoholic solution of iodine, in the presence of sodium acetate. The dibromo- and di-iodo-compounds behave like the dichloro-compound with respect to their reactions, giving indeterminate products with a diazonium chloride, but crystallisable compounds with *p*-nitrobenzenediazonium chloride. The shade produced by treating cotton impregnated with diazotised Primuline, with the three dihalo-diamines deepens considerably as the atomic weight of the halogen increases. The readiness with which the azo-compounds are formed, appears to be greatly increased by the presence of nitro-groups in the molecule of the diamine, and experiments with 5-nitro-2,4-diaminotoluene and with 6-chloro- and 6-bromo-4-nitrophenylenediamine, showed that the nitro group exerts a marked influence when present in the diamine nucleus. The meta-named bases both yield ingrain colours with Primuline.

*4,4'-dimethyl-2,4'-diaminodiphenylene*. Tetra-*m*-amino-*m*-xylene does not condense with diazonium salts, this inactivity being due to the presence of substituents in the two para-positions with respect to the amino-groups, since when one of these positions is free, as in the case of the lower homologue, tetra-*m*-amino-*m*-toluene, the production of the azo compound takes place readily and quantitatively (*Soc. Trans.*, 1902, 81, 659). Dipara-substituted meta-diamines still give azo-derivatives, although in smaller yield than those diamines containing one free para-position. *Soc. Trans.*, 1902, 81, 89, and, in order to proceed far the alkylation of a dipara-substituted meta-diamine, it is necessary to proceed before the production of azo-derivatives, with diazo compounds is quite inhibited, the behaviour of 5-bromo-4,4'-dimethyl-2,4'-diaminodiphenylene. This bromo-derivative, when treated with a diazonium salt of *p*-nitraniline or *p*-bromoaniline, gives an azobenzene-sulphonic acid, yields an ill-defined azo-derivative, which gives the reactions both of an azo- and of an aminoazo-compound. With Primuline on cotton, 5-bromo-4,4'-dimethyl-2,4'-diaminodiphenylene, like 5-bromo-2,4'-diaminotoluene gives a red azo-colour of somewhat duller shade than that given by 4,4'-dimethyl-2,4'-diaminotoluene.—A. S.

*Some Considerations of the Manufacture of Dyestuffs*. E. Knapp. *XXIV*, 1903, 1818.

*Dyes [Sulphide Dyestuffs]*. *Manufacture of Sulphine and of Materials for their Production*. C. H. Albrecht. London. From A. Langens, f. Anl. Fabrikanten, Berlin, Germany. Eng. Pat. 10,208, July 22, 1904.

INDOPHENOLS of the formulae  $O:R:N.R_1.NH.CH_2.C_6H_4.OH$  and  $O:R:N.R_1.NH.CH_2.SO_3H$ , where  $R$  and  $R_1$  represent aromatic radicals of the benzene or naphthalene series, are obtained from aliphylglycines,  $R.NH.CH_2.COOH$ , or  $\alpha$ -naphthylphonic acids of aromatic amines,  $R.NH.CH_2.SO_3H$ , either by oxidising them conjointly with *p*-aminophenols or by reacting upon them with *p*-nitrophenols in presence of concentrated hydrochloric acid or somewhat diluted sulphuric acid. These new indophenols are converted into sulphide dyestuffs, dyeing undyed cotton in bluish-violet to bluish-green shades, by treating them, or their leuco-compounds, with alkali poly-sulphides in boiling aqueous or alcoholic solution. The leuco-compounds from the above indophenols are prepared by dissolving them in an aqueous solution of sodium sulphide and precipitating with sodium carbonate. For example, 16.5 parts of *o*-tolylglycine and 11 parts of *p*-aminophenol are dissolved in 150 parts of water and 21 parts of concentrated sulphuric acid. A concentrated aqueous solution of 20 parts of sodium bichromate is then added with stirring and the indophenol precipitated with sodium acetate. It is preferably reduced to the leuco-compound as described above, before conversion into a sulphide dyestuff. One part of this leuco-compound is then boiled for 24 hours under a reflux condenser with four parts of crystallised sodium sulphide, two parts of sulphur and four parts of water. The mass is then diluted and the dyestuff precipitated by a current of air. It dyes cotton from a sodium sulphide bath in deep blue shades of good fastness. The indophenol from  $\alpha$ -naphthylglycine and *p*-aminophenol dissolves in aqueous sodium hydroxide solution with an intense Bordeaux-red colour.—E. F.

*Colours [Sulphide Dyestuffs]*; *Manufacture of Sulphine*. R. B. Ransford, Upper Norwood, Surrey. From Leopold Casella & Co., Frankfurt-on-the-Maine, Germany. Eng. Pat. 17,318, Aug. 8, 1904.

THE sulphide dyestuffs obtained by heating *p*-*p*-dihydroxydiphenylamine and analogous bodies with polysulphides are treated with oxidising agents in an alkaline solution. In this way, new blue dyestuffs are obtained, distinguished by easy solubility, level dyeing, and fastness to washing, light and chlorine. The simplest manner of producing the primary dyestuffs is to boil the indophenols obtained by simultaneous oxidation of *p*-aminophenol, amino-*o*-cresol [ $OH:CH_2:NH_2 = 1:2:4$ ], or *p*-amino-*o*-chlorophenol [ $OH:Cl:NH_2 = 1:2:4$ ] on the one hand, and phenol, *o*-cresol, *m*-cresol, *p*-xylenol [ $CH_3:CH_3:OH = 1:4:2$ ] or *o*-chlorophenol on the other hand, or their products of reduction, together with polysulphides in a concentrated solution. The primary dyestuffs may also be obtained by directly heating the dihydroxydiphenylamines with sulphur only. The oxidation must take place in alkaline solution. It is most quickly effected with hydrogen peroxide or sodium peroxide at a medium temperature. It may also be very successfully effected by means of electrolytic oxygen, also by blowing a current of air into the solution at 70° C. to 100° C., by potassium ferricyanide or by hypochlorites. For instance, 50 kilos. of the dyestuff obtained by boiling 200 kilos. of indophenol from *p*-aminophenol and phenol, 240 kilos. of sodium sulphide, 125 kilos. of sulphur, and 100 litres of water for 20 hours are dissolved in 50 kilos. of sodium hydroxide solution of 40° B., and about 500 litres of water at 15° C., and 25 kilos. of sodium peroxide are carefully and gradually added. The temperature rises to 60° C., and the greenish-blue colour of the solution changes to a deep reddish-blue. The excess of alkali is then neutralised with hydrochloric acid, and the dyestuff precipitated with salt. It dyes cotton in indigo-blue shades from a sodium sulphide bath. Homologous and chlorinated indophenols yield final products of more reddish shades.—E. F.

*Colouring Matters: Manufacture of Azo — and of Intermediate Products relating thereto.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 19,165, Sept. 5, 1904.

SEE Fr. Pat. 346,007 of 1904; this J., 1905, 84.—T. F. B.

*Indoxyl, its Homologues or their Derivatives: Manufacture of —.* O. Imray, London. From the Basle Chemical Works, Basle, Switzerland, Eng. Pat. 19,474, Sept. 9, 1904.

SEE U.S. Pat. 776,884 of 1904; this J., 1905, 23.—T. F. B.

*Dyes [Azo Dyestuffs]; Production of Blue Mono-azo —.* H. H. Lake, London. From K. Oehler, Offenbach-on-the-Maine, Germany. Eng. Pat. 7839, April 12, 1905.

6-NITRO-2-AMINOPHENOL-4-SULPHONIC acid is diazotised and combined with  $\beta$ -hydroxynaphthoic acid of m.p.  $216^{\circ}$  C. The product dyes wool in indigo blue shades, which are weakened by chroming. The dyeings are unchanged by artificial light and interwoven cotton remains absolutely white on dyeing.—E. F.

#### UNITED STATES PATENT.

*Dyestuff; Reddish Azo —.* K. Krekeler, Elberfeld, Germany, and A. Blank, Leverkusen, Germany. Assignors to Farbenfabriken of Elberfeld Co., New York, U.S.A. U.S. Pat. 792,600, June 20, 1905.

DIAZO-COMPOUNDS are combined with certain naphthimidazoles. The products dye unmordanted cotton in red to reddish-blue shades. The dyestuff prepared by combining the diazo-derivative from o-toluidine with m-amino-1,2-naphthimidazole-5-hydroxy-7-sulphonic acid is specially claimed. It dyes unmordanted cotton in red shades which can be further diazotised on the fibre, and then developed by  $\beta$ -naphthol. Pure red shades are thus obtained, fast to washing and to light.—E. F.

#### FRENCH PATENTS.

*Dyestuffs of the Anthracene Series; Production of a New Series of Derivatives and —, and their Application in Dyeing and Printing.* Badische Anilin und Soda Fabrik. Fr. Pat. 349,531, Dec. 21, 1904. Under Int. Conv., March 25, and Aug. 12, 1904.

SEE U.S. Pat. 786,085 of 1905; this J., 1905, 494.—T. F. B.

*Quinizarin; Process of Manufacture of —.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 350,957, Jan. 23, 1905.

QUINIZARIN is obtained by heating erythrohydroxyanthraquinone with nitrous acid or its derivatives in sulphuric acid solution. The addition of boric acid is advantageous. For example, 20 kilos. of sodium nitrite and 30 kilos. of crystallised boric acid are dissolved in 600 kilos. of sulphuric acid of  $66^{\circ}$  Bé. 30 kilos. of erythrohydroxyanthraquinone are then added and the mixture heated to  $180^{\circ}$ – $200^{\circ}$  C.—E. F.

#### GERMAN PATENTS.

*1-Hydroxyanthraquinone-5-sulphonic Acid [Anthracene Dyestuff]; Process of Preparing —.* Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 158,413, May 3, 1903.

By heating anthraquinone-1-sulphonic acid with fuming sulphuric acid containing less than 40 per cent. of sulphuric anhydride, at temperatures above  $100^{\circ}$  C., it is converted into 1-hydroxyanthraquinone-5-sulphonic acid. This latter is converted into Anthranilin by heating with milk of lime under pressure.—T. F. B.

*o-Nitrotoluene; Method of Purifying —.* Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 158,219, Nov. 8, 1903.

o-NITROTOLUENE may be purified by cooling the crude substance to between  $-4^{\circ}$  and  $-10^{\circ}$  C., allowing it to partly crystallise at that temperature, and then separating the

crystals from the mother liquor. The product obtained is stated to differ materially from that dueled by cooling to below the solidifying point of o-toluene,  $-10.5^{\circ}$  C.—T. F. B.

*Dyestuff; Method of Preparing a Yellow M [Azo] —.* Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat., 160,040, April 20, 1904. Added to Ger. Pat. 158,148, Feb. 14, 1904.

INSTEAD of using o-aminosalicylic acid as in the patent (see this J., 1905, 542), o-aminophenolsulphonic acids and their substitution products are diazotised combined with  $\beta$ -diketones in alkaline solutions dyestuffs produce greenish-yellow to red shades; copper lakes are brownish-yellow to brown, and chromium lakes orange to brown. The dye is faster to rubbing than those produced by the dye of the original patent. The following amino compounds may be used:—2-aminophenolsulphonic acid, 2-aminophenol-4-sulphonic acid, 4-chloro- and 4-aminophenol-6-sulphonic acid, 3-amino-2-cresolsulphonic acid; and the following ketones:—Acetone, ester, acetylacetone, acetoacetanilide, and benzoylacetone.—T. F. B.

*Amines with Formaldehyde; Process for Preparing Condensation Products of Primary Aromatic Amines.* Farbwerke vorm. Meister, Lucius und Brüning. Pat. 158,543, March 18, 1904.

THE salts of aromatic nitro-amino compounds condensed with formaldehyde in aqueous solution to products of the type  $\text{CH}_2(\text{NH} \cdot \text{C}_6\text{H}_4 \cdot \text{NO}_2)_2$ , stated to be valuable for the production of lakes. Analogous products have hitherto only been obtainable by performing the condensation in alcoholic solution.—T. F. B.

*a-Nitroanthraquinones and their Derivatives; Process of Replacing the Nitro Groups of — by Hydroxyl [Anthracene Dyestuffs].* Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 158,891, Sept. 8, 1903.

THE a-nitro groups of a-nitroanthraquinones or their derivatives may be replaced by hydroxyl groups by heating with alkaline-earth hydroxides. Sulphonate groups of a-nitroanthraquinones are also replaced by hydroxyl groups by this method. Thus Anthraquinone obtained from 1,5-dinitroanthraquinone or from 1-nitroanthraquinone-sulphonic acid, and Erythrohydroxyanthraquinone from anthraquinone-a-monosulphonic acid.—T. F. B.

*1,8-Phenyl- or Tolylnaphthylaminesulphonic Acid; Process of Preparing —.* Act.-Ges. f. Anilin. Ger. Pat. 158,923, Oct. 31, 1903.

WHEN 1,4,8-naphthylaminedisulphonic acid is heated with aniline or p-toluidine, with or without the hydrolysis of the base or benzoic acid, to a high temperature the amino group is converted into an aliphylamino group the sulfo group in the 4-position is replaced by hydroxyl whilst the sulfo group in the 8-position remains unchanged; the result is that 1,8-phenyl- or p-tolylnaphthylaminesulphonic acid is produced. 1,4,8-naphthylaminedisulphonic acid is obtained by sulphonating naphthalene, nitrating, reducing, and separating the two thylaminedisulphonic acids.—T. F. B.

*1,6- and 1,7-Phenyl- or Tolylnaphthylaminesulphonic Acid; Process of Preparing —.* Act.-Ges. f. Anilin. Ger. Pat. 159,353, Sept. 14, 1904. Addition to Ger. Pat. 158,923 (see preceding abstract).;

By heating 1,4,6- or 1,4,7-naphthylaminedisulphonic acid to a high temperature with aniline or p-toluidine, without addition of benzoic acid or the hydrolysis of the base, 1,6- or 1,7-phenyl- or p-tolylnaphthylaminesulphonic acid is obtained.—T. F. B.

*Quinophthalone and its Homologues; Process of Preparing Pure —.* A. Eibner. Ger. Pat. 158,761, Dec. 1, 1903.

THE condensation products of quinaldino and its homologues

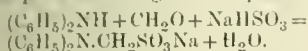


with phthalic anhydride are quantitatively converted into the sodium derivatives of quinophthalone,  $\text{H} \cdot \text{C}_8\text{H}_4\text{O}_2$ , and its homologues, by treatment with ethylate; the free quinophthalones are obtained from their sodium derivatives by boiling with water. The pure products are obtained in a very finely crystalline condition, are more soluble in water, and give shades, faster to light, than the commercial, spirit-soluble quinophthalones. The following homologues are obtained:—*o*,*p*-dimethylquinophthalone; *o*,*p*-and-trimethylquinophthalone; and  $\beta$ -naphthoquinophthalone.

—T. F. B.

*Methyl Derivatives of Aromatic Amines; Method of Preparing* —. Badische Anilin und Soda Fabrik. Add. 158,718, Jan. 9, 1904. Addition to Ger. Pat. 144,762, 1902.

*o*,*p*-DIMETHYLDIPHENYLAMINE is obtained by the action of a bisulphite and formaldehyde on diphenylamine. The product is converted into the  $\omega$ -cyanomethyl derivative by treatment with a metallic cyanide. The following takes place according to the equation:



—T. F. B.

*Process of Preparing a Yellow Cotton Sulphide* —. Badische Anilin und Soda Fabrik. Ger. Pat. 1, March 9, 1904. Addition to Ger. Pat. 144,762, 1902.

*o*-TOLYLTHIOUREA, produced by heating to 100° C., a mixture of *m*-tolylendiamine and a thiocyanate, is obtained with benzidine and sulphur. The resulting dyes give clear greenish-yellow shades on cotton.

—T. F. B.

## REPAIRING, BLEACHING, DYEING, TING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

*Applications of Copper Sulphate in* —. *Reinforcing*. Rev. Gen. Mat. Col., 1905, 9, 185—187.

A new method of treating yarn dyed with azo dyestuffs with copper sulphate is to pass it, after dyeing, through a hot bath containing 2 to 3 per cent. of copper sulphate, calculated on the weight of dyed yarn. In this case the alkali and alkali salts retained in the fibre from the preceding processes are utilised to convert the copper sulphate, and the method is very simple, as much of the copper is not permanently fixed. The process employs the same quantity of copper, which is only fixed by subsequent treatment with sodium hydroxide solution. After dyeing with a direct colour, diazotising and developing on the fibre, the cotton yarn is run out. A solution of 3 kilos. of copper sulphate in 50 litres of water has been meanwhile prepared. One kilo. of cotton is then treated with a mixture of 6 litres of this solution with 6 litres of water. Before treatment with the subsequent kilo. of cotton, half a litre of the copper sulphate solution is added to the bath. 100 kilos. of goods require 56 litres of copper sulphate solution. The goods are then passed, in a similar manner, through a sodium hydroxide solution. 3 kilos. of sodium hydroxide in 57 litres of water. The initial bath is made with 6 litres of this solution and 6 litres of water. After passing each kilo. of cotton, a further half litre of the sodium hydroxide solution is added. The goods are then washed well. If, for instance, the cheapest and most commonly used, namely, Diazo Black B11N—(Eibenschütz's) is used, and subsequently treated as described, it will not fade or change appreciably if exposed to the weather for two years. Moreover, the goods lose little weight if treated in this way, whereas, when dyed with azo-blacks and other dyestuffs, the loss is 4 to 5 per cent. In the case of mercerised goods, a sodium hydroxide bath is not necessary. The copper sulphate rather helps than impairs the effect of mercerisation.

Piece goods may be treated in an exactly analogous manner to hanks. In diazotising on the fibre the action of direct sunlight should be carefully avoided. Diazo Black B11N, which has been treated with copper sulphate, possesses the property, in common with Aniline Black, of being deepened by treatment with glue, giving a very fine black. The following uses of copper sulphate are also mentioned:—(a) In conjunction with dyewood extracts, such as Persian berries, fustic and log-wood; (b) alone, with subsequent treatment with sodium hydroxide, yielding a fast sea-green shade; (c) mixed with permanganate, with subsequent treatment with sodium hydroxide, yielding lilac, olive, and bronze shades; (d) or mixed with iron sulphate, dried and passed through sodium hydroxide solution, to give khaki shades, fast to chlorine and caustic alkali. Copper also is still one of the best oxidising agents for producing Aniline Black on the fibre. It is also used as a preservative, for instance, in conjunction with alum, for preventing bacterial decomposition of orchil extracts. Subsequent treatment with copper sulphate is not advisable in the case of Primuline dyestuffs, as the fastness is not improved whilst the shade is injured. Cobalt and nickel sulphates may often be used, instead of copper sulphate, especially with Poirier's Thiocatechines.—E. F.

*Reserves under Alizarin Colours; Phosphoric Acid and its Salts as* —. L. Specht and A. Hutschek. Z. Farben-u. Textil-Ind. 1905, 4, 297—298.

RESERVES consisting of phosphoric acid and its salts thickened with gum were printed on oiled cotton cloth in different degrees of concentration and treated with an alizarin "for pink" printing paste, containing 7 grms. of alizarin per litre, steamed for 1½ hours under pressure, soaped and washed. The best effects were obtained with sodium metaphosphate, ammonium phosphate, monosodium-dihydrogen phosphate and sodium pyrophosphate. As regards economy di-ammonium-hydrogen phosphate is the most suitable salt. For the production of white discharges, tissues mordanted with alumina are printed with phosphate resists and thereupon dyed with alizarin. The results are as effective as those obtained with organic acids as discharging agents, such as tartaric, citric, and oxalic acids and the like. Although phosphates are used with advantage as precipitants for aluminium mordants, their function as colour resists appears to be due to the solubility of the resulting aluminium phosphate in an excess of fixing agent. Phosphate resists combine readily with direct dyestuffs and can be used in conjunction therewith as coloured discharges to form pleasing designs. Arsenic and silicic acids and their salts act in a similar manner.—D. B.

*Sulphur Dyestuffs; Fixing* — by the aid of Sodium Hydrosulphite-Formaldehyde [Calico Printing]. C. Favre. Bull. Soc. Ind. Mulhouse, 1905, 75, 104—109.

A black colour is obtained upon cotton tissues from a mixture of Immedial Black V "in paste" (½ litre) and caustic soda-lye (¾ litre at 50° B.), which are stirred together and then left at the ordinary temperature for a few hours before being thickened with a solution of British gum (¼ litre), a small quantity of sodium hydrosulphite-formaldehyde being also added to prevent the mixture from blackening the copper printing-rollers. The tissues printed with this mixture, after being steamed for two minutes in a strong current of steam, are passed at full width, for one minute, into a bath of hydrochloric acid and copper sulphate (2 litres of the concentrated hydrochloric acid with 200 grms. of copper sulphate in 100 litres of water); at a temperature of 41° C. After being washed and soaped in the rope state, they are next treated with copper nitrate (2 kilos. in 100 litres of water). The last operation greatly increases the fastness of the dyestuff to bleaching powder, and renders the black colour, which is of a good, deep shade, extremely fast to soap and light. The dyestuff in the form of paste is recommended as giving a better yield of colour than the product which is supplied under the same name in the state of powder.

Grey colours are produced by reducing the black

printing-mixture with a mixture of British gum thickening ( $\frac{3}{4}$  litre) and caustic soda-lye ( $\frac{1}{4}$  litre at 50° B.), the steaming, oxidising, &c., being performed in the same manner as for the black. Immedial Bordeaux J may be used to redden the shade of grey.

A bright blue colour is given by a mixture of Immedial Sky Blue "in paste" ( $\frac{1}{4}$  litre), caustic soda-lye ( $\frac{3}{4}$  litre at 50° B.), and British gum thickening ( $\frac{1}{4}$  litre), the dyestuff and the alkali solution being heated together until the former is dissolved, and the solution then being thickened. Paler shades are obtained from reductions of this standard mixture with a British gum-thickening containing sodium carbonate (150 grms. per litre). A little sodium hydrosulphite-formaldehyde is added to the printing-mixtures, if they show the presence of sodium sulphide. With 2-4 minutes' steaming and a passage through a bath of sodium bichromate (2 grms. per litre) at the ordinary temperature, a blue colour is obtained which is much brighter than, and almost as fast to light as, Indigo. If the oxidation, after steaming, be effected at a temperature of 44° C. with copper sulphate (200 grms.), sodium bichromate (50 grms.), and hydrochloric acid (1 litre of the concentrated solution, per 100 litres of water), the fastness of the colour is increased; the blue thus fixed is stated to be faster to light than Indigo, and exceedingly fast to soap. It is advisable to wash at full width after "fixing" in this manner, in order to avoid "marking-off" of the colour. Mixtures of Immedial Sky Blue with Indigo may be printed and treated in the way described.

Browns are printed with Thiogene Browns GC and GR, which may be shaded, as desired, with other sulphide dyestuffs. They are steamed in the same manner as the blue colour. The "fixing" after steaming may be accomplished with dilute hydrochloric acid. Medium and pale shades are obtained from printing-mixtures prepared by adding a gum thickening containing sodium carbonate to the concentrated, standard printing-mixtures.

For yellow, Immedial Yellow D, shaded with Immedial Orange C, may be used.

Greens are formed from mixtures of the blue and yellow printing-mixtures.—E. B.

*Silk; Use of Thiocyanates for Improving the Durability of Weighted* — O. Meister. Chem.-Zeit., 1905, 29, 723-725.

THE author claims that treatment with a composition prepared by heating together boric acid and glycerol, and adding ammonium thiocyanate to the product, greatly improves the durability of weighted silk. Good results can be obtained by merely adding a thiocyanate to the acid brightening bath. Comparative tests with heavily weighted silk showed that when dyed and finished in the usual manner and then exposed to sunlight, it was so weakened or tendered as to be practically useless after 14 days, whereas if about 1 per cent. of a thiocyanate were added to the brightening bath, the finished silk could be exposed to the sunlight for several months without injury to its strength.—A. S.

#### ENGLISH PATENTS.

*Silk; Apparatus for the Manufacture of Threads of Artificial* — F. W. Howorth, London. From Soc. Franc. de la Viscose, Paris. Eng. Pat. 17,152, Aug. 5, 1904.

SEE Fr. Pat. 345,274 of 1904; this J., 1904, 1212.—T.F.B.

*Flax, Hemp, Jute or other Textile Materials; Impts. in Retting* — L. Legrand, Antwerp, and C. Vansteenkiste, Wevelghem, Belgium. Eng. Pat. 17,089, Aug. 4, 1904.

THE fibrous materials, i.e., stalks of flax, hemp, &c., to be retted are put into crates and then introduced successively into a scouring tank, a retting tank, and a rinsing tank, water being admitted into the last of these, and flowing thence in turn into the retting and scouring tanks, its temperature, while in the retting tank, being maintained at a degree suited to the propagation of the "granulobacterium" which effects the decomposition

of the pectose. While the fibres are being retted, the crates are repeatedly raised from and lowered into the water in order (1) to dislodge from the stalks the matters so produced by the bacteria, and so to produce a more regular uniform action, and (2) to expose the stalks to the action of the bacteria, which greatly increases the activity of the bacteria. The latter end may also be attained by the oxygen or ozone into the water. By this method of retting of the fibres, it is stated, is completed in a series of operations, whereas in the processes hitherto used the operations had to be repeated several times — J.

*Waste Cotton, Polishing Cloths, &c.; Cleaning and Dyeing* — O. Wilhelm, Stralsund, Germany. Pat. 18,720, Aug. 30, 1904.

ENGINEERS' grease-laden sponge-cloths, &c., are cleaned by immersion in "benzene," followed by a treatment with boiling water. The "benzine" solution of the matters, &c., obtained, is withdrawn from the extraction vessel into a still, where the solvent is distilled off along with the residual oils, &c., recovered. The extraction vessel is then filled with water, which is heated to drive off the solvent still retained by the cloths, &c., the solvent thus vaporised being received in a condenser and recovered.—E. B.

*Scouring, Washing, and the like Machines*. J. Baudot, Paris. Eng. Pat. 6726, March 30, 1904. Under Int. Conv., April 1, 1904.

SEE Fr. Pat. 342,108 of 1904; this J., 1904, 899.—

*Dyeing Machine [for Hanks]*. O. Kunz, Vienna. A. Pat. 1156, Jan. 20, 1905.

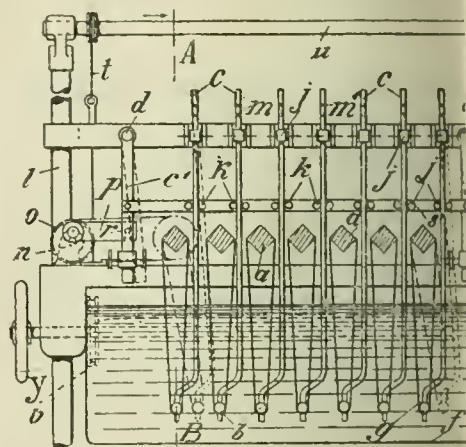


FIG. 1.

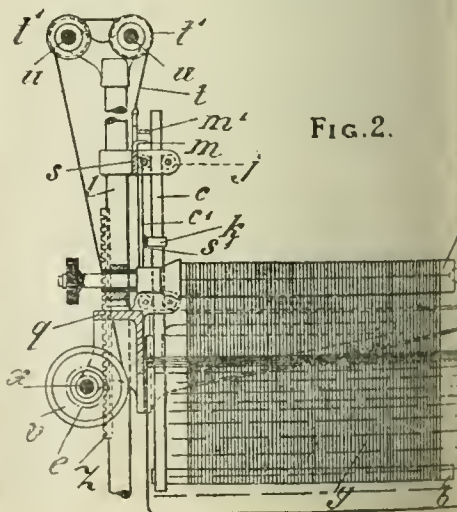


FIG. 2.



see Figs.) extending at right angles from movable rve, in conjunction with reels *u*, for the reception of yarns, more particularly those consisting The bars *c*, as they move, are guided between *k*, carried by rails *s*, *s*<sup>1</sup>, of which the rail *s*<sup>1</sup> is arms *c*<sup>1</sup>, rocking upon pins *d*, projecting from the A reciprocating motion is given to the rods *b* by an eccentric *o*, actuated by a shaft *n*, an arm *p* eccentric engaging with a pin *r* on one of the arms rail *s* is guided on fixed pillars *l* and is suspended s or cords *t* carried over pulleys *l* on shafts *u*, *u*, *e*, *v*, mounted on a shaft *x* provided with a hand-

The rail *s* is provided with tappets *m* which engaged to engage with corresponding tappets on c. Gear wheels *e* are fixed upon the shaft *x*, with racks *z* on the pillars *l*. The reels *u* upon e skeins are spread are mounted on a frame *q* an be moved up and down the pillars *l*. On the handwheel *y* in one direction, the reels *u* and re raised. But the latter being lifted less than ar, the two rows approach each other. The of the dyed skeins and the placing in position of thus facilitated. As the only pressure upon is during the operation of dyeing is the weight ds and bars, and as this is a yielding one, rupture reads during this operation is avoided.—E. B.

*Mechanism for —, wherein the Material to ed is continuously submerged within the Dye Exposure to the Atmosphere during the Dyeing* is. J. R. Greenwood, Upper Chichester, U.S.A. Pat. 2873, Feb. 11, 1905. Under Int. Conv., 12, 1904.

Pat. 776,237 of 1904; this J., 1905, 25.—T. F. B.

*and other Woven Fabrics; Impts. in Printing —.* Hulme, Didsbury. Eng. Pat. 16,798, July 30,

ect of this invention, which is an improvement at forming the subject of Eng. Pat. 1799 of 1891 (1892, 1890), is to enable a discharge pattern and n in indigo or other dyestuff to be produced on during the same passage through the apparatus. end the tissue is passed successively (i) over a roller revolving in a discharge solution; id down over guide rollers in the air; (iii) over a "pattern roller," by means of which indigo or estuff is applied; (iv) over guide rollers; (v) into a where it is sprayed upon or otherwise washed ter or a suitable solution, and thence (vi) into a ere the washing is completed.—E. B.

*ing Pastes for the Discharge of Dyed Textile s; Manufacture of —.* J. Y. Johnson, London. Badische Anilin und Soda Fabrik, Ludwigshafen-ine, Germany. Eng. Pat. 20,178, Sept. 19, 1904.

ond Addition, dated Sept. 17, 1904, to Fr. Pat. of 1900; this J., 1905, 130.—T. F. B.

*tor for Evaporating the Liquid in Brewers' Wash, e, Waste or Spent Dyes and the like, and Conceal- y the Solids in the same, the Evaporator being also able as a Smoke Washer.* A. B. Lennox. Eng. 3,227, June 11, 1904. XVIII.B., page 811.

#### UNITED STATES PATENTS.

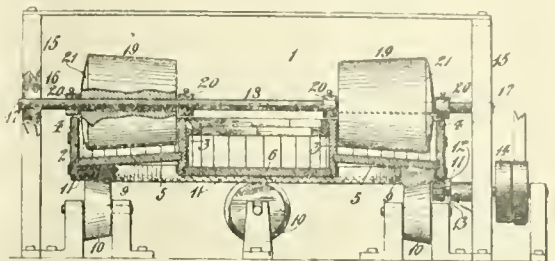
*ethod of Making Artificial —.* H. S. Mork, Walker and A. D. Little, Boston, Mass., U.S.A. Pat. 792,149, June 13, 1905.

LOSE ester, such as cellulose acetate, is dissolved table mixture of a compound of high volatility. compound of low volatility, a small proportion of atile compound being also added to the solution. tion is projected through minute holes (in a draw- to a regulating compound, a number of the fila- produced being twisted together, and wound and der tension, to form threads of artificial silk.—E. B.

*Viscose; Manufacturing Filaments from —.* C. A. Ernst, Lansdowne, Pa., U.S.A. U.S. Pat. 792,888, June 20, 1905.

FILAMENTS prepared from a solution of viscose are passed into a bath containing an inert organic reagent, e.g., wood-spirit; an organic acid, e.g., acetic acid; and a salt soluble in the acid employed, e.g., sodium acetate, in order to set them. They may be afterwards immersed in a bath of an inert organic reagent and an acid, to "revert" the viscose.—E. B.

*Dyeing Machine.* M. Sarfert, Philadelphia, Pa., U.S.A. U.S. Pat. 786,162, March 28, 1905.



THE apparatus which forms the subject of this invention consists of an annular trough 2 (see Fig.), supported by friction rollers 10, and rotated by means of a rack 11 and pinion 12. In the trough are mounted two rollers 19, in such a manner as to be capable (i) of revolving simultaneously with or independently of the shaft 18 upon which they are carried, and (ii) of rising vertically, upon encountering any thick mass of the materials contained in the trough, the curved ends of the rollers coming into contact with the sides of the trough and thus keeping the rollers in position on the shaft. The textile materials which are to be saturated or dyed are placed in the trough, after this has been more or less filled with the necessary liquor, and are conveyed round in the trough and squeezed by the rollers as they are brought under them.—E. B.

*Silk; Treating [Weighting] —.* F. Jochen, Jersey City, N.Y., Assignor to the Jochen Silk Weighting Co., New York. U.S. Pat. 792,218, June 13, 1905.

THE silk is treated "in the usual manner" with a metallic salt, e.g., "tin bichloride," and is then washed and treated with an alkaline solution of an albuminous substance, e.g., casein, and sodium phosphate, and, finally, again washed and dried.—E. B.

*Hydro-Extractor [for Textiles]; Centrifugal —.* N. Cautley, Shelf, Yorks. U.S. Pat. 792,755, June 20, 1905.

SEE Eng. Pat. 11,839 of 1904; this J., 1904, 933.—T. F. B.

#### FRENCH PATENTS.

*Silk; Manufacturing Artificial —.* P. Cazeneuve. Fr. Pat. 350,723, Jan. 12, 1905.

THE objects of this patent are, first, to describe with greater precision the process of making artificial silk filaments which forms the subject of Fr. Pat. 346,693 (this J., 1905, 194 and 331), and, secondly, to specify certain improvements in the process. Acetone (two or three parts) purified and freed from water, of b.p. 56° C., is employed as sole solvent for the mixture (one part) of tri- and tetra-nitrocellulose, from which the filaments are prepared. The solution is maintained at a temperature of 15°–22° C. during the operation of forcing it through the draw-plates. The opaque threads thus produced are unwound from the spools on which they are received from the draw-plates and are exposed, in the form of hanks, for several minutes to an atmosphere of ammonia, at a temperature of 15°–25° C. This has the effect of rendering them transparent and lustrous. They are next denitrated at a low temperature by means of a solution of ammonium sulphide or hydrosulphide, reagents which

have the property, not shared by metallic sulphides, of increasing the lustre of the filaments, prepared from the solution of nitrocellulose compounds in acetone. Finally, the solvent is recovered by the use of a refrigerating apparatus similar to that employed in condensing carbon bisulphide vapours.—E. B.

*Cellulose Threads; Process of Making Lustrous* — R. Linkmeyer and M. Pollak. Fr. Pat. 350,888, Jan. 20, 1905.

SEE Eng. Pat. 1501 of 1905; this J., 1905, 670.—T. F. B.

*Dyeing Textile Fibres; Machine for* — O. Kunz. Fr. Pat. 350,868, Jan. 19, 1905.

SEE Eng. Pat. 1156 of 1905; preceding these.—T. F. B.

*Dye-Vat*. D. F. Waters. Fr. Pat. 350,915, Jan. 21, 1905. SEE U.S. Pat. 785,283 of 1905; this J., 1905, 438.—T. F. B.

*Logwood Extracts; Process for Increasing the Tinctorial Yield of* — Soc. Lepetit, Dollfus et Gansser. Fr. Pat. 351,018, Jan. 25, 1905.

IN dyeing either animal or vegetable fibres black with logwood extract in the customary manner, the intensity of the shade produced can be increased by 10 to 15 per cent. by the addition of magnesium sulphate to the dye-bath, in the proportion of 15 to 30 per cent. of the weight of logwood extract employed. Magnesium sulphate may also be used with advantage in the manufacture of logwood extracts. In addition to its beneficial effect on the dyeing properties, a so-called "crystallised," dry, granular product is obtained, which is not hygroscopic and contains no tannin matters which injure the shade obtained. The magnesium sulphate may be replaced, though without special advantage, by other magnesium salts.—E. F.

*Steaming Apparatus [for Textiles]*. R. Sandreuter-Rauch. Fr. Pat. 350,711, Jan. 12, 1905.

A STEAMING-CHAMBER, serving for the treatment of small quantities of textile materials, is divided into several compartments, each of which is independently supplied with steam. A closed steam-pipe is placed near the wall in each compartment to prevent the condensation of the steam and the consequent wetting of the materials during the operation of steaming.—E. B.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

UNITED STATES PATENT.

*Coating Materials with Silver; Method of* — F. Hilpert, Nuremberg, Germany. U.S. Pat. 792,826, June 20, 1905.

SEE Eng. Pat. 20,709 of 1903; this J., 1903, 1345.—T. F. B.

## VII.—ACIDS, ALKALIS, AND SALTS.

*Nitric Acid and its Hydrates; Constitution of* — W. N. Hartley. Proc. Roy. Dub. Soc., 1905, 10, 373—377.

A SUMMARY of results obtained by the author as the result of spectroscopic observations (Chem. Soc. J., 1903, 83, 658), and a comparison of those obtained by Erdmann (Z. anorg. Chem., 1902, 32, 431) from melting-point and boiling-point determinations, by Veley and Manley (this J., 1901, 1208) from curves of densities and of contractions and from refractive indices, by Pickering (Chem. Soc. Trans., 1893, 63, 436), and by Graham, are given. A list of the hydrates, isolated or indicated by physical data, is as follows:—

Sp. gr.	Composition, Per cent. $\text{HNO}_3$ .	Formula and Constitution
—	100.00	$\text{HNO}_3 = \text{NO}_2 \cdot \text{OH}$
1.490	89.60	Mixture of $\text{H}_2\text{N}_2\text{O}_7$ and $\text{HNO}_3$
—	87.65	$(\text{OH})_2 \cdot \text{NO} \cdot \text{O} \cdot \text{NO}_2$ ; $(\text{OH})_2 = \text{H}_2\text{O}$
—	77.78	$\text{O} \cdot \text{N}(\text{OH})_2 = \text{H}_2\text{N}_2\text{O}_4$
1.432	72.57	Mixture of $\text{H}_2\text{N}_2\text{O}_5$ and $\text{H}_2\text{N}_2\text{O}_4$
1.420	69.80	$(\text{OH})_2\text{N} \cdot \text{O} \cdot \text{N}(\text{OH})_2 = \text{H}_2\text{N}_2\text{O}_6$
1.397	63.03	$(\text{OH})_3\text{N} = \text{H}_3\text{NO}_3$
1.339	53.93	$(\text{OH})_3\text{N} \cdot \text{H}_2\text{O}$
1.263	41.18	$(\text{OH})_3\text{N} \cdot 3\text{H}_2\text{O}$
1.207	33.33	$(\text{OH})_3\text{N} \cdot 5\text{H}_2\text{O}$
1.127	20.31	$(\text{OH})_3\text{N} \cdot 12\frac{1}{2}\text{H}_2\text{O}$

All the experiments indicate unmistakably a basic acid  $(\text{HO})_4\text{N} \cdot \text{O} \cdot \text{N}(\text{OH})_4$  (corresponding to crys arsenic acid  $(\text{HO})_4\text{As}(\text{OH})_4$ ) which was the a maximum viscosity in Graham's experiments. At the ortho-acid,  $\text{N}(\text{OH})_5$ , is produced from at whether stronger or weaker, by blowing air th The octobasic acid, exposed to ordinary air satur moisture, gradually absorbed moisture for five when its sp. gr. was 1.187, and it contained 29.56 of  $\text{HNO}_3$ .—J. T. D.

*Nitric Acid of High Concentration; Strength and Gravity of* — F. Winteler. Chem.-Zeit., 689.

STIMULATED by the demands of the explosives nitric acid makers have of late years produced high concentration practically free from nitro The presence of nitrous acid, even in small amou surprisingly great influence on the specific gravity acid, and all the older tables of specific gr erroneous on that account. In consequence tinued analytical discrepancies arising from the of nitric acid being determined on the one hand titration, and on the other by observation of th gravity and reference to tables, the author ha series of specific gravity determinations and ar pure acids of different strengths, the results of as follows:—(Lunge's figures are given for co All measurements were made at 15° C.)

Sp. gr.	Degrees Baumé.	Per cent. of $\text{HNO}_3$ .	Pe of (H
1.485	47.0	86.3	
—	47.1	86.8	
—	47.2	87.3	
—	47.3	87.7	
1.490	47.4	88.2	
—	47.5	88.7	
—	47.6	89.2	
—	47.7	89.7	
1.495	47.8	90.2	
—	47.9	90.7	
—	48.0	91.2	
1.500	48.1	91.8	
—	48.2	92.3	
—	48.3	92.9	
1.505	48.4	93.6	
—	48.5	94.3	
—	48.6	95.0	
1.510	48.7	95.6	
—	48.8	96.1	
—	48.9	96.7	
1.515	49.0	97.3	
—	49.1	97.8	
—	49.2	98.5	
—	49.3	99.0	
1.520	49.4	99.7	

*Sodium Hydrosulphite; Action of Sodium Pol on* — A. Binz. Ber., 1905, 38, 2051—

SODIUM hydrosulphite has no action upon sodi sulphide, but reacts violently with sodium pol; the latter being decolorised, whilst hydrogen is liberated and sulphur precipitated in varying Definite results are, however, obtained, if sodium l be added to the mixture. The results of qu



iments indicate that the polysulphide sulphur which, on reaction, appears among the final products in the form of monosulphide, and the author concludes that for each mol. of hydrosulphite, only one mol. of polysulphide sulphur is present, this enters exclusively the "sulphoxy" portion (Ber. 38, 1051, this J., 1905, 24) of the hydrosulphite molecule, with the formation of *thiosulphate*, which is decomposed later into sulphite and sulphide:—

$\text{NaSO}_3 \cdot \text{O} \cdot \text{NaSO}_3 + \text{Na}_2\text{S}_2 + 2\text{NaOH} = \text{NaS} \cdot \text{SO}_3\text{Na}$  (sulphite) +  $\text{Na}_2\text{SO}_3 + \text{Na}_2\text{S} + \text{H}_2\text{O}$ ; (2)  $\text{NaS} \cdot \text{SO}_3\text{Na} + \text{OH} = \text{Na}_2\text{S} + \text{Na}_2\text{SO}_3 + \text{H}_2\text{O}$ . In presence of excess polysulphide, the sulphite would, of course, be converted into thiosulphate:  $\text{Na}_2\text{SO}_3 + \text{Na}_2\text{S}_x = \text{Na}_2\text{O}_3 + \text{Na}_2\text{S}_{x-1}$ .—R. L.

*Sulphate*; *Basic*.—A. Recoura. *Comptes rend.*, 1905, 140, 1634—1637.

A saturated solution of normal ferric sulphate, though clear, is partially hydrolysed, and if it be shaken and then left in contact with acetone for a couple of days, the acetone gradually increases in bulk through action of the hydrolytic sulphuric acid, and the aqueous solution solidifies to a spongy mass of greatly increased volume. This substance, thoroughly washed by the aid of impure acetone and dried in the air, is a yellowish powder, soluble in water, and containing ferric and sulphur trioxide in proportions corresponding to  $\text{Fe}_2(\text{SO}_4)_3 \cdot \text{Fe}_2\text{O}_3$ . It is, however, hydrated, and when heated to constant weight at 120° C., and at the ordinary temperature in a desiccator, its composition is expressed by the formulae  $6(\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{SO}_4) \cdot \text{Fe}_2\text{O}_3$  and  $(\text{OH})_6 \cdot 3\text{H}_2\text{SO}_4 \cdot \text{Fe}_2(\text{OH})_6$  respectively. It would appear that the sulphuric acid and ferric oxide or sulphide exist as such in the molecule; but this state of affairs is at once destroyed when the substance is dissolved. —J. T. D.

*Sulphate*; *Hydrolysis of Concentrated Solutions*.—A. Recoura. *Comptes rend.*, 1905, 140, 15—1688.

Hydrolysis demonstrated by the author (see preceding article) makes itself evident in time without the use of acetone, provided the original solution is sufficiently concentrated, for the basic sulphate separates from the solution and leaves in solution a sulphate with excess of acid. The separation is the more rapid, and the hydrolysis goes the farther, the more concentrated the original solution is, and the higher the temperature; but the action of basic salt begins much earlier and is completed more rapidly if the solution be sown with a germ of basic sulphate, and if it be stirred occasionally. No molecular rearrangement as well as hydrolysis is concerned, though the deposition of the basic salt does not begin immediately, yet the freshly prepared solution gives up a considerable amount of sulphuric acid to acetone, showing that hydrolysis occurs at once. Moreover, the solution is completely miscible with alcohol, while the salt, once precipitated, is quite insoluble in alcohol. Recently, then, hydrolysis occurs at once, but the basic salt only deposits after polymerisation or other molecular change. These observations furnish a key to the behaviour of ferric sulphate solutions on evaporation. —J. T. D.

*Hydrogen*; *Oxidation of Atmospheric*.—in the *High-Temperature Electric Flame*. A. Stavenhagen. *XLII.*, page 804.

*Phenylamine*, *Nitrates and Chlorates*; *Detection of*.—by *phenylamine with Resorcinol or 3-Naphthol*. P. J. Jarek. *XXIII.*, page 815.

*Applications of Copper Sulphate in*.—F. Graebbling. *V.*, page 797.

*Calcium and Fluorine*; *Separation and Determination of*.—F. Seemann. *XXIII.*, page 815.

## ENGLISH PATENTS.

*Antimony*; *Treatment of Ores containing*.—J. S. MacArthur, Glasgow. Eng. Pat. 11,123, May 14, 1901.

The comminuted ore containing antimony, is treated with a solution of a fixed alkali hydroxide, such as sodium hydroxide, of not more than 4 per cent. strength (and, preferably not more than 2 per cent. unless the ore contains oxide of antimony) at a temperature exceeding 50° C. The filtered solution is precipitated by carbon dioxide, the reaction being assisted by cooling. The antimonial precipitate is collected in a filter-press, and the filtrate, containing (say) sodium carbonate, is causticised by lime for re-use. The process is particularly applicable in the treatment of ores containing antimony in the form of *stibnite*.—E. S.

*Sodium Perborate*; *Manufacture of*.—The Deutsche Gold- und Silber-Scheideanstalt v. Rössler, Frankfurt-on-the-Maine, Germany. Eng. Pat. 6585, March 28, 1905. Under Int. Conv., June 11, 1904.

MOLECULAR proportions of sodium peroxide, or sodium-potassium peroxide, and of boric acid are caused to react in aqueous solution, and an equivalent quantity of an acid (hydrochloric acid for instance), that will form a readily soluble alkali salt is added, the containing vessel being meanwhile cooled. The crystals that form are separated, washed with ice-water and dried at not above 35° C. The hydrated perborate thus obtained may be deprived of water of crystallisation, and thus enriched in the proportion of available oxygen present, by drying *in vacuo*. (Compare Eng. Pat. 26,790, of Dec. 8, 1904; this J., 1905, 332.)—E. S.

*Dust or Ice on Roads, Streets and the like*; *Method for Producing a Deliquescent Liquor capable of Preventing the Formation of*.—G. J. C.M. de Lichhaber. Eng. Pat. 16,993, Aug. 3, 1904. IX., page 802.

## UNITED STATES PATENTS.

*Prussic [Hydrocyanic] Acid*; *Manufacture of*.—W. Muthmann, Munich, Germany, Assignor to the Roessler & Hasslacher Chemical Co., New York. U.S. Pat. 792,783, June 20, 1905.

SEE Fr. Pat. 335,562 of 1903; this J., 1904, 253.—T.F.B.

*Hydrocyanic Acid from Iron Cyanogen Compounds*; *Process of Making*.—W. Feld, Hönningen-on-Rhine, Germany. U.S. Pat. 792,889, June 20, 1905.

SEE Eng. Pat. 24,920 of 1901; this J., 1903, 93.—T.F.B.

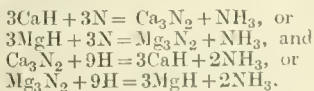
*Salt*; *Manufacture of*.—H. Tec, Seaforth, Lancs. U.S. Pat. 792,632, June 20, 1905.

SEE Eng. Pat. 8117 of 1903; this J., 1904, 749.—T.F.B.

## FRENCH PATENTS.

*Ammonia*; *Manufacture of*.—K. Kaiser. Fr. Pat. 350,966, Jan. 23, 1905.

CALCIUM or magnesium hydride is heated in a tube through which a current of nitrogen is passed; or the fixed product of the reaction, calcium or magnesium nitride, is heated in a current of hydrogen, with production of ammonia in either case, thus:—



The calcium or magnesium hydride or nitride may also, separately or mixed, be subjected to the continuous action of a mixture of nitrogen and hydrogen; and the hydrogen may be replaced by a mixture of it with another gas such as water-gas.—E. S.

*Ammonium Sulphate*; *Saturator for the Manufacture of*.—K. Zimpell. Fr. Pat. 351,011, Jan. 25, 1905. Under Int. Conv., March 30, 1904.

SEE Eng. Pat. 23,379 of 1904; this J., 1905, 81.—T.F.B.

*Zinc Sulphide Ores; Treatment of* — C. E. Dewey.  
Fr. Pat. 350,842, Jan. 18, 1905.

Zinc sulphide ores containing iron are roasted until zinc sulphate and zinc oxide, and iron oxide are formed. The product is placed in a V-shaped vat containing water or the washings from a previous charge, and a mixture of air and sulphur dioxide from a sulphur burner; or a mixture of aqueous vapour, air and sulphur dioxide, is injected into the bottom of the vat, so as to agitate the ore in suspension. The zinc oxide is thus transformed into sulphite, and the latter into sulphate by reaction with the ferric oxide present.—E. S.

#### GERMAN PATENT.

*Platinum, Osmium or Palladium in Colloidal Form [Catalytic Substances]; Method of Producing Preparations containing—*, Kalle and Co. Ger. Pat. 157,172 Nov. 1, 1903. XX., page 813.

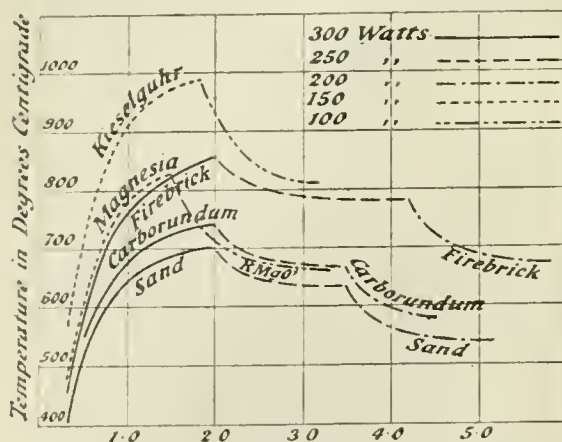
### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

*Heat Insulation; particularly with regard to Materials used in Furnace Construction; Notes on—*, R. S. Hutton and J. R. Beard. Paper read before the Faraday Society, July 3, 1905. [Advance Proof.]

MEASUREMENTS have been made of the heat conductivity of various granular powders for temperatures up to 100° C.; the method adopted being that of Lees and Chorlton (Phil. Mag. 1896, 41, [5] 495—503).

	Conductivity.
Sand (White Calais) .. ..	0.00060
Carborundum .. ..	0.00050
Firebrick .. ..	0.00028
Lime .. ..	0.00029
Magnesia (fused) .. ..	0.00047
Magnesia (light calcined) ..	0.00016
Kieselguhr (infusorial earth) ..	0.00012

An electrically heated tube furnace enabled comparative tests of the various materials to be carried out at high



temperatures more nearly approaching those experienced in practice. The diagram (see Fig.) illustrates the results obtained. The curves represent the temperature attained and maintained by a given expenditure of power, and illustrate how economies in heating can be effected by a suitable choice of furnace jacketing material. The authors advise the use of such methods for the comparison of various grades of fire-brick.—R. S. H.

#### ENGLISH PATENTS.

*Dust or Ice on Roads, Streets and the like; Method of Producing a Deliquescent Liquor capable of Preventing the Formation of—*, G. J. C.M. de Liel.  
London. Eng. Pat. 16,993, Aug. 3, 1904.

THE waste liquors obtained in the manufacture of which are rich in magnesium salts, are treated in a vat or pit with calcium hydroxide (slaked lime) and magnesia is precipitated together with calcium sulphate leaving calcium chloride in solution. The liquid so obtained is used for laying dust on roads, &c., and for melting ice on the same. Before use it may be diluted with water.—A. G. L.

*Wood and other Porous Materials; Impregnation of—*, A. J. Boulton, London. From Hülsberg & Co., Chemnitz, Germany. Eng. Pat. 19,737, Sept. 13, 1904.

SEE Addition of Sept. 27, 1904, to Fr. Pat. 319,190; this J., 1905, 278.—T. F. B.

#### UNITED STATES PATENT.

*Refractory Compound and Process of Making Same*, Davison, Chicago, Ill. U.S. Pat. 792,882, Jan. 10, 1905.

NATURAL magnesite, silica and iron oxide are mixed in dry state, and burnt to clinker in a rotary kiln. The clinker produced is powdered.—A. G. L.

#### FRENCH PATENTS.

*Moulding Argillaceous Matter; Process for Refractory Products obtained by—*, D. B. Williams and J. R. Stauffer. Fr. Pat. 350,960, Jan. 3, 1905.

SEE U.S. Pat. 779,195 of 1905; this J., 1905, 136.—F.

*Clay; Process of Treating—*, D. B. Williams and J. R. Stauffer. Fr. Pat. 350,961, Jan. 3, 1905.

SEE U.S. Pat. 779,196 of 1905; this J., 1905, 136.—F.

*Slag; [Building and Decorating Materials] Manufacture of Objects from Blast-furnace—*, A. F. Le Châtelier. Fr. Pat. 350,659, Jan. 10, 1905.

THE slag as it leaves the furnace or after mixing with bodies such as sodium carbonate, borax, oxide of zinc, or very fusible glass, is worked up by moulding or as in the processes usually employed in glass manufacture into vitreous articles suitable for use as building or decorative materials.—J. H. C.

*Tiles [from Tar and Mineral Oils]; Manufacture of and Non-Brittle—*, A. Couprie and P. Blanc. Fr. Pat. 350,834, Jan. 18, 1905.

A MIXTURE of coal-tar, shale oil, Stockholm tar, and mineral oils is first heated at a temperature of about 100° C. and then intimately mixed with finely divided sand. The whole is moulded and removed from the mould whilst still hot, the mass becoming hard and ready for use in half-an-hour.—A. G. L.

*Fire- and Acid-Resisting Plates, &c.; Manufacture of—*, O. Eissrich. Fr. Pat. 350,852, Jan. 19, 1905.

FINE-ly-DIVIDED sand is added, little by little, to a quantity of asbestos, with continuous mixing and grinding, and the whole is then added to half its weight of a mixture of equal parts of soluble glass (alkali silicate) and water. The mass obtained is compressed by hydraulic pressure in moulds fitted with gauze or similar material. When a hard crust has been formed, the plates, &c., are removed from the moulds in stoves.—A. G. L.

*Covering [Roofing] Material; Flexible—*, The Standard Paint Co. Fr. Pat. 351,014, Jan. 23, 1905.

SEE U.S. Pat. 775,635 of 1904; this J., 1904, 1217.—F.



# X.—METALLURGY.

*Phenomena Accompanying the Reduction of —.* R. Schenck and W. Heller. Ber., 1905, 38, 2132—2139.

The reaction  $2\text{CO} + \text{C} + \text{CO}_2$  is balanced when  $p_{\text{CO}_2} = \zeta$  (where  $\zeta$  is the equilibrium-constant); and the reaction  $\text{FeO} + \text{CO} \rightleftharpoons \text{Fe} + \text{CO}_2$  is similarly balanced when  $p_{\text{CO}}/p_{\text{CO}_2} = \eta$ . If both reactions may proceed at the same time, then when there is equilibrium both of these reactions must hold, and if  $P$  be the total pressure of the gases,  $p_{\text{CO}} = \zeta/\eta$ , and  $P = \zeta(1 + \eta)/\eta^2$ . As  $\zeta$  and  $\eta$  are only on the temperature, it follows that the total pressure, as well as the partial pressure of each gas, is only on the temperature; and that, consequently, the oxide in presence of carbon will be reduced by carbon monoxide if the total pressure of the carbon monoxide and monoxide present be less than  $P$ , while, if the total pressure be greater than  $P$ , iron will be oxidised by carbon separated. The authors have directly determined  $P$  for different temperatures, starting both from iron and carbon with carbon dioxide, and from a mixture of carbon and ferrous oxide, keeping the temperature of the apparatus constant till the pressure began to change. The results were as follows:—

Temp. ° C.	P. mm.	Starting from Ferrous Oxide.	
		Temp. ° C.	P. mm.
0	10.9	468	10.3
0	65.0	540	30.0
—	—	620	81.5
—	—	669	169.2
3	308.0	—	—
9	395.8	728	438.4
		778	750.0
		780	780.0

The results of the two methods agree very closely. It is seen that, working under normal conditions (i.e., atmospheric pressure), there can be no reduction, if an indifferent gas be present, below about 775° C. for iron, and that temperature is the equilibrium-pressure  $P$  for the total pressure of the reacting gases; and that at a lower temperature it is necessary to reduce that pressure, either by working in a partial vacuum or by using an indifferent gas. In the blast-furnace, for example, where air is used to produce carbon monoxide, the total pressure of the carbon oxides cannot exceed atm., and hence reduction may occur at all temperatures above about 695° C. If, locally, the temperature fall below that, the conditions exist for the reoxidation of the reduced iron and the deposition of carbon. Manganese being much more readily oxidised than iron, its value of  $\zeta$  is in its case much higher, and hence that much lower, than in the case of iron. The authors were unable to get any measurable value of  $P$  for manganese below 1200° C. (10 mm.). At 1229° it was 11 mm., but the experiments could not be continued on account of the damage to the quartz tube at these high temperatures.—J. T. D.

*Relation to one another of the Different Modifications of —.* R. Schenck and W. Heller. Ber., 1905, 38, 2139—2143.

The reaction on one another of carbon, carbon monoxide, carbon dioxide, the equilibrium-constant  $\zeta$  depends on a given temperature on the particular modification of carbon concerned; and if the corresponding constant for iron, ferrous oxide, carbon monoxide and carbon be  $\eta$ , then the condition for equilibrium among the whole five of these substances at any temperature is that

$$P = \zeta \cdot \frac{1 + \eta}{\eta^2}$$

where  $P$  is the total pressure of the two reacting gases.

It follows (since  $\eta$  does not involve solid carbon) that  $P$  must be proportional to  $\zeta$ ; and the authors have determined  $P$  for various temperatures, using amorphous carbon (sugar carbon), diamond powder, purified graphite, and carbon reduced by iron from carbon monoxide. The results, plotted in curves, show that the rise of  $P$  with temperature is roughly similar in all cases, becoming more rapid as the temperature rises; but that at any given temperature the value of  $P$  is highest for amorphous carbon, lower for diamond, and lowest for graphite, the gap between diamond and graphite being very much greater than that between amorphous carbon and diamond. The results for carbon monoxide-carbon all fit exactly on the graphite curve, showing that this reduced carbon is very finely divided graphite. Graphite is thus the most stable form of carbon, and reductions (that of iron, for instance) can only be carried out with graphite instead of amorphous carbon (or with coke, say, instead of wood-charcoal) if the temperature be suitably raised.

—J. T. D.

*Steels; Tin-, Titanium-, and Cobalt- —.* L. Guillet. Comptes rend., 1905, 140, 1689—1691.

The author has examined steels of varying carbon content, containing up to 10 per cent. of tin, up to 9 per cent. of titanium, up to 60 per cent. of cobalt. Each of these metals dissolves in the iron, and the carbon present exists entirely as iron carbide. None of the three metals (tin, titanium and cobalt) influences sensibly the mechanical properties of the steel, so that no industrial application of the respective alloys suggests itself. The difference between tin or titanium and silicon, or even between cobalt and nickel, in this respect, is very remarkable, the cobalt steels, like those of tin and titanium, failing entirely to manifest the properties so much valued in nickel steel.

—J. T. D.

*Copper and Zinc; Alloys of —.* O. Saekur. Ber., 1905, 38, 2186—2196

The author has investigated the behaviour of alloys, containing different proportions of these two metals:—1. By observing the limiting composition of those which will precipitate copper from solutions of sparingly soluble salts or salts with complex ions (cuprous thiocyanate, iodide, bromide, chloride, double cyanide and ammonio-cupric compounds), and the rate of precipitation in the cases in which it occurs; 2. By observing the rates of attack of the alloys by acids, especially N/20 sulphuric acid; 3. By determination of the melting and solidifying points, and examination of the curves obtained. The results all agree in indicating changes in the constitution of the alloys with about 41—45 per cent. and 60—62 per cent. of copper. The author considers that the main constituents other than the metals themselves are the compounds  $\text{CuZn}_2$  (32.7 per cent. of copper) and  $\text{CuZn}$  (49.3 per cent. of copper); that the alloys of lower copper content are mixtures of the first compound with zinc, but that, owing to dissociation of  $\text{CuZn}_2$ , there is still free zinc present when the composition of the alloy reaches that of the compound, and that the change in character at 41—45 per cent. of copper is due to the disappearance of free zinc through the influence of the excess of copper on the dissociation of the compound; and that alloys richer in copper are mixtures of the two compounds with metallic copper, the compound  $\text{CuZn}_2$  only ceasing to be present when the excess of copper has neutralised the tendency of  $\text{CuZn}$  to dissociate, i.e., at 60—62 per cent. of copper. Changes in the colour of the alloys, at 40 per cent. of copper, from grey to reddish-yellow, and at 60 per cent. from the latter colour to golden-yellow, also indicate discontinuity at these two points.—J. T. D.

## ENGLISH PATENTS.

*Steel; Melt or Bath for Hardening —.* S. N. Brayshaw, Manchester. Eng. Pat. 12,816, June 7, 1904.

The bath is prepared by mixing 10 parts of sodium chloride with seven parts of potassium chloride. This mixture fuses at a temperature of about 700° C. If desired, a

carburising agent, such as potassium ferrocyanide, may be added to the extent of about 1 oz. per cwt. of the mixture.—W. P. S.

*Zinc Ores; Treatment of* — J. Nicholas, Waterloo, Lancs. Eng. Pat. 13,121, June 10, 1904.

SEE Fr. Pat. 348,804 of 1904; this J., 1905, 550.—T. F. B.

*Sulphide Ores; Smelting* — R. Baggaley, Pittsburg, and C. M. Allen, Lo Lo, U.S.A. Eng. Pat. 3194, Feb. 15, 1905. Under Int. Conv., March 19, 1904.

SEE U.S. Pat. 766,655 of 1904; this J., 1904, 869.—T. F. B.

*Metals or Metallic Articles; Deposition of Metals [Antimony] or Metallic Compounds upon* — S. Cowper-Coles and Co., Ltd., and S. Cowper-Coles, London. Eng. Pat. 13,579, June 15, 1904.

THE metallic article to be coated, cleansed from scale or oxide, is immersed in finely powdered antimony, which may contain up to 25 per cent. of oxide, and from 1 to 6 per cent. of carbon may, in some cases, be added. The antimony powder is contained in a closed vessel, which is heated, but not sufficiently to fuse the powder, and which is meanwhile rotated or otherwise agitated, to ensure intimate contact between the article and the antimony powder. It is desirable to prevent, as far as possible, access of air to the contents of the vessel during the process. The coating of antimony produced is crystalline, and may be equal to an oz. to the sq. ft. of surface for, say, an hour's treatment.—E. S.

*Metal; Method of and Apparatus for Removing Superfluous Metallic Coating from Sheet* — R. E. Phillips, London, from O. S. Fellows and A. E. Hopkins, Middletown, N.Y., U.S.A. Eng. Pats. 5377 and 5379, March 14, 1905.

THE excess of metal is re-melted *in situ* by means of an elongated gas-burner or other suitable contrivance, and then removed by a blast of air, steam, or hot water.

—J. H. C.

*Metal; Method of and Apparatus for Removing Superfluous Metallic Coating from Sheet* — R. E. Phillips, London, from O. S. Fellows and A. E. Hopkins, Middletown, N.Y., U.S.A. Eng. Pats. 5378 and 5380, March 14, 1905.

THE excess of metal is re-melted and then removed by brushing.—J. H. C.

*Aluminium; Special Solder or Flux whereby Ordinary Solder can be used to Solder* — A. W. King, and The Advertising Mirrors Co., Ltd., London. Eng. Pat. 3589, Feb. 21, 1905.

THE "special solder or flux" obtained by melting together at a low red heat, 10 parts of soft solder, 5 parts of pure zinc, and from 5 to 8 parts of aluminium, all by weight, and cast in bars or the like, is used to rub on the heated aluminium surfaces to be joined, which, thus prepared, may be soldered by ordinary soft solder.—E. S.

*Boiler Feed Water; Utilising a certain Waste Product [Galvanising Liquors] for the Treatment of* — W. Branley. Eng. Pat. 17,690, Aug. 15, 1904. XVIII.B., page 811.

#### UNITED STATES PATENT.

*Steel; Method of Making Open-hearth* — N. McConnell, Pittsburg, Pa. U.S. Pat. 792,914, June 20, 1905.

MOLTEN pig metal is blown in an acid-lined converter, in which the silicon and part of the carbon are removed. Portions of the molten metal are then transferred from time to time, to an intermediate furnace, heated externally, in which a large "pool" is maintained, and from which charges are taken to basic open-hearth furnaces, in which the metal is dephosphorised and decarburised.—E. S.

#### FRENCH PATENTS.

*Steel and Iron; Process and Apparatus for Making Castings of* — G. Marconnet. Fr. Pat. 359,450, Jan. 13, 1905.

THE iron ore is charged from above into a cupola pre-arranged with valved conduits or tuyères composed of refractory material, at or near the bottom. Through these, passing a separate heating chamber, powdered carbon and carbon are driven by means of a fan, whereby the mineral is reduced to molten iron or steel as may be required.—J. H. C.

*Steel; New Process for Making* — in the Martin-Silbermann Furnace, operating in two or more Stages and Employing a Decantation Pocket. H. J. B. Delborte. Fr. Pat. 350,750, Jan. 14, 1905.

THE fused metal is run from the furnace into a ladle where, after partial cooling, the slag is removed and the metal thus partially refined is run back to the furnace for further treatment.—J. H. C.

*Metals; Concentrating Volatile* — by the Dry Roasting of Mixed Sulphides. H. Pape. Fr. Pat. 351,042, Jan. 14, 1905.

THE sulphide ores are finely powdered, and the powder is injected with a current of air into a roasting chamber maintained at a high temperature, if need be by aid of an auxiliary furnace. The volatile sulphides are formed, as those of lead and zinc, with the lighter gangue are swept forward by the gases of combustion into a communicating condensing chamber, whilst the heavy oxides, such as those of copper and iron, together with the gangue are deposited in the roasting chamber.

*Fluids of Different Densities [Slag and Matte]; Method of Keeping — Separate and of Distributing them into Distinct Currents*. H. Harris. Fr. Pat. 351,043, Jan. 13, 1905.

THE fluids, e.g., slag and matte, from a blast-furnace are introduced into an oblong trough or receiver, which is divided by a transverse partition having an opening at the bottom of the trough through which the denser fluid passes to the further compartment. Each compartment is furnished with a spout through which the liquid is finally led away.—J. H. C.

*Slag; Manufacture of Objects [Building and Decoration Materials] from Blast-furnace* — A. F. Le Chatelier. Fr. Pat. 350,659, Jan. 10, 1905. IX., page 802.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A.)—ELECTRO-CHEMISTRY.

*Nitrogen; Oxidation of Atmospheric* — in the Tension Electric Flame. A. Stavenhagen. Ber., 38, 2171—2177.

IN the experiments described, an electric flame discharge was produced in a porcelain tube, through which a current of air was passed. The tube was surrounded by a water-cooled condenser containing absolute alcohol cooled with ice. The nitrous fumes were absorbed in standard sodium hydroxide solution, but the absorption was quite complete. An accurate determination of the current-yield was not possible owing to the difficulty of ascertaining the strength and pressure of the secondary current, but the following data are given:—The discharge was produced by means of an induction coil capable of giving a spark 33 cm. long, this coil being connected to a Wehnelt interruptor and a source of current of 15—18 amperes at 100—110 volts. The losses from the secondary current had a calculated strength of 0.07 ampere at 20,000 volts. The following are the results obtained: in a few experiments, a small quantity of oxygen was added to the air.



me.	Velocity of Air Current.	Velocity of Oxygen.	Volume of N/10 NaOH Solution neutralised in 10 mins.	Strength of Primary Current.
ins.	Litres per hour.	Litres per hour.	c.c.	
72	10	0.25	20	about 15 ampères at 110 volts.
27	31	1.0	37	" " "
21	63	—	50	" " "
23	77	—	51	" " "
15	90	—	66	" " "
14	110	—	70	" " "
14	135	—	70	" " "
10	180	—	100	" " "
32	200	—	35	" " "
19	300	—	20	" " "

...tly acid solution of permanganate, a mixture of per cent. solution of hydrogen peroxide with some diluted sulphuric acid, cooled to 0° C., and also diluted sulphuric acid alone, at 0° C., gave favourable results as absorbents for the nitrous fumes.

...e experiments were also made with a tube of fused instead of porcelain, the electrodes being nickel which also served as inlet for the air and outlet for nitrous fumes respectively. It is stated that during experiments, repeated indications were obtained of absence of one or more extremely volatile oxides of iron, which were not retained by the absorbents and could not be condensed by the aid of liquid air. See this J., 1904, 376, 1033; 1905, 672.)—A. S.

*carbons of the Benzene Series: Electrolytic Oxidation* — H. Ethyl-benzene, Cumene and Cymene. D. Law and F. M. Perkin. Paper read before the Faraday Society, July 3, 1905. [Advance Proof.] (this J., 1905, 32.)

In the case of toluene and the xylenes, oxidation of the group is effected by electrolysis in acid solution, first alcohol and then to the aldehyde group, but proceeds rather so long as unchanged hydrocarbon is present. Two or more methyl groups are present, as in xylene mesitylene, one methyl group is fully oxidised to the aldehyde stage before the others are attacked; this is due to the protective action of the negative aldehyde group upon the latter. This protective action of the negative group is also exemplified in the difficulty of oxidising cresols or nitrotoluenes electrolytically. In the case of cymene the methyl group is oxidised whilst the isopropyl group remains intact. The authors are of opinion that the chief agents in these oxidations are the oxygens discharged at the anode.—W. A. C.

*Irony; Electrolytic Determination of* — H. D. Law and F. M. Perkin. XXIII., page 815.

*Hydrogen; Determination of* — by Electrolysis. G. Pellini. XXIII., page 815.

#### ENGLISH PATENTS.

*Baggage [for Electrical Purposes, &c.]; Manufacture of Stratified Blocks of* — The Morgan Crucible Co., Ltd., and C. W. Speirs, London. Eng. Pat. 9875. July 10, 1905.

BAGGAGE, crystalline or flaked, such as that from iron ore, is ground to pass through a sieve of 100 meshes per linear inch, and is compressed in moulds under not more than 20 tons to the sq. in., with suitable pressure of the plane of pressure to the purpose for which the blocks are intended. For commutator brushes, for instance, the lines of stratification should run in the direction of flow of the current, while for wearing surfaces, planes of stratification should be at right angles to the wearing surface, regard to which should also be had in cutting and finishing of the block.—E. S.

*Thermoelectric Couples; Improved Manufacture of Copper Sulphide for* — Comp. Thermo Electrique

(Système Hermite). Soc. Anon., Paris. Eng. Pat. 11,300, May 30, 1905; Under Int. Conv., April 27, 1905.

Copper sulphide, which after its formation is allowed to cool in presence of excess of sulphur, so as to become saturated therewith, is melted in a crucible, and metallic copper is added in small portions until reaction ceases, and the copper sulphide thus obtained is freed from the copper, which latter serves for another operation. Or cupric oxide may be added to melted copper sulphide, whereby sulphur dioxide is disengaged and copper is deposited, leaving the special copper sulphide, which is stated to be perfectly stable, and to give quite regular thermometric results.—E. S.

#### UNITED STATES PATENT.

*Electrolytic Cell.* J. F. Kelly, Pittsfield, Mass., Assignor to Southwestern Exploration Co., New Mexico. U.S. Pat. 792,597, June 20, 1905.

THIS invention relates to an electrolytic cell divided into three compartments, the central electrolyte compartment containing the substance to be decomposed, such as an alkali sulphate, and being separated from the anode and cathode compartments by osmotic diaphragms which prevent "mass mingling" of the liquids. The anode and cathode are of substances not attacked by the acid and alkali respectively, which are the products of the electrolytic action.—B. N.

#### FRENCH PATENT.

*Accumulators; Process of Manufacture of* — F. E. Polzenimsz and R. Goldschmidt. Fr. Pat. 350,898, Jan. 20, 1905.

THIS invention relates to a process of making accumulator plates of zinc-nickel, iron-nickel, &c., the active mass being deposited by electrolytic means as a thin firmly adherent porous layer on a suitable conductor. These are placed in a solution which has no chemical action on the active masses, the positive and negative plates being insulated from each other by means of cloth or parchment.—B. N.

#### (B.)—ELECTRO-METALLURGY.

*Copper; Some Notes on the Rapid Electro-Deposition of* — S. Cowper-Coles. Paper read before the Faraday Society, July 3, 1905. [Advance Proof.]

THE author reviews the different methods for increasing the rate of deposition in electrolytic copper refining, and describes recent developments of his method of revolving the cathode at a critical speed. The critical speed above which smooth, tough deposits can be obtained was determined for any current density by the use of a conical cathode. The variation of bath voltage and current density for rotating cathodes at the critical speed, is illustrated by a curve. Variation of the speed of rotation causes lamination. The plant required for the centrifugal process and the cost of working are also dealt with.

—R. S. H.

## ENGLISH PATENT.

*Furnace; Electric* — L. L. Rosworth, Cleveland, Ohio. Eng. Pat. 2313, Feb. 6, 1905.

THE furnace consists of an outer shell or casing surrounding a refractory non-conducting solid body, around which are wound, from end to end, two resistance coils insulated from each other and from the casing. At one end of the refractory body is an oven into which is fitted a muffle, the latter being made in two sections, one sleeved upon the other, and triangular in cross-section, with walls converging towards the closed end of the muffle in the interior of the furnace. Around the inner section is wound an electrical heating coil, the inner terminal of the coil passing through the outer section, and being brought to the front of the muffle. The resistance and heating coils are in series, and connected with the main terminals by conductors passing through the furnace from front to back. The inner section and heating coil may be withdrawn together, in the event of repairs to the wire being necessary. —B. N.

## UNITED STATES PATENT.

*Metal Mixtures Produced as a By-product in Electrolytic Metal Refining; Process of Treating* — A. G. Betts, Troy. U.S. Pat. 793,039, June 20, 1905.

SEE Eng. Pat. 15,298 of 1904; this J., 1905, 626.—T. F. B.

## FRENCH PATENT.

*Furnace; Oscillating Electric* —, with Conducting Sole. Soc. Anon. Electrometallurgique (Procédés Paul Girod). Fr. Pat. 350,802, Jan. 16, 1905.

THIS invention relates to an electric furnace with a conducting sole acting as one of the electrodes, the other pole consisting of a free electrode of graphite. The furnace is suspended on two trunnions carried by fixed supports or by a waggon, so that the furnace may be oscillated by mechanical means or by the hand. The material is thus poured from the furnace and this gives a regular composition and yield. Two openings are provided for tapping the material, the lower one being used when the sole becomes worn through continued use.—B. N.

*Metals; Electrolytic Process of Obtaining on* —, Deposits with a Metallic Lustre. A. Classen. Fr. Pat. 350,964, Jan. 23, 1905.

A METALLIC lustre is obtained on metals deposited electrolytically by the addition to the electrolytic bath of a certain quantity of one or a mixture of the following substances:—glucosides, "phloroglucosides, phloroglucides, gummides, mannides," glucosides containing nitrogen, or the derivatives of any of them. Instead of these, the extracts of plants, barks or roots containing these substances or their derivatives may be used.—B. N.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*Vegetable Oils; Flashing-Points of Some* — M. Rakusin. Chem.-Zeit. 1905, 29, 690—691.

THE following determinations of flashing-points were made by Herr Kryloff, Chief of the Laboratory of the Imperial Russian gun-factory at Tula:—

Oil.	Sp. gr.	Flashing-point.
		C.
Cocanut .....	0.924	200
Linseed .....	0.930—0.935	205—225
Rape .....	0.915	215
Mustard .....	0.914	225
Gallipoli .....	0.914—0.919	235—240
Olive .....	0.916	240
Sesamé .....	0.923—0.924	240
Poppy .....	0.924—0.935	250
Hemp .....	0.925—0.930	250—265
Castor .....	0.968	255—270

Any mineral oil adulterant is readily detected by lowering of the flashing-point which it causes. This is particularly the case with castor oil, where the adulterant must be colourless.—J. T. D.

*Glycerol; Determination of* — by the Extraction Method with special Reference to its Separation from the Glycerol Waters obtained in Enzymic Processes. W. Landsberger. Chem. Rev. Fett-u. Harz-Ind., 1905, 12, 150—1.

PARALLEL determinations of glycerol were made by the acetin method as prescribed by Lawkowitsch and by the extraction method of Shukoff and Schestakoff (this J., 1905, 294). The results given in detail were as a rule in close agreement, but in certain cases the values given by the extraction method were somewhat too high. The partially concentrated glycerol water of sp. gr. 1.125 yielded 38.2 per cent. of glycerol by the acetin method, as against 40.3 per cent. by the extraction method. This suggested that it is not impossible that in such cases certain substances other than glycerol may have been extracted by the acetone, even in the presence of so much sulphate. A drawback of the method is the time required for a determination—at least nine hours under favourable conditions.—C. A. M.

*Cocanut Oil; Method of Determining the Purity of* E. Milliau. XXIII., page 816.

*Ether; Oxidising Action of Impure* —, and its Influence on Krcis's Reaction. H. Ditz. XXIII., page 8.

## ENGLISH PATENTS.

*Separator and Filter for Mixed Liquids [e.g., Oil and Water]; An Improved* — H. G. Small and Frictionless Engine Packing Co., Ltd. Eng. Pat. 17,625, Aug. 13, 1904. I., page 791.

*Waste [Cotton, Polishing Cloths, &c.]; Cleaning Oil* O. Wilhelm. Eng. Pat. 18,720, Aug. 30, 1904. I., page 798.

*Linseed Oil; Apparatus for Heating* — with D. J. Buchanan. Eng. Pat. 7646, April 11, 1905. XI., page 807.

*Phonograph Records; Composition for use in Making of* —, and Process of making the Same. G. C. M. London. From The New Jersey Patent Co., Orange, New Jersey, U.S.A. Eng. Pat. 3070, Feb. 1905.

THE composition claimed consists of a mixture of metallic soap or soaps with a hard wax, such as carnauba wax (preferably combined with stearic acid to form a compound ester), and non-hygroscopic substances, such as ceresin, and colouring materials such as lampblack. Special claim is made for a composition on these lines prepared by melting 45.5 kilos. of commercial stearic acid at 115° C., and adding an aqueous solution of 50 kilos. of carbonate and sodium aluminate, and subsequently 7 kilos. of carnauba wax. The mixture is then heated to 232° C., so that the excess of stearic acid may combine with the alcohols in the wax, and is then incorporated with 9.71 kilos. of ceresin, from 0.9 to 3 per cent. of lampblack, and finally with sufficient stearic acid to give the desired solidification point, preferably 140° C., and the whole strained through muslin before use. The composition is stated to flow readily when melted, to take a good impression from the matrix, and to give a smooth polished record, which is free from air bubbles and will keep well in damp or hot climates.—C. A. M.

*Soap and Detergent Compounds; Manufacture of* — H. J. Armstrong and M. R. Armstrong, Ashton-under-Lyne, Ribblesdale, and H. H. Armstrong, Penwortham, Preston. Eng. Pat. 17,218, Aug. 6, 1904.

COMPOUNDS of ammonia, preferably ammonium sulphate and of boron, such as borax, are coated either separately or together with a layer of protective material, such as wax, paraffin wax, &c., and incorporated with the soap, with the result that the reaction between the salts does not



ace until required. A detergent powder is obtained using such soap with hydrated sodium carbonate, and claim is made for the addition of calcium borate, dishwashing and cleaning soap for metals, glass, &c., and on of polishing material such as pumice, &c., is Specified proportions of the protected salts are 10 per cent. for soft soap and about 5 per cent. for soap.—C. A. M.

*Process of Manufacturing* —, J. F. G. de ssy de Sales, Paris. Eng. Pat. 1292, Jan. 23, 1905. Inter Int. Conv., March 24, 1904. Ger. Pat. 341,568 of 1904; this J., 1904, 872.—T. F. B.

#### FRENCH PATENT.

*Acid (Oleic); Process for Converting* — into *Acid and Similar Compounds*. A. de Hemptinne. Pat. 350,955, Jan. 23, 1905.

Eng. Pat. 1572 of 1905; this J., 1905, 448.—T. F. B.

#### GERMAN PATENT.

*Process of Preparing Stable Iodine or Bromine substituted* —, E. Merck. Ger. Pat. 159,748, Sept. 902. Addition to Ger. Pat. 96,495, April 8, 1897.

Iodine or bromine substitution products of fats be obtained by the action of bromine or iodine in fat in presence of water and of some reducing agent (sulphur dioxide): by this means it is stated that greatest possible amount of halogen can be introduced into the fat. The original patent described the iodochloride or bromochloride for this preparation. —T. F. B.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

#### (A).—PIGMENTS, PAINTS.

##### GERMAN PATENT.

*Resins with Formaldehyde; Process for Preparing Constitution Products of Aromatic* — [Lakes]. Farbwerke vorm. Meister, Lucius und Brünning. Ger. Pat. 354,313, March 18, 1904. IV., page 796.

#### (B).—RESINS, VARNISHES.

*Balm of Honduras; The so-called* —, A. Tschireh. Schweiz. Woehenschr. Pharm., 1905, 43, 238. Chem. Abstr., 1905, 1, 1705.

A new balsam has nothing in common with the peculiar Peru balsam, from the fruit of *Myroxylon Percivae*, belongs rather to the class of storax balsams. It is free cinnamic acid, a solid resin-ester of cinnamic with a colourless, solid resin-alcohol of the same character as storaxinol, and a mixture of liquid resins of cinnamic acid. The Honduras balsam thus resembles storax, and the odours of the two substances are also alike. It is doubtful whether the Honduras balsam is identical with the white Peru balsam named by Thoms and Biltz (this J., 1904, 1111), but latter cannot be regarded as a genuine white Peru balsam, which would contain coumarin, but no cinnamic acid, either free or combined.—A. S.

*Carbon Tetrachloride; Use of* — as a Solvent in the Manufacture of Varnish. L. E. Andés. Chem. Rev. Mitt. u. Harz-Ind., 1905, 12, 157—158.

EXPERIMENTS to determine the solubility of the raw materials used in the manufacture of varnish in carbon tetrachloride gave the following results:—*Insoluble* (but dissolving on the addition of a relatively small amount of alcohol or turpentine oil): Yellow, acaroid resin, gum zoin, soft (so-called "spirit-soluble") and hard Manila al, gum mastic, sandarac, shellac, celluloid, and agate

shellac. *Partially Soluble or Swollen*: Calcium resinate, fused lead and manganese resins, the former dissolving completely on the addition of turpentine oil, whilst the latter does not. Finely-powdered Manila copal also swells up in the solvent. *Soluble*, Syrian asphaltum (and probably other varieties of asphaltum), Brazil copal (small fragments swell up without dissolving), Dammar resin (turbid solution becoming clear on the addition of 95 per cent. alcohol), galipot, colophony, larch turpentine, fused Zanzibar copal and amber gumlac.

Shellac is soluble in a mixture of 70 parts by weight of carbon tetrachloride and 30 parts of 25 per cent. alcohol, whilst sandarac and mastic dissolve in mixtures of 80 to 90 per cent. of carbon tetrachloride with 20 to 10 per cent. of spirit. It is thus possible to prepare two distinct types of varnishes according to the proportion of carbon tetrachloride used, viz., ordinary brush varnishes, which are thin, transparent, and flow easily, and varnishes for dipping or pouring, which, owing to the volatility of the carbon tetrachloride, cannot be applied by means of a brush, but give a very brilliant coating when applied in other ways. Varnishes containing fatty drying oils can also be prepared by means of carbon tetrachloride, and the addition of as little as 10 per cent. of this to the solvent makes the varnish transparent and to flow well from the brush. If larger proportions are used the product can only be employed as a "dipping" varnish. A brilliant black enamel varnish for small iron articles can be prepared from asphaltum by means of carbon tetrachloride, whilst copals give colourless varnishes.

—C. A. M.

##### ENGLISH PATENT.

*Linseed Oil; Apparatus for Heating* — with Driers. J. Buchanan, Aberdeen. Eng. Pat. 7646, April 11, 1905.

CLAIM is made for an apparatus in which the mixture of oil and driers is maintained at a uniform temperature, the oil being either in the raw state or after preliminary decolorisation and heating in a vessel partially immersed in a hot bath of an aqueous solution of, e.g., caustic alkali. This bath may have an arrangement of pipes with apertures in the sides connected with a condenser, so as to serve the purpose both of conveying the evaporated steam to the condenser and of returning the condensed liquid to the bath. The influence of the air upon the caustic alkali may be obviated by connecting the steam pipe beyond the condenser with a closed vessel containing air, so that the latter can be used over and over again.

—C. A. M.

##### UNITED STATES PATENT.

*Turpentine or other Products from Wood; Apparatus for Recovering* —, R. A. Sibbitt, Carleton Place, and A. K. McLean, Ottawa. U.S. Pat. 792,934, June 20, 1905.

The apparatus consists of a retort with a conical bottom, supported in a casing; the space between the retort and casing communicates with the furnace, which is situated on one side of the retort. A discharge pipe is provided in the centre of the bottom of the retort, and passes through a cooling apparatus, supported immediately beneath the retort.—T. F. B.

#### (C).—INDIA-RUBBER, Etc.

*Naphthalene; India-Rubber as an Absorber of* —, J. O. V. Irminger. H., page 793.

##### ENGLISH PATENT.

*Indiarubber; Process for Reclaiming Waste Vulcanised* —, H. F. Gregory, London, and T. M. Thom, Chesbunt, Herts. Eng. Pat., 8378, April 19, 1905.

The vulcanised rubber is washed, finely powdered, and freed from mineral matter by boiling with hot dilute hydrochloric acid, and from excess of sulphur by boiling with dilute caustic soda solution, the residue being washed

after each treatment. The dried rubber is then treated with a solvent consisting of about 25 lb. of aniline and 10 galls. of "naphtha" to each 100 lb. of the substance, and the mixture, after standing for a few hours, is heated by means of steam to 250—280° F. until solution is complete. The mass is then strained and can be used for moulding, &c., the solvent evaporating during the process, but is unsuitable for re-vulcanisation.—C. A. M.

#### XIV.—TANNING, LEATHER, GLUE, SIZE.

"Soluble Leather:" Method for the Detection and Determination of — in Tannery Liquors. J. G. Parker and V. Casaburi. XXIII., page 817.

##### ENGLISH PATENT.

Skins and Hides; Impts. in Curing —. I. Sonoff and M. Zwerkoff, St. Petersburg, Eng. Pat. 19,244, Sept. 6, 1904.

SEE Fr. Pat. 346,096 of 1904; this J., 1905, 98.—T. F. B.

#### XV.—MANURES, Etc.

Superphosphate; [Determination of] Free Acid in —. L. Schucht. XXIII., page 816.

##### FRENCH PATENT.

Water Charged with Fertilising Substances, &c.; Treatment of —. E. Maris. Fr. Pat. 350,637, Jan. 9, 1905. XVIII B., page 812.

#### XVI.—SUGAR, STARCH, GUM, Etc.

Beet Juice; Influence of the Nitrogen on the Purity of —. K. Andriik and J. Urban. Z. Zuckerind. Böhmen, 1905, 29, 519—522.

THE authors have studied the relations between the percentage of the injurious melassigenic nitrogen (see following abstract) and the total non-sugar constituents of the concentrated saturation juices. An average of a large number of determinations showed that one part of injurious melassigenic nitrogen corresponds to 16.1 parts of total non-sugar. The ratio (16.1) of the injurious melassigenic nitrogen to the total non-sugar is a fairly constant value, and it is termed the "nitrogen co-efficient." If  $K_n$  = the nitrogen co-efficient and  $N_s$  = the proportion of injurious melassigenic nitrogen per 100 parts of sugar, the quotient of purity of a thick juice can be calculated by the expression:

$$Q = \frac{10000}{100 + K_n \times N_s}$$

The calculated results agree satisfactorily with actual determinations. Assuming that 97 per cent. of the sugar and 90 per cent. of the melassigenic nitrogen are extracted from the raw beets, the above expression can be employed for estimating the relative value of beetroots, and for judging the degree of purity which may be expected in the concentrated saturation juice.—J. F. B.

Beetroots and Sugar Factory Products; Determination of the Objectionable [Melassigenic] Nitrogenous Matter in —. K. Andriik. Z. Zuckerind. Böhmen, 1905, 29, 513—518.

THE melassigenic nitrogenous matter of beet products is defined as that which remains dissolved after the precipitation of the albuminoids and the removal of the ammoniacal and amide nitrogen. The solution of cupric hydroxide employed for precipitating the albumin is prepared by decomposing 200 grms. of copper sulphate by caustic soda and dissolving the precipitate in 2 litres of water containing 20 c.c. of glycerol.

One hundred grms. of beet pulp are placed in a marked to contain 403 c.c., and are diluted with to about 340 c.c., the pulp is digested on the water at 80°—85° C. for 15 minutes, 40 c.c. of the cupric re are added together with 10 c.c. of a solution conti 200 grms. of crystallised aluminium sulphate per The whole is shaken and diluted to 403 c.c., and dig again at 80°—85° C. for 15—30 minutes; after co the total volume is again adjusted to 403 c.c., an liquid is filtered through a dry filter. The total nit is determined in 100 c.c. of the filtrate by Kjel method, and the nitrogen in the form of ammoni amides is determined in a second 100 c.c. by boili two hours with 1 c.c. of concentrated sulphuric ac distilling from magnesia. The difference between two determinations is expressed as melassigenic nit A sample of thoroughly exhausted beet molasses con 1.92 per cent. of melassigenic nitrogen and pol 48.0 per cent. On the assumption that 90 per ce the melassigenic nitrogen of the beet is extracte percentage of total molasses produced can be calc from the expression

$M = \text{percentage of melassigenic nitrogen in beet} \times 0 \text{ polarisation of molasses.}$

The relations most usually found in practice are:—0 cent. of melassigenic nitrogen in the beet, yielding 3 cent. of total molasses, i.e., 1.75 per cent. in th sugar, and 2.0 per cent. as actual molasses.—J. F. B.

Sucrose; Polarimetric Determination of —. F. and H. Tempany. XXIII., page 817.

##### ENGLISH PATENTS

Sugar; Process for Converting Wood Cellulose into —. M. F. Ewen and G. H. Tomlinson, Chicago. Eng. Pat. 10,664, May 9, 1904.

SEE U.S. Pat. 763,472 of 1904; this J., 1904, 797.—T

Sugar Crystals; Process and Apparatus for Proc of — from Solutions. V. Schütze, Riga, 1 Eng. Pat. 3972, Feb. 25, 1905.

THE apparatus consists of a long horizontal ja cylinder, connected with a vacuum pump, with in outlet passages through hollow trunnions. The ja space is divided by a helical partition which caus cooling liquid to take a spiral course from one end other. The sugar syrup, at a concentration of ab per cent. and a temperature of 70° C. is admitted interior of the vessel, water at 70° C. having been prev introduced into the jacket space. The vessel is rotated slowly, and cold water is admitted to the at the discharge end of the cylinder. Under the int of the vacuum, the syrup is concentrated durin passage through the vessel and is gradually cooled same time. In this manner, large and pure crysta built up and are collected in a receiver at the disc end.—J. F. B.

Starch-like or Amyloid-like Substances and S Process for Manufacture of —. A. Börner, V Eng. Pat. 16,262, July 22, 1904.

CELLULOSE and materials containing cellulose, su sawdust, shavings, peat, grass, &c., are treated v warm, dilute solution of mineral acid, organic acid, alkali or borax, until a sufficient quantity of a a like body has been removed. The latter is then tated from the residue and freed from resin, if nec and the starch-like substance is precipitated by co salt.—J. F. B.

##### FRENCH PATENTS.

Sugar [from Cellulose]; Process of Making a Cryst —. C. F. Cross. Fr. Pat. 351,048, Jan. 26, 0 Under Int. Conv., April 13, 1904.

SEE Eng. Pat. 8544 of 1904; this J., 1905, 340.—T



in [from Beetroots]; Preparation of Pure — from Diffusion Juices of Sugar Factories. T. de Lewicki. Pat. 350,627, Jan. 9, 1905. XVIII.J., page 811.

Manufacture of "Viennoise" —. Soc. des Ind. Amylacés. Fr. Pat. 350,793, Jan. 16, 1905. XI., page 820.

## II.—BREWING, WINES, SPIRITS, Etc.

The Steeping of Malting —. J. L. Baker and D. Dick. J. Inst. Brewing, 1905, 11, 372—384.

Authors have studied the rate of absorption of barley in the steep and have recorded the results in form of curves. In all these curves certain irregularities or breaks were observed, corresponding in some cases to a temporary cessation of the absorption of moisture for short periods, and in others to an actual decrease in moisture already absorbed. Kiln-dried barley absorbed water in larger quantity and at a greater rate than green barley. Experiments were also conducted to determine the retarding influence of low temperatures upon the rate of absorption of water by barley. The rate of absorption of water in the steep was found to be absolutely independent of the activity of zymes of the barley. The authors also studied the effects of the germinative properties of the barley selected by the temperature of the steeping water, the time of steeping, and by aeration during steeping. Retardation of the growth caused by steeping at low temperatures was very marked after 72 hours' germination but was practically compensated for after 120 hours' growth. Experiments on the effect of the time of steeping clearly illustrated the retarding influence both of under-steeping and of over-steeping on the vigour of the growth. The results confirm the statements of Windisch and others that the stimulating influence of aeration during steeping retards and improves the vigour of the growth and development of the roots. The barley, steeped with oxygen, was found to possess a distinctly lower diastatic power than the barley steeped in the ordinary manner.

—J. F. B.

Autodigestion of —. J. Effront. Monit. Scient. 1905, 19, 485—491.

Autodigestion of yeast may be divided into two processes: (a) the digestion of the carbohydrates, i.e., cellulose, &c., and the fermentation or oxidation of the products; (b) the digestion of the albuminoids. When yeast undergoes autodigestion in presence of water both these processes take place concurrently. In the absence of water the auto-digestion of the yeast is accomplished by a progressive loss of fermentative power, and all cells are dead after 10 days at 30° C. When the autodigestion takes place in presence of alcohol, the digestion of the carbohydrates is very feeble, and the action is almost entirely confined to the digestion of nitrogenous matters. In this case the cells remain apparently intact, with slight structural alterations. The yeast retains its vitality, the effect of its digestion at 30° C. in aqueous alcohol being only to delay the commencement of fermentation for 8 hours, in spite of the loss of 90 per cent. of the nitrogenous matters. The following table shows the percentage of the original constituents remaining in the yeast after digestion:—

Yeast reduced to its original.	A After 10 days in water.	B After 10 days in aqueous alcohol.	C After 30 months in aqueous alcohol.
	Per cent.	Per cent.	Per cent.
Substance	12.8	31.8	29.7
Albuminoids	14.6	10.8	7.59
Hydrates	11.2	64.3	64.4
.....	6.25	10.0	22.2

In all cases traces of formaldehyde and amyl alcohol were observed amongst the products of digestion.—J. F. B.

Yeast Mash [Distillery]; Lactic Acidification of —. W. Henneberg. Z. Spiritusind. 1905, 28, 253—254.

In studying the acidification of the distillery yeast mashes by B. Delbrück on the large scale, the author found that provided the necessary high temperature be maintained, the acidification after the sowing of the first pure culture will maintain itself technically pure for a very long time, i.e., for months. Infection is automatically suppressed as soon as it occurs. In spite of the comparatively low temperature which exists at the surface of the mash, only the true culture bacillus, B. Delbrücki exists there. At a temperature of 50° C. (on the large scale) the quantity of acid produced is only about one-half, and at 56° C. only one-third of that produced at 40° C. The most favourable temperature for the acidification is 46°—47° C. In the laboratory, on the other hand, the acidification is frequently not impaired at 50° C. For the detection of gross infections, such as would be objectionable in practice, a droplet culture prepared direct from the acid mash is sufficient; but for very slight infections the infecting organism must be concentrated by sub-cultivation at 27° C. in sterilised mash.—J. F. B.

Fermentation of Glucose [Dextrose] by Yeast Juice; Influence of Phosphates on the —. A. Harden and W. J. Young. Chem. Soc. Proc., 1905, 21, 189—191.

It has been previously pointed out that the amount of dextrose fermented by a given volume of yeast juice is greatly increased by the addition of boiled and filtered yeast juice (see this J., 1905, 246). The increased fermentation is the result of two phenomena: (a) The addition of the boiled yeast juice causes an initial rapid evolution of carbon dioxide, which soon diminishes until a rate is attained which remains practically constant for many hours. (b) This steady rate is, in general, about the same as that observed with an equal volume of the same yeast juice and sugar, without any addition of boiled juice, but diminishes more slowly than this, so that the fermentation continues for a longer period. The greater proportion of the total increase is usually due to this second phenomenon. An addition of a solution of sodium or potassium orthophosphate also causes an initial rapid evolution of carbon dioxide, but not any marked prolongation of the fermentation. It was found that the extra quantity of carbon dioxide evolved during this initial period is a function of the amount of phosphate present, one molecular proportion of the gas being evolved for every atom of phosphorus added in the form of alkali orthophosphate, or present in the boiled yeast juice in a form precipitable by magnesia mixture. The greatest amount of carbon dioxide obtained in this way from 25 c.c. of yeast juice was 0.46 grm., corresponding with the addition of about 1.5 grms. of anhydrous disodium-hydrogen phosphate. The initial rapid evolution of carbon dioxide represents the fermentation of a corresponding amount of dextrose, as, in all cases, an equimolecular proportion of alcohol was produced. If the liquid in which fermentation has been carried on in presence of phosphate, be boiled and filtered, the added phosphorus is contained in the filtrate, but is no longer in a form precipitable by magnesia mixture or silver nitrate.—A. S.

Cider; Production of Sweet —. G. Warcollier. Comptes rend., 1905, 140, 1711—1713.

The anaerobic activity of yeast is limited and the secretion of zymase gradually ceases in absence of air, leaving more or less of the sugar unfermented. The degree of attenuation should, therefore, be capable of being regulated at will by limiting the quantity of yeast sown, and controlling its multiplication by excluding the air to a suitable extent. The author has applied the above principles with a view to producing a sweet cider, only partially fermented, which will keep in absence of air without ulterior multiplication of the yeast and without tendency to "fret." For this purpose the apple must should contain a minimum quantity of dissolved oxygen, and should be fermented with a limited quantity of yeast, being maintained with rigorous exclusion of air during fermentation and racking. Experiments in the laboratory with sterilised musts, sown with mere traces of yeast and

fermented in closed tanks, have verified the correctness of this view and have shown that attenuation can be curtailed to an extent far beyond that necessary for an ordinary sweet cider. When similar fermentations were carried out at a temperature of 35° C. they ceased after 8 days; at this temperature, however, the cider did not retain the carbon dioxide and required artificial saturation. Unsterilised must, prepared on the practical scale, was converted into sweet cider by drawing off into bottles, with exclusion of air, yielding a clear cider with a gravity of 1.025 clear and free from all but traces of yeast. This cider, when bottled with exclusion of air in such a manner that the bottles were filled right up to the corks, remained perfectly stable, and had a good sparkle; the condition and flavour were exceptionally uniform.—J. F. B.

*Sulphur in By-products of Molasses Distillery; Variations of Proportion of —.* K. Andrik and V. Stanek. Z. Zuckerind. Böhmen, 1905, 29, 522—525.

THE authors have determined the proportion of total sulphur in the by-products of a molasses distillery at various stages:—

Total sulphur calculated as  $\text{SO}_3$

	in 100 parts of ash.	on 100 parts of $\text{K}_2\text{O}$ in the ash.
Original molasses .....	2.31	4.1
Thin vinasse .....	7.24	13.3
Concentrated vinasse from the the Porion evaporator ...	11.18	21.3
Calcined vinasse .....	8.63	18.0

The proportion of sulphur in the molasses, increases up to the stage preceding calcination, and then decreases. The increase of sulphur in the thin vinasse, as compared with the original molasses, is due to the addition of sulphuric acid before fermentation, this addition being equivalent to 5.42 parts of sulphuric anhydride per 100 parts of the ash of the molasses. The increase of sulphur during the process of evaporation is due to the sulphur in the fuel (lignite) employed in the Porion evaporator. The decrease during calcination represents loss of sulphur by volatilisation in the form of sulphuretted hydrogen, carbon bisulphide, &c.—J. F. B.

*Cereals; Determination of Available Extract in Flaked —.* L. Briant. XXIII, page 817.

#### ENGLISH PATENTS.

*Starch-like or Amyloid-like Substances and Sugar; Process for the Manufacture of —.* A. Börner. Eng. Pat. 16,262, July 22, 1904. XVI, page 808.

*Drink free from Alcohol; Production from Fermented Fluid of a —.* H. Linzel and C. Bischoff, Berlin. Eng. Pat. 17,651, Aug. 13, 1904.

THE alcohol is removed from a fermented liquid, such as beer, by heating the latter under reduced pressure, and at the same time passing a current of steam and air into the beer at such a rate that the partial condensation of the steam keeps the volume of the liquid constant. It is claimed that the alcohol is quickly removed by this process, whilst the heavier volatile constituents of the hops and beer remain in the liquid.—W. P. S.

*Evaporator for Evaporating the Liquid in Brewer's Wash, Sewage, Waste or Spent Dyes and the like, and Concentrating the Solids in the same, the Evaporator being also applicable as a Smoke Washer.* A. B. Lennox. Eng. Pat. 13,227, June 11, 1904. XVIII B, page 811.

#### FRENCH PATENT.

*Yeast; Manufacture of "Viennese" —.* Soc. des Prod. Amylacés. Fr. Pat. 350,793, Jan. 16, 1905.

THE cellular residues from the manufacture of starch from

grain, containing all the nitrogenous matters, are mixed with a sufficient quantity of starchy material, and the mixture is digested with water under a steam pressure of three atmospheres for about 30 minutes. The material obtained is cooled to 68° C., and is saccharified by the addition of malt. The wort is then employed for the manufacture of yeast and alcohol.—J. F. B.

#### GERMAN PATENT.

*Brewers' Yeast; Process for Making Dead —, inapparent, for the Purpose of Utilising it as Nutrient Material for the Cultivation of Distillery Yeast.* Kues. Ger. Pat. 158,655, Nov. 1, 1903.

THE waste brewers' yeast, after pressing, is intimately mixed with 20—30 per cent. of an acid phosphate (preferably superphosphate), and the mixture is dried at 40°—45° C., sterilised and powdered.—A. S.

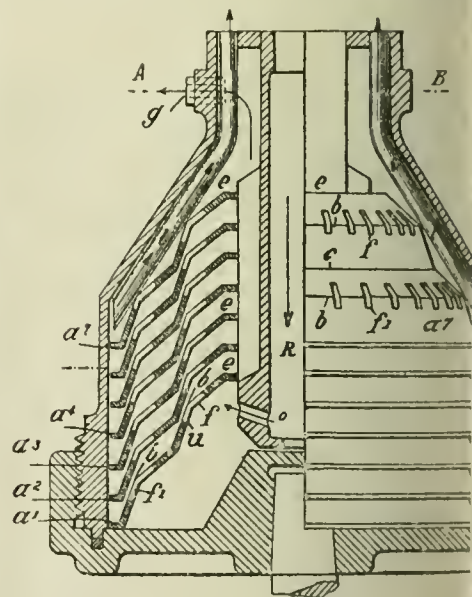
### XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS

#### (A).—FOODS.

##### ENGLISH PATENTS.

*Cream Separators; Impts. in —.* J. Meys, Frankfurt. Germany. Eng. Pat. 16,070, July 20, 1901.

THE drum of the separator is provided with a set of internal plates  $a^1, a^2, a^3, a^4, a^7$ , each of which is made of a number of cone-shaped parts having different inclinations,  $b, c$ , to the axis. The milk is introduced through the pipe R, and passes from this through the opening  $o$ , under the plate  $a^1$ , from which it flows through the openings  $f, f^1$ , into the



under the plate  $a^2$ , then under  $a^3, a^4$ , &c. The milk is detained for a time at the steep parts  $e-b$ , whilst the cream is pressed over the more horizontal parts, and rises until it flows out at  $g$ , the skimmer being forced up through the pipe  $l$ . If desired, the drum may be provided with grooves or channels,  $u$ , through which the cream can pass, and the slots,  $f$ , may be dispensed with.—W. P. S.



and like Liquids; Apparatus for Treating —, to use the Globules of Cream or Fat to a State of Fine Division. C. W. Schou, Copenhagen. Eng. Pat. S, Feb. 13, 1905.

milk is forced under high pressure through a slit 1 by a cylindro-conical core fitting into a hole of ponding cross section. The core is hollow and is in position by a spindle and spring. The hole in which the core passes is bored cylindrically for its length, and for the remainder slightly conically. The neck or shoulder on the core also serves to keep it in position. The core may be in the shape of a tube which encircles another fixed core, or it may consist of sections of different cross section areas passing through corresponding holes.—W. P. S.

d Beverages; Compositions for Making —. J. Jones, London. Eng. Pat. 6617, March 29, 1905.

parts of alkali compounds of albuminous substances, such as those described in Eng. Pat. 15,719, 1898 (S. 1899, 390), milk powders, or powdered milk are mixed with an aerating agent, such as tartaric acid and sodium hydrogen carbonate. The mixture may be mixed with sugar, gelatin, or the like, and pressed into tablets or packed in gelatin capsules. Heat may be applied to the tablets.—W. P. S.

#### FRENCH PATENTS.

in [from Beetroots]; Preparation of Pure — the Diffusion Juices of Sugar Factories. T. de Meke. Fr. Pat. 350,627, Jan. 9, 1905.

albumin cannot be separated in a satisfactory state by the diffusion juice proper, since the latter is too charged with mucilaginous and colouring matters. The juice from the second and succeeding diffusion of the battery is generally colourless. The liquid from the particular diffuser, which shows the albumin-content and the lowest proportion of impurities, is collected separately and with a precipitating agent, such as lime, magnesia or acetic acid. The precipitated albumin is allowed to settle, and the juice is decanted off and returned to the battery, whilst the albumin is drained or pressed and subsequently dried.—J. F. B.

n; Process of Preparing Vegetable —. G. Mitchell. Fr. Pat. 350,683, Jan. 11, 1905.

vegetables or seeds, particularly castor-oil seeds, are treated with water at a temperature of 50° C. The oil and other matters are allowed to settle out, the supernatant liquid, after decantation, is heated to expel the albumin. The albuminous matters and the oil are thus obtained together and are separated by any method which will dissolve the former. The residue of the albuminous matter is finally evaporated.—W. P. S.

and other Emulsions; Machine for Homogenising —. C. W. Schou. Fr. Pat. 350,706, Jan. 11, 1905.

g. Pat. 2948 of 1905; preceding these.—T. F. B.

#### —SANITATION; WATER PURIFICATION.

ia in Drinking Waters; Determination of —. Cavalier and Artus. XXIII., page 816.

#### ENGLISH PATENTS.

ator for Evaporating the Liquid in Brewers' Wash, or Waste or Spent Dyes and the like, and Concentrating the Solids in the same, the Evaporator being also capable as a Smoke Washer. A. B. Lennox, New-Tyne. Eng. Pat. 13,227, June 11, 1904.

oid to be evaporated is placed in the upper part of a tank, where it falls, in the form of a spray, through a perforated plate, to the bottom of the tank. As it falls,

it meets a current of hot air which is blown through the tank. Baffle plates are provided to cause the air current to take a circuitous course through the tank. The air inlet and outlet are placed just above the surface of the layer of liquid which collects at the bottom of the tank. This layer is drawn off as it accumulates by means of a pump and returned to the upper part of the evaporator. The concentrated liquor is finally drawn off through suitable taps. (See also this J., 1905, 342.)—W. P. S.

Sewage; Treatment of —. T. Henderson, Oxford. Eng. Pat. 13,588, June 15, 1904.

SEWAGE that has passed through a preliminary process of aerobic decomposition, is led successively through a series of deep tanks, where bubbles of air are blown through it. The spraying device for the air consists of a funnel-shaped vessel. The air enters at the stem and leaves through a number of small holes in a plate fixed across the top of the funnel. Immediately below this plate is a second plate, and below this, again, is a third. These two latter plates have larger holes corresponding with the groups of small holes in the upper plate, and the middle plate is movable, so that the air supply can be cut off when desired.—W. P. S.

Sewage; Process of Treating and Utilising — [as Fuel]. A. McLean, London, and W. Paterson, Dumfries. Eng. Pat. 1,776, Jan. 30, 1905.

THE liquid portion of the sewage, after precipitation, is passed through filtering layers, such as those described in Eng. Pat. 22,724, 1904 (this J., 1905, 685). The solid portion or sludge is mixed with about 10 per cent. of quick-lime in a mill. The mixture is then conveyed to a series of filtering trays, where the bulk of the water is drawn off by means of a reduced pressure formed in a space below the trays. When practically dry, the mass is removed from the trays, and carried to a revolving, drying chamber heated by a furnace. It is then mixed in a steam-jacketed vessel with about 10 per cent. of tar, and, if necessary, a little more quick-lime, and pressed while still hot into blocks for use as fuel. The liquid extracted from the sludge by the filtering trays is further filtered before being discharged from the outfall.—W. P. S.

Boiler Feed Water; Utilising a Certain Waste Product [Galvanising Liquors] for the Treatment of —. W. Bramley, Middlesbrough. Eng. Pat. 17,690, Aug. 15, 1904.

THE water is treated with a disinfectant formed by neutralising the waste hydrochloric acid solution of iron chloride from galvanising works, with barium carbonate or barium sulphide. When the latter is used, the solution may be heated to expel the hydrogen sulphide. In cases where the water requires less barium chloride than that which would be yielded by neutralising with the barium salt alone, a part of the latter may be replaced by zinc or iron oxide. The quantity of iron added to the water should be equivalent to the bicarbonates present, and the amount of barium added should be about half that equivalent to the calcium sulphate in the water.—W. P. S.

Water; Method and Means for Softening —. Mather and Platt, Ltd., and G. G. Hepburn, Manchester. Eng. Pat. 17,920, Aug. 18, 1904.

THE water is treated with lime and alkali, and then passed over rough metallic surfaces such as borings or turnings. The latter may be contained in layers in a vessel which has a bottom-plate perforated with jagged openings. A preliminary settling of the precipitate may be allowed to take place before passing the water through the above metallic beds.—W. P. S.

Water or other Liquids; Method and Apparatus for Effecting the Destruction of Pathogenic Organisms in —. P. G. Griffith, Green Lanes, Middlesex. Eng. Pat. 17,984, Aug. 18, 1904.

THE water is led from a tank through a closed chamber by means of a number of zigzag pipes. From the latter it is led into a second chamber, where it is heated to a

temperature of 65°–85° C. by means of a steam pipe. The duration of the heating does not exceed 25 seconds. The hot water then passes back into the first chamber, by a pipe leading from the top of the heating chamber, so that it is cooled by the water passing through the zig-zag pipes. The treated water is finally drawn off at the bottom of the first chamber.—W. P. S.

*Tartrates; Solubility of some Metallic — in H<sub>2</sub>O.*  
H. H. Cantoni and F. Zachoder. *Bull. Soc. C.*  
1905, 33, 747–754.

THE authors have continued their work on the solubility of metallic tartrates in water (see this J., 1904, 1905, 1906). The results obtained are shown in the following table and in the curve-diagram (see Fig.).

Temperature.	Strontium Tartrate $C_4O_4H_4Sr, 3H_2O.$	Calcium Tartrate $C_4O_4H_4Ca, 4H_2O.$	Barium Tartrate $C_4O_4H_4Ba.$	Temperature.	Copper Tartrate $C_4O_4H_4Cu, 3H_2O.$	Zinc Tartrate $C_4O_4H_4Zn, 2H_2O.$	Lead Tartrate $C_4O_4H_4Pb.$
°C.	Grms. of Salt in 100 c.c. of Solution.			°C.	Grms. of Salt in 100 c.c. of Solution.		
12	0.1214	0.03665	0.02125	14	0.01965	0.0188	0.0
21	0.21275	0.0478	0.0281	34	0.11035	0.05465	0.00105
22	—	0.04865	0.0284	45	0.1708	0.07265	0.00225
30	0.3184	0.0570	0.03575	55	0.21235	0.1157	0.00225
50	0.47895	0.1252	0.04395	65	0.1767	0.10015	0.00315
75	0.62635	0.1620	0.05135	75	0.15665	0.0778	0.0033
85	0.7547	0.2190	0.05405	86	0.12875	0.04355	0.0054

#### FRENCH PATENT.

*Water Charged with Fertilising Substances, &c.; Treatment of —.* E. Maris. *Fr. Pat.* 350,637, Jan. 9, 1905.

THE water, after being concentrated and disinfected, is mixed with finely-divided peat, sawdust, chaff, seaweed, &c., and the mixture dried to form a manure.—W. P. S.

### XIX.—PAPER, PASTEBOARD, Etc.

#### UNITED STATES PATENTS.

*Paper; Printing —.* J. von Schmaedel, Munich, Germany. *U.S. Pat.* 792,932, June 20, 1905.

SEE *Fr. Pat.* 342,206 of 1904; this J., 1904, 949.—T. F. B.

*Silk; Method of Making Artificial —.* H. S. Mork, W. H. Walker and A. D. Little. *U.S. Pat.* 792,149, June 13, 1905. *V.*, page 799.

*Viscose; Manufacturing Filaments from —.* C. A. Ernst. *U.S. Pat.* 792,888, June 20, 1905. *V.*, page 799.

#### [FRENCH PATENTS.]

*Paper for Hangings. Decoration and other uses; Process of Making —.* A. Fielding. *Fr. Pat.* 350,916, Jan. 21, 1905. Under *Int. Conv.*, Jan. 30, 1904.

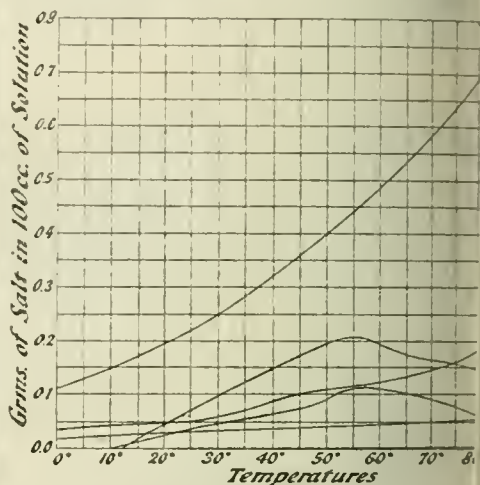
SEE *Eng. Pat.* 2323 of 1904; this J., 1905, 40.—T. F. B.

*Silk; Manufacturing Artificial —.* P. Cazeneuve. *Fr. Pat.* 350,723, Jan. 12, 1905. *V.*, page 799.

### XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Mercury; Formates of —.* R. Varet. *Comptes rend.*, 1905, 140, 1641–1643.

YELLOW mercuric oxide dissolves readily in dilute formic acid, giving mercuric formate, which, however, slowly changes into mercurous formate, with liberation of formic acid and carbon dioxide. The mercurous salt is easily obtained in crystals. The author has determined the molecular heats of formation of these two salts in solution, from liquid mercury, diamond, and gaseous hydrogen and oxygen, as 173.1 and 161.5 calories for the mercurous and mercuric salts respectively. The mercurous salt is thus the more stable of the two.—J. T. D.



Curve No. 1—Strontium tartrate.  
Curve No. 2—Calcium tartrate.  
Curve No. 3—Barium tartrate.  
Curve No. 4—Copper tartrate.  
Curve No. 5—Zinc tartrate.  
Curve No. 6—Lead tartrate.

The form of the solubility curves for copper and lead tartrates is probably due to the hydrated salt losing its water of crystallisation on heating, with formation of a salt containing less or no water of crystallisation, the solubility of which decreases with rise of temperature.

*Dimethyl Sulphate; Formation of Esters with —*  
Graebe. *Annalen*, 1905, 340, 244–249.

ALMOST theoretical yields of esters are obtained by the solid potassium salt of the acid with a moderate excess of dimethyl sulphate to about 120° C. in an oil bath, raising the temperature to 200°–210° C., the ester is distilled off. Potassium benzoate and acetate in this way give theoretical yields of the respective esters. Chlorophthalic acid gave a yield of about 60 per cent. The yield is the same if the acid is dissolved in 100 molecules of sodium hydroxide in a 10 per cent. solution and then warmed with three molecules of dimethyl sulphate. Naphthalic acid, treated by either method, gives about half the above yield. Anhydrous phosphorus pentachloride heated for nine hours in a closed vessel in a water-bath with dimethyl sulphate gives a good yield of the ester.—F. S.



*Sparteine; Stereoisomerism of the two Iodomethylates of*  
C. Moureu and A. Valeur. Comptes rend.,  
140, 1645—1647.

When sparteine hydriodide is heated with methyl iodide, two isomeric iodomethylates are formed. The hydriodide of these are decomposed by heat into methyl iodide and sparteine hydriodide, the latter being the same in both cases, so that the methyl iodide is in each case in two isomers attached to the same nitrogen atom, and substances must therefore be stereoisomers.

—J. T. D.

*Salts of Methylarsenic Acid (Arrhenallic Acid).*  
itali. Boll. Chim. Farm., 1905, 44, 229—237,  
273. Chem. Centr., 1905, 1, 1699—1701.

Salts of alkaloid salts when treated with arrhenallic acid sodium salt of methylarsenic acid  $O:AsCH_3(OH)_2$ , the author names briefly *arrhenallic acid*, yield salts consisting of the arrhenalates of the alkaloids. Arrhenalates of strychnine, quinine, atropine, cinchonine, cinchonidine, quindine, brucine, pilocarpine, morphine, aconitine, narceine, papaverine, cocaine, nareotine, berberine, kairine, caffeine and others have been prepared by triturating a suitable quantity of the sulphate of the alkaloid and a slight excess of the acid to a paste with water, drying the mixture, powdering the residue and extracting it with absolute alcohol, which dissolves the desired salt. The strychnine and quinine salts are stated to be of therapeutic interest.

*Strychnine basic quinine arrhenalate*,  $(C_{20}H_{24}O_2N_2)_2AsO_3H_3$ , forms colourless, odourless crystals having a bitter taste. It melts at  $139^{\circ}$ — $141^{\circ}$  C.; is soluble in 2000 parts of water at  $20^{\circ}$  C., is readily in boiling water; soluble in about 10 parts of absolute alcohol, in 55 parts of 90 per cent. alcohol, in 25 parts of methyl alcohol, in 1000 parts of ether, in 500 parts of acetone, and in 1000 parts of benzene; almost insoluble in benzene, light petroleum, and toluene, but soluble in acids.

*Quinine arrhenalate*  $C_{20}H_{24}O_2N_2 \cdot AsO(OH)_2CH_3$ , occurs in colourless, odourless crystals having a bitter taste; it melts at  $151^{\circ}$ — $154^{\circ}$  C., and is soluble in 1000 parts of water at  $19^{\circ}$  C., in about 30 parts of absolute alcohol, in 40 parts of 90 per cent. alcohol, in 140 parts of ether, in 300 parts of ethyl acetate, in 10 parts of benzene, in 100 parts of alcohol, and in 300 parts of acetone; sparingly in chloroform, almost insoluble in ether and light petroleum, but soluble in dilute acids.

*Atropine arrhenalate*,  $(C_{21}H_{22}O_2N_2)_2AsO_3H_3$ , forms a colourless, and odourless, crystalline substance, bitter taste, soluble in 1000 parts of water, in about 10 parts of alcohol, in 500 parts of glycerol and in 400 parts of ether; sparingly soluble in ethyl acetate, insoluble in ether and light petroleum, but soluble in dilute acids. *Acid strychnine arrhenalate*,  $C_{21}H_{22}O_2N_2 \cdot AsO_3H_3$ , occurs in colourless and odourless crystals, bitter taste, soluble in about 600 parts of water, in 180 parts of 95 per cent. alcohol, in 150 parts of amyl alcohol, in 100 parts of glycerol, and in 1225 parts of acetone; sparingly soluble in ethyl acetate, almost insoluble in ether, light petroleum and chloroform, but easily soluble in dilute acids.—A. S.

*Aldehyde; Synthesis of* —. D. L. Chapman and A. Holt, jun. II., page 792.

*Aldehyde and Acetaldehyde; Thermal Decomposition* —. W. A. Bone and H. L. Smith. II., page 792.

*Aldehydes; Determination of some* —. C. Maselli. XXIII., page 818.

*Acid; Colour Reaction for the Detection of* —. W. A. Bone and H. L. Smith. II., page 792.

*Aldehydes; New Reagent for the Detection of* —. P. Alvarez. XXIII., page 817.

## ENGLISH PATENTS.

*Pharmaceutical Compound [m-Tolylsemicarbazide]; Manufacture of a* —. H. E. Newton, London. From F. Bayer & Co., Elberfeld. Eng. Pat. 18,825, Aug. 31, 1904.

*m-Tolylsemicarbazide* can be produced as follows:—  
(1) By heating, or treating with water, the salts of imido-ethers of *m*-tolylhydrazinecarboxylic acid,  $R.NH.NH.C(=NH.HCl).OC_2H_5 = R.NH.NH.CONH_2 + C_2H_5Cl$ ;  $R$  standing for  $C_6H_4CH_3[1:3]$ .  
(2) By treating halogen imides of the above carboxylic acid with water  $R.NH.NH.C(=NH)Cl + H_2O = R.NH.NH.CONH_2 + HCl$ .  
(3) By treating with reagents capable of splitting off ammonia, the amidine of the above carboxylic acid. The amidine is produced by heating an alcoholic solution of cyanamide with *m*-tolylhydrazine hydrochloride.  
(4) If the esters of *m*-tolylazocarboxylic acid are treated with ammonia, an azocarbonamide is produced,  $R.N:N.CONH_2$ , m. pt.  $72^{\circ}$ — $74^{\circ}$ . This on reduction with zinc dust gives the semicarbazide. If the nitrile of *m*-tolylhydrazine carboxylic acid is treated with hydrochloric acid gas in ether, the imide chloride is produced; if alcohol is present as well, the imide ether is formed.

—F. S.

*Guanines from Cyanamido-4,5-di-amido-6-oxo-pyrimidine and its Homologues; Manufacture of* —. E. Merck, Darmstadt. Eng. Pat. 10,976, May 25, 1905. Under Int. Conv., July 19, 1904.

The pyrimidine is boiled for several hours in a reflux apparatus with a considerable excess of 90 per cent. formic acid. The guanine formate separates out on cooling.—F. S.

## UNITED STATES PATENTS.

*Sulphuretted Hydrocarbons; Process of Making* —. F. S. Valentiner, Leipsic, Germany. Assignor to Cie. "Morana" Soc. Anon., Zurich, Switzerland. U.S. Pat. 792,683, June 20, 1905.

SEE Fr. Pat. 349,833 of 1904; this J., 1905, 750.—T. F. B.

*Dialkyl Barbituric Acids; Process of Making* —. M. Engelmann, Elberfeld, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 792,886, June 20, 1905.

The claim is for the production of 2,4,6-trioxy-5-dialkyl-pyrimidines by treating the corresponding cyanimino-pyrimidines with acids, and then isolating from the products of the reaction the resulting dialkyl-barbituric acids. The production of diethyl-barbituric acid by this process is claimed. (See U.S. Pat. 775,810, this J. 1904, 1237.)—F. S.

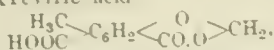
## GERMAN PATENTS.

*Platinum, Osmium or Palladium in Colloidal Form [Catalytic Substances]; Method of Producing Preparations containing* —. Kalle and Co. Ger. Pat. 157,172, Nov. 1, 1903.

SUBSTANCES containing platinum, osmium or palladium in colloidal form are obtained by the action of hydrazine hydrate on solutions of salts of these metals in presence of alkali and an alkali salt of lysalbinic or protalbinic acid. Reducing agents other than hydrazine hydrate react only slowly, and in warm dilute solutions; in concentrated solutions the greater part of the metal is precipitated. These solutions, even if warm, are very stable in presence of salts. On evaporation *in vacuo*, the compounds are obtained in solid form; they are easily soluble in water, and not decomposed by a gentle heat; they are stated to be suitable for use as catalysts (contact masses), the osmium compound being the strongest, then that of palladium, with the platinum compound the weakest catalyst.—T. F. B.

*Methyleneoxyxyvitric Acid: Process of Preparing* —. Chem. Fabr. auf Actien, vorm. E. Schering, Ger. Pat. 158,716, Dec. 13, 1902.

#### METHYLENEOXYXYVITRIC acid



is obtained by the action of formaldehyde or its polymers on hydroxyvitric acid. This condensation differs from that usually occurring with aromatic hydroxy acids, when the hydroxyl groups of two acid residues become united by the methylene group, leaving the carboxylic acid groups free.—T. F. B.

*Diiminothiopyrimidine and its C-C-Dialkyl Substitution Products: Method of Preparing* —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 158,621, Oct. 27, 1903.

THIOCREA condenses with malonitrile or its alkyl derivatives in presence of alkaline condensing agents to form diiminothiopyrimidines,  $\text{CS}:(\text{NH}:\text{C}:\text{NH})_2:\text{CR}_2$ , where R is a hydrogen or alkyl radical. The resulting products are easily converted into the corresponding barbituric acids.—T. F. B.

*Endiminotriazoles: Method of Preparing* —. E. Merck. Ger. Pat. 159,692, March 6, 1904.

ENDIMINOTRIAZOLES are obtained by condensing triarylated aminoguanidines with carboxylic acids or their chlorides. Endanilodiphenyltriazole ("nitron") is obtained from triphenylaminoguanidine and formic acid; triphenyl-endanilo-triazoles from triphenylaminoguanidine and benzoyl chloride, and endaniloditolyltriazole from phenylaminoditolylguanidine and formic acid. The substances are yellow crystalline compounds with strongly basic properties; the ring complex is stable to mineral acids, but is ruptured by alkali hydroxides. They find application in analytical chemistry (see this J., 1905, 291, 458 and 638).—T. F. B.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*Toning [Silver Prints] with Metals of the Platinum Group* K. Siebenstern. Lechners Mittheil., 1905, 144. Chem.-Zeit., 1905, 29, Rep., 192.

In toning with auric chloride in the ordinary way, three atoms of silver are replaced by one atom of gold, with consequent reduction in the intensity of the image; in presence of alkali, however, the solution behaves as though a compound, aurous chloride ( $\text{AuCl}$ ), were present, and no weakening of the image results. The same thing happens with the salts of metals of the platinum group; in this case, the lower halide salts only can be used, as the tetrahalides cause too much reduction of the image. Platinum toning baths must always be acid. The brown image obtained with platinum chloride is found to consist of a considerable portion of silver and little platinum; with palladium toning baths, on the contrary, the image consists mainly of palladium. Iridium trichloride gives violet to blue tones; the image must be printed very deeply, as considerable reduction occurs.—T. F. B.

## XXII.—EXPLOSIVES, MATCHES, Etc.

*Nitric Acid: Strength and Specific Gravity of — of High Concentration.* F. Winteler. VII., page 800.

#### ENGLISH PATENTS.

*Smokeless Powders and their Manufacture; Impts. in* —. A. T. Cocking and Kynoch, Ltd., Kynoch Town, Essex. Eng. Pat. 15,053, July 5, 1904.

CLAIM is made for an improved method of manufacture of a nitrocellulose "bulk" powder, i.e., one which has substantially the same bulk for the same ballistics as black powder. Nitrocellulose containing from 12.0 per cent. to 12.5 per cent. of nitrogen is incorporated with four to five times its own weight of a suitable solvent (acetone) until a uniform solution is obtained of about the consistency

of treacle. Double the bulk of water at 65° C. is added. A small quantity of the water, just sufficient to cover the solution, is first added, and stirring begun, then, whilst stirring violently, the remainder of the water is added quickly. The powder is thus precipitated in grains of the required density, the liquid poured off, the powder dried and sifted. The rate at which water becomes incorporated with the solution is of importance in determining the size and uniformity of grain produced, quicker stirring tending to produce lighter density. Water at a higher temperature decreased viscosity of the solution have also the effect. It is not necessary to dry the nitrocellulose before incorporating with the solvent. In some cases instead of stirring the nitrocellulose solution with water it may be treated with steam in a suitable vessel. The solvent is recovered by distillation.—G. W. McD.

*Explosives containing Aluminium or other Light Metals, relating to* —. H. J. Haddan, London. G. Roth, Vienna. Eng. Pat. 6651, Mar. 29, 1905.

EXPLOSIVES containing aluminium or other light metals can be fully exploded, without using fulminate, by the use of gunpowder, provided they are enclosed in very strong shells and are mixed with suitable materials, adapted to act as high pressure exciters. The following composition is used for purpose:—Sulphur (1 part), lead peroxide (4.5 parts), carbon (2.5 parts), and potassium nitrate (5.5 parts). This composition is placed in a tube closed at one end, the open end being provided with a gunpowder fuse. The tube and fuse are inserted into the shell containing the explosive consisting of ammonium nitrate (45 parts), di- or trinitrotoluene (19.5 parts) and aluminium (22 parts). (See also this J., 1901, 68; 1904, 950.)—G. W. McD.

#### UNITED STATES PATENT.

*Explosive Compound; High —, and Process of Making same.* H. Maxim, New York. U.S. Pat. 771, June 20, 1905.

THE claim is for the process of making an explosive compound by heating a mixture of picric acid (52 parts), dinitrophenol (48 parts) in the presence of water, the temperature below the melting point of each ingredient. The mixture is then melted, washed with warm water, and the wash-water is cooled to separate out the excess compound held in solution.—G. W. McD.

## XXIII.—ANALYTICAL CHEMISTRY

#### APPARATUS, &c.

*Topley Pump; Two Modifications of* —. A. Ber., 1905, 38, 2182–2185.

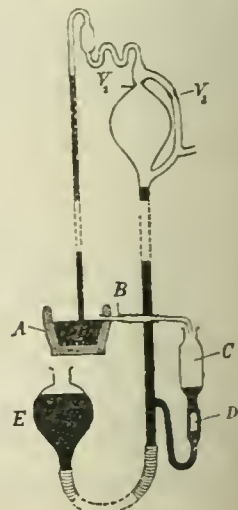


Fig 1



modifications described, are represented in Figs. 1 and 2. In Fig. 1, E is a vessel containing mercury, and on raising this the mercury enters the adjoining tube driving gas out at the vessel A. Any excess of mercury which comes to A overflows by the pipe B to C, and so on to E. D is a valve which closes C when E is raised, to avoid breakage due to a too rapid ascent of the mercury. A glass at  $V_1$  and  $V_2$  is contracted. Another type of pump is shown in Fig. 2. A and B are three-way stopcocks, and a piece of rubber tubing with screw-pinch, and open to the air, is attached to A (as shown). C is an ordinary stopcock. The pump is to be evacuated is attached to D, and E is connected with a pump (Bunsen water-pump), which gives a vacuum of 1 cm. or better. F is a vessel containing a drying gas, G, H and J are valves. K is a glass vessel into which a measured amount of mercury is introduced. Mercury is poured into L through E until the inner tube dips below the surface.

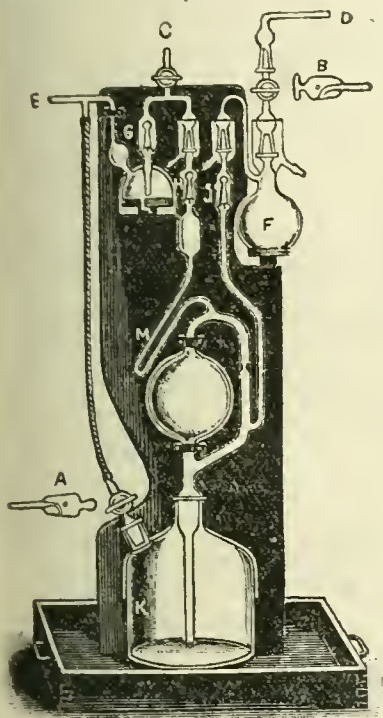


Fig. 2.

use the pump, the stopcock at A is turned so as to connect towards E, the screw-pinch-cock at A being closed. The pump attached to E is then started. When the required vacuum in K is obtained, A is turned so as to connect towards E, and the pinch-cock on the rubber tube at A is gradually opened so as to admit air. The air then rises into the bulb and tubes above K and at H and J. A is then again opened towards E, and evacuation once more begun. The mercury flows into K from above, and so on.

The limb at M contains some mercury which acts as a manometer. The advantages of the pump are:—(1) The small size of manipulation; (2) the rapidity of working; (3) the mercury keeps clean.

By using mechanical contrivances at A the pump operates automatically.—C. E. F.

#### ENGLISH PATENT.

*For Gaseous Mixtures; Process of and Means for Testing the Composition of —.* F. Haber, Karlsruhe, Germany. Eng. Pat. 18,047, Aug. 20, 1904.

The process claimed for testing gaseous mixtures consists

in causing light to pass non-normally through the common surface of contact of the mixture to be tested and a medium of comparison, and determining the deflection. The mixture and the comparative gas may be separated by a plate, through which the light passes non-normally. The comparative gas can be one constituent of the mixture isolated by absorption of the other constituent. A simple device for carrying out this test is described and figured.—F. S.

#### INORGANIC—QUALITATIVE.

*Nitrites, Nitrates and Chlorates; Detection of —, by Diphenylamine with Resorcinol or  $\beta$ -Naphthol.* P. Alvarez. Bull. Soc. Chim., 1905, 33, 717–719.

THE author finds that a mixture of diphenylamine with resorcinol or  $\beta$ -naphthol gives more certain results than diphenylamine alone, especially as a test for nitrates and chlorates. The reagent is prepared by dissolving 0.1 gm. of pure diphenylamine and resublimed resorcinol in 10 c.c. of sulphuric acid (sp. gr. 1.84); five or six drops of this solution are added to 0.001 gm. of the salt in a flat-bottomed porcelain capsule. The following colour changes are obtained:—

*Nitrates.*—Greenish yellow. A thin film on the capsule becomes blue at the edges, especially on blowing. Addition of alcohol gives an orange liquid.

*Nitrites.*—Intense purple blue. A thin film becomes red at the edges. Addition of alcohol gives a red liquid.

*Chlorates.*—( $\beta$ -naphthol in place of resorcinol) Dark green changing to grey and nearly black. Addition of alcohol yields a greyish or blackish liquid.—F. Spx.

#### INORGANIC—QUANTITATIVE.

*Silica and Fluorine; Separation and Determination of —.* F. Seemann. Z. anal. Chem., 1905, 44, 343–387.

THE author has critically examined the various methods for the separation and determination of silica and fluorine, and particularly those which may be applied to minerals, &c., containing both these substances. He finds that silica is most completely separated by precipitation with mercury-ammonium carbonate. The latter is prepared by treating mercuric chloride solution with an excess of ammonium carbonate until the precipitate which forms is re-dissolved, or by digesting freshly precipitated mercuric oxide in an excess of ammonium carbonate solution. The silica solution should be neutralised with hydrochloric acid before adding the reagent, and the mixture twice evaporated to dryness. The residue obtained is easily filtered and washed, and may be directly ignited, when anhydrous silica is obtained. After precipitating the silica with mercury-ammonium carbonate and filtering, the filtrate may be used for the determination of the fluorine. For this purpose the methods proposed by Fresenius, Brandl, Oettel, Carnot and Offermann all give trustworthy results. Precipitation of the fluorine as calcium fluoride is not to be recommended.—W. P. S.

*Antimony; Electrolytic Determination of —.* H. D. Law and F. M. Perkin. Paper read before the Faraday Soc., July 3, 1905. [Advance Proof.]

THE authors propose the use of tartrate solutions in view of the trouble of preparing the sodium sulphide solutions hitherto employed for the electrolytic determination of antimony. A solution of an antimony salt containing 6 to 8 grms. of ammonium tartrate in 120 c.c. of solution is recommended. The deposition is complete in from three to five hours. Current density 0.2 to 1.0 ampère per sq. dm. with P.D. of 2.6 to 3.5 volts. The deposition is preferably carried out from a warm slightly acidified solution.—R. S. H.

*Tellurium; Determination of —, by Electrolysis.* G. Pellini. Gaz. chim. ital., 1905, 35, 514–516.

AN adherent electrolytic deposit of tellurium can be obtained by using a rotating cathode consisting of a cylindrical beaker of platinum with a matt surface. A known

weight of carefully purified tellurium was dissolved in the platinum beaker in nitric acid of sp. gr. 1.25, which was then removed by evaporation, 10 c.c. of strong sulphuric acid being afterwards added and the liquid heated for some time on a sand-bath. On cooling, from 30 to 40 c.c. of a cold saturated solution of ammonium hydrogen tartrate was added to the liquid, which was then shaken and boiled until all the tellurous acid was dissolved, after which a further quantity of the tartrate solution was added so as to bring the total volume of the liquid to 250 c.c. The solution was then electrolysed at 60° C. with a current density of 0.12–0.09 ampère per 100 sq. cm. and a potential difference of 1.8–2.2 volts, the deposit of tellurium being kept immersed by the addition of water previously boiled and cooled in a stream of carbon dioxide. At the end of the electrolysis, which occupied from 7 to 124 hours, the current was stopped, and the still rotating cathode washed with purified water, and then with absolute alcohol. The cathode was then dried for 10 minutes at 90°–95° C. and weighed. The results obtained have errors varying from 0.08 to 0.16 per cent. It is found that quantities of tellurium greater than 1 gm. can be deposited, so that the method may be used for the purification of this element.—T. H. P.

*Superphosphate ; [Determination of] Free Acid in —.*  
L. Schuecht. Z. angew. Chem., 1905, 18, 1020–1023.

Of solvents other than water for extraction of the free acid the author finds acetone most satisfactory. It possesses the following advantages over alcohol or ether:—(1) It dissolves the free acid quickly at the ordinary temperature. (2) It does not liberate phosphoric acid from ferric or aluminium acid phosphates. (3) Titration may be performed without first removing the solvent. Five grms. of the superphosphate are spread as a thin uniform layer on a Büchner's filter of 9 cm. diameter, and is washed ten times with neutral acetone (about 75 c.c.), which runs very rapidly through the filter. The filtrate becomes turbid but clears again on addition of 200 c.c. of water. The free acid is then titrated in the same manner whether acetone or water has been used. Instructions are given for avoiding two sources of error:—(a) Acid phosphates of iron and aluminium are precipitated by caustic soda before methyl orange changes from red to yellow, but may be kept in solution by potassium oxalate; (b) Phosphoric acid, which acts as a monobasic acid in this titration, is neutralised so slowly that it is necessary to hasten the reaction by sodium chloride. A sample analysis is given:—To 500 c.c. of a superphosphate solution (20 grms. per litre) were added 29 c.c. of N/1 neutral potassium oxalate, slightly less than that required to precipitate the calcium. After boiling and filtering, 40 c.c. of 4N/1 sodium chloride were added to 200 c.c. of the cooled filtrate (= 3.78 grms. of substance), which was then titrated with N/2 caustic soda and methyl orange.

The author condemns drying the sample in any case, as changes are brought about by heating. Small quantities of sulphuric and other acids liberate phosphoric acid on storing, and may therefore be reckoned as such. Acid phosphates are not hydrolysed by water alone except in great dilution.—F. SBN.

*Ammonia in Drinking Waters ; Determination of —.*  
Cavalier and Artus. Bull. Soc. Chim., 1905, 33, 745–747.

THE authors have examined the method proposed by Trillat and Turchet (this J., 1905, 251) for the determination of ammonia, based upon the formation of a black precipitate of nitrogen iodide on addition of potassium iodide and alkali hypochlorite. They find that the method is much less delicate than that of Nessler, as the black coloration is not produced with quantities of ammonia less than 3 mgrms. per litre, whereas 0.1 mgrm. of ammonia per litre can be recognised by the Nessler test. A more serious disadvantage of the method, however, is the fact that the black coloration fades sensibly in the course of one minute and disappears almost completely in two or three minutes.—A. S.

## ORGANIC—QUALITATIVE.

*Cocoanut Oil ; Method of Determining the Purity of —.*  
E. Milliau. Comptes rend., 1905, 140, 1702.

THE test is based upon the fact that seed oils give a go-berry-red coloration when treated with both phloroglucinol and resorcinol in an acid medium, the reaction being less sensitive when only one of the reagents employed. Four c.c. of the cocoanut oil are shaken in a test-tube with 2 c.c. of a saturated solution in ether of phloroglucinol and then with 2 c.c. of a saturated solution of resorcinol in benzene, and the tube immersed for a few seconds in water at 10° C. The mixture is then treated with 4 c.c. of nitric acid (40°) free from nitrous vapour, transferred to another test-tube, and shaken for a few minutes, the tube being meanwhile closed by a strip of rubber previously washed in the same acid. Perfectly pure cocoanut oil remains practically unchanged, and a rose colour speedily disappearing points to the presence of negligible traces of impurities. But in the presence of 5 per cent. or less of any grain oil, or of lard oil, or of naphthas or resin oils, the pronounced red coloration is obtained. Any colorations subsequently produced by the prolonged action of the nitric acid are to be ignored.—C. A.

*Ether ; Oxidising Action of Impure — and its Influence on Kreis's Reaction.* H. Ditz. Chem.-Zeit., 1905, 29, 705–710.

COMPOUNDS such as ethyl peroxide and hydrogen peroxide are formed in ether on exposure to the air, and the presence of such peroxidised ether may produce unexpected phenomena, such as the formation of periodides, caffeine alkyl iodide, as shown by Rossolimo (this J., 1905, 288), or the decolorisation of an alkaline solution of cobaltous oxide (this J., 1901, 389), which may be employed as a test for peroxides in ether. The author's experiments with various modifications of Kreis's reaction (this J., 1904, 1001) for decomposed or insolated ether showed that the coloration was not obtained when impure ether was used, and that when obtained with pure ether it could be destroyed by the addition of the oxidised product. The latter could be purified by stirring over sodium hydroxide for two days, and then distilled. The ethyl peroxide formed in the reaction of the hydrogen peroxide—a result in agreement with Rossolimo's experience. Rancid fats gave a coloration instead of the red when impure ether was used in the test, which was evidently due to some other reaction. On shaking a solution of phloroglucinol in ether with concentrated hydrochloric acid, a reddish-brown coloration was obtained, and the reaction was so sensitive that it could be used as a test for traces of peroxides in the ether. The intensity of the reaction increased with the proportion of phloroglucinol, a 0.1 per cent. solution giving a bright yellow coloration. Sesame oil that had been fresh for a year gave an intense coloration in the reaction (bluish-green colour with concentrated hydrochloric acid, this J., 1899, 1158 ; 1904, 194), but the coloration disappeared on the addition of the impure ether. When sesame oil was treated, first with the ether and then with the concentrated acid, only a greenish-yellow coloration of the acid, changing to yellow, was obtained. The author attributes this to the action of the ethyl peroxide, a phenolic substance, sesamol, isolated by Kreis, and cautions is given as regards Wiedmann's modification of Kreis's test (5 c.c. of a 0.1 per cent. solution of phloroglucinol in acetone with 5 c.c. of the melted fat and one or three drops of concentrated sulphuric acid), for the coloration was obtained in certain cases where the reaction gave a negative result. This was found to be due to aldehyde in the ether, and the same coloration was produced in a blank experiment in which the fat was not used. Kreis attributed his reaction to the presence of two hydroxyl groups in a meta position in the ether, and to the presence of aldehydes or ketones in the impure fat (this J., 1903, 575), and in this connection the author calls attention to various reactions with formaldehyde. An aqueous solution of resorcinol treated with formaldehyde



acidified, and heated gave a red-brown insoluble precipitate, whilst *o*-, *m*-, or *p*-cresols gave only white or faint precipitates under the same conditions. It was found that the colour reactions were not invariably associated with two hydroxyl groups in the meta position. Under certain conditions, red or reddish-violet reactions were given by, e.g., salicylic acid and catechol formaldehyde.—C. A. M.

*vic Acid; Colour Reaction for the Detection of —.* P. Alvarez. *Bull. Soc. Chim.*, 1905, 33, 716—717.

Freshly prepared solution of  $\alpha$ - or  $\beta$ -naphthol (0.1 gm. to 0.05 gm.) in sulphuric acid of sp. gr. 1.83 (1.8) has already been proposed by the author as a reagent for the investigation of the organic acids (*Comptes Rendus*, Feb. 8, 1897). One drop of the acid is added to drops of the reagent in a porcelain capsule, which is gently warmed. The following colour changes are associated with pyruvic acid:—

*Naphthol*.—The reagent acquires a bright red colour on cooling, changing to an intense blue on warming. Addition of water or alcohol causes a fugitive yellow colour to develop.

*Naphthol*.—The reagent becomes yellow in the cold, changing to an intense orange on very gentle warming. Colour persists after dilution with water or alcohol.

This test serves to distinguish between this and other organic acids such as citric, tartaric, malic, &c., and also obviously between  $\alpha$ - and  $\beta$ -naphthols.—F. SDN.

*Reagents; New Reagent for the Detection of —.* P. Alvarez. *Bull. Soc. Chim.*, 1905, 33, 713—716.

The reagent is hydrated sodium dioxide ( $\text{Na}_2\text{O}_2 \cdot 8\text{H}_2\text{O}$ ), and is employed in the following manner. To 0.20 gm. of anhydrous perfectly dry sodium dioxide, 0.04 gm. of the polyphenol and 5 c.c. of absolute alcohol are added in a small porcelain dish of 30 c.c. capacity. On gentle warming the reaction the dish is gently rotated, four to six seconds being allowed (A). Finally 15 c.c. of cold distilled water are added (B). The colorations obtained are given in the following table:—

	A	B
1. <i>Resorcinol</i> .....	Rose-colour, changing to green, finally brown. Film on dish, greenish-blue by blowing.	Reddish-brown.
2. <i>Resorcinol</i> ....	Pale yellow, changing to greenish.	Green, more intense.
3. <i>Resorcinol</i> (hydroquinone) ..	Very intense reddish-yellow. Film on dish, transient blue by blowing.	Orange.
4. <i>Resorcinol</i> ....	Brownish-red .....	Intense red. Orange in 24 hours.
5. <i>Resorcinol</i> .....	Purple red, changing to brown.	Film on dish, yellow.
6. <i>Resorcinol</i> .....	Purple blue .....	Colour more intense, but almost colourless after 24 hours.
7. <i>Resorcinol</i> .....	Intense rose colour ...	Rose colour.
8. <i>Catechol</i> (nonydroquinone) ..	Purple blue, changing at once to red. Film on dish, greenish-yellow in air.	Reddish-brown, edges yellow.
9. <i>Resorcinol</i> .....	Intense orange. Film on dish, intense yellow.	Wine-red, fading slowly.

—F. SDN.

### ORGANIC—QUANTITATIVE.

*Leather*”; *Method for the Detection and Determination of —, in Tan-yard Liquors.* J. G. Parker and V. Casaburi. *Collegium*, 1905, 210—212.

During the early stages of tanning while the pelt is in an unfixed

condition, considerable waste of hide substance occurs, by reason of the action of bacteria and various salts present in the liquors, which act on the hide substance, rendering it soluble in acid or alkaline liquors; this “peptonised” hide substance differs from ordinary hide substance in producing a compound with tannin capable of being dissolved in excess of gallic and other acids.

The authors propose the following method for accurately determining the amount of soluble leather or hide substance present in a tan-liquor, and state that by its use neither the nitrogen from the ammonium salts introduced into the liquor by the hides, nor that naturally present in the liquor is determined.

200 c.c. of the unfiltered tan-liquor are treated with 25 c.c. of a concentrated sodium acetate solution, and ferric acetate solution is afterwards slowly added until precipitation no longer takes place. The precipitate after filtration is washed, allowed to drain, and the nitrogen present estimated by Kjeldahl’s method.—M. C. L.

*Beetroots and Sugar Factory Products; Determination of the Objectionable (Mclassigenic) Nitrogenous Matter in —.* K. Andriik. *XVI.*, page 808.

*Sucrose; Polarimetric Determination of —.* F. Watts and H. A. Tempamy. *West Indian Bull.*, 1905, 6, 52—60.

The authors have made careful observations with pure sucrose, with a view to determining the correction which should be applied to compensate for the decrease in the rotatory power of sucrose at tropical temperatures. Determinations made at 30° C. have led the authors to propose the correction:— $\text{Pol.} + (0.00023t)N$ , for this error, where  $N$  = the Ventzke scale degrees, and  $t$  = the difference between the temperature of observation and that at which the instrument was graduated. Combining this correction with that proposed by Jobin for the change of rotatory power of the quartz wedge, the total correction of the polarimetric reading for tropical temperatures (about 30° C.) becomes:  $\text{Pol.} + (0.00039t)N$ .

The authors have also determined the error due to the volume of the lead precipitate and found that the volume of this precipitate varies according to the quality of the sugar, being 0.305 to 0.45 c.c. for Muscovado sugars.

At tropical temperatures the error due to the volume of the lead precipitate practically compensates that due to the change in the rotatory powers of the sucrose and quartz, but at the normal temperature the error due to the lead is very serious.

They find that Horne’s method (this *J.*, 1904, 340) of adding dry lead subacetate to the sugar solution is very nearly accurate, provided the lead be not used in excess.

The following rules are proposed for the polarisation of sugars:—

(1) Dissolve 26 grms. of the sample and dilute to 100 true c.c. (equivalent to 26.048 grms. in 100 Mohr c.c.).

(2) Clarify by means of “anhydrous” basic lead acetate, avoiding excess (0.35 gm. gives good results with Muscovado sugars).

(3) Polarise at the same temperature as that at which the solution has been prepared and correct the reading by the formula  $\text{Pol.} + (0.00038t)N$ .—J. F. B.

*Cereals; Determination of Available Extract in Flaked —.* L. Briant. *J. Inst. Brewing*, 1905, 11, 395—398.

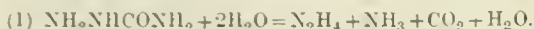
In order to avoid the variations in the results found when malts of different diastatic powers are mashed together with the flaked cereals (see Baker; this *J.*, 1905, 353), the author prefers to effect the conversion of the starch by means of a cold-water extract of malt, instead of by the malt-grist itself. Experiments have shown that, provided sufficient of the malt extract be employed, the results are perfectly concordant with malts of widely divergent diastatic powers.

A tender, good malt, preferably one with a diastatic power between 30° and 40° Lintner, is ground and extracted for 1½ hours with three times its weight of cold water. Twenty grms. of “flakes” are mixed in a beaker with 120 c.c. of water, and the temperature is raised to 160° F. with constant stirring; 50 c.c. of the filtered

cold-water extract of malt are added gradually, and the mash is allowed to remain at a temperature of 150° F. for two hours. The mash is then cooled to 60° F., diluted to 200 c.c., and filtered. The difference between the sp. gr. of the filtered wort and that of the malt extract after treatment in exactly the same manner, when multiplied by the factor 3.32, gives the lb. of available extract contained in 336 lb. of "flakes."—J. F. B.

*Hydrazides; Determination of some* —. C. Maselli. *Gaz. chim. ital.*, 1905, 35, 267–273. *Chem. Centr.* 1905, 1, 1742.

THE method is based upon the fact that semicarbazide and semioxamizide when boiled with dilute acid in aqueous solution are decomposed, in accordance with the following equations:—



*Determination of Semicarbazide*.—The aqueous solution of the semicarbazide salt is rendered acid with sulphuric acid, boiled for  $\frac{1}{2}$  hour, an excess of a standardised solution of potassium iodate added, and after again boiling, the excess of iodate titrated with sodium thiosulphate.

*Determination of Semioxamizide*.—In this case, owing to the formation of oxalic acid, the amount of hydrazine produced cannot be determined by means of potassium iodate. The solution after boiling with sulphuric acid, is therefore rendered alkaline with sodium hydroxide, and the ammonia distilled off and determined.—A. S.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Synthesis by means of the Silent Electric Discharge*. J. N. Collie. *Chem. Soc. Proc.*, 1905, 21, 201–202.

By subjecting pure ethylene to the action of the silent electric discharge in a vessel cooled to –20° C., a liquid was produced together with some hydrogen gas. In one experiment about 40 c.c. of hydrogen were obtained from 210 c.c. of ethylene. On fractionating the liquid reaction-product, the distillate collected mainly in two portions distilling between 100° and 150° C. and 150° and 200° C. respectively. The residue, amounting to 40 per cent. of the total, was a dark resinous substance, which on heating gave an odour resembling that of burnt india-rubber. Small quantities of aldehydes were formed when a mixture of ethylene and carbon monoxide was subjected to the action of the silent electric discharge, but the chief reaction that took place was the same as in the preceding experiments, the ethylene condensing to form hydrocarbons having high boiling points. The substances chiefly formed, boil at about 150°–160° C., and appear to approximate in composition to  $\text{C}_{10}\text{H}_{20}$ ; on further condensation, loss of hydrogen occurs and compounds approximating both in properties and composition to terpene derivatives are produced.—A. S.

*Acids; Influence of various Sodium Salts on the Solubility of Sparingly soluble* —. J. C. Philip. *Chem. Soc. Proc.*, 1905, 21, 200.

EXPERIMENTS with cinnamic, benzoic, salicylic and o-nitrobenzoic acids and sodium formate, acetate and butyrate, showed that the solubility of the acids was increased by addition of sodium salts of weak acids. If this increased solubility be due to the formation of undissociated sodium salts of the sparingly-soluble acids, then the extent to which the solubility of the acid is increased by the presence of the sodium salt NaA would depend on the strength of the acid HA. This was found to be the case, curves obtained by plotting the concentration of the added salt (NaA, NaA', NaA'', &c.) against the concentration of the sparingly-soluble acid in the saturated solution of the salt, being in the same order as the strengths of the acids HA, HA', HA'', &c.

It is pointed out that these results are in agreement with the view that the greater solubility of magnesium hydroxide in ammonium chloride solutions than in pure

water, is due to the formation of undissociated ammonium hydroxide, and the consequent removal of hydroxyl ions, this leading to the solution of more hydroxide.—A. S.

*Diazo Reactions; Influence of Light on* —. K. J. Orton, J. E. Coates and F. Burdett. *Chem. Proc.*, 1905, 21, 168–169.

PREVIOUS experiments on the action of light on diazo reactions have, apparently, been carried out exclusively with the solid substances (this J., 1890, 1001; 1901, 171). The authors have studied the effect of light on solutions of diazonium salts. On boiling an aqueous or acid solution of a *s*-tribromobenzenediazonium salt, no *s*-tribromophenol is formed (*J. pr. Chem.*, 1883, 27, 113; *Ber.*, 1883, 2517), but dibromoquinonediazide is chiefly produced, with liberation of bromine (*Chem. Soc. Trans.*, 1902, 83, 802). When, however, solutions, especially acid solutions, of the diazonium salts are exposed to sunlight, the diazo compound is rapidly decomposed even at the ordinary temperature, with formation of *s*-tribromophenol and nitrogen. The corresponding bromobenzenediazotates are not affected in the slightest degree by exposure to sunlight. The decomposition of *s*-tribromobenzenediazonium salts in methyl alcohol, alcohol and acetic acid solutions is also affected by light. On boiling the solutions, *s*-tribromophenol is formed in all three cases, but by exposure to sunlight the products are *s*-tribromoanisole,  $\text{C}_6\text{H}_2\text{Br}_3\text{OCH}_3$ , bromophenetol,  $\text{C}_6\text{H}_2\text{Br}_3\text{OC}_2\text{H}_5$ , and *s*-tribromophenyl acetate,  $\text{C}_6\text{H}_2\text{Br}_3\text{O.C}_2\text{H}_3\text{O}$ , respectively. Similar results were obtained with other diazonium salts and diazotates. Solutions of diazonium salts can be kept at the ordinary temperature for some weeks in the dark, but decompose rapidly on exposure to sunlight, with formation of the corresponding phenol. The results of the experiments indicate that the conversion of diazo compounds into phenols, ethers and phenylacetates is a reaction characteristic of the diazonium ion.—A. S.

*Soot; Some Constituents of Manchester and other* —. E. Knecht. *Mem. and Proc. Manchester Lit. and Phil. Soc.*, 1905, 49 [14].

THE soot taken for examination was an average sample obtained from bulk at a dealer's. It was extracted with boiling dilute sulphuric acid to remove basic constituents, then with sodium hydroxide to separate acid compounds and phenols, and finally with benzene to extract the carbonaceous matter. In all samples under examination it was found that the aqueous extract showed a strongly acid reaction due to the presence of free sulphuric acid. It also contained practically the whole of the ammonia and pyridine bases. From the acid extract, impure calcium sulphate was separated, whilst the filtrate from the latter was found to contain ammonia equivalent to 10.7 per cent. of ammonium sulphate calculated on the weight of the original soot. From the alkaline extract, left after previous boiling the soot with dilute sulphuric acid and washing, a dark brown liquid was obtained, which, on acidification, yielded a brown product having a strong sooty odour, resembling humic acid in properties. When this was melted with sodium sulphide, a dyestuff was formed, giving fast shades on cotton varying according to the amount of colour employed from a light fawn to a brown black. The benzene extract consisted mainly of the carbonaceous matter having high boiling points and represented complex mixtures. The soot after extraction with benzene possessed a brownish-black colour due possibly to the presence of a considerable amount of ash. In this condition it is highly inflammable, taking fire spontaneously when heated to 100° C., and is then difficult to extinguish. The percentages of constituents estimated directly were: Ammonium sulphate, 10.7; mineral matter (ash), 10.7; acid constituents, 10.9; benzene extract, 13.0; difference (carbon ?), 45.8. London soot contained considerably less extractive matter than Manchester soot, the difference being most noticeable in the small amount of the benzene extract (1.3 per cent.). A sample of soot from Prague (lignite coal) gave a neutral aqueous extract. The acid extract contained only traces of ammonia.



benzene extract only amounted to 0.2 per cent. The amount of acid constituents soluble in sodium hydroxide 10 per cent.—D. B.

*Effect of Liquid Air on Germination of —.* Becquerel. Comptes rend., 1905, 140, 1652—1654.

observers have concluded that exposure to cold (to  $-250^{\circ}$  C.) arrests vital processes, and that living matter may be preserved indefinitely at these low temperatures in a dormant state, ready to recover its original vitality on being thawed. The author concludes from his experiments that the effect of low temperatures depends on the amounts of moisture and of gas which the seeds contain. If these amounts be sufficient, exposure to cold disorganises the protoplasm through the physical effects of freezing and contraction; but if the seeds are thoroughly desiccated, exposure to cold produces no effect on them—there is no more evidence of “arrest” of vital processes in the cold seed than in the desiccated seed at the ordinary temperature. Proof of this “arrest” can only be possible after exposure to cold for a period longer than the longest period recorded during which dried seeds at the ordinary temperatures have preserved their vitality of germinating when submitted to suitable conditions.—J. T. D.

*Antimony; Physico-Chemical Studies on —.* Cohen and T. Strengers. Z. physik. Chem., 1905, 52, 1—170.

Authors have made an exhaustive investigation of the conditions under which so-called explosive antimony is formed, and of the behaviour of ordinary antimony, explosive antimony, and exploded antimony, i.e., the product after the explosion. By the electrolysis of solutions of antimony tri-bromide and tri-iodide, of whatever concentration, explosive antimony is always formed. In the case of antimony tri-chloride, on the other hand, explosive antimony is only produced when the concentration is within the limits 10—86 per cent. With solutions containing less than 10 per cent. of antimony trichloride, another product is obtained, to which the name non-explosive antimony has been given. Solutions of antimony tri-chloride always yield pure antimony on electrolysis. According to the authors, explosive antimony is a solid form of antimony trichloride, tribromide, or tri-iodide antimony, the latter being a meta-stable form of ordinary antimony. Exploded antimony and non-explosive antimony are solid solutions of antimony tri-chloride, tribromide or tri-iodide in ordinary antimony. It is found that if the explosive antimony deposited by electrolysis of an 18 per cent. solution of antimony tri-chloride, were exploded whilst still in the electrolyte, non-explosive antimony was deposited on continuing the electrolysis.—A. S.

### New Books.

*WISCH-CHEMISCHES JAHRBUCH, 1903.* Ein Bericht über die Fortschritte auf dem Gebiete der chemischen Technologie. Herausgegeben von Dr. RUDOLF BREDESEN, 26ter. Jahrgang. Friedrich Vieweg und Sohn. Braunschweig, 1905. Price, M.15.

Volume, containing 567 pages of subject matter, and alphabetical indexes of authors' names and subjects, and, as a Register of Patents. The text contains 33 communications. The Report, dealing with the advance of Chemical Technology, embraces the subjects under the following heads:—I. Iron. II. Aluminium, &c. III. Gold and Silver. IV. Copper. V. Zinc. VI. Lead. VII. Nickel, Manganese and Chromium. VIII. Tin, &c. IX. Sulphur and Sulphuric Acid. X. The Alkali Industry. XI. Electrochemistry. XII. Ammonia and Cyanogen Compounds.

XIII. Alkaline Earths, &c. XIV. Gases. XV. Phosphorus, Boreen, Silicon and Carbon. XVI. Glass. XVII. Earthenware and Porcelain. XVIII. Cements and Artificial Stone. XIX. Explosives and Matches, &c. XX. Illuminants. XXI. Fuels. XXII. Sugar. XXIII. Starches, Dextrone and Starch Sugar. XXIV. Fermentation Industries. XXV. Fats, Soaps and Resins. XXVI. Ethereal Oils and Scents. XXVII. Water. XXVIII. Foodstuffs. XXIX. Organic Products. XXX. Albuminoids. XXXI. Dyestuffs. XXXII. Textile Fibres. XXXIII. Paper. XXXIV. Photography. XXXV. Tanning and Glue, &c. XXXVI. Manures, Fertilisers, and Disinfection. XXXVII. Apparatus. XXXVIII. New Book Reviews.

### Trade Report.

#### I.—GENERAL.

MEXICO; TRADE OF —.

For. Off. Ann. Series, No. 3429.

The value of certain articles of export from Mexico are as follows:—

Articles.	1901-02.	1902-03.	1903-04.	July 1 to Dec. 31, 1904.
Gold .....	£ 911,525	£ 1,420,877	£ 1,072,644	£ 659,973
Silver .....	5,963,251	7,755,467	7,907,489	2,996,284
Copper .....	1,684,983	2,012,233	2,323,421	3,656,197
Lead .....	573,084	566,907	482,564	1,440,157
Other metals .....	54,677	118,178	135,898	52,340
Dye-woods .....	128,877	96,401	84,755	54,300
Raw hides .....	628,657	746,648	655,408	309,215

The subjoined table shows the value of certain articles imported into Mexico:—

Articles.	1902-03.	1903-04.	1904. (2nd half)
Mineral products .....	£ 4,803,284	£ 4,497,495	£ 2,083,174
Chemical and pharmaceutical products .....	558,325	631,641	296,706
Spirits, natural, and artificial fermented liquors .....	626,648	678,604	305,922
Paper and manufactures of paper .....	385,072	467,290	220,162
Machinery, &c. ....	2,067,417	2,124,495	967,656
Arms and explosives .....	359,262	435,922	188,271

PORTUGAL; CHEMICAL IMPORTS INTO —.

For. Off. Ann. Series, No. 3418.

The imports of chemicals through Oporto during the years 1900-04 were as follows:—

	Quantity.				
	1900.	1901.	1902.	1903.	1904.
Alkalis, caustic, solid or liquid	Tons. 681	Tons. 679	Tons. 725	Tons. 691	Tons. 660
Nitrate of potash (saltpetre)	224	265	202	312	317
Chloride of calcium .....	328	286	432	459	327
Sulphate of sodium, of potash, of copper and of iron .....	835	700	1,026	1,812	2,566
Carbonate of soda, crystallised or refined, dry .....	442	494	557	614	558
Dye extracts .....	806	909	1,128	1,071	1,318
Chemical products not specified .....	1,439	1,039	1,309	2,026	2,698

## III.—TAR PRODUCTS, PETROLEUM, Etc.

## PETROLEUM IN ROUMANIA.

For. Off. Ann. Series, No. 3432.

Official statistics show an output of 497,000 tons of petroleum during 1904. The monthly average of 1904 was 37,176 tons during the first half-year and 45,635 tons during the second half. Of the four oil-bearing districts of Roumania, the district of Prahova is the richest, the total output of this district showing 455,354 tons against 26,234 tons in Dambovitza, 8236 tons in Buzen and 7064 tons in Bacan. The number of hand wells have increased owing to their small cost. Official figures show 744 wells in 1904 against 675 in 1903, and those in process of sinking 195 against 163. On the other hand the number of productive borings has decreased, the figures being 290 for 1903 against 224 in 1904. The borings under drill have, however, increased from 114 to 192.

The year under review records the most noteworthy events in the history of the petroleum industry of Roumania. German capital played a large part—the three German banks, Deutsche Bank, Disconto Gesellschaft and the Schaffhausen Bankverein being the mediums through which fresh companies were formed and old ones supported.

The exports of petroleum from Roumania during the years 1899–1903, together with the exports to the United Kingdom, were as follows:—

Year.	Total.		To United Kingdom.	
	Quantity. Tons.	Value £	Quantity. Tons.	Value £
1899	62,109	305,558	4,155	16,633
1900	72,700	386,519	20,916	102,192
1901	42,600	237,694	12,676	83,400
1902	68,772	129,739	21,354	42,210
1903	103,962	171,092	31,836	38,440

## IX.—BUILDING MATERIALS, Etc.

## CEMENT MANUFACTURE IN ROUMANIA.

For. Off. Ann. Series, No. 3432.

Two cement factories exist in Roumania, one in Braila and the other in Cernavoda. The former produced 10,500 tons, 1150 tons of which went to Egypt, 550 tons to Bulgaria and 10 tons to Greece. The remainder was used in the country. The firm is registered under the name *Fabrica de Cement Portland, Braila*. In Cernavoda there exists the *Société Anonyme des Ciments Portland de l'Europe Orientale*, the head office of which is in Antwerp. Last year the firm exported 250 tons to Turkey *via* Constantza.

## MAGNESITE BRICK; U.S. CUSTOMS DECISION.

June 19, 1905.

The Treasury Department has appealed to the United States Circuit Court the decision of the Board of General Appraisers of June 7, 1905, which held bricks made from magnesite to be dutiable at 1 dol. 25 c. per ton as "fire brick," under paragraph 87 of the tariff. The Department considers the issue of importance and maintains the assessment of duty at 25 per cent. *ad valorem*.

—R. W. M.

## LUMBER; FIREPROOFED —. U.S. CUSTOMS DECISION.

June 8, 1905.

The United States Circuit Court rendered a decision on fireproofed lumber making it dutiable as a "manufacture

of wood" at 35 per cent. *ad valorem*, under paragraph 87. The lumber in question was ordinary sawed lumber, which had been treated with phosphate and sulphate of ammonia in a closed vessel to render it fireproof. The Board of General Appraisers sustained the contention of the importers that it was dutiable as sawed lumber at 2 dols. per 1000 ft. This was reversed by the Court, which held that it has by reason of the treatment which it has received become a new article and dutiable as a new article. —R. W. M.

## X.—METALLURGY.

## MINERAL PRODUCTION OF QUEENSLAND.

Ed. of Trade J., July 6, 1905.

The following details are extracted from the Annual Report of the Under Secretary for Mines on the Queensland Mining Industry for 1904.

The value of last year's mineral production was 3,704,241*l.*, an excess over that of the preceding year of 18,148*l.*, and thus the largest hitherto recorded. The yield of gold has fallen off to the extent of 124,000*l.*; copper shows a deficiency of 27,226*l.*; lead of 13,000*l.*, and, although silver, tin and coal have advanced, the total value has receded, last year's pre-eminence is really due to a large increase in the quantity of wolfram mined, the higher price obtained for that mineral. The serious decline is in the gold yield, which of late has maintained so high a level. The greater part of last year's supply of silver and lead came from the Charters Towers smelters, which during the twelve months produced 357,196 ozs. of silver and 1661 tons of lead, the furnace being chiefly fed by the Girofla Mine, at Mount Morgan, and by the Crooked Creek Silver-lead Mine, near Albany. By far the largest quantity of Queensland tin is derived from the lodes of the Herberton district, and of the Vulean, at Irvinebank, still maintains its supremacy. A drive from the 900 ft. level in this mine encountered a large body of good ore, and has, for a distance of 100 ft., been extended through what appears to be a solid mass of ore estimated to contain 12 per cent. of black tin. The actual dimensions of the body have yet to be determined by means of crosscuts, but the discovery is important, showing that here, as in older tin-mining countries, the ore persists at a depth.

Despite a deficiency of 27,226*l.* in the value of last year's production, the outlook for copper mining is to be promising, and the current year should witness considerable expansion of this branch of the industry. The largely increased consumption of wolfram in the manufacture of high-grade steel has created a demand that has met with a ready response in Queensland. The northern portion of the State appears to be one of the principal sources of the world's supply of the metal, and, while the total output from 1894, when any record of wolfram first appears in reports, up to the end of 1904 was 996 tons, valued at 30,894*l.*, last year's production from the figures furnished by the Wardens, reached 1,100 tons, of a value of 161,635*l.*, the value of the ore actually exported during the same period returned by the Customs at 96,000*l.* Although manganese is by no means of rare occurrence in Queensland, the very limited local demand for the metal, and the difficulty of establishing an export trade in the face of the competition from the Caucasus and elsewhere, affords small encouragement to attempt the development of the numerous manganese deposits that are to be found in the southern and central parts of Queensland. The only local market is the Mount Morgan Mine, the requirements of the company are supplied by the Mount Miller Mine, at Gladstone, which last year produced 830 tons of manganese, valued at 3540*l.*

Last year's production of coal reached 512,000 tons, valued at 166,536*l.*, an increase in quantity of 4.2 per cent. and in value of 1538*l.* The principal coalfield in the State



the Ipswich district, and it is from these mines that increased production has been derived.

# COLUMBIA; MINERAL PRODUCTION OF —, IN 1904.

*Bd. of Trade J., June 29, 1905.*

Following figures showing the output of minerals—British Columbia, for the year 1904, are taken from the annual report of the Minister of Mines. Figures for 1903 are added for purposes of comparison.

	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
		Dols.		Dols.
Coal, ozs.	53,021	1,060,000	55,765	1,115,000
.. ..	232,831	4,813,000	222,042	4,590,000
.. ..	2,996,204	1,521,000	3,222,481	1,720,000
.. lb.	34,359,921	4,547,000	35,710,128	4,578,000
.. ..	18,089,283	690,000	36,646,244	1,422,000
.. 240 lb.	1,168,194	3,505,000	1,253,638	3,761,000
.. 240 lb.	165,543	828,000	334,102	1,192,000
.. Minerals	—	532,000	—	600,000
	—	17,496,000	—	18,978,000

## ORES EXPORTED FROM NEW CALEDONIA.

*For. Off. Ann. Series, No. 3431.*

The following table shows the amount of ores exported during the years 1899-1904:—

	Quantity.		
	Nickel.	Chrome.	Cobalt.
	Tons.	Tons.	Tons.
1899	101,909	12,635	3,287
1900	101,319	10,474	2,438
1901	132,814	17,451	3,122
1902	129,365	10,281	7,512
1903	77,360	21,437	8,292
1904	98,655	21,437	8,964

In 1903 nine tons of copper and five tons only of lead were exported, and none in 1904. At one time the export of two minerals was more important. Slight traces of gold have been discovered, but never in any paying quantity. The very varied mineral riches of New Caledonia have as yet hardly been touched for want of outside capital.

## MINERAL EXPORTS FROM MEXICO.

*For. Off. Ann. Series, No. 3429.*

The fiscal year 1903-04 gold to the value of 125,713*l.* was exported in excess of the previous year, and in the half of 1904 was 57*l.* more than during the corresponding period of the previous year. The increase in the value of silver in 1903-04 over 1902-03 amounted to 5*l.*, but during the latter half of 1904 there was a decrease under the corresponding period of the previous year.

The value in Mexican currency of the silver exports from July 1 to December 31 in 1903 and 1904 are as follows:—

	Value.	
	1903.	1904.
	Dollars.	Dollars.
Mexican silver dollars	12,143,337 0	632,107 25
Foreign silver coins	42,476 0	45,944 0
Silver bars	24,545,018 66	24,186,933 39
Silver slimes, &c.	6,804,274 8	5,097,577 39
Total	43,625,105 74	29,962,802 3

Exports of copper during recent years were:—1899-1900, 28,266 metric tons; 1900-01, 33,351 metric tons; 1901-02, 61,864 metric tons; 1902-03, 62,132 metric tons; 1903-04, 80,286 metric tons. (See also under Class I., p. 819).

With the introduction of modern metallurgical methods Mexico will probably export fewer ores than heretofore, and there will be more and more treated in the country. Since the development of mining in the United States and elsewhere, new methods have gradually been introduced all over Mexico. There are about 90 smelters for the reduction of precious metals to-day in the Republic, the most important of which is that situated about 4 miles from Aguascalientes, employing several hundred men, with an annual consumption of about 150,000 tons of ore. The others are those of Monterrey, San Luis Potosi, Mapimi and Parral.

## PLATINUM: PRODUCTION OF — IN RUSSIA. W. A. Dyes. Chem. Ind., 1905, 28, 378-381.

Notwithstanding an increased supply in recent years, platinum has become considerably dearer, the price during 1904 ranging from 16,000 to 19,000 roubles per pound (1 rouble=3*s.* 2*d.*; 1 pound=36 lb.). Both the price and production (95 per cent. of the total) of Russian platinum have fluctuated considerably, as is shown in the following table:—

Year.	Price.	Production.	Year.	Price.	Production.
	Roubles.	Pouids.		Roubles.	Pouids.
1869	1,600	140-0	1893	—	311-3
1874	—	120-0	1894	—	318-0
1882	—	250-0	1895	—	269-5
1890	12,000	270-0	1896	—	301-0
1891	5,000	258-6	1897	—	342-0
1892	7,000	279-2	1898	13,000	367-0

In 1900, the production was 310-7, and in 1901, 389 pounds, whilst during the period 1899-1904, it averaged 350 pounds. The increased production of 1901 has not been maintained, owing chiefly to two reasons. In the first place the greater number of the more important mine-owners are bound by contracts covering a period of 10 years, whereby, whatever be the price of platinum in the markets of the world, they have to deliver their product to the large refining firms at a fixed price of 10,000 or 11,500 roubles per pound. These mine owners, not being in a position to receive any advantage from the rise in price of the metal, have, therefore no inducement to increase the supply. The second cause of the gradual decrease in the production of platinum lies in a diminution of the yield of the richer mines. In 1900, the maximum platinum content of the ore was 15-68 grms. per 1,000 kilos., but in 1901 the corresponding figures were only 5-89 grms. per 1,000 kilos. In 1900, 100 firms, and in 1901, 120 were engaged in platinum mining in Russia. The mines are all situated in the Government of Perm, in three districts, of which Gorablagodatj produced 193-4 pounds in 1901 (118 in 1900), Krestowosdwichensk 98-8 pounds (99 in 1900), and Mischnetagilsk 71-8 pounds (76 in 1900). (See also this *J.*, 1890, 1077; 1892, 532; 1894, 995; 1898, 1,083; 1904, 567, 1169).—A. S.

## XII.—FATTY OILS, FATS, Etc.

## GREASE; SOLUBLE ——. U.S. CUSTOMS DECISION.

The Treasury Department has decided to take no further action in the case of soluble grease recently decided by the Circuit Court to be dutiable at 20 per cent. *ad valorem*, under Section 6 of the tariff, as a "manufactured article unenumerated." The article is a sulphonated grease, used in finishing, and was claimed by the Government to be dutiable at 30 per cent. *ad valorem*, as an "alizarin assistant," under paragraph 32.—R. W. M.

## DISTILLED OIL—WOOL OIL; U.S. CUSTOMS DECISION.

June 23, 1903.

An article variously known as "wool oil," "pure oleine," and "pure oleine grease" is dutiable at 25 per cent. *ad valorem*, under the provisions of paragraph 3 of the tariff for "expressed, rendered and distilled oils." The analysis of the sample was as follows:—Sp. gr. (15° C.), 0.9085; free fatty acids, 53.90 per cent.; neutral fat, 1.32 per cent.; unsaponifiable matter, 44.78 per cent. The claim of the importer that it was free of duty, under paragraph 568, as a "grease used only for wire drawing or stuffing or dressing leather," was overruled, as it was shown that it was also used for lubricating and dressing wool. The further claim that it was dutiable at 3 c. per lb., under paragraph 279, as "wool grease," was also overruled, on the ground that the process of distillation which it had undergone had destroyed its character as wool grease and produced a new article.—R. W. M.

## SESAME OIL; U.S. CUSTOMS DECISION.

June 1, 1905.

The United States Circuit Court decided that ground sesame seed or sesame pulp from which the oil has not been extracted is free of duty as "sesame oil" under paragraph 626 of the free list of the tariff. The assessment of duty at 20 per cent. *ad valorem* as a "manufactured article unenumerated" under Section 6 was overruled on the ground that it is commercially known as sesame oil, although a more refined product is also known under the same name.—R. W. M.

## XIII. C.—INDIA-RUBBER, Etc.

## GUTTA-PERCHA AND RUBBER TRADE OF SINGAPORE.

U.S. Cons. Rep., No. 2296, June 29, 1905.

Gutta-percha exports to the value of 6,570,000 dols. were shipped from Singapore in 1903, coming chiefly from Dutch North Borneo, Penang, and Sumatra, and a smaller amount from the Sulu Archipelago. Of the amount exported, 3,891,464 dols. worth went to Great Britain, 2,213,019 dols. worth to Germany, and 207,131 dols. worth to the United States. The statistics for 1904 are not yet complete. In 1903 Singapore exported 236,297 dols. worth of india-rubber (nearly all to Great Britain) and 1,108,989 dols. worth of Borneo rubber, of which 336,121 dols. worth went to Austria, 372,922 dols. worth to the United States, 216,150 dols. worth to Great Britain, and smaller amounts to Japan, France, Italy, and Germany. The shipments of Borneo rubber during 1904 have considerably increased.

## XIV.—SUGAR, STARCH, GUM, Etc.

## SUGAR PRODUCTION OF MEXICO.

For. Off. Ann. Series, No. 3429.

The production of molasses in Mexico during the year 1903-04 was 69,418 metric tons, and of sugar, 107,547 metric tons. The production of sugar in the Republic

of Mexico during the last five years was:—1899-1900, 75,000 tons; 1900-01, 95,000 tons; 1901-2, 103,000 tons; 1902-03, 112,000 tons; 1903-04, 107,000 tons.

As will be seen by this statement there has been a shortage in the production of 1903-04 on that of 1902 of about 5000 tons, due to the fact that in the State of Morelos there was a shortage of about 4000 tons at Oaxaca about 2000 tons, but on the other hand Puebla increased 1000 tons. It is feared that owing to continual rains which have fallen during the whole of the latter part of 1904 and also during the first part of 1905 this crop will also be a short one. The estimate of this year's crop is put down at 115,000 tons.

Much of the sugar from the State of Morelos has been exported to the United Kingdom, and Morelos fetches a good price in the local market, from 13 to 14 p. per arroba (3s. per 25 lbs.).

## SUGAR PRODUCTION OF ROUMANIA.

For. Off. Ann. Series, No. 3432.

At present there are five sugar refineries in Roumania, viz., Roman, Marasesti, Chitila, Repiceno (Bote Săscut), and their annual output is said to be from 10 to 20,000 tons. About 75 per cent. of the sugar cubes and the remainder crushed and in loaves. Labour employed on the beet-fields is mostly from large percentage being Hungarian. The men receive 1 fr. 50 c. to 1 fr. 60 c. per day, and the girls employed in cutting up beet receive 70 to 80 c. In order to put the present refineries the Government have decided to grant no further licenses for new enterprises. The crop for 1904 equalled only about two-thirds of that of 1903. The figures were:—1900, 236,580 tons; 1901, 254,780 tons; 1902, 130,830 tons; 1903, 208,480 tons; 1904, 145,090 tons.

## XVII.—BREWING, WINES, SPIRITS, Etc.

## BREWING AND DISTILLING IN JAPAN.

U.S. Cons. Rep., No. 2291, June 23, 1905.

The only distilled liquor produced in Japan is "shochu," distilled from rice, just as the natural beverage "sake" is brewed from the same material. The product "shochu" for 1902 amounted to 5,161,000 galls., is rather difficult to ascertain the number of distilleries as the liquor is generally manufactured by the brewers as a side line. Distilling is conducted in a simple fashioned style. No distillery of foreign spirits, whisky and brandy, has yet been started in Japan. In recent years the manufacture of spurious foreign liquors by the mixture of alcohol has prevailed, but owing to the imposition of a heavy import duty on alcohol the business has undergone a check.

In 1902 there were fifteen small manufacturing distilleries, the total output amounting to only 5888 galls. There are more than 20,000 "saké" brewers in the country, and the consumption of "saké" from the Government derives a large revenue, does not diminish, despite the gradual increase of tax on the output of "saké" in 1902 was 160,433,258 galls.

Until about fifteen years ago there were only one beer brewery in Japan, but in 1902 the number increased to seven. The output of beer in 1902 was 3,614,526 galls. The rapidity with which the consumption of beer has increased among the Japanese is remarkable. At first all the breweries were getting their supply of malt from abroad, but at present several breweries are making malt from Japanese barley.

## SPIRITS; EXCISE DUTY ON FOREIGN — IN CAPE COLONY.

Bd. of Trade J., July 6, 1905.

The Cape of Good Hope Government Gazette for 2nd June last contains the "Additional Taxation Act, No. 26 of 1905," which was assented to on 1st June.



et in question provides than an Excise Duty of proof gall.\* shall be imposed, with effect from June, 1905, on foreign spirits sold, removed or d of in Cape Colony. The term "Foreign Spirits" include spirits manufactured in any Colony or terri- Customs Union from the growth or produce of olony or Territory.

duty is increased proportionately if the strength is above

## XX.—FINE CHEMICALS. Etc.

### CITRAL; A NEW SOURCE OF —.

*Chem. and Druggist*, 1905, 67, 17—18.

ie present time nearly the whole of the lemon-grass essence comes from the native States of Travancore chin, the annual exports from these States being in 3000 cases. A slight falling off in the exports ochin is shown in the latest returns, the figures for od and half of 1904 being 1340 cases, as compared 136 and 1490 cases in the corresponding periods of nd 1902. Lemon-grass is grown in Ceylon, but hat is small. At a recent meeting of the Agri- l Society in that island, Mr. H. Wright stated that rass and citronella can be cultivated successfully levation of 2000 ft. in the Central Province, equally id in some cases better yields of oil being obtained the more low-lying places in the south and South- rovinces. In view of the high price of lemon- J. endeavours have been made to find a substitute s a source of citral for the manufacture of ionone. sential oil of *Backhousia citriodora* containing cent. of citral (see this J., 1905, 689, 749) would e to be quite satisfactory in this respect if regular s can be furnished.—A. S.

### BERGAMOT OIL.

*Oil and Colourman's J.*, July 1, 1905.

field of bergamot oil this season is only from 40 to cent. of that of last season, hence the rapid rise n. The ester value is not more than 35 to 38 per cept in a few isolated cases, when 38 to 40 per eached. The future position of this oil depends on the next flowering, which will very possibly scanty.

## Patent List.

—In these lists, [A.] means "Application for Patent," and Complete Specification Accepted."

e a Complete Specification accompanies an Application, an is affixed. The dates given are (i) in the case of Applica- r Patents, the dates of application, and (ii) in the case of e Specifications Accepted, those of the Official Journals e acceptances of the Complete Specifications are advertised elete Specifications thus advertised as accepted are open to on at the Patent Office immediately, and to opposition two months of the said dates.

## -PLANT, APPARATUS, AND MACHINERY.

A 3,805A. Massey (Massey-Harris Co., Ltd.). Liner for centrifugal separators. July 8.

13,763. Lane. Furnaces. [U.S. Appl., July 5, 1904.]\* July 4.

[A.] 14,092. Liddiard. Construction of acid-proof vessels for distilling and other purposes.\* July 8.

" 14,099. Hatmaker. Concentrating or drying liquid mixtures or solutions of inorganic substances. July 8.

" 14,278. Royle. Mode and apparatus for drying peat and other mixtures of solids and liquids. July 11.

" 14,327. Moll. See under VII.

" 14,379. Boulton (Milwaukee Evaporator Co.). Evaporating apparatus.\* July 12.

" 14,413. Humphrey. Apparatus for charging fluids with gases. July 13.

" 14,572. De Laval. Processes for obtaining a violent chemical reaction between materials and apparatus therefor. [Appl. in Sweden, July 19, 1904.]\* July 14.

" 14,584. Glassford. Apparatus for separating liquids of different densities. July 15.

[C.S.] 15,776 (1904). Ogle, and the Cyanide Vacuum Filter Co. Apparatus for the separation of liquids from solids, particularly applicable to the extraction of metals from their ores. July 19.

" 16,652 (1904). Challis. Filters, filtering media, and matters appertaining thereto. July 12.

" 19,092 (1904). Duckworth. Apparatus for mixing granulated, powdered, or similar substances or fluids. July 12.

" 865 (1905). Gayley. Method of extracting moisture from air and other gases for use in the arts. July 19.

" 4369 (1905). Wolff. See under IX.

## II.—FUEL, GAS, AND LIGHT.

[A.] 11,971A (1904). Clay. Production of combustible fluids for power purposes. July 13.

" 12,160A. Eveno. See under XI.

" 13,826. Hutchins. Producer gas generators. July 5.

" 13,914. Connell, Haldane and Thomson. Treatment of the liquid distillery refuse known as "pot ale" or spent wash, brewery yeast, and the like for the production of fuel therefrom. July 5.

" 14,061. Shrewsbury. Process for producing compressed non-porous briquettes or blocks of coke. [U.S. Appl., Aug. 15, 1904.]\* July 7.

" 14,090. Towns. Gas producers.\* July 8.

" 14,098. Anderson, and Kynoch, Ltd. Suction gas producers. July 8.

" 14,137. Jouques. Manufacture of briquettes from coal dust. July 8.

" 14,264. Griffin. Suction gas apparatus. July 11.

" 14,334. Illy. Apparatus for supplying and vaporising water for gas generators.\* July 11.

" 14,405. Gasmotoren-Fabr. Deutz. Production of motor fluid for gas turbines from bituminous coal. [Ger. Appl., July 13, 1904.]\* July 12.

" 14,414. Lachomette. Coking ovens. July 12.

" 14,485. Coppée. Regenerative coke ovens. July 13.

" 14,498. Fielding. Gas producers. July 14.

" 14,575. Foster and Greener. Gas producers. July 14.

[C.S.] 18,975 (1904). Roberts and Anstey. Apparatus for the manufacture of generator gas. July 19.

" 19,183 (1904). Brotherhood. Producer gas manufacturing apparatus. July 19.

" 22,917 (1904). Oliphant and Scott. Apparatus for converting oil into gas. July 19.

- [C.S.] 351 (1905). Wagner. Process for the preparation of compounds for fuel briquettes. July 19.  
 „ 1816 (1905). W. and J. George, Ltd., and George. *See under VII.*

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [A.] 14,294. Fell (Korndörfer). Manufacture of emulsifying mineral oils and mineral oil soaps. July 11.

### IV.—COLOURING MATTERS AND DYESTUFFS.

- [A.] 13,804. Ransford (Cassella und Co.). Manufacture of polyazo colours. July 4.  
 „ 13,950. Lake (Oehler). Manufacture of brown sulphur dyes.\* July 6.  
 „ 14,189. Tompkins. Production of indigo and indigo producing substances. July 10.  
 „ 14,543. Huray (Meister, Lucius und Brüning). Manufacture of red, dark red to violet sulphurised dyestuffs. July 14.  
 „ 14,578. Johnson (Badische Anilin und Soda Fabrik). Manufacture of new compounds of the anthracene series and colours therefrom, and their application in dyeing and printing. July 14.  
 „ 14,618. Nuth, Hold and Ruegg. Process for the preparation of new raw materials and of new azo dyestuffs. [Fr. Appl., July 16, 1904.]\* July 15.  
 [C.S.] 23,072 (1904). Newton (Bayer und Co.). Manufacture of new tetrazo dyestuffs. July 19.  
 „ 82 (1905). Imray (Soc. Chem. Industry in Basle). Manufacture of azo dyestuffs for wool. July 19.  
 „ 12,854 (1905). Johnson (Badische Anilin und Soda Fabrik). Production of indigo. July 12.

### V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 13,714. Henry. Processes of cold dyeing especially by means of new pigmentary and interferential colours.\* July 3.  
 „ 13,952. Soc. Schmid Frères. Process and apparatus for ungumming, bleaching and dyeing silk. [Fr. Appl., July 27, 1904.]\* July 6.  
 „ 14,023. Serek. Chemical colour printing process. July 7.  
 „ 14,193. Brown and Young. Impregnating or coating goods or material with a liquid or semi-liquid substance. July 10.  
 „ 14,202. Abel (Act.-Ges. f. Anilinfabr.). Dyeing hairs. July 10.  
 „ 14,480. Nitritfabrik Ges. m.b.H. Process for mordanting wool. [Ger. Appl., July 14, 1904.]\* July 13.  
 „ 14,626. Castle. Filling and finishing textile fabrics, also applicable to the sizing of yarns. July 15.  
 [C.S.] 16,313 (1904). Boulton (Poisson). Method of retting and washing textile fibres. July 19.  
 „ 18,742 (1904). Kraus, and the Bradford Dyers' Association, Ltd. Nitrocellulose solutions for use in the treatment of fabrics. July 12.  
 „ 2192 (1905). Lacroix. Manufacture of artificial silk. July 12.

- [C.S.] 4534 (1905). Denis. Apparatus for producing threads from collodion and recovering the solvents employed. July 19.  
 „ 6199 (1905). O'Kassa. Washing and scouring machines. July 19.  
 „ 10,448 (1905). O'Brien (L'Huillier). Apparatus for dyeing yarns in cops and pirns. July 19.

### VI.—COLOURING WOOD, PAPER, LEATHER,

- [C.S.] 19,989 (1904). Nusch (Sorel). Dyeing process for skins for glove making and other uses. July 19.

### VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 13,619. Holloway. Process for the production of zinc oxide from solutions of zinc salts. July 19.  
 „ 14,282. Peel. Apparatus for slaking and deliming. July 11.  
 „ 14,327. Moll. Apparatus for evaporating and at the same time producing high pressure steam.\* July 11.  
 „ 14,409. Biguet. Process and apparatus for extracting arsenious acid from ores. [Fr. Appl., July 1904.]\* July 12.  
 „ 14,541. Potter. Manufacture of silicon monoxide. [U.S. Appl., Dec. 30, 1904.]\* July 14.  
 „ 14,573. Howorth (Soc. Anon. Metallurgique des cédés de Laval). *See under X.*  
 [C.S.] 18,899 (1904). Piolunowsky. Manufacture of alkali and alkaline earth carbonates and salts therefor. July 12.  
 „ 1816 (1905). W. and J. George, Ltd., and George. Apparatus for generating sulphuretted hydrogen and other gases. July 19.

### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 13,886. Colloseus. Treatment of blast furnace slag for production of a material similar to concrete.\* July 5.  
 „ 13,912. Thomson. Manufacture of artificial silicate and lime sand bricks. July 6.  
 „ 14,239. Harcastle, and Kay, Bros., Ltd. Compound which forms an emulsion with water, to be applied to roads, &c., for preventing wear. July 11.  
 „ 14,282. Peel. *See under VII.*  
 „ 14,288. Jacobs. Building materials. [U.S. Appl., March 9, 1903.]\* July 11.  
 „ 14,298. Propper. Artificial building stone. July 11.  
 [C.S.] 24,451 (1904). Boulton (Hülsberg und Co.). Impregnation of wood and other porous materials. July 19.  
 „ 2467 (1905). Brown. Manufacture of cement, building composition, and other articles made from like material. July 19.  
 „ 4369 (1905). Wolff. Apparatus for drying tiles, cement, peat, timber, and like materials. July 19.  
 „ 9221 (1905). Thom. Manufacture of artificial marble, dolomite and the like. July 12.

### X.—METALLURGY.

- [A.] 13,613. Hobson. Silver alloys.\* July 3.  
 „ 13,626. Gebauer and Zenzen. Process for refining or modifying the blown molten iron in a converter for cast steel.\* July 3.



- 13,687. Channet. Alloys applicable for jewellery and for soldering. \* July 3.
- 13,811. Davies and Clark. Method of welding iron or steel and of welding or coating them with other metals and fluxes employed for that purpose. July 4.
- 13,955. Zimmer. Apparatus for cleaning and separating minerals. July 6.
- 14,068. Rawson and Elmore. Process for extraction of gold from solutions. July 8.
- 14,330. Richardson. Method of brazing metals. [U.S. Appl., Aug. 1, 1904.]\* July 11.
- 14,331. Heskett. Process and apparatus for obtaining metals from their sulphides. July 11.
- 14,365. McLean. Soldering of platinum and platinum alloys by means of platinum. July 12.
- 14,377. Jones, White and Salter. Aluminium solder and flux. July 12.
- 14,573. Howorth (Soc. Anon. Metallurgique Procédés de Laval). Process of extracting zinc or zinc oxide from its ores. July 14.
- 14,574. De Laval. Process of extracting iron from its ores. July 14.
- 15,577 (1904). Nicholas. Recovery of metals from ores and other material. July 19.
- 15,776 (1904). Ogle, and Cyanide Vacuum Filter Co., Ltd. *See under I.*
- 16,028 (1904). Johnson (De Moya). Manufacture of steel. July 19.
- 17,624 (1904). Leisel and Küpper. Material applicable for soldering and coating metals. July 19.
- 17,034 (1904). Esser. Ore concentrators. July 12.
- 19,374 (1904). Sulman, Picard and Ballot. Separation of metalliferous minerals from gangue. July 19.

#### ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- 2,160A. Eveno. Electrolytic process for obtaining fixed gases from any suitable carburant. July 12.
- 3,689. Gardner (Thoresen and Tharaldsen). Method of deviating or drawing out arcs or electric discharges and apparatus for chemical decomposition and combination of gases by means of such deviated or drawn arcs or discharges.\* July 3.
- 3,690. Girod. Electric furnaces. [Fr. Appl., July 4, 1904.]\* July 3.
- 3,808. Cowper-Coles. Electrolytic production of metallic sheets, tubes, wire, strip, &c. July 4.
- 14,129. Luis and Lark. Primary batteries. July 8.
- 14,214. Kjellin. Electric furnaces. [Swiss Appl., July 11, 1904.]\* July 10.
- 14,333. Girod. Electric furnaces.\* July 11.
- 18,840 (1904). British Thomson-Houston Co. (General Electric Co.). Processes of electro-deposition. July 19.
- 3525 (1905). Birkeland. Apparatus for producing electric reactions in gases by aid of electric arcs. July 19.

#### FATTY OILS, FATS, WAXES, AND SOAP.

- 13,790. Barnes. Soaps. July 4.
- 14,294. Fell (Korndörfer). *See under III.*

- [A.] 14,339. Ralph and Bedford. Manufacture of soap. July 12.
- „ 14,340. Ralph and Bedford. Process for the manufacture of glycerin. July 12.
- [C.S.] 20,185 (1904). Ambleston. Apparatus for removing or extracting the oil or oily fibre from nuts, e.g., palm nuts. July 19.
- „ 23,187 (1904). Markel. Process and apparatus for producing bars of soap. July 19.

#### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc

##### (A.)—PIGMENTS; PAINTS.

- [A.] 13,617. Tomlins and Bowley. Self cleansing compositions for prevention of fouling of ships' bottoms. July 3.
- „ 14,202. Dunnett, Nelson and Nelson. Anti fouling paints and compositions. July 10.
- „ 14,611. Dunnett, Nelson and Nelson. Anti-fouling paint or compositions. July 15.

#### XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

- [A.] 14,402. Bigland. Manufacture of size from resin and other materials and bye products and apparatus therefor. July 12.

#### XVII.—BREWING, WINES, SPIRITS, Etc.

- [A.] 13,914. Connell, Haldane and Thomson. *See under II.*
- „ 14,103. Rice. Art of producing malt.\* July 8.

#### XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

##### (A.)—FOODS.

- [A.] 13,861. Kronheim. Preparation of a substitute for coffee.\* July 5.
- „ 13,931. Héritte. Preservation of organic substances. July 6.
- „ 13,948. Morel. Process and apparatus for the production of gluten in the dry state. [Fr. Appl., July 6, 1904.]\* July 6.
- „ 14,444. Wendt. Process for improving the burning and rendering soluble of cocoa beans. [Ger. Appl., Dec. 19, 1904.]\* July 13.

##### (B.)—SANITATION; WATER PURIFICATION.

- [C.S.] 18,484 (1904). Hawliczek. Purification of distillery and like refuse effluents. July 19.
- „ 10,382 (1905). Commin. Installation for the septic tank treatment and filtration of sewage. July 19.

#### XIX.—PAPER, PASTEBOARD, Etc.

- [A.] 14,385. Gagedois. Production of white pulps from natural vegetable matter or with coloured or dyed waste material for use in paper making.\* July 12.
- „ 14,459. Fearnley. Strainer for paper pulp. July 13.
- [C.S.] 14,839 (1904). Grimoin-Sanson. Treatment of cork for the manufacture of cork fabrics. July 12.
- „ 18,742 (1904). Kraiss, and the Bradford Dyers' Association, Ltd. *See under V.*

XX.—FINE CHEMICALS, ALKALOIDS,  
ESSENCES, AND EXTRACTS.

- [A.] 13,618. Roden and Wilkinson. Means for rendering Droitwich brine suitable for medicinal purposes. July 3.
- „ 14,161. Traube. Process of producing dialkylmalonylurea. [Ger. Appl., July 13, 1904.]\* July 10.
- „ 14,316. Mettler. Manufacture of aromatic alcohols and ethers by the reduction of aromatic esters. [Ger. Appl., July 15, 1904.]\* July 11.
- „ 14,542. Imray (Meister, Lucius und Brüning). Manufacture of  $\Delta_4$ -cyclohexanic acid. July 14.
- [C.S.] 19,568 (1904). Tompkins. Production of symmetrical tetrachlorethane and chlorethylenes from acetylene. July 19.
- „ 24,672 (1904). Imray (Soc. Chem. Industry in Basle). Manufacture of crystallised methyl and ethyl salicylglycollates and of a product therefrom for use in therapeutics. July 19.
- „ 9550 (1905). Chem. Fabr. auf Actien, vorm. E. Schering. Manufacture of camphor. July 19.

XXI.—PHOTOGRAPHIC MATERIALS AND  
PROCESSES.

- [A.] 14,449. Ponton and Horne. Production of color effects on photographic emulsions on any surface from the action of fluorescent or phosphorescent states of matter. July 13.
- [C.S.] 9246 (1905). Sandell Films and Plates, Ltd., and Smith. Photographic plates and films. July 13.

## XXII.—EXPLOSIVES, MATCHES, Etc.

- [A.] 13,901. Silberrad. Explosives.\* July 5.
- „ 13,969. Silberrad. Explosives. July 6.
- „ 14,481. Bichel. Manufacture of safety explosives. July 13.
- „ 14,545. Imperiali. High explosives.\* July 13.

## XXIII.—GENERAL ANALYTICAL CHEMISTRY

- [A.] 14,232. Newton. Process for the rapid analysis of air. July 11.



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Kingzett, C. T.; Journals to Sanitas Co., Ltd., Locksley Street, Limehouse, E.

Lachmann, Arthur; Journals to Charles Ash, address as before.

Langstaff, Wm., 1/o Tremley; Grasselli, N.J., U.S.A.

Major, Ernest, 1/o Glossop Street; Balmain Post Office, Sydney, N.S.W.

Marsh, John, 1/o Grays; 29, High Street, Maidstone, Kent.

Morris, J. Haydn; all communications to 18, Travessa da Amoreira, Pampalha, Lisbon.

Nathan, Major F. L.; now Lt.-Col. F. L. Nathan, address as before.

O'Brien, Claude H., 1/o Fiji; Bureau of Central S. Mills, Brisbane, Queensland, Supervising Chemist.

Otsuki, Prof. C., 1/o Berlin; 16, Shinsuwachō, Kōkawaku, Tokyo, Japan.

Patterson, E. V., 1/o Baltimore; Hotel Wolcott, New York City, U.S.A.

Roseburgh, Prof. T. R.; Journals to 203, Kirk Avenue, Syracuse, N.Y., U.S.A.; communications as before.

Speyer, Jas.; Journals to Librarian, University Student Society, 184, Eldridge Street, New York, U.S.A.

Stevenot, G. A., 1/o New York City; c/o H. A. Metcalf, Co., 4, North Clark Street, Chicago, Ill., U.S.A.

Trobridge, A., 1/o Gateshead; Trobridge and Co., Heworth Shore, Felling-on-Tyne.

Wachtel, G., 1/o St. Petersburg; retain Journals.

Watson, Charles, 1/o Glasgow; c/o Josiah H. Ltd., Aston Church Road, Birmingham.

### Member Omitted from List.

1903. Holde, Dr. D., Königl. Materialprüfung Grosser Lichterfelde W., Germany, Principal

### Annual General Meeting.

(Continued.)

Dr. W. H. Nichols has received the following reply to the telegram sent to President Roosevelt on the occasion of the Annual Dinner:—

Department of Science,  
Washington,  
July 16th, 1905.

Sir,

I am directed by the President to acknowledge with deep appreciation, the receipt of your telegram of the 12th inst., stating that, at a dinner of the Society, his health, proposed by the Lord Chief of England, had been enthusiastically received as conveying an expression of sympathy in view of the death of the late Secretary of State.—I am, Sir, obedient Servant,

(Signed) ALVEY A. ALLEN,

To W. NICHOLS, Esquire,

President, Society of Chemical Industry,  
Hotel Russell, London, England.

THURSDAY, JULY 13TH, 1905.

About 250 members and guests of the Society travelled to Haslemere, whence they proceeded to Lytham where they were entertained by Mr. and Mrs. R. Garton. The house is beautifully situated, almost on top of Blackdown; from the grounds and cricket ground adjoining, magnificent views of the Sussex Weald were obtained. During luncheon, the pipers of the Seaforth Highlanders played on the lawn, and the band of the regiment performed a selection of music during the afternoon; a sword dance and Highland reel were



ed. The American and Canadian members visited h, the home of the late Lord Tennyson, over which re conducted by Lord and Lady Tennyson. Parties members also went on motor cars to Hindhead and vil's Punch Bowl, from which points splendid f the surrounding country were obtained.

o evening, a reception was given by the President inel of the Royal Society, at Burlington House, as attended by a large number of members. Among eets of interest on view were busts of King H. (Founder of the Society), King George III., ewton, Faraday, and Davy; portraits of Franklin, Wheatstone, Joule, Faraday, Dalton, Graham, Davy, and many others. In the principal ere seen the mace, charter book and original seal Royal Society, and examples of books from its brary. The following instruments were also d:—Air-pump with double barrel, said to have esented by Boyle in 1662; Huygens aerial tele- esented in 1671; an object glass of 170 ft. focal y Huygens; an object glass by the same for a e of 210 ft.; a chronometer by Arnold, which ined Cook on his second and third voyages; battery made in a tailor's thimble by Wollaston; l machine, constructed by Priestley; original 'Davy's miners' safety lamp; mountain barometer Darwin in his voyage round the world in H.M.S. apparatus used by Graham in his principal es between 1834 and 1866, (i.) tubes with discs ate and hydrophane for experiments on diffusion (ii.) apparatus used for ascertaining the diffusion liquids, (iii.) apparatus used in researches on pressure, (iv.) apparatus used in experiments on or liquid diffusion applied to analysis, (v.) reser- om pressed air by aid of which capillary liquida- in relation to chemical composition was in- ed, (vi.) tube atomlyser for the separation of gases sion, (vii.) waterproof silk bag for dialysis of air, d in experiments on absorption and dialytic on of gases by colloid septa, (viii.) thermometer d by half degrees from 36° to 92° F. The appa- ed by Andrews, of Belfast, in his experiments on ensation of gases, with the aid of which he deter- e critical point of carbon dioxide (1869) was also d.

g the evening Dr. Wm. H. Nichols presented a of Lord Kelvin, executed on cameo glass, to the it of the Royal Society, who accepted it on behalf ociety. Lord Kelvin gave many sittings for this

#### FRIDAY, JULY 14TH.

CITY CHURCHES. Leader: Mr. THOS. TYRER.

##### *The Charterhouse.*

Master of the Charterhouse, the Rev. Dr. Haig received the visitors in the chapel, and gave a ion and history of the Charterhouse. The com- includes the Master and 55 brethren, or hospitalers. rterhouse is no longer a school as in former times, revenues have increased to such an extent that, of the original 40, 800 scholars are now educated sed at the new Charterhouse at Godalming, which the six great public schools of the country. Many oldiers, divines, historians, and novelists were d at the Charterhouse, notably Thackeray, who e place in his novel, "The Newcombes." Mrs. own conducted the party through the residential ents which contain pictures and objects of interest bly connected with the Charterhouse. Mr. J. the Registrar, kindly exhibited old documents, ents and letters of Wesley, and others who were d here.

##### *St. Bartholomew the Great.*

church was founded much earlier than the Charter- The visitors were received by the Rector, the r Borrodaile Savory, Bart., and Mr. E. A. Webb, Churchwarden. Mr. Webb described the building viciisitudes, the encroachments upon it in the

16th and 17th centuries, and the means taken to restore its original beauty. He then showed the monuments, notably that of Rahero, the founder. Some idea of the encroachments, now removed, may be obtained when one learns that a fringe factory stood over the altar, and a blacksmith's forge occupied a side chapel in which the present rector saw horses regularly shod. The crypt has been recently cleared, and now serves as a mortuary chapel.

Thence the party proceeded to St. Bartholomew's Hos- pital, passing on the way the spot where the Martyrs were burned at the stake, and in memory of which a tablet has been placed on the wall of the hospital. The noble staircase is adorned by Hogarth's pictures illustrating the life of Rahero, mentioned above, and the Hall contains portraits of celebrated physicians and surgeons, and notably one of H.M. the King, presented by himself, on retiring from the presidency of the hospital.

##### *St. Giles', Cripplegate.*

The Rev. Prebendary Barff, M.A., conducted the party over the church, which has been thoroughly restored. A notable alteration has been made in the north front of the Church by the removal of old shops and the ancient Quest House. The roadway has been thereby widened and on part of the space or forecourt, a statue of Milton—who was buried within the Church—has been erected. The muniments and archives contain an entry of the marriage of Cromwell, and register of Milton's burial. The register of burials during the plague is marvellous for its clearness and accuracy, seeing that more than 2,500 burials took place in one month in the churchyard. The churchyard also contains a complete bastion of the ancient City Wall.

Luncheon was taken at the Guildhall Tavern, after which the party joined another group at the Guildhall.

(2) THE OLD CITY. Leader: Mr. BRYAN CORCORAN.

The interesting sights included St. Magnus the Martyr (the passage still under this tower formerly led on to old London Bridge); the Monument; the wholesale Fruit Market; Billingsgate Fish Market in full swing (among the congested narrow lanes in a secluded court, Sir Christopher Wren's house still exists); Coal Exchange, where Roman remains are preserved: the spire of St. Dunstan's in the East; and the Custom House. The party drove by way of Lower Thames Street, past Galley Quay to the Tower of London, where they were received by General Sir Hugh and Lady Gough at St. Thomas' Tower, and afterwards conducted round the special sights in the Tower; then across Tower Hill to a portion of the old City Wall, along Cooper's Row and Crutched Friars, to another part of the Wall, now being partially pulled down, where samples of Roman materials 2,000 years old were provided for visitors to take away with them; St. Olave's, Hart Street (Pepys' Church) where the party was received by the Rector, the Rev. A. B. Boyd Carpenter, M.A. The very interesting monuments were explained by Mr. Corcoran and Mr. T. Pallester Young. The original Gate way of the Old Navy Office, old business premises, and the old Ambassador's house were seen; the party thon proceeded to Allhallows Barking (Laud's church), where they were received by the Vicar, the Rev. A. W. Robinson, B.D., who personally described the church, and showed William Penn's entry in the register, &c. The Corn Exchange, in Mark Lane, was seen during its busiest market hours. After inspecting the tower of Allhallows Staining (the church has been pulled down), and lunching at the London Tavern, Fenchurch Street (where the dish and cover used by Queen Elizabeth are still shown), the party drove to Guildhall, where they were received by the librarian, Mr. C. Welch, who showed them the principal objects of interest.

(3) ST. PAUL'S, WESTMINSTER ABBEY AND THE TOWER.

Leader: Mr. C. G. CRESSWELL.

Another party attended morning service at St. Paul's Cathedral, after which Archdeacon Sinclair took them to the crypt, in which lie the remains of Sir Christopher Wren,

Lord Nelson, the Duke of Wellington, and many other eminent men. The classic sarcophagus of Nelson was originally made for Cardinal Wolsey and placed in readiness in the Wolsey Chapel at Windsor. Wolsey, however, died in disgrace and was buried at Leicester, and his sarcophagus was used for Henry VIII. When George III. converted the Wolsey Chapel into a burial place for the Guelph dynasty, Henry VIII.'s body was placed in a tomb more in keeping with the style of the building, and the vacant sarcophagus was sent to St. Paul's and now holds the remains of Lord Nelson. The monuments of Nelson, Wellington, and Gordon in the Nave and of Creighton in the South Choir Aisle were also shown. The party then proceeded to the Tower of London, where they were received by General Sir Hugh Gough, V.C., G.C.B. (Keeper of the Regalia), and Lady Gough at their residence in St. Thomas' Tower. They were shown the regalia, the Bloody Tower and the White Tower, with its fine Norman Chapel, its armouries and dungeons. A visit to the Church of St. Peter ad Vincula, with its memorials of those who perished within the precincts of the Tower completed the survey. The President, Lady Ramsay, and others were afterwards entertained at luncheon by Sir Hugh and Lady Gough. The remainder of the party lunched at the Westminster Palace Hotel, and then proceeded to the Deanery, where they were received by the Dean of Westminster, the Very Rev. Armitage Robinson, who first showed the "Jericho" parlour with its antique stained glass windows, and then the "Jerusalem Chamber," the "withdrawing room" of the Abbots of Westminster. The party next proceeded to the Abbey, and inspected the Chapel and shrine of Edward the Confessor, Henry VII. Chapel, and all the famous monuments, including the tomb where Queen Elizabeth and Queen Mary rest together, and that of Mary Queen of Scots. After a visit to some of the chapels and the Poets' Corner, the party inspected the great and little cloisters and Westminster School, the Great Hall of which once served as the Monks' dormitory.

In the afternoon His Majesty the King received the following gentlemen of the Society of Chemical Industry:—Dr. W. H. Nichols, of New York, President; Professor C. F. Chandler, Columbia University, Past President; Sir William Ramsay, Past President; Dr. E. Divers, President-Elect; Mr. A. Gordon Salamon, Chairman London Section; and Mr. Julian L. Baker, Hon. Sec. London Section.

At 4 p.m. Mr. and Mrs. J. Fletcher Moulton gave a garden party to the members and their friends, at their London residence, 57, Onslow Square, South Kensington, S.W. Afterwards the American Ambassador, Mr. Whitelaw Reid, received a large number of members of the Society at Dorchester House, Park Lane.

In the evening some 200 members paid a visit to the Coliseum, St. Martin's Lane.

#### SATURDAY, JULY 15.

About 400 members and ladies paid a visit to the works of Messrs. Burroughs, Wellcome & Co., at Dartford, Kent, and were entertained at the quarter century commemoration fête of the Company at the Wellcome Club and Institute, founded for the benefit of the firm's employees. After fire drill, the chemical department with its vacuum stills of two to three thousand gallons capacity, the works office, the boilers, dynamos, and engineers' department, the powdering, compressing, drying, sugar coating, and packing rooms, the photographic, analytical and pharmaceutical departments and the ample works laboratories, were shown in rapid succession.

The tour of the works being completed, carriages conveyed the visitors to the Wellcome Club and Institute, where, after some aquatic sports, luncheon was served in a marquee for both visitors and employees. Mr. Henry S. Wellcome was in the chair, and Mr. R. Clay Sudlow, the General Manager, occupied the vice-chair.

After luncheon, the toasts of "The King," and "The President of the United States," having been duly honoured, the Chairman proposed the toast of "The Society of Chemical Industry," and Dr. Nichols, in

replying, said that Mr. Wellcome had found the philosopher's stone of technical success, in that he not forget those who worked for him. Prof. I. Armstrong, F.R.S., in proposing "Burroughs, Wellcome & Co.," said that the firm had set a great example in helping the cause of science in every direction. Chairman replied. Mr. A. Gordon Salamon proposed a toast of "Medicine and Pharmacy," which was read by Sir James Dick and Mr. R. A. Robinson, President of the Pharmaceutical Society.

The rest of the afternoon was taken up with a sports of various kinds, after which Lady Mansel contributed the prizes.

Members and ladies dined together at the Crayke Restaurant, and then spent the remainder of the evening at the Naval Exhibition at Earl's Court.

#### SUNDAY, JULY 16TH.

On Sunday morning a number of members and ladies took train from Charing Cross to Canterbury. Lunch at the County Hotel, the party made a tour of the city, seeing St. Augustine's Priory and other remaining objects of interest. At 3 p.m. they attended service at the Cathedral, after which they were escorted by the Dean (the Very Rev. Henry Wace) and Canon Holland round the Cathedral and crypt. Some members and visitors were entertained by Mrs. V. W. at the Deanery, the remainder going to the Hotel. Afterwards the party returned to town.

### Nottingham Section.

Meeting held at Burton-on-Trent, on May 3rd 1900.

MR. J. T. WOOD IN THE CHAIR.

#### A METHOD OF DETERMINING THE PEPTOLYTIC ACTIVITY OF PEPSIN.

BY JAMES O'SULLIVAN.

The activity of pepsin in dissolving albumin in the presence of acid is the only means we have of measuring this enzyme and at the same time of determining its proteolytic action.

To quantitatively determine the activity of pepsin the methods employed are usually (1) To act upon undigested egg-albumin in a hydrochloric acid solution to the end of the experiment to determine the amount of coagulable in the remainder. (2) To act upon coagulated egg-albumin, or blood fibrin, in a hydrochloric acid solution and weigh the undissolved albumin. These methods necessitate filtration from the undigested portion for an inquiry relative to proteolysis, I found this unsuitable, as I had to deal with comparative small volumes of liquid varying much in their rate of filtration.

The method I employed to determine the activity of pepsin is, I think, of sufficient interest to bring before the Society. It occurred to me that the albumin, calculated from the nitrogen which goes into solution in the proteolysis, could be taken as a measure of the activity of pepsin.

In a paper on "The Hydrolytic Functions of Pepsin" (Jour. Chem. Soc. 1892, 927), I pointed out the importance of keeping the yeast in suspension, and in a paper on "The Hydrolytic and Fermentative Functions of Pepsin" (Jour. Fed. Inst. Brew., 1899, 5, 167), I described a specially constructed piece of apparatus, by means of which I was able to conduct two experiments side by side and also to keep the solutions undergoing either



or hydrolysis at a constant temperature and continuously stirred.

digestion of albumin by pepsin has, in common with that mentioned, the necessity for keeping the solvent liquid continuously agitated, and at a constant temperature, and the experiments I shall describe in support of method I employ to determine the activity of pepsin were conducted with the above-mentioned apparatus.

It is obvious that in carrying out experiments, the results of which are based on the quantity of nitrogen goes into solution by the action of pepsin, the amount of nitrogen in the pepsin itself must be known.

Although I determined the nitrogen in the blood fibrin, and egg-albumin, it was not necessary except to verify that the process (Kjeldahl's) for determining nitrogen could be relied upon to give a true measure of the amount of albumin which goes into solution. It is evident that if it is required by this method to determine the influence of any solution containing organic nitrogen on peptic digestion, the amount of this in the solution must be known.

Determinations of the albumin in the pepsin gave 37 per cent., (2) 21.39 per cent., average, 21.63 per

cent. determinations of the albumin in the finely divided blood-fibrin gave (1) 85.9 per cent., (2) 87.9 per cent., (3) 88.3 per cent., or an average of 87.4 per cent.

**Preparation of Egg-Albumin.**—The white of three eggs was carefully separated from the yolk, and the mixture was poured on to a flat-bottomed nickel dish, which covered with a watch glass was placed level on a water-bath in the cold, and the temperature gradually raised till the albumin was coagulated; it was then left to remain on the bath for ten minutes. It is important to cover the albumin with the glass to prevent formation of a hard scum on its surface, which is usually unacted upon by pepsin. Indeed, in my experience, this has a bearing on the digestion of eggs, which, when cooked without the shell. After cooling the albumin, about 3 mm. thick, was cut on the dish into strips with a cork borer 5 mm. in diameter. In this way pieces were obtained of practically equal surface

**Method of Procedure.**—In the apparatus already referred to are two glass cylinders side by side, resting in a water-bath at temperature bath; in each cylinder is a stirrer, driven by an electric motor, whereby their contents are stirred at the same rate. To start an experiment the quantity of hydrochloric acid was poured into the cylinders, and when this attained a temperature of about 1° less than that of the bath, the quantity of pepsin for each experiment was added, and the time

During the digestion a definite quantity of solution was collected without removing any undissolved albumin in the following manner:—A piece of glass tube of sufficient length to reach to the bottom of the cylinder had one end bent at right angles, and was then connected by a piece of rubber tube with a special piece of apparatus corresponding to a test-tube provided with a double bored and glass-tubed rubber stopper. By this means a definite quantity of the solution was drawn into the test tube, and to prevent the dissolved and undissolved albumin from being drawn with the dissolved matter, the end of the glass tube which was immersed in the mixture was restricted to 10 mm. from its end, and this portion was plugged with cotton wool before use. The solution thus collected was removed from suspended matter, and it was easy, when a definite quantity was drawn into the test tube, to stop it by pinching the rubber connection. The solution remaining in the glass tube was then blown back into the test tube with the plug of cotton wool.

It is well known that acids aid the digestion of albumin; one writer, Dr. Gillespie, in his estimable work, "The Natural History of Digestion," speaks of the digestion of proteids by the action of acids aided by pepsin.

I found that four times as much egg-albumin was dissolved by pepsin and hydrochloric acid at 40° C. as by pepsin alone, and that hydrochloric acid alone scarcely any action on blood fibrin.

**The Activity of Hydrochloric Acid and Pepsin on Blood Fibrin.**—(a) 1 gram. of fibrin was added to 200 c.c. of hydrochloric acid (0.25 per cent.) and 0.5 gram. of pepsin, and after 30 minutes' digestion there was dissolved 0.877 gram. of albumin, or 67.7 per cent. After removal of 25 c.c. from which the total albumin in solution was deduced, there was dissolved in the next 30 minutes 0.116 gram. of albumin; allowance being made for the proportion of soluble albumin and albumin in the pepsin in the 175 c.c. at the start of the second 30 minutes. In the remaining 150 c.c., after another hour's digestion, there was in solution, allowance being made as before, 0.660 gram. of albumin. It was found, after 2 hours' digestion that there was a slight apparently insoluble portion and the albumin in this was determined by filtering the 150 c.c. and employing the residue for the estimation; it amounted to 0.014 gram. The albumin thus accounted for in the 1 gram. of blood fibrin is as follows:—

	Gram.
Removed in 25 c.c. after 30 minutes digestion	0.085
Removed in 25 c.c. after 60 minutes digestion	0.1016
In solution in 150 c.c. after 2 hours' digestion	0.6600
In residue .. .. .	0.0140
	0.8606

or 86.06 per cent. in the fibrin against 87.4 per cent. the average it was found to contain.

Is the quantity of albumin dissolved by pepsin-hydrochloric acid from egg-albumin and from blood fibrin in proportion to the amounts of these submitted to its action? To answer this question egg-albumin was employed of which two determinations of its albumin gave (1) 12.79 per cent.; (2) 13.07 per cent.; an average 12.93 per cent.

(b) To 200 c.c. of the hydrochloric acid (0.25 per cent.) and 0.6 gram. pepsin, 5.033 gram. of egg-albumin were added.

(c) To 200 c.c. of the same acid and pepsin 10.066 grms. of egg-albumin were added.

After one hour's digestion there was dissolved in (b) 0.42 gram. of albumin, and in (c) 0.5897 gram. of albumin.

(b) In the 180 c.c. left the amount dissolved in the second hour, allowing for what was already in solution, was 0.0582 gram., and in the 160 c.c. left after this, allowance being made as before, there was dissolved in the third hour 0.1156 gram. of albumin, and in the 140 c.c. left there was dissolved in the fourth hour 0.0183 gram., and in the remaining 120 c.c., after a further digestion of 18 hours, there was in solution 0.4011 gram. of albumin.

An account of the 0.651 gram. of albumin, which the 5.033 grms. of egg-albumin contained and which was dissolved, is as follows:—

	Gram.
Removed in 20 c.c. after 1 hour's digestion ..	0.042
Removed in 20 c.c. after 2 hours' digestion ..	0.0484
Removed in 20 c.c. after 3 hours' digestion ..	0.0642
Removed in 20 c.c. after 4 hours' digestion ..	0.0668
In solution in the 120 c.c. after 22 hours' digestion .. .. .	0.4011
	0.6225

or 12.37 per cent. in the albumin against the average 12.93 per cent., which it was found to contain.

(c) The albumin dissolved per hour for 4 hours in this experiment was determined in a similar manner to that dissolved in (b), and an account of the 1.302 grms. which the 10.066 grms. of egg-albumin contained, and which was dissolved in the 4 hours is as follows:—

	Gram.
Removed in 20 c.c. after 1 hour's digestion ..	0.0589
Removed in 20 c.c. after 2 hours' digestion ..	0.0878
Removed in 20 c.c. after 3 hours' digestion ..	0.1097
In solution in 140 c.c. after 4 hours' digestion	0.8659
	1.1223

(d) To 200 c.c. of the hydrochloric acid and 0.5 gram. of pepsin 2 grms. of blood fibrin were added, and (e) to a similar solution 1 gram. of fibrin was added.

In 1 hour there was dissolved in (d) 1.687 grms. of albumin, and in (e) 0.8117 gm. of albumin.

From the experiments in which it is shown, by the nitrogen which goes into solution that practically the whole of the albumin is accounted for, I conclude Kjeldahl's process can be used to determine the nitrogen in the soluble products and that this nitrogen, as such, or calculated as albumin ( $N \times 6.25$ ), can be taken as the measure of the proteolytic action of pepsin.

The quantity of coagulated egg-albumin submitted to the action of pepsin does not appear to influence the amount dissolved in the early stage of proteolysis; however, as time goes on the quantity dissolved bears a relation to the initial amount. This is no doubt due to the fact that as the agitation proceeds the pieces of egg-albumin are made smaller by attrition which favours the contact of enzyme, acid and albumin. Blood fibrin dissolves more rapidly than egg-albumin in consequence of it being more finely divided to start with than the egg-albumin.

If we go back to the early history of pepsin, we find that until Prout, Tiedemann and Gmelin made the discovery that hydrochloric acid was present in the stomach, little was known of the action of pepsin although there was of gastric juice. Gastric juice was found to possess high solvent action on albumin, but pepsin isolated from it showed little action in the absence of hydrochloric acid. In the paper above referred to (*Jour. Chem. Soc.*, 1892, 934) I drew attention to a difference between the hydrolytic action of yeast and that of invertase prepared from it. Fernback (*Ann. Inst. Pasteur*, 9, 90) and O'Sullivan and Tompson (*Jour. Chem.*, 1890, 57) were unable to find any relation between the amount of invertase employed and its hydrolytic action until the "proper quantity of acid was used," Harden (*Jour. Inst. Brewing*, 1905, 11, 12) says that zymase—yeast juice—is capable of being divided by dialysis into a filtrate, and a residue neither of which, practically speaking, has any fermentative action on glucose; but if these are mixed the action on glucose is again comparable with that of the original yeast juice. He infers from this, if his results are confirmed, that it points to the necessity of a co-ferment. Yeast juice, when freshly prepared, is acid, as a rule, invertase is always alkaline, and in Harden's work there is no mention of the relative acidity of the residue and filtrate. It is most probable that the reason why the residue he obtained did not ferment the glucose was that the acidity was removed in the filtrate. Pepsin and invertase are enzymes which require acidity in order to obtain their maximum activity; may not zymase have a similar property?

#### DISCUSSION.

Mr. J. T. WOOD said that in experiments made by him on skins with pepsin, he had found the action so small that he had given up its use in favour of the more powerful trypsin. It seemed to him that hydrochloric acid alone at a sufficiently high temperature would produce the same effect as pepsin, while hydrochloric acid of the same strength as gastric juice had no action on albumin at 40° C., yet at higher temperatures it behaved like pepsin.

Mr. J. O'SULLIVAN said he could not say what action hydrochloric acid at high temperature would produce. As to the source of pepsin or its quality, he once had a sample which was no better than sand as far as proteolysis was concerned; on the other hand, he had a sample in his possession now which was as active as it was six years ago. He did not think there was anything definitely known as to the action of hydrochloric acid in combination with the albumin. If they could get the products of proteolysis to diffuse away they would most probably get a more rapid solution of the albumin.

## Yorkshire Section.

Meeting held at Queen's Hotel, Leeds, on Monday, 17th, 1905.

PROF. SMITHELLS IN THE CHAIR.

### MAGNALIUM AND OTHER LIGHT ALLOYS.

BY R. E. BARNETT, B.Sc.

The magnesium-aluminium alloy, known as magnalium, is interesting from its lightness, and further that amounts of heavier metals, such as nickel or copper, be added to it without raising its density above that of the fundamental metal, whilst at the same time considerably altering its mechanical properties.

The evolution of magnalium has been somewhat hazy. Wöhler in 1866 prepared two definite alloys  $Al_3Mg_2$  and  $AlMg_2$ , but these were of no practical use, both being brittle and easily oxidised. Since then many attempts have been made to obtain air-resisting magnesium alloys of good mechanical properties and in many of these the idea of adding very small amounts of active metals, but still keeping within the density of aluminium, has been more or less completely carried out. In a series of these alloys for which during the past few years have been taken out, the magnesium has been steadily reduced from 2 to about 30 per cent. of the alloy. The general tendency has been for the amount of magnesium to be reduced, as the alloys containing more of this metal are mostly unworkably hard and brittle.

Alloys of these two metals containing more than 10 per cent. of magnesium have been thoroughly studied from the scientific point of view, by Boudonard. He finds (this *J.*, 1901, 814, and 1902, 258) that the strength of these alloys diminishes as one recedes from the pure metals. Alloys in which the proportion of each constituent exceeds 15 per cent. are brittle, the maximum brittleness being reached with a 50 per cent. alloy, which can be crushed by the fingers. The strength curve has two maxima, corresponding to the alloys represented by  $AlMg$  and  $AlMg_2$ , both of which Boudonard succeeded in isolating.

At the present time, three magnalium alloys are in regular use, denoted by the letters X, Y, and Z. The first of these is for forging or for casting, in which strength is a primary consideration. Alloy X is done at about 330° C., special care being taken to avoid oxidation. The second, Y, is used for casting. To secure good results, the melt must be carefully guarded against, the metal must not be agitated or overheated, and after the casting should be cooled as quickly as possible. The melting point is slightly above that of aluminium. The castings when properly made are clean and strong. The third alloy, Z, is used for rolling and drawing. Rolling is done between 300° and 350° C. Annealing is necessary unless very hard sheet is required. Apart from the method pursued in rolling, it is found that soft sheet can be made springy by heating to 390° C. and slow cooling. Rapid quenching makes the metal soft. Similar considerations apply to drawing into wire or tube. Frosting is done, as with aluminium, itself, by alkaline liquors.

It will be noticed that except for its greater tendency to oxidation when hot, the treatment of magnalium in the foregoing processes is very similar to that required for aluminium. Magnalium has, however, two advantages at least over pure aluminium. Its tensile strength is decidedly higher. This is said to range from 10 tons in the case of ordinary castings (X), to 23 tons for Z, when rolled hard. The most conspicuous advantage is in its behaviour with tools. As is painfully familiar to all who have had to use aluminium, such operations as filing, turning, drilling, and screwing are far from satisfactory with



metal. It drags and tears and clogs the cutting. Very small cuts have to be taken at high speed, good lubrication. The case is very different with aluminium. It works cleanly in the lathe. When I cut at a surface speed of 100 ft. per minute, without lubricant, long spiral shavings come off and the work left is free from any signs of dragging or tearing, also free from tool-marks, a circumstance which sets that the softness of the metal makes it flow on contact with the cutting edge. This idea is supported in a curious way in which the metal builds up on to the tool-edge when being turned or drilled without a coolant. I find that a cutting edge, whose angle is 65°, such as would do for steel, serves very well with aluminium. A less acute angle, such as is used for steel, is not so satisfactory. When turned in the manner described, a silvery-white surface is produced on any polishing operations seem superfluous.

In order to see if the presence of magnesium would render aluminium susceptible to corrosion, I made a comparative test by exposing sheets of magnalium to laboratory atmosphere for three weeks, side by side with sheets of aluminium, zinc, copper and iron; all the surfaces being in a precisely similar position. The magnalium showed no special signs of corrosion, and the laboratory atmosphere had decidedly little effect on the zinc, copper and brass.

For chemical composition, careful qualitative analyses have been made of drillings from ingots of X and Y, and of a piece of soft sheet which is presumably Z. Detailed quantitative analyses have also been carried out, in the case of Y, which was done before the special difficulties of the analysis were fully realised, no great reliance can be placed on the results, which are therefore preliminary. The chief trouble was caused by the relatively small proportion of aluminium, which appears in each to exceed 94 per cent. In the qualitative analyses, the bulky character of the aluminium hydroxide prevented amounts being taken and so rendered the detection of its constituents difficult. Moreover, it was found that in the case of re-precipitation, the aluminium hydroxide carried large quantities of other metals. For instance, after re-precipitation with ammonia in presence of ammonium chloride, the nickel (in alloy X) was present in apparently larger quantity in the aluminium hydroxide than in the united filtrates. It was noticed on boiling the liquid containing the precipitated hydroxide as usual to expel excess of ammonia, a marked change occurred. In consequence of these facts, in the qualitative work, and also in the quantitative analysis of X, the re-precipitated hydroxide was digested in pure sodium hydroxide solution in a platinum dish. Nearly all the aluminium was thereby dissolved after diluting and filtering, the residual precipitate, black-grey in colour, was dissolved in acid and then used for all metals beyond the "hydrogen sulphide" in the usual course.

In order to avoid this lengthy procedure, Mr. J. B. Murray suggested the preliminary treatment of the alloy with sodium hydroxide solution in order to remove the greater part of the aluminium before commencing the ordinary analytical separation. He applied this method to a complete analysis of the sample of soft sheet, namely Z, and found it very satisfactory. The insoluble solution of sodium aluminate was found to contain only a trace of tin, which was, however, easily precipitated as aluminated hydrogen after acidifying. The results of the analyses may be stated briefly as follows:—Alloy X contains copper (1.76), magnesium (1.60), nickel (1.16), and antimony and iron in smaller quantities. Alloy Y contains copper, magnesium, tin, lead, a small amount of iron and a doubtful trace of antimony. As far as I can judge, Y is intermediate in composition between X and Z, except as regards nickel. Alloy Z (sheet) contains tin (3.15), copper (0.21), magnesium (0.1), lead (0.72), and the usual amount of iron, about 1 per cent.

Traces of titanium were found, presumably derived from the bauxite. Indications of other rare metals were noticed, but the difficulties in the way of taking large quantities of the samples for analysis prevented any

confirmatory work. Alloy X dissolved in *aqua regia* left an insoluble residue amounting to 0.38 per cent.

The most noteworthy result of the analytical work is that in no case was as much as 2 per cent. of magnesium found. The highest result was 1.86 per cent. in the soft sheet. This result was obtained by precipitating (twice) the magnesium as the double phosphate from an alkaline solution in which the aluminium was retained by the presence of alkali tartrates. But I have reason to believe that this result is too high. The alloy dissolves very vigorously even in diluted hydrochloric acid and considerable care is needed in this operation. It is little affected by nitric acid.

"Zisium" and "ziskon" are two light alloys prepared for use primarily in scientific instrument making. Zisium was first named zisium, but it was found that this name could not be registered. Both alloys are silver-white in colour and make good castings, in which form only they are supplied.

Zisium is the lighter, having a density of 2.95 as compared with 3.35 for ziskon. The latter is, however, much harder and stronger. The tensile strength of the metals (cast in sand) is stated to be nearly five and 11 tons per sq. in. respectively, according to tests made at the National Physical Laboratory. My experience of their working properties is confined to the making of turnings for the purpose of analysis. Zisium cuts like very soft brass, in short curly chips, using a tool as described for magnalium. Ziskon seems to have a texture resembling that of cast-steel, though, of course, much softer. It needs to be cut at a slower speed than zisium and gives long shavings.

Want of time has prevented my doing more than making a qualitative analysis of each of the two sample castings of these alloys which I have had. The results show, as might be expected from the specific gravity, that both are aluminium alloys. Zisium, like magnalium, appears to be essentially aluminium, modified by the presence of small amounts of other metals. I find in it zinc, tin, and copper with a trace of antimony, and a minute trace of bismuth and possibly thallium.

Ziskon has a different character. It is a zinc-aluminium alloy, containing perhaps one-fourth its weight of the former metal, as far as could be judged by a rough weighing of the zinc sulphide obtained in the qualitative analysis.

Zinc-aluminium alloys have been studied by J. W. Richards (abstract, this J., 1902, 121). He confirms the previous statements of Durand as to the remarkable mechanical properties of one containing one-third of its weight of zinc. It is very hard, resembling tool-steel, and its specific gravity is given as 3.8. On the other hand, alloys containing only one-sixth of zinc or less are soft enough for rolling or drawing. An alloy intermediate in composition, containing 25 per cent. of zinc, is said to give excellent castings, easily worked, and to be much used for scientific instrument-making. Its specific gravity is given as 3.4, thus closely agreeing with that of ziskon. These statements, I think, confirm the results of my examination of ziskon (given above).

A great many other aluminium alloys, containing such metals as zinc, copper, nickel, and tungsten, have been patented in recent years, and some are in actual commercial use.

The numerous aluminium bronzes do not come within the scope of this paper, as they are not light alloys, since aluminium is not their principal constituent.

In conclusion, I must express my indebtedness to Mr. J. B. Murray for a great deal of valuable assistance, and to Mr. J. Arthur Williams, of Hatton Garden, who has rendered indispensable help in the supply of specimens and information.

#### DISCUSSION.

Mr. C. P. FINN asked if Mr. Barnett had made experiments towards the examination of magnalium by microscopic methods of analysis. The results of such an examination of the structural changes produced in the alloy by chilling, &c., would be of great interest. What method should be used in soldering magnalium? How did the co-efficient of expansion of the alloy compare with that of aluminium?

Mr. J. W. COBB said the alloy appeared to be soft, and so would easily scratch and flow, and be difficult to polish. Decreasing hardness made polishing increasingly difficult, as for example in the case of lead. This would, no doubt, interfere with the obtaining of polished surfaces suitable for photo-micrographic study. Were the aluminium laboratory paints used to prevent corrosion of apparatus, &c., analogous in composition to magnalium? He could appreciate the difficulties of securing good separations by double precipitation, as, in analysing magnesite, he had found three or four precipitations necessary to secure satisfactory results. Since small quantities of molybdenum and tungsten converted steel into a high speed cutting steel, with special properties, the presence of titanium even in small quantity might produce its own effect in magnalium. For this reason, he thought it should not be concluded, that because the titanium was probably introduced through the bauxite, from which aluminium was extracted, it would not have some effect on the properties of the alloy.

Mr. T. FAIRLEY suggested that there was a possibility of the amount of magnesium in the alloy diminishing in the working or casting. If 2 per cent. were originally present, the final percentage might be much lower owing to oxidation by the atmosphere during heating. He had given students analyses of aluminium paints for exercises in examinations, and in certain cases the results showed the presence of about 3 per cent. of tin. He supposed

magnalium like aluminium was affected by caustic alkalis.

Mr. F. W. BRANSON said, that while at King's College came across an aluminium alloy which contained a small amount of silver.

Mr. R. E. BARNETT said he had done nothing to test the suitability of magnalium for photo-micrographic study, and had seen nothing on this point in any description of the alloy. He thought Mr. Cobb's view would be correct. In turning the metal, the remarkably even surface suggested that it flowed in front of the cutting tool. To get a surface for metallography, he thought something like casting to glass, and then breaking away the latter, might be resorted to. The alloy would have to be soldered like aluminium; no flux should be used, but a soft solder of aluminium with some other metals. Scrubbing under the molten solder with the bit or even with a brush would be necessary to remove oxide. Other than of aluminium and magnesium, such as magnalium is used for flash light purposes, probably contained magnesium. The analytical results were curious, showing remarkably low percentages of magnesium, and were puzzling discrepancies between these results and published statements. If the amount of magnesium originally put into the alloy was the published percentage, this discrepancy might be explained by Mr. Fairley's suggestion, that some magnesium was lost through oxidation in the heating and preparation of the alloy.

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### I.—PLANT, APPARATUS & MACHINERY.

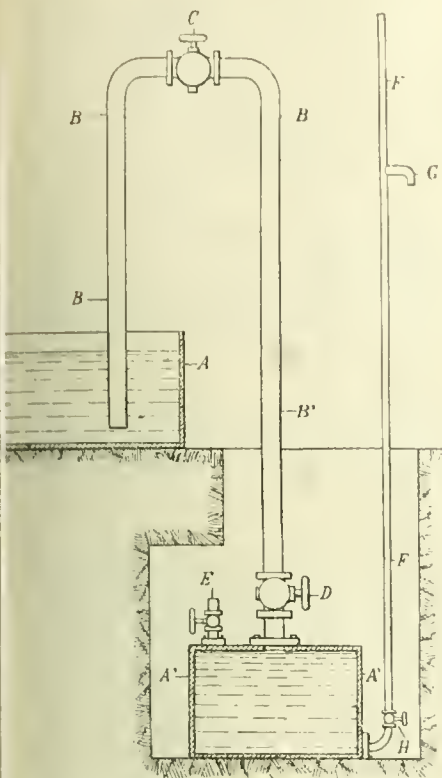
#### ENGLISH PATENTS.

*Raising Liquids; Apparatus for* —. F. Palau, M. Sibis, and L. Navarro, Barcelona. Eng. Pat. 5147, March 11, 1905.

A SIPHON B, B' the shorter limb B dipping into the liquid to be raised, which is contained in the cistern A' is pro-

vided with an air-cock C and with a stop-cock D in the longer limb B' which opens into the closed vessel placed at a lower level than A. The vessel A' has a opening into the air, and an upright delivery provided with a stop-cock H, and an overflow spout the latter being placed at a slightly lower level than the highest part of the siphon B, B'. On closing the C, H, and opening D, E, the liquid siphons over A to A', the air in the latter escaping through E. A' is full, E is closed and C and H are opened; the





to act, but the liquid rises in F to the level at which ds in B', and a portion overflows from G. To the siphon, H and C are closed, and E is opened, he liquid again fills the siphon B, B'.—W. H. C.

[of Methylamine or Ammonia] for Motors; od of and Apparatus for the Production of —. J. Fournier, Paris. Eng. Pat. 12,506, June 2, 1904. Pat. 338,706 of 1903; this J., 1904, 708.—T. F. B.

#### UNITED STATES PATENTS.

or Evaporating Liquids; Apparatus for —. J. Grace, Assignor to H. R. Worthington, New York. U. S. Pat. 793,129, June 27, 1905. Eng. Pat. 7468 of 1905; this J., 1905, 792.—T. F. B.

ing Apparatus. A. Hinze, Rositz, Germany. U. S. Pat., 793,133, June 27, 1905.

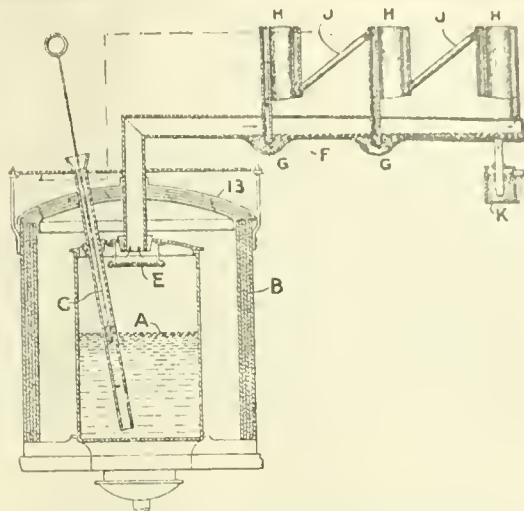
AM-JACKETED tank is divided into compartments tions, which are perforated alternately above and A shaft, mounted horizontally in the tank, through all the compartments and has spirally ad radial arms and perforated scoops mounted t. The material to be treated and the lixiviating are caused to pass through the tank in opposite ons.—W. H. C.

ing Liquids; Apparatus for —. S. H. Johnson, gnor to S. H. Johnson and Co., Ltd., London. U. S. Pat. 793,725, July 4, 1905.

ng. Pat. 10,753 of 1904; this J., 1904, 757.—T. F. B.

ing Apparatus —. E. E. Morlan, Kansas City, Kans. U. S. Pat. 793,732, July 4, 1905.

AM generating retort A, enclosed in composite walls ver, B and 13, has a gauge pipe C and a steam outlet is shewn, provided with a deflector E and communi- with the inclined pipe F. The latter has depressions



G, G, formed on its lower side, and condensers H, H, H, communicating by the pipes J, J, and arranged as shown in the figure; it is also provided with a trap K.—W. H. C.

#### FRENCH PATENTS.

*Drying Machines with Intermittent Discharge Openings.* G. ter Meer. Fr. Pat. 351,143, Jan. 26, 1905.

THE material is fed into the machine through a centrally placed conduit in the shaft, and the drying is effected by centrifugal force, which throws the water through the screens. Slides or the like are provided for cutting off the supply when it is desired to empty the machine. The discharge of the dried material may be effected by the centrifugal force itself, which throws out the material when the machine is opened. Two or three methods of arranging the filtering material or gauze are described. —W. H. C.

*Furnace; Industrial Regenerative* —. E. Lionne. Fr. Pat. 351,083, Jan. 28, 1905.

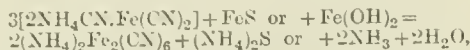
THE muffle or crucible heating chamber is surrounded by two concentric annular chambers, with metallic walls. The air necessary for combustion, passes first through the outer and then through the inner chamber. It is claimed, that the use of metal for the construction of the heating chambers facilitates the passage of heat and enables the furnace to be easily set up or taken to pieces. The primary and secondary air may be led through separate regenerative chambers.—W. H. C.

#### II.—FUEL, GAS, AND LIGHT.

"Cyanogen Mud." A. Hand. Z. angew. Chem., 1905, 18, 1098—1106.

THE author has investigated the composition, &c., of the "cyanogen mud" obtained in the Bueb process of separating hydrocyanic acid from the gaseous products of destructive distillation, especially of coal (this J., 1900, 999; 1903, 204, 356). His results differ considerably from those obtained by Feld (this J., 1904, 316). If the conditions prescribed by Bueb, especially with regard to the concentration of the ferrous sulphate solution, be maintained, the "cyanogen mud" is obtained as a dark brown mass containing:—(1) in solution: ammonium ferrocyanide, ammonium sulphate, ammonium carbonate or bicarbonate, small quantities of ammonium sulphide, ammonium thiosulphate, and, on the average, about 0-13 per cent. of ammonium thiocyanate; and (2) in the insoluble portion: an insoluble ammonium-iron-cyanogen compound, which is the chief constituent, undecomposed ferrous sulphide, tar, oily substances, and mechanical impurities such as sand, and ferric oxide from the iron

connections, &c., of the gas plant. The amount of cyanogen, expressed as Prussian blue,  $\text{Fe}_7(\text{CN})_{18}$  ranges in general from 8 to 15 per cent. The insoluble iron-ammonium-cyanogen compound was found to be a double compound of ferrous cyanide and ammonium cyanide,  $2\text{NH}_4(\text{CN}) \cdot \text{Fe}(\text{CN})_2$ ; it is usually accompanied by moderate quantities of soluble ammonium ferrocyanide. Feld's proposal to use weaker solutions of ferrous sulphate is considered to be unsatisfactory, results obtained in practice having shown it to be more advantageous to fix the cyanogen in the form of the insoluble iron-ammonium-cyanogen compound than as soluble ammonium ferrocyanide. Feld's statement that the recovery of the ammonia in "cyanogen mud" is too complicated a process to be undertaken in the gas-works, is also controverted, and the author shows that by merely boiling the mud or by treating it with acid, the insoluble compound mentioned above, is converted into the white insoluble compound  $(\text{NH}_4)_2\text{Fe}_2(\text{CN})_6$ , with separation of ammonia; after this treatment, three-fourths of the total ammonia is present in the soluble form. The reaction proceeds according to the equation:—



and if the mud does not contain sufficient undecomposed ferrous sulphide for the purpose, a suitable addition of ferrous hydroxide or sulphide must be made. In presence of sufficient ferrous hydroxide or sulphide, the soluble ammonium ferrocyanide is also converted into the white insoluble compound.

The difference between the results obtained by Feld and by the author in the examination of the "cyanogen mud," is attributed to the different methods used for the determination of the soluble ferrocyanide and ammonia.

According to Feld the "cyanogen mud" after being diluted with cold water will not filter clear, and he therefore recommends an addition of magnesium chloride solution. The author finds, however, that by diluting with a smaller quantity of water, e.g., 50 grms. of mud with water sufficient to make a total volume of 260 c.c., a perfectly clear filtrate can be obtained. In the author's hands, Feld's method (this J., 1903, 1068) gave varying results with one and the same sample of mud, owing probably to decomposition of some of the constituents of the mud caused by the excessive dilution with water, and favoured by the presence of the weakly basic magnesium chloride.—A. S.

#### ENGLISH PATENTS.

*Fuel; Manufacture of Peat —, and Apparatus therefor.*  
L. Whittaker and C. Whittaker and Co. (1900), Ltd., Accrington. Eng. Pat. 13,822, June 18, 1904.

THIS patent relates to a process and apparatus for making peat fuel blocks. The peat is dried in a centrifugal machine, provided with a removable scraper for removing the peat from the sides, and causing it to fall through a door at the bottom on to an edge-runner mill. After being ground, the peat is kneaded in a steam-jacketed vessel provided with a worm of diminishing pitch, whereby the peat is expressed through a nozzle in a long column, which is then cut off into finished blocks. The edge-runner mill is arranged so that one roller runs over a dead or smooth part of the pan, and the other over grids, the bars of which have sloping faces, and together with suitably arranged guide plates, this second roller exerts a scissors-like action on the peat. A plunger pug-mill may be used in place of the tapered kneading machine, the pug-mill being provided with a valve to admit air to the compression chamber, and thus prevent the plunger tending to suck back the column of peat, on the return stroke.

—W. C. H.

*Fuel.* H. B. Bayles, Brooklyn, U.S.A. Eng. Pat. 14,947, July 4, 1904. Under Int. Conv., July 2, 1903.

THE claim is for a fuel composed of asbestos or other fibrous material saturated with glycerin which is said to burn with a hot smokeless flame.—W. H. C.

*Briquettes; Process for the Manufacture of Coke*  
L. L. D. Zuiderhoek, Amsterdam. Eng. Pat. 14,948, Aug. 17, 1904.

100 PARTS of powdered and sifted coke are mixed with say 3 to 10 parts of lime, and 1 to 3 of Portland cement, and 10 to 20 per cent. of water added, pressed in the form of steam or spray. The mass is allowed to set and then pressed into briquettes in suitable moulds.—W. C.

*Blast Furnace Gases; Method and Apparatus for Rendering Iron — Available for Working Gas Engines.* B. H. Thwaite, London. Eng. Pat. 14,949, June 30, 1904.

THE invention relates to improvements in method and apparatus for washing blast furnace gases described in Eng. Pats. 8670 of 1894 (this J., 1895, 663), and 23,597 of 1896 (this J., 1896, 724, and 1897, 4225 of 1901).

The claims are for the arrangement of the box washers in series, for the addition of tar or oil to the water washers and to that supplied to the fan, and for the construction of a sawdust filter provided with a rotating agitator to shake up the filtering medium.—W. I.

*Gas Producers; Impts. in —.* G. Hatton, Bristol. Eng. Pat. 18,214, Aug. 23, 1904.

FOR mixing atmospheric air with steam or water and supplying the same to the gas producer, use is made of a vaporising chamber containing a water spray heated internally by waste heat from a chimney vapour from this chamber passes into a mixer together with a supply of atmospheric air drawn in by a blower, which latter also draws or forces the hot air from the chimney into the vaporising chamber, which delivers the mixture to the gas producer.—C. S.

*Carburetted Air and other Gases; Automatic Apparatus for —.* E. Bouchaud-Pracig, Angoulême, France. Eng. Pat. 6158, March 23, 1905. Under Int. Conv. March 31, 1904.

THE air or gas to be carburetted is forced through a meter, connected by a flexible tube with a vaporising vessel charged with the carburetted liquid, a reservoir with which it communicates by one or more flexible tubes. The supply of carburetted liquid is controlled by the gas meter, the movable vessel being mounted on a screw nut, working on a spindle actuated by the mechanism of the meter, so that as the meter rotates, the vessel moves downward. The nut is also fitted with a spring hinge, so that on reaching the bottom of its travel it can be returned, with the aid of a spring, to the top of the spindle.—C. S.

*Incandescence Bodies; Manufacture of Electric Lamps.* The Electric Equipment and Securities, Ltd., London, and C. Ruzicka, Willesden, Middlesex. Eng. Pat. 16,425, July 25, 1904.

THE material consists of a mixture of one or more non-conductors of high melting point (e.g., iridium, iridium alloy), one or more refractory non-conductors (e.g., zirconium oxide), which are normally non-conductors but increase in conductivity as the temperature rises, and one or more special earths, such as gadolinium oxide, or the oxides of rare earth metals, e.g., ceria.—C. S.

*Filaments for Incandescing Electric Lamps; Manufacture of —.* J. R. Crawford, London. Eng. Pat. 16,426, June 11, 1904.

ONE or more carbides of the earth metals are mixed with either a metal of high melting point, such as molybdenum or boron, or a mineral of high melting point, such as silicate or like silicates of the earth metals, feldspar, quartz, magnesium oxide, in the ratio of about 3 parts of the former to 2 of the latter. When a refractory material is used, the metal in it is reduced by causing the filament to glow in an atmosphere of a reducing gas.—W. I.



*secret Electric Lamps; Manufacture of [Filaments* —. A. Just and F. Hanaman, Vienna. Eng. Pat. 23,899, Nov. 4, 1904.

Pat. 347,661 of 1904; this J., 1905, 431.—T. F. B.

#### UNITED STATES PATENTS.

*and Process of Making same.* H. E. Marshall, for to W. P. Wagy, Los Angeles, Cal. U.S. Pat. 793,795, July 4, 1905.

EIGHT parts of fine coal are intimately mixed with of lime or gypsum, and the whole moistened with of water in which 1 part of gelatin and 1 part of potassium bichromate have been dissolved. The is thoroughly incorporated, and afterwards pressed into briquettes and dried.—W. H. C.

*Gas Furnace for Burning* —. W. L. Harder, Birmingham, Ala. U.S. Pat. 793,070, June 27, 1905.

rnace, which is for burning producer gas under a boiler is provided with an ignition chamber which at the outer end of the combustion chamber, which is surrounded by walls of refractory material, after not being exposed to the chilling influence of the boiler. The gas and air are preheated in through conduits disposed within the chambers, then enter the ignition chamber, means being provided for regulating the supply of gas. Here the preheated of gas and air is ignited before entering the ignition chamber. The chambers and conduits have a refractory flooring and are so constructed that the admitted flows in a substantially straight course.—R. L.

*Producer.* W. Viggers and R. F. Ball, Durango, Mexico. U.S. Pat. 793,554, June 27, 1905.

is producer consists of a cylindrical shell, closed at top and bottom. A ring is fixed to the inside of the central portion and a crucible is suspended from it by means of an outwardly projecting flange on the ring. The crucible, in which the gas is generated, is surrounded by a water-jacket and provided with a grate on its bottom. A cylindrical magazine, open at the top and closed at the bottom by a removable cover, is connected from the top of the outer shell over the top of the crucible and acts as a feeding hopper. The water in the water-jacket can be adjusted by a valve arrangement. The steam raised in the jacket is conveyed into a blow-pipe and is discharged. The gas, with air drawn in, enters the crucible through a bottom grating. To keep the fuel in the desired state of incandescence, the air chamber surrounding the crucible may be connected with a fan blower. The gas, generated, is discharged through a service pipe at the bottom of the producer.—R. L.

*Producer.* A. B. Duff, Pittsburg, Pa. U.S. Pat. Reissue, 12,367, July 4, 1905.

vention relates to a special form of gas-producer which, by means of one or more louvred cones, superimposed on the gratings in the lower part of the producer, permits of the mission of air can be closely controlled. The air between the cones and the gratings are so proportioned, that a sufficient quantity of air is admitted to the upper portion of the fuel in the producer to cause incandescence, while the lower mass of fuel is kept at the desired temperature for the proper working of the gas-making process.—J. B. C. K.

*Generator.* W. Neeken, Mülheim-on-Rhine, Germany. U.S. Pat. 794,037, July 4, 1905.

form of gas-producer covered by this patent, has an air chamber supplied with water arranged around the fuel chamber at a part intermediate between the top and bottom. The steam produced in this chamber is used in the gas-producing process. Claim is also made for an intermediate opening for gas-discharge.—J. B. C. K.

*Gas Generating Apparatus.* L. Guenot fils, Paris. U.S. Pat. 794,498, July 11, 1905.

SEE Eng. Pat. 11,105 of 1901; this J., 1905, 79.—T. F. B.

*Gas Purifier.* E. A. Uehling, Passaic, N.J. U.S. Pat. 793,110, June 27, 1905.

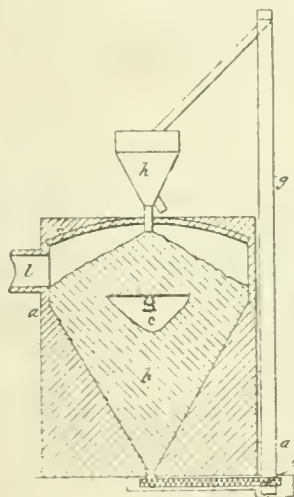
THE apparatus consists of an upright cylindrical shell, with a central shaft extending longitudinally through it and provided with a helical flange. The gas is forced through the purifier in an upward direction, and at a high velocity by an exhausting fan. By means of the spiral flange, a rotary motion is imparted to the gas, which is washed by water continually running down the inner surface of the shell from a tank surrounding the top of the purifier, and directly connected with it throughout its periphery, by means of an overflow. The washing liquor is collected at the bottom of the purifier and discharged through a water-sealed overflow.—R. L.

*Gases; Apparatus for Purifying Blast-Furnace* —. W. Schwarz, Dortmund, Germany. U.S. Pat. 793,544, June 27, 1905.

SEE Fr. Pat. 350,592 of 1905; this J., 1905, 794.—T. F. B.

*Gases; Means for Removing Dust from* —. J. Shields, Willesden Green, Middlesex. U.S. Pat. 793,745, July 4, 1905.

A CONICAL chamber *a*, is continuously fed with "granular



material" from the hopper *h*, so that a mound *b*, is formed which has a conical top as shown. The gas, which is to be freed from dust, enters by the conduit *c* into the centre of the mass and passes upwards through the "granular material," and away by the pipe *l*, leaving the dust behind. The dust-laden material is removed from the bottom of the chamber by the screw conveyor *d*, and after being cleansed, is raised through the pipe *g* and delivered again into the hopper.—W. H. C.

*Gas; Process of Purifying* —. A. W. Fischer, Assignor to Schutte and Koerting Co., Philadelphia, Pa. U.S. Pat. 794,000, July 4, 1905.

A METHOD is claimed for separating gases, vapours or solid particles from any gaseous medium or mixture, by means of a liquid spray or mist. The liquid to be used for this purpose is heated in a separate vessel to a point considerably above its boiling point, under pressure, and the superheated liquid is then delivered by any suitable device, into the chamber containing the gaseous mixture. A rapid diffusion of the purifying liquid is thus obtained in the form of spray or mist, and the sub-

stances which are to be removed from the gas, are carried down and precipitated with this mist, as it condenses on the floor of the chamber.—J. B. C. K.

*Gas Purifying Apparatus; Centrifugal* — E. Theison. Baden-Baden, Germany. U.S. Pat. 794,201, July 11, 1905.

SEE Eng. Pat. 8761 of 1903; this J., 1904, 434.—T. F. B.

#### FRENCH PATENTS.

*Fuel: Artificial* — H. R. Woltmann. Fr. Pat. 351,525, Feb. 15, 1905.

SEE Eng. Pat. 3154 of 1905; this J., 1905, 793.—T.F.B.

*Smokeless Combustion in Hearths [or Furnaces]: Production of —, by the Introduction of Liquid Combustibles*. O. Bender and F. Hoiliger. Fr. Pat. 351,210, Feb. 1, 1905.

COMPLETE and therefore smokeless combustion of the carbon monoxide, produced by the reduction of carbon dioxide, is claimed to be brought about by the introduction of vapours of hydrocarbons into the zone poorest in oxygen, to lower the temperature of ignition of the mixture.—W. H. C.

*Gas Retorts; Impts. in* — E. Derval. First Addition dated Jan. 27, 1905, to Fr. Pat. 343,699 of June 4, 1904 (this J., 1904, 1021).

THIS addition covers the use of special refractory pieces placed on the tops of the retorts in order to oppose the passage of heat to the top of the retorts and to throw back the flames on to the bottom of the superposed retorts.—W. C. H.

*Gas Producer*. Soc. P. Schmidt and Desgraz, G.m.b.H. Fr. Pat. 351,336, Feb. 6, 1905.

THE producer is provided with return channels which lead gas from the upper part of the hollow portion of the producer into the lower or combustion zone, and one or more collecting chambers are arranged in the wall of the producer, where the gases are previously mixed, and purified from tarry components before being again introduced into the producer. (See also Fr. Pat. 338,626 of 1903; this J., 1904, 653.)—W. C. H.

*Cellulose Products formed by the Decomposition of a Solution of Cellulose by means of Bases; Process of Making* — Ver. Glanzstoff-Fabr., Act.-Ges. Fr. Pat. 351,206, Feb. 1, 1905. XIX., page 855.

*Cellulose Threads & Films; Process of Making Elastic, Tenacious & Transparent* — Ver. Glanzstoff-Fabr., Act.-Ges. Fr. Pat. 351,208, Feb. 1, 1905. XIX., page 856.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[Petroleum] *Illuminating Oils; Relation of Flashing Points to the Boiling Points of* — P. Dvorkovitz. Pet. Rev., 1905, 13, 7—8; 24—25.

THE experiments made, are considered to confirm the author's opinion that the distillation test is the true criterion of the safety of petroleum oils, since it reveals the actual proportions of light oils present. The flashing points of Roumanian, Galician and "Royal Daylight" burning oils are approximately the same (26.0°—27.5° C.), and though they all contain about 12 per cent. of fractions flashing below 0° C., the two latter oils contain 54.27 per cent. and 50.75 per cent. of fractions flashing at 60° C., whilst

the Roumanian oil contains only 37.96 per cent. of fractions. The following table gives the flashing points of the principal fractions of these and other oils:—

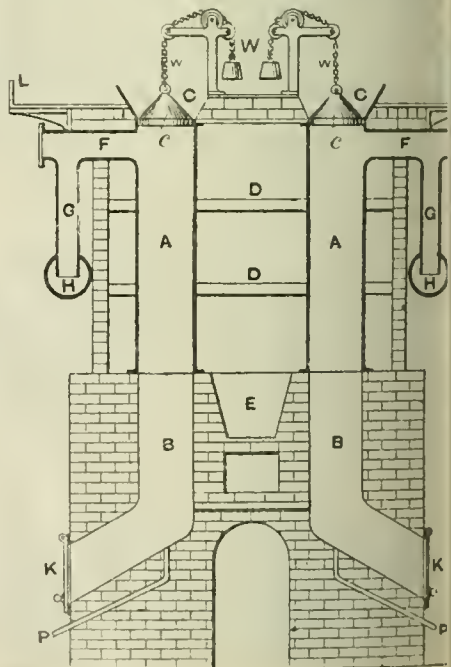
#### Flashing Points.

Fraction boiling at	170 °C.	270 °C.	300 °C.	above 300
Royal daylight (sp. gr. 0.804) ...	15	—	87	1
Russian oil (sp. gr. 0.825) .....	16	—	120	1
Texas oil (sp. gr. 0.819) .....	17	99	(no higher fractions)	
Galician oil (sp. gr. 0.812) .....	204	—	124	1
Amer. water-white (sp. gr. 0.7954) ..	22	—	125	1
Roumanian oil (sp. gr. 0.811) ...	24	—	99	1

The difference between the two American oils is due to the low-flash oil containing about 12 per cent. light fractions and 16 per cent. of fractions above 300° the figures for the other oil being 1½ per cent. and per cent. respectively. Again, while the several fractions have similar sp. grs. in each case, the flashing points are considerably (16°—30°), thus indicating a great dissimilarity in the constituent hydrocarbons. In the case of Roumanian oil, the sp. gr. of the fractions above 21 shows a remarkable increase, the range between 21 point and 300° C., being 0.821—0.873, the latter of which exceeds the figure for the corresponding fraction of Russian oil (0.8645). The Texas oil contains high similar to those in Roumanian oil, whilst the sp. gr. of the middle fractions is higher than that of Russian oil and there are no fractions above 270° C. The author considers that safe oils of good candle power would be ensured by the adoption of a standard for illuminating oils of not more than 10 per cent. of fractions boiling below 150° C., these being counterbalanced by a similar quantity of fractions boiling above 300° C.—C. S.

#### ENGLISH PATENT.

*Peat, Turf, Wood and other similar Materials; Apparatus for Treating [Carbonising]* — T. R. Harrison. Manchester. Eng. Pat. 16,543, July 27, 1904.





per parts of the retorts A are made of cast iron, and provided with balanced charging cones C, and with gas-delivery pipes F G extending into the hydraulic D. The upper portions A are set in a heating furnace B, arranged above a furnace E, while the lower parts B, are of brickwork or of iron set in brickwork, curved as shown in the fig., and provided with sliding doors K and with pipes P for injecting steam. Distillation takes place in the upper portion A, and the parts B serve as cooling chambers for the residual liquid.—W. H. C.

# UNITED STATES PATENTS.

*Peat or Similar Material; Kilm for —.* M. Ar, Berlin-Schöneberg, Germany. U.S. Pat. 60, June 27, 1905.

g. Pat. 19,241 of 1901; this J., 1902, 1127.—T.F.B.

hen. E. Coppée, Brussels. U.S. Pat. 794,662, July 11, 1905.

g. Pat. 23,544 of 1902; this J., 1903, 1079.—T.F.B.

*Alcohol Apparatus.* W. F. Rosencrans, Stamford, Vt. U.S. Pat. 793,542, June 27, 1905.

paratus consists of a casing containing a fire-box, which is a heater that prevents the flame from directly upon a pair of retorts arranged side by side. Above the retorts communicates with the fire-box, a discharge pipe leading out of the casing.—E. S.

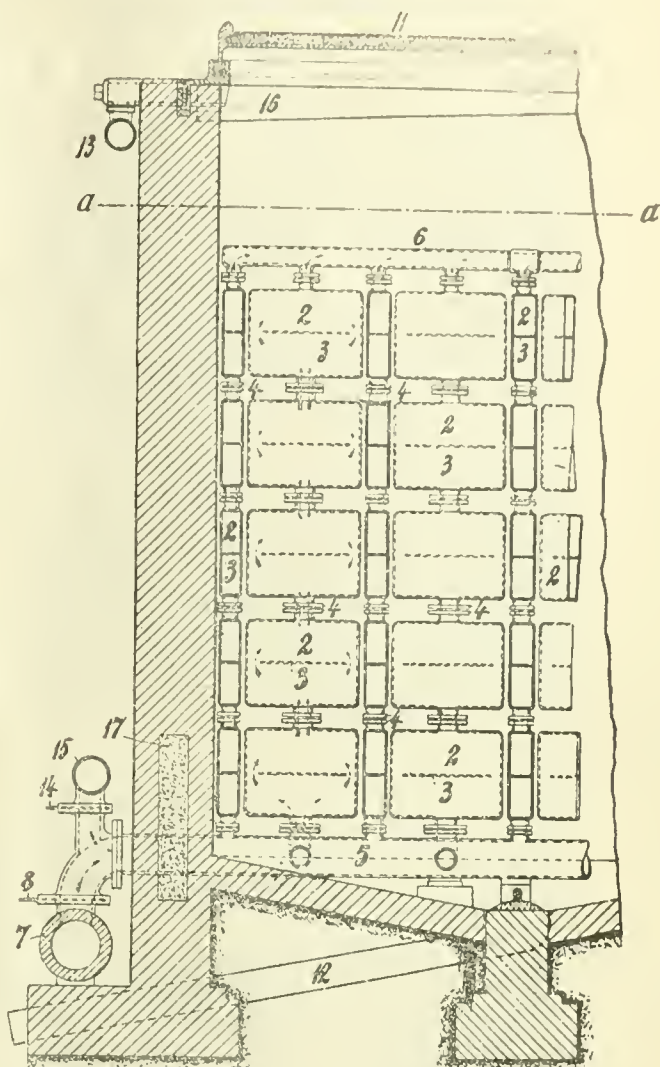
# FRENCH PATENTS.

*Products [from Coal]; Recovery of — in the Manufacture of Coke.* Dr. C. Otto and Co., G.m.b.H. Fr. Pat. 65, Dec. 30, 1904.

process for the recovery of the by-products in the distillation of coal consists in conveying all the products of distillation, including the ammoniacal liquor, to a point where the temperature of the gas has been lowered to 10° C., or below the boiling point of water, and then directing their course at that point. The reflux pipe has been lined position. The hot gases cause renewed distillation of the light hydrocarbon and ammonia from condensed tar, and condensation takes place according to the temperature of the returning gases. The quantity of tar and oil required for the extraction of ammonia from the outflowing gas is very small, and a concentrated ammoniacal liquor can be obtained.—R. L.

*Using Wood, Peat, and other Similar Substances; Process and Furnace for —.* C. J. R. Müller. Fr. Pat. 351,209, Feb. 1, 1905. Under Int. Conv., Feb. 6,

furnace consists of a rectangular casing, the bottom of which slopes downwards towards the centre (to enable liquid residues to be easily collected), and provided with a removable top; the casing is divided into vertical compartments by a number of thin hollow elements 2, 2, vertically above one another as shown in the figure, provided with baffle plates 3, 3; each one is connected to the one above it by flanged tubes 4, 4; these are traversed by gas or other heating media, introduced by the pipe 7 to 5, where they are distributed in a series of chambers. The wood, peat, &c., is introduced into the vertical compartments of the furnace in sheets made of iron wire or perforated sheet iron. Carbonisation is complete, cold water or other cooling medium is caused to traverse the heating system, avoiding the direct quenching with water usually



resorted to. The gases and other products of distillation are drawn off by the pipe 13.—T. F. B.

*By-products, especially Ammonia, from Gases obtained by Dry Distillation, or by the Gasification of Combustibles; Simplified Process for the Recovery of —.* H. Koppers. Fr. Pat. 351,268, Feb. 4, 1905.

THE crude gas obtained by distillation, is cooled to the temperature most suitable for the separation of the tar, and the water separated at the same time, is then re-vaporised and reintroduced into the gas, which is afterwards heated, and treated in a bath of sulphuric acid, the strength of which is kept constant, and from which the salt which is separated is continually removed. The liquor remaining after the re-vaporising process, is treated in a column still, and the vapours pass directly to the acid bath. The apparatus designed for carrying out the process, comprises, amongst other things, three coolers, of which the first serves also to heat the gas after removal of tar, the second for the re-vaporising of the water separated on cooling the crude gas, the necessary heat being derived from the crude gas itself. There is also an apparatus provided, with finely perforated sheet-iron plates, through which the gas passes in order to separate tar in suspension.—W. C. H.

#### IV.—COLOURING MATTERS AND DYE STUFFS.

*Aromatic Azo Compounds and Aromatic Amines; Reaction between* — entirely distinct from that of the Induline Melt. A. Weinschenk. Z. Farben- u. Text.-Ind., 1905, 4, 337—339.

EQUIMOLECULAR proportions of *a*-naphthylamine and azobenzene are heated together to 70°—120° C. in solution in excess of 70—80 per cent. sulphuric acid. The products are (1) benzidine, to the extent of almost half the weight of the azobenzene used, and (2) a mixture of bases, the sulphates of which are readily soluble in dilute sulphuric acid. This mixture of bases is also readily soluble in dilute hydrochloric acid. It can be acetylated in the usual manner, and then loses the power of forming salts. It is diazotisable, reacting with about half its weight of sodium nitrite, in hydrochloric acid solution, to form a diazo-solution of deep brown colour. This solution combines with amines and phenols to form direct azo dyestuffs. It can be combined, for instance, to half the possible extent with a naphthionic acid or  $\gamma$ -acid salt in presence of sodium acetate, or in acetic acid solution, to form insoluble products, which react with an alkaline H-acid salt solution to form unsymmetrically combined azo dyestuffs. By treating the original base with only half the quantity of sodium nitrite with which it is capable of reacting, an insoluble diazo compound is formed, which is converted into the soluble compound by more nitrite. The azobenzene in the above reaction may be replaced by other azo compounds, including azo dyestuffs, and the *a*-naphthylamine by other aromatic amines. *o*-Azo-toluene does not yield noticeable amounts of tolidine when treated with *a*-naphthylamine under the above conditions. —E. F.

##### ENGLISH PATENTS.

*Dyestuffs; Manufacture of Anthracene* —, and their Application in Dyeing and Printing. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 20,527, Sept. 23, 1904. SEE Fr. Pat. 346,398 of 1904; this J., 1905, 128.—T. F. B.

*Colouring Matters [Azo Dyestuffs]; Manufacture of Azo* —, J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 11,205, May 29, 1905.

DIAZO-COMPOUNDS of the benzene and naphthalene series are combined with the 1,3-dihydroxyquinolines described in Ger. Pat. 117,167. The colour of the products ranges from lemon-yellow to reddish-brown, and they are specially suitable for the manufacture of lakes. The dyes obtained from non-sulphonated and non-carboxylated amines are insoluble in water, whilst those obtained from aminosulphonic or aminocarboxylic acids can be converted into sparingly soluble or insoluble lakes. For example, 93 parts of aniline are diazotised in the usual manner and the solution poured at the ordinary temperature into a solution of 205 parts of the disodium salt of 1,3-dihydroxyquinoline in 3000 parts of water and excess of sodium carbonate. The product is yellow.—E. F.

##### UNITED STATES PATENTS.

*Dyestuff; Anthracene* —, and Process of Making same. O. Bally, Mannheim and H. Wolff, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 793,558, June 27, 1905.

SEE Addition of Jan. 6, 1905, to Fr. Pat. 349,531 of 1904; following these.—T. F. B.

*Diazo Compounds [of the Naphthalene Series]; Process of Making* —, T. Sandmeyer, Assignor to Aniline Colour and Extract Works, formerly J. R. Geigy, Basle, Switzerland. U.S. Pat. 793,743, July 4, 1905.

SEE Eng. Pat. 10,235 of 1904; this J., 1905, 433.—T.F.B.

*Dyestuff; Orange-Red Acridine* —, O. Sohst, Assignor to Farbwerke vorm. Meister, Lucius und Brüel, Hoechst on the Main, Germany. U.S. Pat. 793,744, July 4, 1905.

LEUCO-ACRIDINE Yellow is alkylated with alcohol hydrochloric acid, and the product is heated to a temperature with formaldehyde and concentrated sulphuric acid. The dyestuff thus obtained is soluble in water to an orange-yellow solution, dyeing orange shades on cotton treated with tannin, and on leather. The dyestuff dissolves in sulphuric acid to a yellow solution with green fluorescence, which turns orange and blue on addition of water. It is soluble with difficulty in alcohol, and insoluble in ether, petroleum spirit ("benzene") and benzene.—T. F. B.

*Dyestuff; New Azo* —, A. Thauß, Elberfeld, Germany. Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 794,568, July 11, 1905.

THE dyestuffs obtained by combining diazo compounds (e.g., that of *o*-toluidine) with *m*-aminobenzoylthioanilinonaphthol-7-sulphonic acid are brownish-yellow, soluble in water, and dyeing unmordanted cotton yellowish-red to bluish-red shades; they are capable, when the fibre of being diazotised and combined with  $\beta$ -naphthylamine, of dyeing deeper shades being thus obtained, and are fast to washing.—T. F. B.

##### FRENCH PATENTS.

*Dyestuff [Sulphide Dyestuff] Dyeing Unmordanted Cotton; Manufacture of a Black* —, H. R. Vidal and J. Junius. Fr. Pat. 349,873, April 21, 1904.

THE dyestuff obtained by the action of limited quantities of sodium sulphide on hydroxyazobenzene, nitrosophenol or *p*-nitrophenol, which dyes unmordanted cotton wine-red shades, is treated either with sodium hydroxide and sulphur or with sodium sulphide and sulphur. The product is directly soluble in water and dyes unmordanted cotton in black shades, very fast to alkalis, and requires no oxidising agent for their development. Its solutions possess a characteristic property that they are not precipitated by the air. For example, 15 kilos. of the crude dyestuff obtained from hydroxyazobenzene and limited quantities of sodium sulphide, 12 kilos. of sodium hydroxide and 40 kilos. of 40° B. and 5.5 kilos. of sulphur are heated to 250° C. with stirring.—E. F.

*Dyestuffs capable of being Chromed on the Fibre; Reduction of Azo* —, Soc. pour l'Ind. Chim. et le Tissage. Fr. Pat. 351,125, Jan. 4, 1905. Under Int. Cl. B. Dec. 27, 1904.

SULPHONIC acids of 1-amino-2-hydroxynaphthalene converted by treatment of their basic salts with acidic agents such as acid anhydrides or acid chlorides into 1-amino-2-acidoxynaphthalene sulphonic acids. The latter are readily converted in the usual manner, in presence of ice and mineral acid, into the corresponding compounds, and are then combined, either as such or after separating the acidyl group by allowing to react with water or by heating gently, with amines or phenols to form dyestuffs. For example, 23.9 kilos. of 1,2-diaminonaphthol-2-sulphonic acid are dissolved in 200 litres of water and 29 kilos. of sodium hydroxide solution of 30° B. are added. Acetylation is then effected by agitation of this solution with 11 kilos. of acetic anhydride at 0°—10° C. Seven kilos. of sodium nitrite are added to the neutral or weakly alkaline solution, which is then acidified by quickly adding 30 kilos. of commercial hydrochloric acid, the temperature of the liquid being kept at 0°—10° C. The product of the reaction, from which yellow crystals of the compound separate, is then poured into a solution of 18 kilos. of  $\beta$ -naphtholate of sodium in an excess of sodium carbonate solution. A red acetylated dyestuff is formed which is converted into a greenish-blue dyestuff on heating to 30°—40° C. The latter dyes wool blue on acid bath in violet shades which change to deep blue by chroming on the fibre. The same final product is obtained by allowing the diazo-compound to stand



aretylated, and then combining with  $\beta$  naphthol. 4-aminonaphtholsulphonic acid may be replaced by sulphonic acids of 1-amino-2-naphthol, for example by 1.2.8-aminonaphtholsulphonic acid or aminonaphtholdisulphonic acid.—E. F.

*Of the Anthracene Series; Production of New Derivatives and —, and their Applications in Dyeing Printing.* Badische Anilin und Soda Fabrik. First Addition, dated Jan. 6, 1905, to Fr. Pat. 349,531, Dec. 1904. Under Int. Conv., Aug. 20, 1904.

According to the original patent (this J., 1905, 726) new dyes, termed benzanthrones, are prepared by condensing glycerol with anthraquinone derivatives, their sulphonic acids, and their reduction products, that is, anthrol, oxanthranol, &c. According to the present invention hydroxvanthraquinones and their reduction products, such as alizarin and quinizarin, may also be condensed with glycerol, for instance in sulphuric acid solution. It is best, in starting from an unreduced anthraquinone, to add a reducing agent, such as sulphate, aniline sulphate, zinc or tin, to the melt. The product obtained from alizarin dyes on mordants.

—E. F.

*Of [Sulphide]; Production of Blue Substantive —.* Badische Anilin und Soda Fabrik. Fr. Pat. 351,451, 11, 1905. Under Int. Conv., Feb. 19, 1904.

SEE Pat. 790,167 of 1905; this J., 1905, 669.—T. F. B.

*Hydroxyanthraquinone, Anthraquin and Chrysazin; Manufacture of —.* Soc. Anon. des Prods. Fréd. et Cie. First Addition, dated Jan. 17, 1905, to Fr. Pat. 336,867 of Nov. 21, 1903. Under Int. Conv., 16, 1904.

According to the original patent (this J., 1904, 438), anthraquinone- $\alpha$ -monosulphonic acid, and 1.5- and 1.8-sulphonic acids, are converted into erythrohydroxyanthraquinone, Anthraquin and Chrysazin respectively by treating them with water in the presence of oxides or hydroxides of the alkaline-earth metals. According to the present addition it is advantageous to replace the above by a mixture of alkali hydroxide and a salt of an earth metal. For instance 100 kilos. of a 5 per cent. paste of anthraquinone-1.8-disulphonate of sodium, 90 kilos. of 27 per cent. sodium hydroxide solution, 50 kilos. of crystallised barium chloride and 100 kilos. of water, are heated for 12 hours at a pressure of 1 atmosphere.—E. F.

*Of [Fluorescent] —.* E. Turpin. First Addition, dated Jan. 24, 1905, to Fr. Pat. 346,363, Sept. 20, 1904. Under Int. Conv., page 854.

## PREPARING, BLEACHING, DYEING, FINISHING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

*Of [Action of Human] — on Bleached Cotton.* E. J. Soc. Dyers and Col., 1905, 21, 189—190.

A piece of bleached cotton, saturated with saliva, and then taken up considerably more dyestuff than untreated cotton; after 20 minutes' treatment, the cotton taken up was roughly double that taken up by untreated cotton. This is not due to mucus, or to the salts contained in the saliva, but probably to the enzyme ptyaline, since saliva loses the characteristic property after boiling. Of other enzymes, diastase was found to have some action, but even under the most favourable conditions it was very slight indeed. The action of saliva may explain some of the faults in the goods with which dyers have frequently to contend.

—T. F. B.

### ENGLISH PATENTS.

*Manufacture of Artificial —.* G. D. Lacroix, Assignor. Eng. Pat. 2192, Feb. 3, 1905. Under Int. Conv., Feb. 6, 1904.

SEE Pat. 351,265 of 1905; following these.—T. F. B.

*Mordanting and Loading Silk and other Textile Fibres.* C. E. Carstanjen, Como, Italy. Eng. Pat. 17,822, Aug. 16, 1904.

SEE Fr. Pat. 344,782 of 1904; this J., 1901, 1212.—T. F. B.

### UNITED STATES PATENTS.

*Oils, Grease, &c.; Process of Extracting — from Seeds, Wool, &c.* J. McMahon. U.S. Pat. 793,464, June 27, 1905. XII., page 851.

*Dyeing Machine.* J. A. Willard, Assignor to the Vacuum Dyeing Machine Co., Chattanooga, Tenn. U.S. Pat. 793,488, June 27, 1905.

THE apparatus claimed consists of a combination of a dye-vat; a removable, perforated plate surmounting the dye-vat; a vertically-movable, perforated, false bottom supporting the materials to be dyed; means for circulating dye-liquors through the vat; a rod, worked by means of a lever, for raising and lowering the false bottom; and means for actuating the lever.—E. B.

*Dyeing, &c.; Machine for —.* S. W. Cramer, Charlotte, N.C. U.S. Pat. 793,510, June 27, 1905.

THE apparatus, which forms the subject of this invention and which is designed for use in bleaching, dyeing, &c., textile materials, is composed of a stationary, external casing or curb; a removable cover for the casing; a central spindle and means for revolving it; a disc rigidly attached to the spindle; a perforated cylinder resting on and firmly affixed to the disc; a second cylinder, of greater diameter than, and concentric with the first-mentioned cylinder, also affixed to the disc and provided with openings for the escape of dye-liquors, &c., and with means for closing the openings; a removable false bottom supporting the materials to be treated; a cover for the materials; means for compressing the materials by applying pressure to the last-mentioned cover; and means for supplying "elastic fluid" and circulating this through the materials.—E. B.

*Dyeing Apparatus.* O. Kunz, Vienna. U.S. Pat. 793,594, June 27, 1905.

SEE Eng. Pat. 1156 of 1905; this J., 1905, 798.—T. F. B.

*Indigo White; Process of Making —.* P. Seidel and R. Wimmer, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 794,049, July 4, 1905.

SEE Eng. Pat. 6226 of 1904; this J., 1905, 127.—T. F. B.

*Indigo Vat; Hydrosulphite —.* P. Sollet, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 794,050, July 4, 1905.

SEE Eng. Pat. 8510 of 1902; this J., 1903, 362.—T. F. B.

*Dyeing; Process of —.* B. Richard, Assignor to Aniline Colour and Extract Works, formerly J. R. Geigy, Basle, Switzerland. U.S. Pat. 794,314, July 11, 1905.

WOOL is dyed from an acid bath with a dyestuff obtained by combining the diazo derivative of a monohalogenated  $\alpha$ -aminophenolsulphonic acid with  $\alpha$ -naphthylamine or with ethyl- $\alpha$ -naphthylamine, and the dyed goods are then treated with a solution of a copper salt. If desired, the copper salt may be added to the dye-bath.—T. F. B.

*Formaldehyde-Sulphoxylate [Discharging Compound] and Process of Making Same.* M. Bazlen and T. Wohlfahrt, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 793,559, June 27, 1905.

SEE Eng. Pat. 13,955 of 1904; this J., 1905, 727.—T. F. B.

*Discharging Compound [Dyeing].* K. Reinking and E. Dehnelt, Ludwigshafen and H. Labhardt, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 793,610, June 27, 1905.

SEE Eng. Pat. 13,955 of 1904; this J., 1905, 727.—T. F. B.

*Size [for Cotton Thread]; Process of Manufacturing* —. W. Möller-Holtkamp. München-Gladbach, Germany. U.S. Pat. 793,600, June 27, 1905.

SEE Eng. Pat. 16,105 of 1904; this J., 1905, 544. T. F. B.

*Fabric and Method of Ornamenting same.* W. J. Pope and J. Hübner, Manchester. U.S. Pat. 794,045, July 4, 1905.

SEE Eng. Pat. 4907 of 1904; this J., 1905, 273.—T. F. B.

#### FRENCH PATENTS.

*Cellulose Products formed by the Decomposition of a Solution of Cellulose by means of Bases; Process of Making* —. Ver. Glanzstoff-Fabr., Act.-Ges. Fr. Pat. 351,206, Feb. 1, 1905. XIX., page 855.

*Horsehair, Artificial; Process of Making — of great Elasticity and Possessing the Transparency of Glass, also Films of the same Nature.* Ver. Glanzstoff-Fabr., Act.-Ges. Fr. Pat. 351,207, Feb. 1, 1905. XIX., page 856.

*Cellulose Threads and Films; Process of Making Elastic Tenacious and Transparent* —. Ver. Glanzstoff-Fabr., Act.-Ges. Fr. Pat. 351,208, Feb. 1, 1905. XIX., page 856.

*Silk; Process of Making Artificial* —. G. D. Lacroix. Fr. Pat. 351,265, Feb. 4, 1905. Under Int. Conv., Feb. 6, 1904.

In place of using nitro-cotton containing 25–30 per cent. of moisture for the preparation of collodion, a nitro-cotton containing 35–45 per cent. is employed; after nitration and washing, no drying is necessary, the material being gently pressed. Such a material is stated to be very economical to use, inasmuch as it requires less ether for its solution than nitro-cotton containing less moisture. A solvent consisting of equal parts of ether and alcohol is preferable to 2 parts of alcohol as generally used.

—T. F. B.

*Silk; Process of Weighting* —. A. Bussy. First Addition, dated Jan. 28, 1905, to Fr. Pat. 348,291, Feb. 3, 1904 (see this J., 1905, 495).

THE silk is impregnated with a solution of one or more salts which are dissociated by steaming, either simple, or in presence of some other vapour; such salts are acetates, formates, &c., of aluminium, magnesium, zinc, chromium, &c. After draining, the silk is steamed, and treated with a solution of an alkali phosphate or silicate, or of tannin. Glycerin, sugar, tannin or similar substance may be added to the first bath, to keep the silk soft.

—T. F. B.

*Mordanting Vegetable Fibres Preparatory to Dyeing or Printing; Impts. in* —. The Calico Printers Association, Ltd. Fr. Pat. 349,877, Dec. 29, 1904. Under Int. Conv., Nov. 19, 1904.

SEE Eng. Pat. 25,165 of 1904; this J., 1905, 194.—T. F. B.

*Colours giving a "Shot" Silk Effect; Process of Making* —. C. Ludewig. Fr. Pat. 351,274, Feb. 4, 1905.

MINERAL colouring matters are mixed with a hot solution of glue or gelatin to a thick paste, which is dried, ground, and mixed with bronze powder, and then applied to freshly-printed surfaces. By subsequent brushing, a "shot-silk" effect is stated to be produced.—A. S.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

*Rattan Canes [for Chairs]; Bleaching of* —. Jenekel. Färber-Zeit. 1905, 16, 193–195.

RATTAN canes, imported from Singapore, have generally been freed from the layer of bast fibres before shipment. One species has a distinctly resinous surface, whilst another is quite smooth; both kinds are covered with a silicious

scale which must be removed before bleaching, canes are sorted according to thickness, flexibility, colour; the soft canes are rejected. The sorted canes are scoured with sand and then immersed, in batches of 5 tons, in a 1–2 per cent. solution of hydrofluoric acid for two or three hours. They are then removed, washed, re-arranged and immersed for a further 12 hours. The acidified canes are then neutralised by immersion over-night in a solution of sodium carbonate. The bleaching of these canes can only be effected satisfactorily by means of an alkaline hypochlorite bath. This is prepared by the addition of excess of sodium carbonate to a solution of calcium hypochlorite; the hypochlorite is prepared electrolytically from brine gives unsatisfactory greenish shades. The strength of the bath should be equivalent to a N/10–N/7 solution of available chlorine with an alkalinity equal to a N/10 solution. The time of bleaching depends very much on the temperature, at 15° C. is an average duration. With lignified tissues such as these, there is a very great danger of spoiling the colour by over-bleaching. The accumulation of bicarbonate is prevented by the occasional addition of slaked lime. After immersion for three hours, the canes are removed and the available chlorine, alkalinity and temperature of the bath are determined; the duration of further treatment (3–5 hours) and the necessary addition to the bath are then calculated from the results. After the second immersion, the canes are rinsed and hung to dry; if they are dull in colour, they are improved by completing the drying at 40° C., if reddish, they are treated over-night with sulphur dioxide whilst still half dry. In any case, they receive a further treatment with sulphur dioxide after drying; 10 kilos. of sulphur are sufficient for five tons of cane. The darker coloured canes are then sorted out, but a second bleaching is useless for improving their colour. The subsequent treatments, such as polishing, slicing, etc., are mechanical and improve the lustre and flexibility. Only the outside of the canes is used for chair seats; the insides or "peddy" are unaffected by the bleaching process.—J. F. B.

#### ENGLISH PATENTS.

*Leather; Process of Dyeing* —. C. D. Abel, Ltd. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 18,096, Aug. 20, 1904.

THE diphenylamine derivatives obtained by reduction of condensation products of *p*-nitrochlorobenzene with aniline (NO<sub>2</sub>:SO<sub>3</sub>H:Cl=1:3:4) with *m*-phenylenediamine or chloro-*m*-phenylenediamine are found, by reason of their easy oxidation, to be well suited to the dyeing of leather, especially chrome-dyed leather, on which greyish-blue to blue-black shades are produced when the leather is treated with an alkali. One of the above compounds together with an oxidising agent such as hydrogen peroxide or a chromate, is used to tan leather is dyed by this method grey or greenish black shades. In either case the dyings can be toned by the use of a suitable dyestuff.—T. F. B.

*Printing Plates; Manufacture of Plastic Compositions for use in the Production of —, but also applicable to other purposes.* L. Collardon, Leipzig. Eng. Pat. 27,090, Dec. 12, 1904.

THE plastic mass is obtained by moistening insoluble casein or albumin, mixing the same thoroughly with a hardening medium, and then submitting it to pressure and heat. As moistening agents, water, strong ammonia, and organic compounds not too easily volatilisable are suggested, and as hardening media, tannins, formaldehyde, hexamethylentetramine, chromates, bichromates, &c. To counteract any alkaline reaction of the hardening media, solid acid bodies, and acid phosphates, bichromates, &c., may be added to the casein. It is advisable to add organic bodies, which melt at temperatures above 100° C., and act as solvents on the surface of the casein, and albumin, and facilitate adhesion. The hardness of the mass may be increased by the addition of filling materials such as metallic oxides, silicates, &c., or the mass may be softened by the addition of suitable



rium sulphate, magnesia, chalk, kaolin, &c. The also include the use of this plastic mass for the eture of printing and impressing dies.—W.C.H.

## I.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

*ferrocyanic Acid; Compounds of Sulphuric Acid* —. *Sulphonic Substitution in the Molecule of Cyanides. Oxyferrocyanides.* P. Chrétien, *ptes rend.* 1905, 141, 37—39.

aturated solution of hydroferrocyanic acid in strong ic acid be gradually diluted with water and left to rhombohedral crystals are deposited, having mposition  $H_4Fe(CN)_6 \cdot 7H_2SO_4$ ; if the addition er be continued till a permanent turbidity the crystals are needles, and their formula is  $(CN)_6 \cdot 5H_2SO_4$ . These two substances readily disso-

moist air. Hydroferrocyanic acid be dissolved at 100° C. in sulphuric acid, the solution on cooling deposits a, which, when exposed to air on a porous tile, phuric acid. The resulting substance crystallised

cohol has the composition  $H_4Fe(CN)_6 \cdot 11_2SO_4$ ; stability in moist air and its other reactions t to be really the hydrate of a sulphonic acid  $(CN)_6 \cdot HSO_3 \cdot 11_2O$ . If for ordinary sulphuric acid e substituted a mixture of this with fuming sul-

acid, similar treatment gives two substances, one the composition  $Fe(CN)_6SO_2$ , the other being the ic acid just mentioned. These bodies are formed two successive reactions  $2Fe(CN)_6H_3 + S_2O_7 \cdot H_2 + 2Fe(CN)_6(SO_2)H_2$  and  $2Fe(CN)_6(SO_2)H_2 + O = 6(SO_2H)11_2 + Fe(CN)_6SO_2$ . The action of alkalis on er substance results in the formation of hydroxy- amides:— $Fe(CN)_6SO_2 + 3H_2O = Fe(CN)_6(OH)H_3 +$  Sodium hydroxide yields a double salt, crystal- from alcohol,  $Fe(CN)_6(OH)Na_3 \cdot SO_4 \cdot Na_2$ ; while carbonate forms barium sulphate and a crystal- salt  $(Fe(CN)_6OH)_2Ba_3 \cdot 4H_2O$ .—J. T. D.

ising; *Theory of* —. G. Bodländer and R. ces. *Z. angew. Chem.* 1905, 18, 1137—1141.

ilibrium point of the reaction  $K_2CO_3 + Ca(OH)_2 + 2KOH$  depends on the relative solubility of calcium hydroxide and calcium carbonate. a hydroxide dissolves in water till the product  $2OH$  has reached a constant value  $k_1$ . If the

already contains hydroxyl ions, the value  $k_1$  will ed by the solution of a smaller amount of calcium ide than if it does not, i.e., calcium hydroxide soluble in a solution of alkali hydroxide than in

Similarly when a solution is saturated with a carbonate,  $C_C \times C_{CO_3}$  has a constant value  $k_2$ ,

alkali carbonate in solution diminishes the solubility um carbonate. Thus as the reaction above is from left to right the solubility of calcium ide gradually diminishes and that of calcium ate increases, and equilibrium occurs when the ular solubilities" are alike, i.e., when  $C_C$  is the

or the hydroxide as for the carbonate. At that then  $k_1/C^2_{OH} = k_2/C_{CO_3}$ , or  $C^2_{OH}/C_{CO_3} = k_1/k_2 = k_3$

his shows that the concentration of the carbonate eases as the square of that of the hydroxyl ions; ore concentrated the solution of hydroxide y produced, the smaller the proportion of the l carbonate causticised, in other words the poorer

ld. Lunge's figures illustrate this, and the authors, eriments conducted by shaking lime with solutions

alkali carbonate and hydroxide at 18° and at 25° C., uilibrium was attained, found that as the final ration of sodium hydroxide increased from N

ily 3N, the yield diminished from 94 per cent. per cent. and 87 per cent. respectively. The

of temperature on the equilibrium can be predicted: ion which evolves heat will not proceed so far, one

which absorbs heat will proceed farther, as the tempera- ture is raised. In very dilute solutions the reaction  $Na_2CO_3 + Ca(OH)_2 = CaCO_3 + 2NaOH$  evolves heat, but in more concentrated solutions absorbs it; so that as usually practised, elevation of temperature favours the reaction, though but slightly. It has the further advantage, however, of increasing the speed of reaction, and thus accelerating the attainment of equilibrium. An application of the phase rule presents itself in considering the causticising process. There are four constituents, sodium hydroxide, calcium carbonate, calcium hydroxide and water; and four phases, solid lime, solid calcium carbonate, solution and vapour. It is well known that loss of alkali occurs through its being carried down with the lime. If this be (as is usually assumed) in the form of Gaylussite,  $CaCO_3 \cdot Na_2CO_3 \cdot 5H_2O$ , it forms a fifth phase, and this loss can only occur at one definite concentration, thus a mode of working may be devised which will prevent the formation of gaylussite; but if it be as a solid solution, then there are only four phases, and the loss of alkali may occur at various concentrations. The employment of dilute solutions for the sake of high yields involves the concentration of these dilute solutions; and to avoid this, other hydroxides instead of that of calcium may be sought. The relative solubilities of magnesium hydroxide and carbonate are still more unfavourable than those of the corresponding calcium compounds; but barium and especially strontium compounds are much more suitable, for while  $k_3$  in the case of calcium works out to 2350, its value in the case of strontium is 195000. Experiments, similar to those previously quoted, gave with strontium yields of 99.5 and 99 per cent. against 83 and 87 per cent. with calcium. With strontium elevation of temperature is prejudicial to completeness of causticising. A practicable method of employing strontium would be to causticise with lime as far as possible, and to pour off and treat the clear liquid with strontium hydroxide.—J. T. D.

*Potassium Sulphate; The Process of Causticising* —. J. Herold. *Z. Elektrochem.* 1905, 11, 417—430.

THE equilibrium-constant of the reaction  $Ca(OH)_2 + SO_4^{--} \rightleftharpoons CaSO_4 + 2OH$ , since the concentrations of the calcium hydroxide and sulphate, in contact with the solid substances, are constant, has the form  $k = C^2_{OH}/C_{SO_4}$ , and can be calculated (if the dissolved salts be supposed completely dissociated) from the solubilities of calcium hydroxide and calcium sulphate. In concentrated solutions the reaction is more complex, from the formation of syngenite,  $K_2Ca(SO_4)_2 \cdot H_2O$ , and the constant has the form  $k' = C_{OH}/C^2_{SO_4}$ . In the first case, the reaction producing hydroxyl ions (causticising) will be favoured by dilution; in the second, on the other hand, by evaporation and consequent concentration.

Calculation of the solubilities of calcium sulphate and hydroxide at high temperatures, using van't Hoff's formula for extrapolation, seemed to indicate that good results would be obtained by causticising at high temperatures under pressure. But some of the deductions from the figures so obtained threw doubt on their accuracy, and the author undertook some direct determinations of the solubility of calcium hydroxide, the results of which were:—

Temp. °C.	1 litre contains grms. CaO.
120	0.314
	0.309
	0.301
	0.167
150	0.171
	0.169
	0.169
	0.088
190	0.083
	0.080

Direct experiments on causticising were now carried out by heating together potassium sulphate and lime, and also potassium hydroxide and gypsum (or anhydrite for temperatures above 100° C.) till equilibrium was approximately attained, and determining the composition of the resulting clear liquid. The general trend of the results at each temperature is that  $k$  lessens in value as the concentration increases; but  $k$  can only be cal-

culated from the total concentrations of the salts, for their degrees of dissociation are not known so as to furnish the ionic concentrations. The difference is most marked at the higher temperatures. While the experiments at higher temperatures show that at equal dilutions the production of potassium hydroxide goes farther than at 70° C., yet the difference is not very marked, while on the other hand, the results at 0° C. suggest that it may be possible to carry out the process at this temperature profitably on the industrial scale. Though the figures suggest that the formation of potassium hydroxide goes farthest at low concentrations, yet these are only proportional or relative amounts, and the absolute amount obtainable at a higher concentration may be equally great, and more economically separable. This separation will possibly be better carried out by freezing than by boiling down; for as the temperature falls below 2.6° C. both ice and potassium sulphate separate, one at the surface and one at the bottom.—J. T. D.

*Ammonia; Reactions in Liquid* —. E. C. Franklin, J. Amer. Chem. Soc., 1905, 27, 820—851.

Of all known solvents liquefied ammonia most closely resembles water in general physical properties, and the author draws attention also to the close analogy between the relations of the acid amides, metallic amides, and the metallic derivatives of the acid amides to ammonia, on the one hand, and the relations of the ordinary oxygen acids, bases and salts to water, on the other. In view of this general similarity, the author proposes the names *ammono-salts*, *ammono-bases* and *ammono-acids* for the ammonia derivatives bearing to ammonia the relations which ordinary salts, bases and acids (or *hydro-salts*, *hydro-bases* and *hydro-acids*) bear to water. Ammono-acids and ammono-bases dissolved in liquefied ammonia react to form ammono-salts. For example, acetamide and potassium amide form potassium acetamide:  $\text{CH}_3\text{CONH}_2 + \text{KNH}_2 = \text{CH}_3\text{CONHK} + \text{NH}_3$  or  $\text{CH}_3\text{CONH}_2 + 2\text{KNH}_2 = \text{CH}_3\text{CONK}_2 + 2\text{NH}_3$ ; whilst urea and potassium amide form potassium carbamide:  $\text{CON}_2\text{H}_4 + \text{KNH}_2 = \text{CON}_2\text{H}_3\text{K} + \text{NH}_3$ , or  $\text{CON}_2\text{H}_4 + 2\text{KNH}_2 = \text{CON}_2\text{H}_2\text{K}_2 + 2\text{NH}_3$ . Some metallic salts are decomposed in liquefied ammonia in a manner analogous to hydrolytic decomposition in water (see François, this J., 1900, 80; Joannis, this J., 1903, 49; and Vigouroux and Hugot, this J., 1903, 887). For this class of reactions, the designation *ammonolysis* is proposed, analogous to hydrolysis. Salts of the heavy metals when dissolved in liquefied ammonia react with the soluble alkali amides to form amides, imides or nitrides of the heavy metals. Silver amide, lead imide and mercuric and bismuth nitrides, which are all explosive compounds, were thus prepared, in accord with the following equations:—(1)  $\text{AgNO}_3 + \text{KNH}_2 = \text{AgNH}_2 + \text{KNO}_3$ ; (2)  $\text{Pb(NO}_3)_2 + 2\text{KNH}_2 = \text{PbNH}_2 + 2\text{KNO}_3 + \text{NH}_3$ ; (3)  $3\text{HgI}_2 + 6\text{KNH}_2 = \text{Hg}_3\text{N}_2 + 6\text{KI} + 4\text{NH}_3$ ; (4)  $\text{BiBr}_3 + 3\text{KNH}_2 = \text{BiN} + 3\text{KBr} + 2\text{NH}_3$ . These ammono-bases are insoluble in liquefied ammonia, but dissolve readily in solutions of ammonium salts in liquefied ammonia. They are decomposed by the action of water, ammonia being evolved. In many cases, when an excess of the metallic salt is used, ammono-basic salts are produced in an analogous manner to the formation of ordinary basic salts in aqueous solutions. Ammono-basic mercuric iodide,  $\text{Hg}_2\text{NI}$ , (see François, this J., 1900, 80, 463), ammono-basic mercuric bromide,  $\text{Hg}_2\text{NBr}$ , ammono-basic mercuric chloride,  $\text{Hg}_2\text{NCl}$ , the known "infusible white precipitate," and ammono-basic lead iodide,  $\text{Pb}_2\text{NI.NH}_3$ , were prepared in this way. The author considers that all the so-called mercuri-ammonium compounds may be regarded as belonging to one of three classes of ammonia derivatives: first, ammono-basic compounds; second, mercuric salts with ammonia of crystallisation; and (3), mixed ammono-basic and hydro-basic compounds. Nessler's precipitate (see François, this J., 1900, 463) for example is considered to be a mixed ammono-basic and hydro-basic mercuric iodide,  $\text{NH}_2\text{.Hg.O.Hg.I}$ . Certain ammono-bases, for instance, the silver, aluminium, copper and lead compounds dissolve in excess of potassium amide in liquefied ammonia solution just as many metallic hydroxides and oxides

dissolve in aqueous solutions of potassium hydroxide. A lead compound prepared in this way had a composition corresponding approximately to the formula  $\text{PbNKH}_2$  or  $\text{PbNH}_2\text{.NHK}$ . (See also this J., 1899, 180; 1901, 474.)—A.S.

*Potassium Chlorate; Decomposition of* —, by Hydrochloric Acid. E. Davidson. Z. angew. Chem., 1901, 18, 1047—1054.

The author has examined the decomposition of potassium chlorate by hydrochloric acid in dilute solution, taking every precaution to exclude air, and determining after varying intervals of time the amounts of chlorate set free (by iodide and thiosulphate, and also by arsenic acid). His conclusion is that the reaction is unimolecular, the active substance being the potassium chlorate; however its concentration be varied, the same value of the affinity-constant, is obtained, and the same time requisite for the reaction to proceed half-way to completion. Rise of temperature accelerates the reaction in such a way that the speed of reaction increases in a constant ratio with equal intervals of temperature-rise. The presence of potassium iodide during the reaction accelerates it; this effect is catalytic, for the effect of varying the concentration of potassium iodide is not in agreement with Guldberg and Waage's law. The speed of reaction increases with increase of the concentration of hydrochloric acid, and is only measurably rapid when a considerable excess of hydrochloric acid is present. The effect of change of concentration of hydrochloric acid, however, is not consistent with the reaction being bi- or tri-molecular. The author's view is that the effect of the hydrogen of the hydrochloric acid is to push the equilibrium in the reaction  $\text{HClO}_3 \rightleftharpoons \text{H}^+ + \text{ClO}_3^-$  towards the left; and as undissociated chloric acid is decomposed and equilibrium disturbed, more is formed from the ions till decomposition is complete. The energetic decomposition of potassium chlorate, compared with the sluggish reaction in aqueous solution in which the anion  $\text{ClO}_3^-$  exists, favours this view. The experiments do not afford material for deciding whether the chloric acid gives off all its oxygen at once, which then reacts on the hydrochloric acid, or whether hypochlorous acid is formed intermediate. Probability is in favour of the latter view, however, though the actual isolation of hypochlorous acid has not been accomplished.—J. T. D.

*Ferric Sulphate; Molecular Transformations of* Hydrochloric Acid. A. Recoura. Comptes rend., 1905, 141, 109.

When an aqueous solution of ferric sulphate is left to evaporate, two phases occur in the process. At a certain concentration, the basic sulphate  $6\text{Fe}_2(\text{SO}_4)_3\text{.Fe}_2(\text{SO}_4)_3$  (this J., 1905, 801), deposits, leaving acid sulphate in solution; then the acid liquid and the basic solid combine to form a yellow solid of composition  $\text{Fe}_2\text{O}_3\text{.3SO}_3\text{.9H}_2\text{O}$ . This substance, however, is not perfectly homogeneous. If the perfectly dry substance be very finely powdered and then dissolved in a very small amount of water, and stirred out with a brush in a thin layer on glass plates, it becomes a perfectly white solid, absolutely homogeneous, having the same composition  $\text{Fe}_2(\text{SO}_4)_3\text{.9H}_2\text{O}$ . It differs from the yellow salt in being very slowly dissolved in water, soluble without decomposition in alcohol, and stable in moist air. The separate identity of the two substances, however, does not persist in their aqueous solutions. —J. T. D.

*Thermite Process; Binary Metallic Compounds prepared by the* —. A. Colani. Comptes rend., 1905, 141, 33—35.

The author has prepared a number of compounds (sulphides, phosphides, silicides, &c.) by firing a mixture of metalloid, the metallic oxide, and aluminium. Sometimes the oxide of the metalloid is used; and copper may be added to increase, or copper filings to lessen the intensity of the reaction. The compounds are, however, for the most part contaminated by aluminium and sometimes by iron, and many trials are sometimes required before a satisfactory fusion is obtained.—J. T. D.



*Hydroxide in Presence of Sodium Carbonate; Metric Determination of —.* K. Novotny. III., page 860.

*Cyanogen Mud.* A. Hand. II., page 835.

#### ENGLISH PATENTS.

*Processes of the Alkaline Earths and Sulphates of the Alkalies; Process for Reducing — to Sulphides for Reducing Metallic Oxides to Metals.* C. Agnioni and L. Calastretti, Milan, Italy. Eng. Pat. 13,565, June 15, 1904. Under Int. Conv., June 20, 1904.

Eng. Pat. 343,926 of 1904; this J., 1904, 1090.—T.F.B.

*Sulphites; Manufacture of Stable —.* J. Y. Mason, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 15, Oct. 31, 1904.

Second Addition, dated Nov. 7, 1904, to Fr. Pat. 3 of 1904; this J., 1905, 333.—T. F. B.

*Hydrochloric Acid; Processes and Apparatus for Manufacturing —.* E. A. and J. G. Behrens, Bremen, Germany. Eng. Pat. 13,981, June 20, 1904.

Eng. Pat. 343,903 of 1904; this J., 1904, 1089.—T.F.B.

#### UNITED STATES PATENTS.

*Hydrochloric Acid Manufacture; Catalytic Substance for — Process of Making same.* R. Knietsch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 794,512, July 11, 1905.

Eng. Pat. 10,729 of 1901; this J., 1902, 548.—T.F.B.

*Hydrochloric Anhydride; Catalytic Apparatus for Making —.* M. Schroeder, Düsseldorf, Germany, Assignor to New Jersey Zinc Co., N.J. U.S. Pat. 793,543, July 27, 1905.

The apparatus comprises a receptacle containing a number of compartments, each having a body of contact material resting on a screen. Between the separate compartments contact material are arranged mixing diaphragms, forming a central restricted aperture, of the shape of a truncated frustrum of a cone, so that the gases are easily mixed on their passage, and brought to a uniform temperature. (Compare U.S. Pat. 789,634, July 19, 1905; this J., 1905, 619.)—E. S.

*Solutions; Electrolytic Decomposition of —.* A. Larchar, Assignor to Penobscot Chem. Fibre Co. U.S. Pat. 793,138, June 27, 1905. XI.A., page 850.

*Carbon Dioxide; Process of Absorbing —.* A. Nultze, Charlottenburg, Germany. U.S. Pat. 793,077, July 4, 1905.

The process described in the main patent, and in the addition thereto of Aug. 18, 1904 (this J. 1905, 90), is claimed as also applicable to vanadium ores.

#### FRENCH PATENTS.

*Processes of Copper, Zinc, Cadmium, Silver, Nickel, and Tungsten; Process of Obtaining the — by the Wet Way, by direct Extraction.* D. Lance. Second Addition, dated Jan. 9, 1905, to Fr. Pat. 342,865 of 1904 (this J., 1904, 1032).

The processes described in the main patent, and in the addition thereto of Aug. 18, 1904 (this J. 1905, 90), are claimed as also applicable to vanadium ores.

In precipitating the solutions obtained, magnesia preferably, or another base capable of affording a soluble salt with the acid used to effect the solution, is employed. The hydroxides of the several metals are precipitated fractionally from the boiling solution. The first precipitate includes the iron present, together with a certain proportion of nickel, and this precipitate may be washed and reduced and fused to obtain an alloy of iron and nickel, the proportion of nickel in which may be reinforced by addition from the second precipitate, containing wholly or chiefly nickel hydroxide. The precipitates generally are washed by a hot ammoniacal solution during passage of ammonia gas in excess, with or without the presence of amines.—E. S.

*Leucite, or Minerals containing Leucite; Disintegration of —, by treatment with Alkalis.* A. Piva. Fr. Pat. 351,338, Feb. 7, 1905.

LEUCITE, or an ore containing it, in fine powder, is placed in an autoclave with a concentrated solution of potassium or sodium hydroxide, and live steam is passed in under a pressure of from 20 to 25 atmospheres, and at a temperature exceeding 200° C. Alkali aluminates and silicates are thus obtained, which yield alumina and an alkali carbonate on suitable treatment.—E. S.

#### VIII.—GLASS, POTTERY, AND ENAMELS.

*Glassware; Chemical —.* P. H. Walker. J. Amer. Chem. Soc., 1905, 27, 865—875.

THE glassware was subjected to a series of tests including solubility determinations, and mechanical tests as regards breaking or cracking in consequence of changes of temperature. The following kinds of glassware were examined:—(1) Flasks and beakers of Kavalier (Bohemian) glass; (2) Flasks and beakers of Weber's resistance glass, also known as Greiner and Friedrichs' resistance glass, and bearing the permanent trade mark "R"; (3) Flasks and beakers of Wiener Normal glass, bearing the trade mark "Wiener Normal Geräte Glas"; (4) Beakers of Thüringen glass; (5) Beakers, flasks and Erlenmeyer flasks of Jena glass, bearing the trade mark "Schott and Gen. Jena"; (6) Beakers of "Nonsol" glass, bearing the trade mark "Nonsol W. T. Co."; (7) Beakers, flasks and Erlenmeyer flasks of laboratory glassware of American manufacture; (8) Beakers of Bohemian Normal glass from an American dealer; (9) Beakers and flasks of resistance glass of Verein. Fabr. für Laboratoriumsbedarf; (10) Beakers and flasks of "F.Z." resistance glass, bearing the trade mark "F.Z."; and (11) Bohemian glass beakers from an American dealer. Analysis showed that those glasses bearing permanent trade-marks, viz., Nos. (2), (3), (5), (6), and (10), were all borosilicate glasses in which a portion of the lime had been replaced by zinc, whilst the other glasses were alkali-lime silicates. The zinc borosilicate glasses and the Kavalier (Bohemian) glass gave the best results in the different tests. Of the borosilicate glasses the Wiener Normal glass (No. 3) was the least resistant to reagents, and its properties more nearly resembled those of the alkali-lime silicate glasses. It was observed that with the same variety of glass, the beakers were more resistant to reagents than the flasks. The American alkali-lime silicate glasses were, in general, of very poor quality.—A. S.

*Shrinkage on Firing; Investigations on —.* R. Lucas. Z. physik. Chem. 1905, 52, 327—342.

REFRACTORY oxides, such as alumina, magnesia, beryllium oxide, titanate, iron oxide, and the oxides of the rare earths, when heated to high temperatures contract in a marked degree. The contraction is greater, the higher the temperature, and it is remarkable that practically no alteration in the absolute weight occurs. The contraction on firing is distinct from the contraction on drying. The method of experiment was to work some fine soft powder of the above-mentioned bodies into

a kneadable mass with a little water, and to press the mass out into a cylindrical thread, which was dried in the air, and then as far as possible by heat, and the dried cylinder cut into smaller rods, the dimensions of which were measured before and after burning by means of a micrometer. The course of the shrinkage at different temperatures was followed in many experiments in an electrical platinum resistance furnace, and the temperatures determined by a platinum-platinum-rhodium thermo-couple. Before the experiments, the heat distribution in the inner tube was determined, and zones of constant temperature located. For further experiments two other furnaces were used, one composed of magnesia and graphite, and the other of an iridium tube, and the temperatures were measured by comparing the light given out with that given by a Nernst incandescent lamp, and calculating the temperature in degrees centigrade from the deflections of the galvanometer in the circuit.

The author found that the contraction depended upon the rate of heating. When the substances are brought slowly to a given temperature, the contraction is always less than when the bodies are heated rapidly, and the difference increases up to about 950° C., when it amounts to about 4 per cent. (linear). At higher temperatures the difference slowly decreases, and at very high temperatures entirely disappears.

The contraction of the materials experimented upon was not the same in all directions, for when placed in a horizontal position, the contraction in the direction of length was always found to be smaller than the linear contraction in a vertical direction, and the difference increases with increase of temperature.

The sharp falling off of the contraction curve appears to be characteristic of contracting bodies. Though the position of the initial and final points of the shrinkage on firing is different for individual bodies, the character of the individual curves is essentially the same.

With regard to the effect produced by the length of time of burning upon the contraction, it was found that a rod contracted very rapidly at first under the influence of heat, but that afterwards only a relatively small alteration occurred when a definite temperature was maintained for a longer period. Thus, a rod burned at 1170° C. for one hour contracted from 100 to 80.4, whilst a further 12 hours' heating at the same temperature caused a further contraction of only 0.7. A rod that has been burned for a long time at about 1000°, on heating further to 1100° C. shows a diminution of the power of contraction.

The strength of these substances is increased owing to the contraction.

Shrinkage on firing on the one hand gives strength to a body, and on the other causes a marked diminution of volume, without any essential alteration in the absolute weight; hence the contraction can only be explained by the fact that the bodies possess hollow spaces, which under the influence of heat contract. This explanation is confirmed by actual determinations of porosity, hence the amount of shrinkage depends upon the degree of porosity. Shrinkage being dependent upon the diminution of the hollow spaces, it may be assumed that elastic forces are at work, which tend to reduce the free surfaces to a minimum, and that the body must be in a condition to answer to a contractive force—in other words a cementation of individual particles occurs. These conditions are satisfied by amorphous bodies. Since kaolin contains two molecules of water of crystallisation, it might appear to be an exception; but hydrated bodies that have been heated sufficiently to drive off this combined water, behave like amorphous substances, and shrinkage is shown by experiment to occur in kaolin only when the temperature has risen above the point of dehydration. A decrease of specific volume, shown by an increase in density, occurs on heating many bodies (e.g. amorphous magnesia) to high temperatures, at which polymerisation, in other words rearrangement of molecules, takes place, causing a contraction of the free surface. Assuming then that bodies that shrink are in an amorphous condition, then, at all temperatures, capillary forces come into play and must tend to diminish the surface, and gradually diminish the porosity. At ordinary temperatures the

internal tension is too great to allow this contraction occur to any marked degree, but with rise of temperature the tension decreases and the rate of contraction correspondingly increases.—W. C. H.

*Glaze; Blood-red Chinese* —. C. Otsuki. Z. ang. Chem. 1905. 18, 1054—1055.

ANALYSIS of this glaze carefully separated from the underlying body gave the following results:—

SiO<sub>2</sub>, 59.58 per cent.; SnO, 0.32; CuO, 1.20; PbO, 8.20; Fe<sub>2</sub>O<sub>3</sub>, 1.39; Al<sub>2</sub>O<sub>3</sub>, 8.38; CaO, 11.11; MgO, 1.70; K<sub>2</sub>O, 2.74; Na<sub>2</sub>O, 5.27 per cent.; and MnO, trace. This would give a formula (2.0 RO + 0.04 Fe<sub>2</sub>O<sub>3</sub>) 0.4 Al<sub>2</sub>SiO<sub>5</sub>, where RO is 0.5 SnO, 3.7 CuO, 9.0 PbO, 48.0 CaO, 10.0 MgO, 7.1 K<sub>2</sub>O, 22.0 Na<sub>2</sub>O. Such a glaze can be composed of a mixture of silica, 175.0 grms.; stannic oxide, copper carbonate, 5.4; lead carbonate, 29.0; calcareous carbonate, 57.0; potassium bicarbonate, 17.0; sodium bicarbonate, 34.0; ferric oxide, 4.0; alumina, 2 and magnesia, 5.0 grms.—J. T. D.

#### ENGLISH PATENT.

*Silica [Quartz Glass]; Impts. in the Working of Fused Silica* —. J. F. Bottomley, Wallsend-on-Tyne, and J. Paget, North Cray, Kent. Eng. Pat. 18,437, Aug. 1904.

THE specification contains descriptions of various forms of electrically heated furnaces for fusing silica, which consist essentially of a vessel containing sand, with internal resistance core, which can be withdrawn from the fused mass, to allow of the further working of the plastic material. The initial separation of the core is effected by allowing the formation of a small quantity of gas round the surface of the core (graphite). After fusion of the sand and withdrawal of the internal core, which can be separated from one or both electrodes, the plastic cylinder may be shaped by one or more processes of drawing, blowing, or mechanical pressing. Forms of apparatus are described to allow of the rotation of the heating core and surrounding material, about a longitudinal or transverse horizontal axis for the processes mentioned. A plastic cylinder glazed externally may be produced either by limiting material surrounding the core so that the whole is within an external jacket, or by heating it in an electrically heated chamber, prior to shaping the mass. By closing one end of the plastic cylinder, and pressing the sand round a refractory nozzle, to form a gas tight seal, and by introducing compressed air or gas through the nozzle, the cylinder may be drawn into tubing or into shape in a mould.—W. C. H.

#### FRENCH PATENT.

*Tiles of Ceramic Paste or Cement; Apparatus for Applying and Distributing Colouring Matters for the Manufacture of Inlaid Tiles* —. Erste Schattauer Thonfabriks-Act.-Ges. (vorm. C. Schlinp). Fr. Pat. 354,400, Feb. 3, 1905.

THE apparatus consists, for each colouring matter, of two plates enclosing a groove, and having open spaces which correspond with those of the network in which the colouring matter is to be distributed, and designed so that those of the upper plate are used for the addition of the said colouring matter, which is fed on to the upper plate and falls into the open spaces of the network when the groove is drawn back. The apparatus also has distributing plates or curtains mounted in the open spaces of the upper plate, and also distributing registries mounted obliquely in the spaces of the network.—W. C. H.

### IX.—BUILDING MATERIALS, CLAY, MORTARS, AND CEMENTS.

*Building Materials; Determination of Porosity of Mortars* —. W. Thörner. Chem.-Zeit., 1905, 29, 744—746.

IN 1884 (see Eisen. u. Stahl, 1884, 4, 594) the author described a simple method of determining the porosity and specific gravity of coke and charcoal. Two



menometers were used of the form shown in Fig. 1; smaller held about 100 c.c. up to the zero mark on the measuring tube, and the latter about 200 c.c. The former filled with liquid to about the zero mark, and when the temperature was constant, the volume was noted. A fixed quantity of finely powdered, that is pore-free, substance was carefully shaken down into the apparatus, the volume then read off; the difference between the readings, gives the volume of the substance taken, and divided into the weight in grammes gives the specific

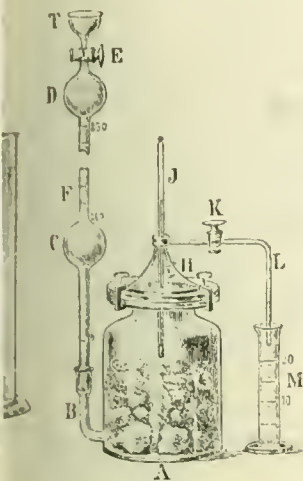


Fig. 2.



Fig. 3.

ty. A small weighed lump of the substance, about 12 mm. wide, was covered with distilled water in a jar, heated to boiling, and put aside to cool. This was used to drain in a funnel, and then slowly slid into the apparatus; the difference between the initial and readings of the instrument gives the volume of the substance taken, and the specific gravity of the substance is the quotient obtained by dividing the weight of the substance taken by the observed volume of substance and pores.

The porosity of building materials is often distributed unequally through the mass, and in order to obtain accurate average values, the author has devised the following larger apparatus, which is useful for substances other than building materials. The thick-walled bottle the volumeter (Fig. 2) holds about 800 c.c., is covered with a dome-shaped cover H, provided

with some form of locking ring, and carrying a thermometer J, and an overflow tube L with stop-cock K. Near the bottom of the bottle is fused on an upright branch tube B, into which a measuring tube F is ground, having two widenings C and D, between which the tube is divided into tenths of a c.c. for 50 c.c. A stop-cock E, with a funnel-shaped opening T is placed above the bulb D. A porosity determination is made, as follows:—The stop-cocks E and K being open, the bottle A is filled with distilled water, through the funnel T, until water begins to flow out from L, and stands at the zero point. The apparatus is then tilted, until the bulb C is completely and D partially filled with the water, when E is shut to prevent the return of the water, on again standing the volumeter upright. The cover is removed, and large pieces of the substance, up to about 250—500 grammes, are put into A, the pieces having previously been heated to boiling in water and cooled and drained. The cover is put on again, the cock K being shut, and a small measuring cylinder placed under L. The cock E is opened, and by carefully opening K, liquid is allowed to slowly refill A, till water just escapes from L, when K is quickly shut, and the volume displaced read off directly in c.c. on the measuring tube.

A simpler and cheaper form of the apparatus is shown in Fig. 3, and consists of a thick walled bottle, with a dome-shaped cover provided with an upright tube expanded into a funnel-shaped opening at the top. Up to the mark M the apparatus holds 1000 c.c. About 500—800 grms. of the sample, in large lumps, soaked with water, &c., as before, are used, and put into the bottle. One of the following methods can then be used:—1. The bottle and sample are weighed on a balancer, and the apparatus filled up to the mark with distilled water and again weighed. The weight of water thus found subtracted from 1000, gives the volume of water displaced by the porous substance, in other words, the volume, in c.c. occupied by the body and pores. 2. A litre-flask filled with water is weighed, and the volumeter filled up to the mark with some of the water, and the rest and the flask again weighed the difference, subtracted from 1000, gives the volume of water displaced. 3. The water necessary to fill up to the mark is measured direct with a measuring cylinder, and the final amount with a burette. This deducted from 1000 gives the volume displaced. In all cases, the rest of the calculation is the same as before. The sources of error in the apparatus are that a little liquid will always remain adhering to the soaked sample, and that a small portion of the absorbed liquid may escape from the mouth of the pores; but for technical purposes it gives sufficiently accurate results. The following table gives the porosity of some building materials and shows how greatly it varies, and how advisable it is to determine beforehand the porosity of materials to be used, as the permeability of walls is so important from the point of view of health.

	Specific Gravity.		Pore-volume in 1000 grms. of Material.	Substance Volume in 1000 grms. of Material.	Volume of 1000 grms. of Porous Substance.	Weight of 1000 c.c. of Porous Substance.
	Substance without Pores.	Porous Substance.				
Building stones—						
Slag stone .....	2.525	1.335	354.0	396.0	750.0	1335.0
Slag stone .....	2.660	1.511	286.0	374.0	662.0	1511.0
Hard sandstone .....	2.604	1.748	188.0	384.0	572.0	1748.0
Brick (hard burnt) .....	2.654	2.252	68.0	376.0	441.0	2252.0
Sandstone .....	2.660	2.315	56.0	376.0	432.0	2315.0
Quarry stone (Muschelkalk) ..	2.660	2.523	20.0	376.0	396.0	2523.0
Marble .....	2.717	2.652	9.0	368.0	377.0	2652.0
Cement (coarse) .....	2.632	1.613	240.0	380.0	620.0	1613.0
Cement (medium) .....	2.551	2.128	78.0	392.0	470.0	2128.0
Cement (fine) .....	2.028	1.870	42.0	493.0	535.0	1870.0
Cement mortar—						
Cement 1:3 sand .....	1.961	1.575	125.0	510.0	635.0	1575.0
Cement 1:2 sand .....	2.000	1.695	90.0	500.0	590.0	1695.0
Cement 1:2 sand .....	1.961	1.681	85.0	510.0	595.0	1681.0
Cement 1:1 sand .....	1.942	1.681	80.0	515.0	595.0	1681.0
Cement without sand .....	1.852	1.695	50.0	540.0	590.0	1695.0

## ENGLISH PATENTS.

*Non-conducting Material; Improved Heat —.* G. Müller, Kiel, and E. Jarek, Hamburg, Germany. Eng. Pat. 16,940, Aug. 2, 1904.

TWENTY-FIVE per cent. of clay, 10 of asbestos fibre, 25 of silicious marl, 5 of vegetable fibre, 17 of ground cork, 3 of aluminium sulphate, 4 of starch flour, 1 of yeast and 10 of water are intimately mixed together in a mixing machine and allowed to ferment. The resulting moist and spongy mass is either applied directly to the surfaces to be insulated or else compressed in moulds to form insulating sholls. In applying these latter, the surfaces to be protected are first given a coating of the moist paste, on which the shells are then pressed, any joints between the shells being also filled in with the paste. The compound is stated to be capable of resisting temperatures up to 500° C.—A. G. L.

*Composition for Building and other Purposes; Manufacture of —.* E. Laine, Brussels. Eng. Pat. 8024, April 14, 1905.

In this process, dolomite and freshly calcined magnesia form the basis, but grinding and sifting, even through silk does not give the material in a sufficiently fine or pure state of division for the necessary reaction to take place to form the oxychloride. The material is said to be obtained in a very finely divided state, and free from iron, lime or manganese salts by precipitation, and is then well washed and calcined. To mould it into the required shapes, the material is mixed with a composition of 3 volumes of pure magnesium chloride to 1 volume of alcohol, denatured by acetone, to which cellulose has been added and containing in solution a variable proportion of gum elemi, gum sandarac or the pure resin of *pinus laryx*. This is said to yield a white homogeneous paste.—W. C. H.

*Marl, Clay or like Material; Impts. in Separators and Grinding Mills used in the Treatment of —.* J. S. Wilkes, Sutton Coldfield. Eng. Pat. 17,563, Aug. 12, 1904.

The claim is for an inclined revolving screen with differently meshed portions, the coarsest mesh being at the lower end. The screen is provided with internal longitudinal bars, carried on brackets and serving to break up the material. The screen is carried, either by an internal shaft attached by brackets, or on external anti-friction rollers. A pair of tapered horizontal crushing rolls, placed below the lowest portion of the screen, serves to break up the lumps of clay passing through.—W. H. C.

*Cements; Manufacture of Keen's or other —, having a Gypsum Base.* T. J. Armstrong, Carlisle. Eng. Pat. 1457, Jan. 25, 1905.

Raw gypsum in a fairly dry state, preferably gypsum that has lain in the air for a few days after having been raised from the mine, is powdered and moistened with a solution of what is termed "a supplementary salt." The damp mass is formed into cakes, which are calcined as usual, the product then being reduced to powder. In this way an intimate mixture of the salt and gypsum is obtained with only one calcining.—A. G. L.

## FRENCH PATENTS.

*Mortars; Binding Material for — and Process of Manufacturing the same.* Soc. Anon. de Fondations par Compression Mécanique du Sol. Fr. Pat. 349,866, April 18, 1904.

The binding material is made by burning together chalk or cement and silica, silicates, or even carbonates. The materials are crushed, dried and finely powdered separately, and only mixed at their entry into a horizontal rotating kiln, made of a steel tube lined with silica and containing a number of flints, which serve to mix and powder the material during the burning. Gas-firing is used for the kiln. The product emerges ready ground for use.—A. G. L.

*Non-conducting Material; Manufacture of Heat —.* C. Henke. Fr. Pat. 351,192, Feb. 1, 1905.

THE material is made from the dust obtained in purified blast-furnace gases. The dust is first dried and powdered. It is applied either in the form of powder or after moulding into shells or pads, &c.—A. G. L.

## X.—METALLURGY.

*Steels; Classification and Properties of Ternary.* L. Guillet. Comptes rend., 1905, 141, 107—10.

IN regard to their microstructure, all these steels (ni manganese-, chromium-, tungsten-, molybdenum-, sil vanadium-, titanium-, tin- and cobalt-steels) may be grouped into:—(1) Pearlitic steels, (2) martensitic (3) steels containing  $\gamma$ -iron, (4) steels containing carbide (5) steels containing graphite. The properties of pearlitic steel depend on the nature of the third substance introduced into the iron-carbon alloy. Martensitic (and those containing troostite) have a high tensile strength and elastic limit, are hard and difficult to machine. Carbide steels are only found in the cases of chromium, tungsten, molybdenum, and vanadium alloys, and the size of the granules of carbide varies with the metal in the steel. As a rule the micrographic examination of steel allows conclusions to be drawn as to its properties and industrial applications, though this is, unfortunately, not the case with the largest class, the pearlitic.—J.

*Rivets; Effect on Mechanical Properties of Iron Steel used for —, produced by the Operation of Riveting.* C. Frémont. Comptes rend., 1905, 141, 40.

MECHANICAL tests were made of Swedish iron and steel of six varieties of steel, each being tested (1) in its original state, (2) after being heated to the temperature necessary for riveting, but not mechanically treated, (3) after being heated and subjected to compression and to tension under tension exactly like a rivet. The tensile strength, elastic limit, and reduction of area indicated in the case that the metal was improved by the treatment. This improvement was not simply due to hardening, the fragility was not increased in any case.—J. T.

*Iron; Action of Slightly Alkaline Waters on —.* C. H. Cribb and F. W. F. Arnaud, Analyst, 1905, 3, 225—242.

THE authors find that, by immersing a strip of iron plate in 100 c.c. of water and keeping the plate at a temperature of 100° C. for 24 hours, in the majority of cases in which a natural water has a corrosive action on the metal of a boiler, some indication will be given of the fact by this simple test. In the case of artificially softened waters, which contain a slight excess of lime, sodium hydroxide or carbonate it was found when the alkali exceeded a certain amount, no corrosion whatever occurred, but that with small amounts of the action was equal in intensity to that of the unsoftened water. It was ascertained that the presence of hydrogen peroxide and carbon dioxide had no effect on the rate of the corrosive action of the softened waters, which were energetic in the dark, and this, together with the fact that the metal of a boiler soon becomes coated with incrustation, may explain why "pitting" is not uncommon where these waters are used.

L. Archbutt, in an addendum to the above considers it to be possible that after all, carbon dioxide is the chief corrosive agent, the action of which when a sufficient excess of alkali has been added in this respect, it is necessary to show that distilled water freed from every trace of carbon dioxide and which is more corrosive to iron when slightly alkaline, when no alkali has been added.—W. P. S.

*Rubidium and Caesium; New Method of Preparing —.* L. Hackspill. Comptes rend., 1905, 141, 106—10.

AN iron boat containing a mixture of fragments of metallic calcium and the chloride of the metal (previously



absolutely dry), is placed in one limb of a very flat tube which has a vertical tube fused on at the angle. The vertical tube is drawn off so as to be readily sealed by the blowpipe. The apparatus is rendered vacuum by the boat heated. Reaction is vigorous, and metallic rubidium or cesium is distilled off and is easily collected and sealed in the vertical tube. The process was found inapplicable to lithium, as that could not be distilled off from the boat. —J. T. D.

*See Solutions; Determination of the Chief Constituents in* —. J. E. Clennell. XXIII., page 860.

#### ENGLISH PATENTS.

*and Metallic Products; Annealing and Tempering* —. H. Krautschneider. Berlin. Eng. Pat. 14,479. Dec. 27, 1904.

Articles to be annealed or tempered are heated to required temperature in a non-fusible bath heated by electric currents. The furnace used is pre- of magnesite or the like, closed, except as to the top opening at the top, and the walls are protected against outward radiation of heat. The bath may be of iron, carbides, carbonates, &c., a bath consisting of mols. of sodium chloride and 1 mol. of sodium-nitrofluoride, being specified as suitable. The heating is effected by immersed electrodes, an alternating current being preferably used to avoid electrolysis, and the temperature is controlled by suitable means to ensure uniform heating. —E. S.

*Blast Furnace Gases; Method and Apparatus for Utilizing* —. available for Working Gas Motor Engines. H. Thwaite. Eng. Pat. 14,757. June 30, 1904. page 836.

#### UNITED STATES PATENTS.

*Separator and Concentrator*. R. T. Marshall. Merion Station, Pa. U.S. Pat. 793,945. July 4, 1905.

Series of connected pans is arranged on successively higher levels, each pan being of inverted ungula-shape with a sloping bottom, and provided at one side with a circular hopper discharging into its lower portion, and at the opposite side, with a spout projecting into the rear of the next adjacent pan. There are transversely-arranged deflecting-lips arranged adjacent to the discharge of both the hoppers and the spouts, amalgam-carried by one of the hopper lips, and riffles disposed along the lower side of the pan. There is a flat nozzle to each deflecting lip, receiving a supply of water. —E. S.

*Process of Extracting* — from its Ores. G. Gin. Paris. U.S. Pat. 793,186. June 27, 1905.

U.S. Pat. 328,801 of 1903; this J., 1903, 1003. —T.F.B.

*Concentration*. H. L. Sulman & H. F. Kirkpatrick. London. U.S. Pat. 793,808. July 4, 1905.

Eng. Pat. 20,419 of 1903; this J., 1904, 1150. —T.F.B.

*Process; Ore Treating* —. A. M. Beam. Denver, Colo. U.S. Pat. 793,816. July 4, 1905.

The furnace consists of a horizontal rotary flue-cylinder provided at one end with a smoke-stack; the other end is L-shaped, and projects into a combustion chamber. A horizontal stationary conduit, made of and supported by standards of refractory material extends horizontally through the combustion chamber, and is connected with a flue-cylinder which is placed concentrically within the L-shaped cylinder. The ore is fed into the ore-cylinder from the top; it is passed by means of a screw-conveyor to the horizontal conduit and is finally discharged through a large opening covered by an adjustable plate. —J.H.C.

*See*. J. Kirby. Assignor to the Kirby Furnace Manufacturing and Refining Co., Pittsburg, Pa. U.S. Pat. 793,838. July 4th, 1905.

The furnace consists of fire-boxes, inclined ore-smelting basins, and collecting basins having removable tops. A

central flue extends around and beneath the basins so as to communicate heat thereto from the products of combustion, which products are further cooled by water-sprinklers before being discharged. —J. H. C.

*Furnace; Roasting* —. C. H. Repath, Anaconda, Mont., and F. E. Marcy, Chicago, Ill., Assignors to F. Klepetko, New York. U.S. Pat. 794,118, July 4, 1905.

In a furnace having a series of superposed hearths, a rotating central vertical hollow shaft passing through them carries a series of "flanged structural members," extending into the several hearths, and supporting hollow rabble-arms, the walls of which have openings for the passage of air into the hearths. Terminal keys are carried by the structural members for forcing the hollow arms against the shaft to bind the parts together. (Compare U.S. Pat. 740,589 of Oct. 6, 1903; this J., 1903, 1197.) —E. S.

*Flue-dust; Process of Using* —. C. S. Price, Westmont, Pa. U.S. Pat. 794,152. July 4, 1905.

EIGHT parts of ore- or flue-dust are mixed with not less than one part of clay and sufficient water to make a stiff mass, which is charged in plastic lumps into a blast-furnace. —J. H. C.

*Flue-dust; Utilisation of* —. C. S. Price, Westmont, Pa. U.S. Pat. 794,153. July 4, 1905.

FINELY divided ore- or flue-dust is mixed with water and clay in proportions to make stiff plastic lumps which are charged into a blast-furnace without previous drying. —J. H. C.

#### FRENCH PATENTS.

*Copper, Zinc, Cadmium, Silver, Nickel Cobalt and Tungsten Hydroxides; Process of Obtaining* —, in the Wet Way, by Direct Extraction. D. Lance. Second Addition, dated Jan. 9, 1905, to Fr. Pat. 342,865. May 4, 1904. VII., page 845.

*Zinc Furnaces heated by Gas*. E. Derval. Fr. Pat. 351,055, Jan. 27, 1905.

THE retorts, four groups of which are arranged in separate, but adjoining furnaces, are adapted to be heated together or separately, by gas from a producer, delivered through an aperture in the arch of each furnace, hot air being admitted at different elevations to the retorts, from the regenerating chambers, these being placed transversely to the furnaces, and beneath the main supporting wall of the latter. All parts of the furnaces are easily accessible for cleaning, and the regenerators are so arranged and connected as to permit of the flames being directed to the least heated parts as occasion requires. Cold air is admitted to the bases of the regenerators, and these are provided with boxes for collection and withdrawal of the soot. (See U.S. Pat. 762,578, of 1904; this J., 1904, 745.) —E. S.

*Tantalum; Application of* —, in the Manufacture or Preparation of all Instruments, Tools, Surfaces, Points, Cutting Edges, &c., which are subject to Mechanical Wear. Siemens and Halske A.-G. Fr. Pat. 351,351, Feb. 8, 1905.

TANTALUM, or an alloy of the same with small proportions of silicon, boron, aluminum, titanium or tin, is applied to the purposes indicated in the title. Tantalum containing a small proportion of iron, or iron containing a small proportion of tantalum, is recommended for many purposes. Oxygen and hydrogen are included in the number of bodies that may be combined with tantalum. Among the applications claimed for certain of these alloys, are to the manufacture of watch springs, clock movements, pens, &c., and also to fixed objects, such as anvils. (See Fr. Pat. 337,607, of Dec. 12, 1903; and Eng. Pat. 21,766, of Oct. 10, 1904; this J., 1904, 494 and 1225 respectively.) —E. S.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A).—ELECTRO-CHEMISTRY.

*Electrolysis with alternating Currents.* A. Brochet and G. Petit. *Z. Elektrochem.*, 1905, 11, 441—453.

THE authors have proved experimentally, that the action of alternating currents when used for electrolysis, varies with the chemical nature of the reaction. The action of the intermittent current at anode or cathode, may also differ from the action obtained by direct current under similar conditions, but if a Wehnelt interruptor or a mechanical circuit breaker be inserted in the direct current circuit, the actions obtained at the anode or cathode are alike in the two cases. Alterations in the current density of the alternating current, as a rule, have no effect upon the nature of the chemical reactions, but in special cases, such a change is to be noted. The general explanation of the chemical changes which occur during electrolysis with alternating currents, is that, for a very brief period, ions of opposite electrical charges are in close contact with one another, and if the speed of the chemical reaction be high, these ions unite again, and reform the original compound. In order to obtain other results from the electrolysis, it is therefore necessary to arrange, that one or other of these groups of ions shall have entered into combination before the ions of opposite electrical charge are liberated. The reaction speed and the alternating period have thus considerable influence upon the final results. The surface of the electrodes used with alternating currents has a tendency to become spongy, and thus the conditions at the end of an experiment may differ materially from those under which it was commenced. Very little practical use has yet been made of electrolysis with alternating currents, the formation of barium platinum-cyanide being the chief application.—J. B. C. K.

*Copper and Zinc Cyanides; Electrolysis of* —. [Part II. *Determination of Copper and Zinc.*] F. Spitzer. *XXIII.*, page 860.

#### ENGLISH PATENTS.

*Electrical Resistances; Manufacture of* —. The Electric Equipment and Securities, Ltd., London, and C. Ruzicka, Willesden, Middlesex. Eng. Pat. 16,422, July 25, 1904.

The resistances are made of a mixture of plumbago, graphite, or the like, clay, quartz sand or some finely divided mineral substance, and a metallic salt (e.g., barium carbonate), unless already present in the mineral substance used. For use with direct current motors, the resistances are composed of a mixture of carbon and/or metallic carbides, mineral substances (stones, &c.), barium borate or similar metallic salts and coal tar, wood tar or like hydrocarbons.—C. S.

*Electrical Resistances; Manufacture of* —. The Electric Equipment and Securities, Ltd., London, and C. Ruzicka, Willesden, Middlesex. Eng. Pat. 16,423, July 25, 1904.

The ingredients include metals or metallic compounds, such as carbonates, oxides or chlorides; quartz sand, soapstone, felspar or other suitable minerals; a suitable clay, e.g., slate clay, and one or more metallic salts if not already present in sufficient quantity. The mixture is reduced to fine powder, worked with a suitable liquid to a homogeneous paste, moulded, dried, baked slightly below fusing point, and heated in a furnace in a reducing atmosphere, to reduce the metallic elements. The paste may also be heated to fusing point and then moulded, or the moulding may be delayed until after the reduction treatment.—C. S.

*Insulating and Non-Heat-Conducting Compositions; Manufacture of Electrical* —. H. H. Lake, London, From Soc. Anon. Matthey and Co., Vallorbe, Switzerland. Eng. Pat. 18,920, Sept. 1, 1904.

THE composition is prepared by first making a mixture

of amianthus ("fibrous asbestos"), calcium sulphate and water, which is moulded and dried, and then impregnated with a mixture of pitch "or residual matters of distillation of tar," india-rubber and sulphur.—W. C.

*Silica [Quartz Glass]; Impts. in the Working of* —. J. F. Bottomley and A. Paget. Eng. Pat. 18,437, Aug. 25, 1904. VIII., page 846.

*Chlorine Gas; Art of [Electrically] Treating and Utilising* —. E. C. Parmore, Germantown, U.S.A. Eng. Pat. 7034, April 3, 1905.

SEE U.S. Pat. 786,595 of 1905; this J., 1905, 503.—T.

#### UNITED STATES PATENTS.

*Battery; Secondary* —. I. Kitsee, Philadelphia. U.S. Pat. 793,881, July 4, 1905.

THIS invention relates to a method of restoring the usefulness of over-charged active material of positive electrodes in secondary cells. The active material is brought into contact with a compound in solution which partly reduces the active material to a lower state of oxidation, and partly changes it to a salt, the latter acting as a binder for the particles of the lower oxide.—B.

*Saline Solutions; Electrolytic Decomposition of* —. A. B. Larchar, Oldtown, Me., Assignor to Pencil Chemical Fibre Co., Me. U.S. Pat. 793,138, July 1905.

THE passage of caustic soda and undecomposed sodium through the diaphragm immersed in and separating bodies of liquid, one containing the anode and the other the cathode, is controlled by regulating the depth of liquid in the cathode compartment. The liquid circulating through the diaphragm is conducted in flexible thin sheets by passing it through narrow passages extending through the cathode.—A. G. L.

#### FRENCH PATENT.

*Tanning; Process of Electrical* —. R. Benoit. Fr. Pat. 351,261, Feb. 4, 1905. XIV., page 85.

### (B).—ELECTRO-METALLURGY.

*Alloys not containing Iron; Magnetic Qualities of* —. J. A. Fleming and R. A. Hadfield. Roy. Soc. Proc., 1905, 76, A, 271—283.

THE authors have determined the principal magnetic constants of two alloys similar to those prepared by Hensler (see Hadfield, this J., 1904, 985). Alloy No. 1 contained 22.42 per cent. of manganese, 60.49 per cent. of zinc and 11.65 per cent. of aluminium, together with 1.5 per cent. of carbon, 0.37 per cent. of silicon, and 0.21 per cent. of iron. Alloy No. 2 contained approximately: manganese, 18; copper, 68; aluminium, 14; and lead, 4 per cent. The results obtained are arranged in a series of tables and curves. They show that the alloys possess magnetic properties identical with those of the feeblely ferro-magnetic material. Alloy No. 1 has a maximum permeability of 28—30, a value not inferior to those shown by cobalt or low grades of iron for small magnetic forces. Alloy No. 2 has a maximum permeability of 14. The two alloys have greater hysteresis than pure iron, nickel or cobalt, corresponding cycles of magnetisation. They exhibit the phenomenon of magnetic retentivity; i.e., they are not merely magnetic, but can be permanently magnetised. The most important conclusion to be drawn from the results is that ferro-magnetism can no longer be regarded as a peculiar characteristic of certain chemical elements, iron, nickel and cobalt, but is due to certain molecular groupings, since the two alloys examined respectively are fairly strong ferro-magnetic materials produced by admixture of metals possessing in themselves separately no such property.—A. S.



## ENGLISH PATENT.

*types or the like; Production of* —. S. Cowper-Coles and Co., Ltd., and S. Cowper-Coles, London. Eng. Pat. 15,762, July 15, 1904.

ould be mounted in conjunction with a perforated anode upon a carrier which rotates, the whole so arranged that during rotation, the electrolyte is through the perforations and projected against the face of the mould. In this way it is claimed that "in lines" on the deposited metal caused by the action of the raised portion of the mould to the electrolyte, are prevented.—R. S. H.

## FRENCH PATENT.

*als; Treatment of* — by *Electrolysis*. M. A. Bert. First Addition dated Jan. 30, 1905, to Fr. Pat. 3,294, Feb. 4, 1904.

main specification (this J., 1905, 505), the voltage bath for the extraction of zinc with sodium sulphate is stated to be from 6 to 10 volts. The present claim is that the voltage should be modified according to conditions of the process, such as concentration, nature and nature of the electrodes.—R. S. H.

## II.—FATTY OILS, FATS, WAXES, AND SOAP.

*Synthesis of* —. A. Grün. Ber., 1905, 38, 2284—2287.

author finds that a satisfactory method for the esterification of the glycerides of higher fatty acids consists in esterification of glycerol by sulphuric acid, and then esterification of the glycerol ester with solutions of fatty acids in concentrated sulphuric acid. The esterification of glycerol by sulphuric acid results in the quantitative formation of glycerol-disulphuric acid,  $C_3H_5(OH)(OSO_3H)_2$ , when excess of the acid is used, and consequently subsequent action of fatty acids, diglycerides are formed. The reaction between the glycerol ester and fatty acids proceeds rapidly at a relatively low temperature; reversible, but good yields (70—80 per cent. of theoretical) of the glycerides are obtained. If glycerol is used in place of glycerol,  $\alpha$ , $\beta$ -diglycerides are obtained instead of the  $\alpha\alpha$ -compounds obtained when the latter is employed. By replacing the hydroxyl group in these diglycerides by an acyl group according to known methods, symmetrical or unsymmetrical triglycerides can be produced. The preparation of dipalmitin (m.pt. 70° C.), distearin (m.pt. 76° C.), diarachin (m.pt. 70° C.),  $\beta$ -acetodipalmitin (m.pt. of crystals, 49° C.; after previous fusion, 33° C.), dipalmito- $\alpha$ -chloro (m.pt. 48°—50° C.), and  $\alpha$ -acetodipalmitin (m.pt. 67° C.) is described.—A. S.

*Use of Mineral Oil in Examining* — by the *Mauenené Test*. F. Suzzi. Boll. Chim. Farm., 1905, 391—398. Chem. Centr., 1905, 2, 80—81.

examination of oils which give high values in the Mauenené test, it is preferable to use olive oil as a diluent than mineral oil. Experiments with arachis, cotton-seed, linseed, coarses, olive, sesamé and other oils in Mauenené's apparatus (see this J., 1904, 668), showed that results obtained in the case of oils diluted with varying amounts of olive oil, always corresponded with those obtained with the undiluted oils, whereas in the presence of mineral oil, values were obtained which were higher than the true ones and which varied according to the quantity of mineral oil used. In cases where circumstances necessitate the use of mineral oil, the true Mauenené  $\gamma$ , may be calculated by the aid of the formula;

$\gamma_v$ , where  $\gamma$  is the increase of temperature observed,  $v$  the volume of the mixture minus that of the mineral

oil and  $v$  the total volume of the mixture. Uniform results can never be obtained, however, in the case of drying oils such as linseed oil, by the use of mineral oil. —A. S.

*Olive Oil extracted by Carbon Bisulphide; Detection of* — in *Expressed Olive Oils*. G. Halphen. XXIII., page 860.

## ENGLISH PATENTS.

*Sulphonated Oils and Fats; Compounds of* — and *Method of Producing the same*. J. Stockhausen. Krefeld, Germany. Eng. Pat. 13,983, June 20, 1904.

SEE Fr. Pat. 344,125 of 1904; this J., 1904, 1102.—T. F. B.

*Oils and Fats containing Iodine and Sulphur; Process for the Preparation of* —. W. Loebell. Eng. Pat. 27,105, Dec. 12, 1904. XX., page 857

## UNITED STATES PATENTS.

*Oils, Grease, &c.; Process of Extracting* — from *Seeds, Wool, Etc.* J. McMahon, New York. U.S. Pat. 793,464, June 27, 1905.

THE material is first subjected to the action of an inert condensable gas (carbon dioxide) in a closed vessel, so as to expel the air, and is then extracted under ordinary pressure by means of a volatile solvent. The last traces of the latter may be expelled after the extraction by means of an inert gas, with or without the aid of heat. The oil thus extracted in the absence of light, heat and air can be freed from colouring matter by filtration through charcoal prior to the separation of the solvent. The vapour and inert gas (carbon dioxide) may be passed into an absorbent solution (sodium carbonate) and the condensed solvent separated from the latter. —C. A. M.

*Oils; Apparatus for Bleaching* —. C. L. Weiberg, Jacksonville, Flo., U.S.A. U.S. Pat. 793,253, June 27, 1905.

THE apparatus claimed consists of an air-tight tank provided with a steam drying coil, a series of strainers and means for drawing off the moisture and volatile impurities separated from the oil and bleaching substances. There is also an air pipe with a nozzle so arranged that when air is forced through it, the oil is drawn through a pipe and delivered on to the uppermost strainer of the series.—C. A. M.

*Oils; Process of Chemically Modifying* —. E. Meusel, Liegnitz, Germany. U.S. Pat. 794,373, July 11, 1905.

SEE Eng. Pat. 7410 of 1903; this J., 1903, 874.—T. F. B.

## FRENCH PATENTS.

*Castor Oil; Preparation of a Derivative of* — capable of *Admixture with Mineral Oil*. Soc. Anon. Française Stern-Sonneborn pour la Fabrication des Vaselines. Huiles et Graisses Ind. Addition dated Jan. 4, 1905, to Fr. Pat. 350,511, Jan. 3, 1905. (This J., 1905, 741.)

THE process claimed consists of heating the oil under a reflux condenser, in order to obtain a product miscible with mineral oils.—C. A. M.

*Soaps; Manufacture of* — with *Simultaneous Separation of Glycerol*. E. A. Ruch. Fr. Pat., 349,889, May 4, 1904.

THE oil is first saponified in the usual way with caustic alkali and the soap solution heated with a calculated amount of a salt (preferably the sulphate) of zinc or aluminium or both, so as to form an insoluble soap, which can be readily separated from the aqueous solution of glycerol. The insoluble soap is then reconverted into an alkali soap by treatment with caustic alkali, or can be treated with sulphuric acid in a leaden vessel if free fatty acids are required.—C. A. M.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

#### (A.)—PIGMENTS, PAINTS.

##### ENGLISH PATENT.

*Colouring Matters [Also Dyestuffs]: Manufacture of Also —.* J. Y. Johnson, from the Badische Anilin und Soda Fabrik. Eng. Pat. 11,205, May 29, 1905. IV., page 840.

##### FRENCH PATENTS.

*Size suitable for Paper and for Paints of the Nature of Whitewash.* Le Fibrocol. Fr. Pat. 349,885, April 30, 1904. XIX., page 855.

*Lakes very Fast to Water: Production of —.* Badische Anilin und Soda Fabrik. First Addition, dated Jan. 18, 1905, to Fr. Pat. 342,903, May 5, 1904. Under Int. Conv., March 8, 1904.

SEE Eng. Pat. 9861 of 1904; this J., 1905, 448.—T. F. B.

*Lakes very Fast to Water: Production of —.* Badische Anilin und Soda Fabrik. Second Addition, dated Jan. 23, 1905, to Fr. Pat. 342,903, May 5, 1904. Under Int. Conv., May 4, 1904.

SEE Eng. Pat. 10,895 of 1904; this J., 1905, 506.—T. F. B.

### XIV.—TANNING, LEATHER, GLUE, SIZE.

##### FRENCH PATENTS.

*Tanning; Process of Electrical —.* R. Berthon. Fr. Pat. 351,261, Feb. 4, 1905.

In the process of electrical tanning, it is claimed that the absorbent power of the hides is increased and rendered more uniform by subjecting them to the action of an electric current in the presence of a saline solution, as in the electrical process for drying green wood. The saline solution employed contains both plumping and astringent substances. An addition of manganese resinate is made to the tanning liquor to ensure the uniform absorption of the tannin. A suitable saline solution consists of: water, 10 hectolitres; crude barium chloride, 20 kilos.; hydrochloric acid, 30 litres; and crude sea salt, 200 kilos. The skins are immersed in this solution and subjected to the action of an alternating current of 25–30 volts. The tanning liquor may be composed of: water (at 30° C.), 10 hectolitres; oak bark, 100 kilos.; crude oil of turpentine, 2 litres; and manganese resinate, 1 kilo.; per 100 kilos. of hides.—A. S.

*Bone; Product Derived from — and Process for Obtaining it.* J. R. Hunter. Fr. Pat. 351,340, Feb. 7, 1905.

SEE U.S. Pats. 781,880 to 781,884 of 1905; this J., 1905, 245.—T. F. B.

### XV.—MANURES, Etc.

##### FRENCH PATENT.

*Organic Materials [Meat, Fish, &c.]: Production of Assimilable Products [Fertilisers] from —.* J. Courmand and P. Geffroy. Fr. Pat. 349,880, April 28, 1904.

THE material is heated in an autoclave, first at a moderate temperature and finally at a high temperature until the desired transformation is effected. For this purpose the material is placed in one of a series (four) of closed vessels, contained in a heated chamber. The vessels are fixed to the revolving lid or cover of the chamber, so that their contents are gradually brought nearer to the furnace which heats the chamber, the furnace being placed at one side of the latter. The process particularly applies to the treatment of meat and of fish residues for the production of manure.—W. P. S.

### XVI.—SUGAR, STARCH, GUM, Etc.

*Starch-Glucose Syrups; Fermentation Methods for Extraction of —.* von Raumer. XXIII., page 86

##### ENGLISH PATENTS.

*Separating Apparatus [for Starch Manufacture]; Cylindrical —.* F. Kachl, Berlin. Eng. Pat. 14,706, June 21, 1904. Under Int. Conv., July 31, 1903.

SEE Ger. Pat. 155,562 of 1903; this J., 1905, 629.—T. F. B.

*Viscine; Process for Purifying Crude — Obtained from Plants of the Ilex Class.* W. Loebell, 1 Zschachwitz-on-the-Elbe. Eng. Pat. 26,383, Dec. 1, 1904.

THE crude viscine, obtained from plants of the *Ilex* class, is kneaded with carbonate of lime, afterwards treated with a suitable dehydrating agent, and the mass extracted with benzene or a suitable oil. The solvent is distilled off, and the residual product is mixed, if desired, with a suitable oil, such as "fat mustard oil."—B.

##### FRENCH PATENT.

*Sugar Syrup; Apparatus for Making and Filtering [Cold] —.* V. E. T. Noirod. Fr. Pat. 351,261, Jan. 28, 1905.

THE apparatus consists of a cylindrical vessel divided into two equal compartments by a circular perforated plate. On this plate is placed a membrane or skin and above it a perforated arch-shaped metallic plate. The upper part of the cylinder is filled with sugar and in suitable proportions, whilst the lower part serves as a receptacle for the filtered syrup. The lower and side parts of the cylinder are connected by an external pipe to equalise the air pressure.—W. P. S.

### XVII.—BREWING, WINES, SPIRITS, Etc.

*Malt; Proteolytic Enzyme in Bavarian Malt.* M. Krandaue. Z. ges. Brauw., 1905, 28, 449–4

BAVARIAN malt contains a powerful peptic enzyme, which acts most favourably at 50° C. A tryptic enzyme, which further breaks down the dissolved peptic products (albumoses) into amides, may also be present. In the practical mashing operations it scarcely comes into play. In the Windisch mashing process, the activity of the peptase is considerably weakened owing to the high temperature (65° C.) employed and the rapidity of the process. By the adoption of this process, the wort is very poor in albumoses and other nitrogenous products are obtained. On the other hand, the mashing process yields worts containing the largest amount of nitrogen and albumoses, owing to the low temperature employed, and to the fact that the peptase can exert its action practically until the wort is run off.—T. H.

*Fermentation; Further Researches on Cell-free Fermentation.* E. Buchner and W. Antoni. Chem.-Zeit., 1905, 29, Rep., 200; from Z. physiol. Chem., 1905, 44, 206

PRESSED yeast extract loses its fermentative power when standing in the air for a few days, but no difference is exhibited between two portions of the same extract through which oxygen and hydrogen respectively have passed. Contrary to the observations of Bokorny, the author finds that, when highly and equally concentrated solutions of cane-sugar and dextrose in the yeast extract are prepared, the amount of fermentation is the same in both cases. Inversion will take place in a very concentrated solution of cane-sugar (20 grms.) in water (80 grms.), to which 0.2 c.c. of fresh pressed yeast extract is added.

When permanent yeast ("Dauerhefe") is pounded, it exhibits fermentative activity towards a solution of cane-sugar in either water or pressed yeast extract is temporarily injured.



aldehyde has but little action on sensitive enzymes in many cases may be used as an antiseptic, but fluoride has a strong injurious effect on the action of yeast. The addition of 0.05 per cent. of quinine chloride effects a slight increase on the fermentative power of permanent yeast prepared by means of acetone. The addition of permanent yeast gradually diminishes the quantity of ethyl alcohol added is in. Acetone hinders fermentation to a greater extent than alcohol.—T. H. P.

*Glucose Syrups; Fermentation* <sup>Methods for</sup> *Preparation of* —. von Raumer. XXIII., page 861.

#### ENGLISH PATENTS.

*Manufacture of* —. E. C. Schrottky. Calcutta. Eng. Pat. 28,619, Dec. 28, 1904.

*Purification* deals with the addition to the wort or of a material prepared by the action of green or air-malt on raw or prepared grain mixed with spent —T. H. P.

*and other Spirits; Maturing and Improving* —. R. Hunt, Liverpool. Eng. Pat. 14,382, 25, 1904.

*Process* consists in adding sugar and hydrated lime silicate (moist pipeclay), either together or separately, to the raw spirit, blowing air through and so the separation or decomposition of certain deleterious ingredients and then preferably distilling the spirit to get rid of the added saccharine matter, clay and ties.—T. H. P.

*and other Spirits; Treatment of* —. R. Hunt, Liverpool. Eng. Pat. 14,827, July 1, 1904.

*Use* fusel oil separated from the spirit in the usual manner, mixed, at a temperature of 70° F., with from 5 to 10 per cent. of its weight of sugar dissolved in a little water. From 5 to 10 per cent. of pipeclay mixed to form a slurry with water, is also added. A current of air is blown through the mixture for about one hour and the latter is then distilled. The product is added to the original spirit in the proportion of one part to 600 or 1000 parts. —W. P. S.

#### FRENCH PATENT.

*Apparatus*. E. Guillaume. First Addition, dated Jan. 25, 1905, to Fr. Pat. 288,270, April 27, 1899.

*Improvements* claimed relate to the process and apparatus described in the original patent, particularly the position of the battery of diffusers and its various parts. The fermentation is carried out in a series of small vessels instead of a single one. Means are provided for cooling the juice and recovering the heat in the "vinasse." The method of aerating the juice by fermentation, by passing it over shallow inclined plates is also claimed.—W. P. S.

### XIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

#### (A).—FOODS.

*Influence of some Constituents of "Whole-Meal" Flour on the Extraction of* —. Lindet and Ammann. Comptes rend., 1905, 141, 56—58.

*Effect* the gluten of white flour is readily separated by washing and kneading the cake of dough under a quantity of water, in the case of "whole meal" flour, or the use of the same with white flour, a coherent mass of gluten cannot be obtained. This is probably due to the coarser quality of the flour, to the presence of mucilaginous substance in the latter, and to the fact that it contains more glutenin and less gluten than

white flour. The finely divided bran, also, has the effect of preventing agglutination. The gluten extracted from flour containing only a small quantity of bran, is usually found to contain less nitrogen than is present in ordinary gluten. This is accounted for by the fact that the bran is separated along with the gluten. Owing to their lack of agglutinating power, whole meal or inferior flours do not "rise" well in bread-making.—W. P. S.

#### ENGLISH PATENT.

*Food-stuffs for Cattle or other Live Stock; Manufacture of* —. C. Beadle and H. P. Stevens, London. Eng. Pat. 14,588, June 29, 1904.

*COTTONSEED* hulls or other material containing difficultly digestible fibre are thoroughly mixed with about 5 per cent. of their weight of hydrochloric acid (sp. gr. 1.16) and heated in a closed vessel, provided with a stirrer, to a temperature of 212°—300° F. The amount of acid to be added depends on the material employed and on the duration of the heating. By heating for 30 minutes, the above percentage of acid is required, but the quantity may be reduced if the heating be prolonged. After heating, the substance is ground and at the same time mixed with some basic substance such as sodium carbonate, chalk, cottonseed kernel meal, &c., to neutralise the acid. During the heating, the acid vapours coming from the mixture may be led into a second quantity of material contained in a separate vessel, air being drawn through both vessels to facilitate the removal of the acid vapours. —W. P. S.

#### UNITED STATES PATENTS.

*[Milk] Separator; Centrifugal Liquid* —. E. C. Pawley, Chicago, and A. W. Ruwell, Sycamore, Ill. Assignors to Smith Manufacturing Co., Chicago, Ill. U. S. Pat. 793,222, June 27, 1905.

*A CORRUGATED*, perforated skimmer is mounted upon an inward projection in the bottom of the bowl of the centrifugal separator. The skimmer is provided with a frustum-shaped cap and the bowl has a cover in which outlets are arranged for the "blue milk" and cream. —W. H. C.

*Fruit; Process of Preserving* —. D. F. Sherman, Chicago. Assignor to California Concentrated Fruit Co. U. S. Pat. 793,614, June 27, 1905.

*THE* fruit is mashed and reduced to a pulp, the coarser part of the fruit being separated. The mixture of fine pulp and juice is then concentrated under reduced pressure, and the product pressed into blocks, which are finally completely dried. A "binding" material may be added to the pulp before concentrating.—W. P. S.

*Fruit Product; Preserved* —. D. F. Sherman, Chicago. Assignor to California Concentrated Fruit Co. U. S. Pat. 793,615, June 27, 1905.

*THE* product claimed is obtained by concentrating fruit pulp under reduced pressure, with or without the addition of a binding material, until a solid product results. (See preceding abstract.)—W. P. S.

#### FRENCH PATENTS.

*Albuminous Substance from Maize; Extraction of an* —. E. Donard and H. Labbé. Second Addition, dated Jan. 5, 1905, to Fr. Pat. 320,027, March 28, 1902. (This J., 1902, 1548.)

*THE* albuminous substance obtained as described in the original patent may be dissolved in a solvent such as ethyl alcohol, amyl alcohol, acetone, &c., and applied as a varnish or coating to articles of food, pills, &c., to prevent them attracting moisture or becoming oxidised. Pills so coated are not dissolved until they reach the intestines.—W. P. S.

*Oils; Process for Preparing Alimentary or other —, and Alimentary Products by means of these Oils, and the Products Resulting from these Processes.* J. E. Bloom. Fr. Pat. 351,142, Jan. 26, 1905.

SEE U.S. Pats. 782,820 and 782,821 of 1905; this J., 1905, 341.—T. F. B.

*Bread Products containing Iron; Process of Making —.* C. Aufsberg. Fr. Pat. 351,213, Feb. 1, 1905.

SEE Eng. Pat. 27,266 of 1904; this J., 1905, 207.—T. F. B.

*Alimentary Product; New —.* Soc. B. Henneberg et ses Fils. Fr. Pat. 351,291, Feb. 6, 1905.

THE product consists of curd (caseum) from which all bacilli have been eliminated, except the species termed "bacilli bulgare."—W. P. S.

*Milk; Process of Making Dried —, and Products containing Milk Albumin.* J. R. Hatmaker. Fr. Pat. 351,298, Feb. 6, 1905. Under Int. Conv., Feb. 12, 1904.

SEE Eng. Pat. 3531 of 1904; this J., 1905, 206.—T. F. B.

## (B).—SANITATION; WATER PURIFICATION.

### ENGLISH PATENT.

*Water; Methods and Means for Purifying, Softening and Treating —.* Mather and Platt, Ltd., and E. Hopkinson, Manchester. Eng. Pat. 17,994, Aug. 19, 1904.

THE hard water is led into a tank divided into two compartments by a partition, in which are arranged two adjustable weirs, one placing the two compartments in communication with each other, and the other allowing the water to flow into a lime tank. Alkali is supplied from a tank into a tipping basin in one compartment, connected with a ball-float in the other compartment. The level of the alkali in the basin is regulated by a ball-cock, and the quantity of alkali added to the water is governed by a slit in the side of the basin and by the action of the ball-float. A portion of the hard water, after passing over one of the weirs, enters a chamber where it comes in contact with a layer of lime, and then flows down a pipe to the bottom of a tank. The nozzle of the pipe is provided with baffle plates. In this tank any excess of lime settles out, and the water then passes from the top of the tank down a pipe, where it meets the main supply of water already treated with alkali. Both supplies enter a settling tank through a helical pipe, and from the top of this settling tank the softened water is led into a second settling tank provided at the top with a dished plate on which are placed a layer of jagged metallic bodies, and a layer of filtering material, such as peat. The softened water is finally drawn off below this filter, but above the dished plate. In an alternative apparatus described, only one settling tank is employed, and the supply of water to the lime tank is regulated by a water-wheel, and revolving stand pipe.—W. P. S.

### FRENCH PATENT.

*Chlorine or Oxygen Compounds of Chlorine; Process of Eliminating —, from Water designed for Drinking, Industrial or Agricultural Uses.* G. Demoussy. First Addition, dated Jan. 14, 1905, to Fr. Pat. 339,163, Nov. 12, 1903. (This J., 1905, 40.)

MAGNETIC iron oxide, cobalt oxide or manganese oxide may be employed for reducing the chlorine compounds in the water.—W. P. S.

## (C).—DISINFECTANTS.

### UNITED STATES PATENT.

*Fungicide and Method of Making same.* F. J. Smith, Elizabeth, N.J., Assignor to American Agricultural Chemical Co., New York. U.S. Pat. 794,644, July 11, 1905.

PHOSPHORIC acid is added in excess to a solution of copper sulphate, the product is neutralised with lime, dried, pulverised and mixed with calcium arsenate.—T. F. B.

## FRENCH PATENTS.

*Antiseptic; Fluorescent —.* E. Turpin. First Addition, dated Jan. 24, 1905, to Fr. Pat. 346,363, Sep. 2, 1904. (See this J., 1905, 148.)

THE bromofluoresceins in general, and Eosin in particular are found to have antiseptic properties superior to those of Fluorescein itself: di- and tetranitrofluorescein, mono- or diethylfluorescein, as well as its chloro and bromo derivatives all possess antiseptic properties, and application for disinfectant purposes is claimed.—T. F. B.

*Sulphur; Process for Making — easily Miscible with Water for the Antirypogamic Treatment of Vegetables.* E. Mauriat. Fr. Pat. 351,306, Feb. 6, 1905.

By adding to sulphur about 8 per cent. of gum, dextrin, starch, molasses, glucose, gelatin, glue or similar product it can be easily mixed with water to form a paste, the suspension suitable for the treatment of vegetables.—T. F. B.

## XIX.—PAPER, PASTEBOARD, Etc.

*Paper; Use of Higher Fatty Amides in Sizing.* A. Müller-Jacobs. Z. angew. Chem., 1905, 1141—1143.

THE use of rosin-soaps for sizing has almost superseded other methods, though the durability of papers so sized this process has lately been severely questioned. According to Wurster, the active agent in this process is rosin-soap itself, but rosin in an extremely fine division, produced possibly along with basic aluminium sulphate by reaction of excess of alum on the rosin, perhaps partially by the reaction on the resinic, boric acid contained in the large quantities of water. Similarly beeswax-soap, when used, probably by means of very finely divided myricyl alcohol in a similar way. The author has found that stearamide, prepared by heating ammonium stearate under pressure at 100° C. can be dissolved in water by long boiling with so much more rapidly when a little sodium carbonate is added. The hot solution is clear and viscous, and when diluted, becomes milky. This milky liquid containing stearamide in suspension in a state of such fine division that it does not deposit even after months of standing, and by adding metallic salts to the liquid, the corresponding metallic soaps are deposited in a flocculent form, the stearamide settling out at the same time. The deposit it can be separated by digestion with alcohol, any other solvent which does not dissolve the soap. The pure substance melts at 109° C., is not destroyed by acids, alkali hydroxides or carbonates, and is unaltered by light, air, or moisture. It can be used with the advantage in sizing paper: for 150 tons of dry pulp of stearamide are dissolved in a solution of 0.8—1.0 of good soap and 0.2 ton of soda crystals in 10—15 of boiling water, strained through a cloth, and added to the pulp in the hollander with a solution of 1—2 of alum or the corresponding quantity of aluminium sulphate. In the subsequent calendering, the stearamide is removed, which further improves both the appearance and the resisting power of the paper. The process is cheap, and sizing with wax, though it is not applicable to the same varieties of paper; and it will probably be found to be a reproach of lack of durability cannot be levelled at this sized in this way.—J. T. D.

*Parchment Paper; Methods of Testing the Impermeability of — to Fats.* C. Bartsch. Papier-Zeit., 1905, 2190.

THE so-called "blister test" is frequently used as a means of determining whether or no parchment is grease proof. It consists in heating parts of the parchment to a flame and noting whether blisters are produced to the impermeability of the outer layers of parchment, allowing the steam formed in the interior to escape sufficiently rapidly. Turpentine oil is also frequently employed as a reagent, and samples of parchment



when rubbed with a few drops of that liquid allow to pass are regarded as being grease proof. Since these methods are simpler than those officially the author has made comparative practical tests onimens of parchment paper of different origin and 1. In the actual tests with fats, small portions of ttor and bacon were wrapped in pieces of the parchaper of about 10 by 15 cm. in size, a piece of paper then wrapped round the outside, and the pressed flat and kept at 18° to 20° C. for 24 hours, nich the writing paper was examined to see whether ere any grease spots. In the turpentine tests f the paper were vigorously rubbed with four or ps of turpentine oil, applied by means of the The results, given in tabular form, show a close out between the results of this test and the practics with fats. In some cases papers that were gainst lard or butter allowed fat from the bacon which is to be attributed to the fact that a certain of that fat separates in the liquid state at from 18° %; but in such cases the paper was also porous to ine oil. As a general rule the blister test also gave corresponding with the fat tests, but this was not ly the case. In the author's opinion the turpentine the advantage of detecting the presence of the oles that frequently occur in parchment paper, they are not shown by the blister test.—C. A. M.

# ENGLISH PATENTS.

*Pulp Strainers; Impts. in Oscillating Cylindrical*  
H. Sanguinetti, London. Eng. Pat. 16,245,  
22, 1904.

ernal partitions of an oscillating straining cylinder per or cellulose manufacture are provided with s to equalise the pressure within the cylinder. ritions are of a conical or doubly conical shape, in er case the greatest diameter being at the centre, to facilitate the discharge of the material. Claim made for the construction of a pocket provided with arge valve, in the lowest portion of the vessel in the cylinder works.—W. H. C.

*d Paste; Process of Manufacture and Application*  
— in Imitation of White Horn, Buffalo Horn,  
disc Shell, Ivory, Mother of Pearl and the like. T.  
r, Puy-Guillaume, France. Eng. Pat. 22,245,  
15, 1904. Under Int. Conv., Nov. 3, 1903.  
E. Pat. 336,970 of 1903; this J., 1904, 453.—T.F.B.

*Acetates; Process for Directly Converting Cotton*  
— Fabr. de Produits Chimiques Flora Soc.  
1. Dübendorf, Switzerland. Eng. Pat. 9998, May  
905. Under Int. Conv., Aug. 23, 1904.  
E. Pat. 345,764 of 1904; this J., 1905, 40.—T.F.B.

*id; Manufacture of* — A. Béhal, Paris. Eng.  
Pat. 11,512, June 1, 1905.

OLS are found to possess the property of forming nitrocellulose homogeneous compounds resembling d, in presence of suitable nitrocellulose solvents. roduct, consisting almost entirely of isoborneol, ed by the hydration of camphene, is especially y for this purpose. One kilo. of nitrocellulose is ned with a sufficient quantity of alcohol of 96 per strength, and is mixed with a solution of 500 grms. of rneol dissolved in 500—600 grms. of ethyl acetate; ture is submitted to centrifugal action, or deprived olvent in any other convenient way. Camphor may substituted for a portion of the borneol if desired.  
—T. F. B.

# UNITED STATES PATENT.

*boards; Apparatus for Drying* — W. R. Hope,  
gnor to the E. I. Du Pont de Nemours Powder Co.,  
nington, Del. U.S. Pat. 793,374, June 27, 1905.

boards are dried between frames with battens on their faces which converge together, and when the frames eed in position for drying, come into contact with

rollers arranged vertically in paired sets, at varying distances apart, in such a manner as to form a wedge-shaped container for the frames. As the boards contract, the holding-frames gradually move downwards, so that a constant and uniform pressure is maintained upon the boards. The frames carrying the rollers are secured to stanchions upon the framework of a car, which is mounted upon wheels.—E. B.

# FRENCH PATENTS.

*Size suitable for Paper and for Points of the Nature of White-wash.* Le Fibrocol. Fr. Pat. 349,885, April 30, 1904.

A SIZING suitable for paper is obtained by mixing 5 parts of viscose (containing 12 per cent. of cellulose) with 3 parts of a solution of casein (mixed with 10 per cent. of its weight of borax) in 5 times its weight of water. This product, may, if desired, be mixed with barium sulphate, kaolin, or similar material. If it be desired to prepare a sizing for mixing with paints, the best proportions are viscose (containing 5 per cent. of cellulose) 4 parts; casein dissolved with 20 per cent. of borax, in five times its weight of water, 1 part. This can be mixed with kaolin and "asbestine" in the following proportions:—Viscose-casein size, 13 parts; "asbestin," 10 parts; kaolin, 3 parts. The mass is thoroughly mixed, and 1 per cent. of formaldehyde is added as a preservative.—T. F. B.

*Celluloid or Collodion Sheets of Variable Thickness; Process of Making* — Act.-Ges. f. Anilinfabr. Fr. Pat. 349,884, April 30, 1904.

SEE Eng. Pat. 9962 of 1904; this J., 1905, 248. T. F. B.

*Celluloid; Process of Making Non-inflammable Substances Resembling* — P. A. D. Prost and E. Mickey. Fr. Pat. 351,555, Jan. 17, 1905. Under Int. Conv., March 14, 1904.

NITROCELLULOSE is dissolved in acetone, ether-alcohol, or other solvent in which has been dissolved a sufficient quantity of a metallic salt to render the final product non-combustible. Such salts are alum, zinc chloride, aluminium chloride, &c.; the solution is run into suitable moulds, which are placed in a heating chamber connected with a condenser. The products are stated to be translucent and non-combustible, and to be useful as substitutes for celluloid. The finished articles may be further treated with a solution of an alkali carbonate or silicate, to precipitate a superficial layer of metallic carbonate or silicate on the object.—T. F. B.

*Cellulose Xanthate; Use of* — for the Manufacture of Substitutes for Wood, Horn, etc. Soc. Franc. de la Viscose. Fr. Pat. 351,089, Jan. 28, 1905.

CELLULOSE xanthate, obtained by the action of carbon bisulphide on alkali cellulose, is allowed to harden by standing at the ordinary temperature for a day or two, when it is ground between cylinders in the cold for about half an hour, until it has become perfectly smooth. After standing for about 24 hours, the soluble xanthate is passed into a suitable press, where it is compressed into a homogeneous mass, which is introduced into suitable moulds, and then "fixed" by keeping it for 24—36 hours at a temperature of about 30° C. The product is stated to be quite homogeneous, of even density throughout, and free from cavities, &c. It can be moulded to the desired shape and coloured or otherwise treated to resemble wood, horn, &c.—T. F. B.

*Cellulose Products formed by the Decomposition of a Solution of Cellulose by means of Bases; Process of Making* — Verein. Glanzstoff-Fabriken, Act.-Ges. Fr. Pat. 351,206, Feb. 1, 1905.

SOLUTIONS of cellulose in ammoniacal copper solutions are forced through small orifices into solutions of bases, such as sodium or potassium carbonate, washed and dried under tension. The products are said to contain copper, and to have much greater resistance to water than when acids are used as the coagulating agents. The copper may be removed from the products, if desired, by treatment with sulphurous or chromic acid.—T. F. B.

*Horschair; Process of Making Artificial — of Great Elasticity and Possessing the Transparency of Glass, also Films of the same Nature.* Verein. Glanzstoff-Fabriken Act.-Ges. Fr. Pat. 351,207, Feb. 1, 1905.

THE threads or films containing copper, described in Fr. Pat. 351,206 (see preceding abstract), are immersed for about 15 minutes in a "concentrated" solution of sodium carbonate, containing 2 to 6 per cent. of ammonia; it is stated that under this treatment the material acquires considerable elasticity, tenacity and transparency. It is then washed and freed from part or all of the copper it contains, and finally dried under tension. Films made by this process can be used for photographic purposes or as textile substitutes, whilst the threads, after carbonisation, are of use as filaments for incandescent electric lamps.—F. F. B.

*Cellulose Threads and Films; Process of Making Elastic Tenacious and Transparent —.* Verein. Glanzstoff-Fabriken Act.-Ges. Fr. Pat. 351,208, Feb. 1, 1905.

THE threads or films obtained by forcing "cellulose cuprammonium" through orifices or thin slits into a coagulating medium which will remove the copper and ammonium compounds (e.g., 35 to 60 per cent. sulphuric acid), are wound on a cylinder, which is caused to rotate in a "concentrated" solution of sodium carbonate. The product is washed with water containing a little acetic acid until free from alkali, and then dried under tension. The resulting threads or films are stated to be very tough and elastic, and as transparent as glass. (Compare Fr. Pat. 350,206, above.)—T. F. B.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Cinnamyl Alcohol (Styrone); Conversion of Cinnamic Aldehyde into —.* P. Barbier and G. Leser. Bull. Soc. Chim., 1905, 33, 858—859.

CINNAMYL alcohol cannot be obtained by the direct reduction of cinnamic aldehyde, since the latter polymerises. The diacetyl derivative of the aldehyde, obtained by the action of acetic anhydride, may, however, be easily reduced by means of iron in acetic acid solution. The product is diluted and extracted with ether, and the ethereal extract distilled, the distillate between 120° and 160° C. (14 mm.) being saponified, and the product fractionated. The yield of alcohol amounted to about 20 per cent. of the aldehyde used.—T. F. B.

*Antipyrine; A Compound of Mercuric Oxide with —.* C. Astre and J. Ville. Bull. Soc. Chim., 1905, 33, 842—845.

By heating 20 grms. of mercuric oxide with a solution of 50 grms. of antipyrine in 500 c.c. of water for 6—7 hours at 100° C., a white crystalline mass is obtained, which, when dry, has the composition  $(C_{11}H_{12}N_2O)_2HgO_2H_2$ ; its m. pt. is 195°—196° C., it is sparingly soluble in water, ether and benzene, easily soluble in alcohol and chloroform. Its aqueous solutions do not exhibit the properties of mercuric salt solutions, but they give the reactions of antipyrine. Its general properties indicate that its constitution is—

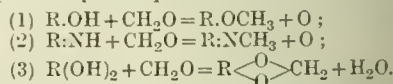


By passing hydrochloric acid gas into its saturated chloroform solution at the ordinary temperature and at 40° C., hydrochlorides containing three and four molecules of hydrogen chloride respectively are produced.—T. F. B.

*Alkaloids; Formation of — in Plants.* A. Pictet. Arch. Sc. phys. nat., Genève, 1905, 19, 329—352.

THE view generally held at the present time with regard to the formation of the alkaloids, is that they are the nitrogenous waste products of the metabolism of the plant, resulting from the partial decomposition of more

complex substances. Certain species of plants have power of destroying these waste products, and in them no alkaloids are found. In those plants which have the power of destroying the alkaloids, the latter are set up in certain cells or special tissues where they do not impede the general activity of the vital functions of the plants. Before being stored up in such special tissues, however, the waste products, in general, undergo chemical change within the plant, the effect being to render them less injurious. The following facts are in favour of this view:—(1) In most alkaloids, the molecule is composed of two distinct parts, viz., a central nitrogenous nucleus to which are connected by intermediary atoms of nitro or oxygen one or more secondary groups of an entirely different character. (2) When several alkaloids are produced in the same plant, the central nucleus is the same in all the compounds, the differences being due to the nature or nature of the secondary groups. (3) Very few alkaloids contain free hydroxyl or imino radicals; in most the hydrogen of these radicals is replaced by a group. The secondary groups which enter into the molecule of the nitrogenous waste products to form alkaloids, vary in different cases. In a few instances, a dextrose ring enters the molecule, the alkaloids formed being glucosides, e.g., solanine, achilleine, and sinanine. Frequently the group introduced is an acyl group, for example, cocaine and aconitine (benzoyl), atropine (tropyl or  $\alpha$ -phenylhydroxypropyl), piperine (piperidinyl), sinapine (sinapyl), pseudo-aconitine and veratrine (veratryl), colchicine (acetyl), and veratrine (angelic  $\alpha$ -methylisocrotonyl). In by far the largest number of cases, however, one or more methyl groups are introduced which saturate the hydroxyl and imino groups. Variations occur in the case of piperine, narcotine, narkotine, hydrastine and berberine, where a methylene instead of a methyl group is introduced. The author regards the methylating agent, the formaldehyde, which is found in the green portions of the plant by the action of carbon dioxide on carbon dioxide in presence of light and heat. The formation of methyl and methylene derivatives may be expressed by the equations:—



In respect to the central nitrogenous nuclei, all may be divided roughly into four classes:—(1) those containing a pyridine, piperidine or quinoline nucleus;

(2) those containing a pyrrol nucleus,  $N \begin{array}{c} \diagup C \diagdown \\ \diagdown C \diagup \end{array}$  associated with a pyridine or benzene nucleus; (3)

those containing a purine nucleus,  $N \begin{array}{c} \diagup C \diagdown \\ \diagdown C \diagup \end{array} \begin{array}{c} \diagup N \diagdown \\ \diagdown C \diagup \end{array}$ ; and (4) those containing a number of non-cyclic quaternary bases containing a group  $(CH_3)_3N.C.C.$ ; such as choline, betaine, &c. In these classes of alkaloids, evidence is adduced that those containing a purine nucleus and those belonging to the choline group result from the partial decomposition of vegetable nuclei and lecithin respectively. Alkaloids containing a pyrrol nucleus are produced by the decomposition of albuminoid substances; and those containing pyridine, piperidine or quinoline nuclei are formed indirectly from albuminoids, the pyrrol or quinoline nuclei in the latter being first methylated, and then undergoing chemical transformation into pyridine, piperidine or quinoline nuclei. The author has proved experimentally that methylated derivatives of pyrrol and indole can be converted into pyridine and quinoline derivatives.

*Sparteine; Action of Ethyl Iodide on —.* C. J. Valeur. Comptes rend., 1905, 141, 49—

WHEN ethyl iodide and sparteine are heated together, sparteine hydriodide is formed, ethylene being liberated according to the equation:  $C_{26}H_{34}N_2 + C_2H_5I = C_{26}H_{32}N_2 + C_2H_4 + C_2H_5I$ . In alcoholic solution, the action is rapid, sparteine hydriodide and two isomeric iodo-ethyl derivatives being formed. (See also this J., 1905, 813.)—W. L.



leaves; Presence of a Glucoside of Hydrocyanic acid. — E. Bourquelot and E. Danjou. Comptes 1905, 141, 59—61

ling elder leaves according to the method previously d by one of the authors (this J., 1901, 1244), being employed, it was found that they contain ide. Dextrose, hydrocyanic acid and an aldehydic ee were obtained, showing that the glucoside ed amygdalin, if it were not the latter itself. Hydrocyanic acid has not been detected in these before, is due to the fact that they contain no . Only on acting on the leaves with emulsin hydrocyanic acid set free.—W. P. S.

# ENGLISH PATENTS.

acetone-chloroform]. Pharmaceutical Compound Process for the Manufacture of the same. J. Wetter, on. From F. Hoffmann-Laroche and Co., Bale, erland. Eng. Pat. 18,147, Aug. 22, 1904.

Pat. 778,277 of 1904; this J., 1905, 150.—T. F. B.

Ethers; Manufacture of Iodine [Iodoxy] Com- is of —. O. Imray, London. From Farb- vorm. Meister, Lucius and Brüning, Hoechst on aine, Germany. Eng. Pat. 20,195, Sept. 19, 1904.

Pat. 777,962 of 1904; this J., 1905, 104.—T. F. B.

d Fats Containing Iodine and Sulphur; Process e Preparation of —. W. Locbell, Klein-Zschach- on-the-Elbe, Germany. Eng. Pat. 27,105, Dec. 904.

nds of oils and fats with iodine and sulphur, for the preparation of ointments, &c., are prepared ng a hot solution of iodine in oil to the product d by heating the fat or oil with sulphur to about . Suitable proportions are stated to be six parts oil to one of sulphur. The resulting mass is ously stirred until quite cold, so as to avoid on of tough resinous products.—T. F. B.

r; Manufacture of —. Chem. Fabr. auf n, vorm. E. Schering, Berlin. Eng. Pat. 8297, 18, 1905. Under Int. Conv., April 27, 1904.

L or isoborneol may be oxidised almost quanti- to camphor by means of ozone. For example, it ozone at the ordinary temperature is passed into on of ten kilos. of isoborneol in 40 kilos. of petroleum to which 10 kilos. of water have been added. When tion is complete, a portion of the petroleum ether led off, and the camphor allowed to crystallise out esidue. The product is stated to be very pure, and in no additive products or aldehydes. The action e on camphene produces only camphenilone and hyde.—T. F. B.

# FRENCH PATENTS.

r; Preparation of — by Synthesis. A. Dubosc O. Picquet. Fr. Pat. 349,852, April 13, 1904.

turpentine is treated with dry hydrochloric acid d the mixture of liquid and solid pinene hydro- es (said to be thus produced) is converted into hol formic" ester by heating with a formate. ter is stated to be resolved on saponification into acid and borneol, which is oxidised to camphor by al method.—T. F. B.

r; Process for the Synthetic Preparation of —. A. éhal, P. Magnier and C. Tissier. Fr. Pat. 349,896, 5, 1904.

RE containing camphene and a small quantity of and isobornyl acetates may be obtained by boiling hydrochloride with lead acetate in acetic acid . Sixty-nine parts of pinene hydrochloride may be with 128 parts of lead acetate and 200 parts of acetic acid. By conducting the reaction in an re at about 130°—135° C. for two hours, the pro- sists almost entirely of camphene. By working

at 180° C., the chief products are bornyl and isobornyl acetates; these may be isolated by distilling off the acetic acid, which carries with it any unaltered camphene. Any of the products can be oxidised and converted into camphor by the usual methods. —T. F. B.

Dialkylbarbituric Acids; Process of Making —. Act.- Ges. f. Anilinfabr. Fr. Pat. 349,856, April 14, 1904.

SEE Eng. Pat. 8543 of 1904; this J., 1905, 345.—T. F. B.

Dialkylbarbituric Acids; Process of Preparing —. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 351,218, Feb. 1, 1905.

SEE U.S. Pat. 780,421 of 1905; this J., 1905, 151.—T. F. B.

Cresote; Process for the Transformation of — [into Medicinal Products]. A. G. Meyer. Fr. Pat. 351,227, Feb. 2, 1905.

SEE Eng. Pat. 28,997 of 1904; this J., 1905, 290.—T. F. B.

Albuminous Substance from Maize; Extraction of an —. E. Donard and H. Labbé. Second Addition, dated Jan. 5, 1905, to Fr. Pat. 320,027, March 28, 1902. XVIII.4., page 853.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Homocol as a Sensitiser; Properties of —. A. J. Newton, C. E. K. Mees and S. E. Sheppard. Phot. J., 1905, 40, 264—267.

THE absorptions of solutions of Homocol (1 in 20,000) both in presence and in absence of ammonia, and the colour sensitising action on plates are given in tables and curves. A series of experiments made by Eder's method to determine the ratio of blue sensitiveness to yellow sensitiveness (viz., by exposing plates behind screens made to divide the spectrum at wave length 4900, so that one screen transmits all the yellow and green rays, and the other the rays from wave length 4900 downwards), gave this ratio as 1.1 to 1.4; plates bathed with Erythrosin give 12 to 20; "good" panchromatic plates, 5—10; plates with subdued blue sensitiveness, 2—5. The ratios with Pinachrome and Pinaverdol were 1.1 and 2.1 respectively. The Homocol plates were freer from fog than those bathed with the two last-named dyestuffs.—T. F. B.

Photographic Processes; The Theory of —. II. The Chemical Dynamics of Development; including the Microscopy of the Image. S. E. Sheppard and C. E. K. Mees. Proc. Roy. Soc., A, 1905, 73, 217—234.

By constant development for a short time, the depth of the image (in the emulsion) is independent of exposure; by increasing the time of development, the depth increases to a maximum for each exposure, and then becomes constant. When the degree of development ( $\gamma$ ) is low the size of the grain of reduced silver increases with the exposure; as the time of development increases, the size of grain does also, until at  $\gamma_{\infty}$  it is independent of the exposure; addition of bromide causes a diminution in the size of the grain (see also this J., 1904, 799). At moderate degrees of development, the number of grains of silver on the surface of the film is constant; in the thickness of the film, the number of grains increases with the exposure and degree of development to a maximum. By exposing plates through the glass side, it was ascertained that the grains receiving most exposure start developing first, and are thus most active. With constant exposure, and within certain limits, the velocity of development varies as the concentration of the developer. In most cases it is found that hardening agents have no influence on the development velocity of an emulsion; thus a plate was immersed in a 4 per cent. solution of formaldehyde until the film became quite insoluble in boiling water, but the development velocity of the emulsion was found to be undiminished.—T. F. B.

*Erdmann's Salt as a [Photographic] Reducing Agent; Some Results with ——. S. E. Sheppard. Phot. J., 1905, 40, 267–269.*

EXPERIMENTS on the reducing action of a solution of Erdmann's salt, prepared as indicated by Smith (see this J., 1905, 635), on negatives made from slow plates of varying densities, showed that at first the reducing action was slight, and very little selective, but after longer action the reduction was more rapid, and selective to the lower tones. This is contrary to Smith's results. In the case of a fast plate the reduction was found to increase somewhat with the density, so that the action of Erdmann's salt is not constant, owing partly to the variation of the size of the grain, due to different conditions of exposure and development. (See Lumière and Seyewetz; this J., 1904, 799.)—T. F. B.

#### FRENCH PATENTS.

*Cellulose Products formed by the Decomposition of a Solution of Cellulose by means of Bases; Process of Making ——. Ver. Glanzstoff-Fabr., Act.-Ges. Fr. Pat. 351,206, Feb. 1, 1905. XIX., page 855.*

*Horschair; Process of Making Artificial — of great Elasticity and Possessing the Transparency of Glass, also [Photographic] Films of the same Nature. Ver. Glanzstoff-Fabr., Act.-Ges. Fr. Pat. 351,207, Feb. 1, 1905. XIX., page 856.*

*Cellulose Threads and [Photographic] Films; Process of Making Elastic, Tenacious and Transparent ——. Ver. Glanzstoff-Fabr., Act.-Ges. Fr. Pat. 351,208, Feb. 1, 1905. XIX., page 856.*

### XXII.—EXPLOSIVES, MATCHES, Etc.

*Explosives; Twenty-ninth Annual Report of His Majesty's Inspectors of ——. 1904. (See under "New Books.")*

*Modifications of the Law.*—There have been two modifications during the course of the year, taking the form of orders of the Secretary of State; the one regulating the deposit of explosives in dust-bins, &c., for conveyance as rubbish, the other consolidating and re-arranging the regulations in regard to the packing of explosives for conveyance.

*Accidents.*—The number of deaths (13) from accidents in the manufacture of explosives is considerably above the average for the decade (7.5).

*Factories.*—The total number of factories under continuing certificate or license is 148.

#### Importation.—

	1903.	1904.
	lb.	lb.
Nitroglycerin explosives ..	2,330,582	2,244,723
Ammonal .....	154 & 2 cases	325
Castropite .....	14	—
Picric Acid .....	—	252,256
Titanite .....	—	25
Detonators (number) .....	17,313,975	15,279,412

Of the above quantity of nitroglycerin explosives imported during 1904, 1,759,652 lb. were transhipped for other countries.

*Dr. Dupré's Report.*—Out of 417 samples examined, 66 were rejected. The number of rejections is rather higher than usual, due mainly to the high proportion of samples rejected in the case of a small number of explosives. In connection with an accident which occurred in the manufacture of a cap composition, it was found that the electrolytic plumbago used, contained a very appreciable quantity of free sulphuric acid, an ingredient known to be highly dangerous in chlorate mixtures. Further experiments

were made with the vapour tension test for the stability of explosives (this J., 1904, 727). Samples of caps returned from stations abroad, on account of low test, were submitted to the test, which in all cases passed satisfactorily. If future experience should confirm these results, the test will have proved itself capable of deciding whether a low heat test shown by cordite indicates danger or not, and, so far, is the only test among those proposed which is apparently, like the heat test, directly applicable to nitroglycerin explosives. An examination was also made of the Bergmann and Junk test, (this J., 1904, 953). It was found that duplicate experiments gave very concordant results, but that the test was influenced to a considerable degree by variations in the percentage of moisture in the samples tested, more especially if the sample was not perfectly purified. An investigation of the temperature of explosion showed that differences between the temperatures of the exploding points of samples differing widely in purity are too small to allow of discrimination by means of this test between samples differing but slightly. Many experiments were undertaken to determine the varying conditions influencing the test, and to fix as far as possible the precise conditions under which it should be carried out. It is considered for the purposes of the department, which deals exclusively with explosives of recent manufacture, that the heat test, when carefully carried out, is well qualified to decide whether these explosives have or have not been sufficiently purified. Moreover, the heat test is the only test advanced which is at all capable of being applied in a satisfactory manner with the great variety of explosives contained in the authorised list.

*Woolwich Testing Station.*—Captain Desborough reports that out of 18 explosives submitted to the office in seven cases the tests were successful. Experiments undertaken to determine whether an explosive, surrounded by a material which is a relatively bad conductor of heat, is likely to be affected as regards its liability to fire the gas mixture, showed that high explosives are not affected, but with slow explosives, the indications that a decided effect is produced. A table is appended to the report giving an account of the results of ignitions of fire-damp, which have arisen from the use of explosives which have passed the test now in vogue.

The following specific dangers are pointed out:—

(1.) Danger of firing two shots within a short interval of time without an examination for gas being made between the firing of the first.

(2.) Danger of overcharging, more particularly in the case of slow explosives.

(3.) Danger of firing a shot in a hole in which a fissure exists.—G. W. McD.

#### UNITED STATES PATENT.

*Explosive Composition. H. Boyd, London. U.S. Pat. 794,583, July 11, 1905.*

SEE Fr. Pat. 346,135 of 1904; this J., 1905, 105.—T.

#### FRENCH PATENT.

*Explosives; Process for the Manufacture of — with special Danger when required for Use. Soc. Franco-Américaine de Poudres de Sécurité. Fr. Pat. 351,289, Feb. 6, 1905.*

IN order to avoid any danger in the transport or use of explosives, the combustible and oxygen-yielding constituents are kept separate and are mixed only when the explosive is required for use. The following suitable mixtures of combustible substances are proposed: (1) o-Nitrotoluene, 27; mononitronaphthalene, 9; dinitronaphthalene, 64 parts. (2) Paraffin wax, 3; o-nitrotoluene, 50; and trinitrotoluene, 15 parts. (3) Paraffin wax, 23; o-nitrotoluene, 13; trinitrotoluene, 13; and iron filings, 51 parts. The mixture (1) is intended for use with the nitrates of ammonium, aniline and potassium whilst (2) and (3) are suitable for use with potassium chlorate. When required for use, the combustible mixture is liquefied by warming to about 100°C. and then mixed with the nitrate or chlorate.—A. S.



## XXIII.—ANALYTICAL CHEMISTRY.

## APPARATUS, Etc.

## UNITED STATES PATENT.

*Ants; Apparatus for the Examination of Liquid*  
— K. Wilkens, Berlin. U.S. Pat. 793,487, June 1905.

Eng. Pat. 20,998 of 1902; this J., 1903, 1065.—T. F. B.

## INORGANIC—QUALITATIVE.

*Antimony and Tin; Separation of* —. O. Verne. Rep. Congress Chim. Pharm. Liege, 1905.

Method proposed relates to the separation of arsenic, antimony and tin, and is applied to the sulphides of these metals, after the said sulphides have been separated from the sulphides of other metals by means of ammonium chloride. The solution of the sulphides in the latter is treated with hydrochloric acid, and the precipitate collected and washed. A portion of the precipitate is treated with a 2 per cent. solution of borax and a few drops of 10 per cent. ammonium chloride, when the arsenic chloride is dissolved. After cooling, the solution is treated with the arsenic trisulphide re-precipitated in the solution by the addition of an excess of tartaric acid and ammonium chloride. The precipitate, consisting of antimony and tin sulphides, remaining on the filter, is washed with a solution of borax and ammonium chloride, and is treated with a 5 per cent. sodium carbonate solution containing ammonium chloride. The antimony trisulphide goes into solution and is filtered off. The separations appear to be exactly quantitative, each separated metal being contaminated with a trace of the other —W. P. S.

## INORGANIC—QUANTITATIVE.

*Hydroxylamine; Quantitative Separations by means of*  
— in Ammoniacal Solution. P. Jannasch with E. Rühle, Cohen, and J. Schilling. J. pr. Chem. 1905, 72, 13, 14—26, 26—34, 35—37.

If these separations depend on the precipitation of hydroxides of certain of the metals by ammonia in the presence of hydroxylamine, and the retention in solution of the hydroxides of other metals. The outline of the process is as follows:—The substance (0.3—0.5 gm.) dissolved in hot water with 5 c.c. of hydrochloric acid. A sufficient hydroxylamine hydrochloride (say 5 to 10 c.c., but experience will soon show the most appropriate quantities in each case) is added, the solution heated to boiling, and excess of ammonia added very cautiously and gradually, the operation being conducted in a tall conical beaker, on account of the evolution of nitrogen. The beaker is heated on the water-bath till the precipitate has settled well, the clear liquid decanted through a filter, the outer paper of which is larger than the beaker, the precipitate washed once or twice by decantation, and then on to the filter, and washed thoroughly. Individual peculiarities are mentioned under the several separations. In all cases, the quantitative accuracy of the process was proved by experiments with the pure substances before attempting separations.

*Iron from Manganese*.—After precipitation by say 10 c.c. of strong ammonia (very cautiously, as the evolution of gas is stormy), the solution is heated for half an hour on the water bath, the clear liquid decanted, the precipitate added once or twice, collected on the filter, drained, and filtered off into the original beaker with hot dilute hydrochloric acid, and reprecipitated as at first, using only 5 c.c. of hydroxylamine salt. The precipitate is added well on the filter, dried, ignited, and weighed. The precipitate should be absolutely free from manganese and silica. The filtrates are evaporated, the residue heated gently to expel ammonium and hydroxylamine

salts, and then dissolved in hydrochloric acid for the determination of the manganese by precipitation with hydrogen peroxide or by other methods.

*Iron from Magnesium*.—The process is conducted exactly as above, and a second precipitation is always necessary. It is found that the presence of the ammonium and hydroxylamine salts does not interfere with the precipitation of magnesium by sodium phosphate, so that it is not necessary to expel them.

*Aluminium from Manganese*.—The details are as above, but a single precipitation with about 25 c.c. of ammonia effects complete separation, and the ignited alumina is absolutely white. (In all these alumina precipitations, it is unnecessary to avoid the presence of excess of ammonia or to expel such excess, as is the case when hydroxylamine is not present.)

*Aluminium from Zinc*.—The separation is carried out exactly as the immediately preceding separation, save that a few grms. of ammonium chloride are added before the ammonia. After evaporation of the filtrates, bromine water is added to destroy the salts of hydroxylamine, lest zinc should be reduced and volatilised during the expulsion of the ammonium salts.

*Aluminium from Nickel*.—The aluminium is precipitated as above. The ammonium and hydroxylamine salts must be expelled by ignition before precipitating the nickel with sodium hydroxide. Mere boiling of the concentrated filtrates with sodium hydroxide does not give complete precipitation of the nickel.

*Aluminium from Magnesium*.—The separation is effected exactly as that of iron from magnesium, save that a single precipitation is enough.

*Chromium from Manganese*.—About 40 c.c. of ammonia are used to precipitate; complete precipitation of the chromium occurs in the boiling liquid, even in presence of considerable excess of ammonia, and the precipitate after settling for half an hour on the water-bath filters rapidly and easily.

*Chromium from Zinc*.—Usually a single precipitation with 30 c.c. of ammonia gives complete separation, but in doubtful cases a second may be necessary.

*Chromium from Nickel and Magnesium*.—These separations are carried out exactly as in the corresponding separations from aluminium.

The reduction of chromates by hydroxylamine is very sharp and rapid, and greatly preferable to reduction by alcohol. The chromium hydroxide precipitated in presence of hydroxylamine has no tendency to pass the filter, is readily washed, and does not carry down potassium or sodium salts. In all of these precipitations the presence of iodides or bromides (or the corresponding acids) has no noticeable effect on the precipitation; sulphuric acid renders the precipitate a little more difficult to wash; nitric acid, if present in considerable amount, destroys the effect of the hydroxylamine, and must be removed. Formic acid does not interfere with the process, but acetic acid and still more tartaric or citric acid, prevents complete precipitation.

*Aluminium from Copper*.—After precipitation, settling, and decantation of the clear liquid, 150 c.c. of water and 30 c.c. of neutral 5 per cent. ammonium acetate solution are added and allowed to stand on the water-bath for 15 minutes before decantation. The precipitate must be very thoroughly washed with boiling water, and ammoniacal water should be used to extract all copper from the filter. The ignited alumina must be pure white. The filtrates are boiled down to small bulk, and acidified with hydrochloric acid, when the liquid loses its colour through formation of cuprous chloride (hydroxylamine is much to be preferred to sulphurous acid as a reducer of cupric salts). To the warm liquid a 10 per cent. solution of ammonium thiocyanate is gradually added with constant stirring till precipitation is complete; after 6 hours the liquid is filtered and the precipitate carefully washed with cold water, dried, incinerated, and ignited in a stream of oxygen.

*Chromium from Copper*.—To the solution are added 3 c.c. of hydrochloric acid and 2.5 grms. of hydroxylamine, and after reduction in the boiling solution, precipitation is effected by 15 c.c. of ammonia. After standing and decantation, the precipitate is washed, first with water

containing ammonium chloride, then with pure water. The rest of the process is as above.

**Iron from Copper.**—To the solution (200 c.c.) is added hydroxylamine in quantity about five times equivalent to the iron present, then 5 c.c. of hydrochloric acid, and the whole is then boiled till decolorised. About 15 c.c. of ammonia, very gradually added, suffice for precipitation. For washing, both by decantation and on the filter, water alone is used.

**Iron from Zinc.**—The process is carried out as for copper; but a little ammonia is used in the wash-water, and the washing should not be continued longer than necessary.

**Thorium from Uranium.**—The process is carried out as in the general description. The thorium is completely precipitated as hydroxide, and weighed, after ignition, as dioxide. If chlorides be present the ammonium and hydroxylamine salts must be expelled from the filtrate, but if only nitrates the filtrates may be at once evaporated and the residue ignited. The ignited residue is weighed as  $U_3O_8$ , then ignited in hydrogen and again weighed as  $UO_2$ . The separation of iron from uranium is carried out in exactly the same way.

**Precipitation of Thorium by Organic Acids and their Salts.**—When thorium nitrate is boiled with ammonium, sodium or potassium succinate, it is completely precipitated as basic salt, which yields thorium oxide on ignition. Acetic acid, tartaric acid, or their salts, give very imperfect precipitation.—J. T. D.

**Sodium Hydroxide in Presence of Sodium Carbonate: Volumetric Determination of —.** K. Novotny. Z. Elektrochem., 1905, 11, 453–455.

THE author has examined the method proposed by Lunge and Schmidt for the determination of sodium hydroxide in presence of sodium carbonate, and also the modification proposed by Treadwell. Lunge and Schmidt's method consists in first determining the total alkali by titration with a mineral acid, using Methyl Orange as indicator, and then the caustic alkali by titration with oxalic acid solution in presence of phenolphthalein, after precipitation of the carbonate with barium chloride. Treadwell's modification consisted in the substitution of hydrochloric for oxalic acid, in the second titration.

The author has found that barium carbonate suspended in pure water has an alkaline reaction—this being due, in his opinion, to solution and hydrolysis of the carbonate with formation of barium hydroxide. This chemical change can, to some extent, be avoided, by using a large excess of barium chloride, since by doing so, barium ions are present in sufficient amount and concentration, to suppress the solution and hydrolysis of the barium carbonate. As regards the titration of the solution containing barium carbonate, the author finds more correct results are obtained with hydrochloric acid than with oxalic acid. The excess of barium chloride required by the modified procedure, tends to obscure the sharpness of the end of the reaction when oxalic acid is employed, owing to the formation of barium oxalate. The removal of the barium carbonate from the solution by filtration before titrating with the standard acid, the author considers to be unnecessary.—J. B. C. K.

**Cyanide Solutions; Determination of the Chief Constituents in —.** J. E. Clennell. Eng. and Mining J., 1905, 79, 1230–1232.

THE following methods have been used successfully in the analysis of cyanide solutions obtained in the treatment of gold- and silver-bearing ore at the Redjang Lebong mine, Sumatra. The solutions contain from 0.15 to 0.20 per cent. of "total cyanide," calculated as potassium cyanide, together with thiocyanates, iron (as ferrocyanide) and small amounts of copper, manganese and selenium.

**Determination of Gold and Silver.**—A suitable quantity of the solution is evaporated in a dish made of lead foil. The dish and residue are scorified with the addition of a small quantity of borax, the lead button is expelled, and the bead of gold and silver is parted in the usual manner. The presence of selenium interferes with the colorimetric tests of Cassel and Moir (this J., 1903, 1257), stannous chloride precipitating this element in the form

of a reddish-brown powder, which obscures the precipitate produced by the gold.

**Determination of Thiocyanate.**—The colorimetric method proposed by Sharwood (see this J., 1898, 928) is employed. The solution is acidified with hydrochloric acid, filtered and treated with ferric chloride, the colour produced compared with that given by a cyanide solution containing a known amount of thiocyanate and treated in the same way.

**Determination of Iron (Ferrocyanide), Zinc and Copper.**—The cyanide, thiocyanate and ferrocyanide are decomposed by heating 50 c.c. of the solution to boiling with 10 c.c. of concentrated hydrochloric acid, adding 0.5 gram of potassium chlorate, and continuing the boiling for 15 minutes. In the clear yellow solution, the metals are determined by ordinary methods, viz., iron by precipitation with ammonia and determination colorimetrically as thiocyanate, copper colorimetrically, and zinc by titration with ferrocyanide, using uranium acetate as indicator.

**Determination of Calcium and Magnesium.**—The solution is boiled with hydrochloric acid and potassium chlorate as described above, the heavy metals removed as sulphides, and the calcium precipitated as oxalate. In the filtrate the magnesium is determined as phosphate.

The free cyanide, total cyanide and protective cyanides are determined by the usual methods, and manganese by the colorimetric method previously described by the author (this J., 1905, 46).—A. S.

**Copper and Zinc Cyanides; Electrolysis of —.** [Part II. Determination of Copper and Zinc.] F. S. Z. Elektrochem., 1905, 11, 391–407. (For Part I see this J., 1905, 739.)

IN the electrolysis of alkali cyanide solutions, platinum dissolved at the anode and deposited at the cathode; this must be taken into account in analytical work of this nature. The deposition of copper and zinc is hindered by the presence of potassium cyanide, the metal separation only progressing in so far as the oxidation at the anode removes the cyanide. The best condition for the decomposition of potassium cyanide is a slight alkalinity (about 0.2-N.) of the solution. With wire gauze electrodes the electro-deposition of zinc from alkaline cyanide solutions is capable of being used with accuracy as an analytical method, since with these electrodes the tendency to form spongy zinc is much diminished. On the other hand, cyanide solutions are chiefly of use where, for analytical purposes, electrolytic metal separations have to be carried out.—R. S. H.

**Building Materials; Determination of Porosity of —.** W. Thörner. IX., page 846

## ORGANIC—QUALITATIVE.

**Olive Oil Extracted by Carbon Bisulphide; Determination of — in Expressed Olive Oils.** G. Halphen. Pharm. Chim., 1905, 21, 54–56.

OILS extracted by means of carbon bisulphide invariably contain sulphur or sulphur compounds, which when treated with sodium hydroxide solution are partially converted into thiosulphates. The soap is separated from the solution by the addition of sodium sulphate or chloride and on heating the acidified filtrate with silver nitrate a brown precipitate of silver sulphide is obtained. Carbon olive oils, however, that have not been extracted with carbon bisulphide also give a brown deposit in this but the impurities that cause this can be eliminated by precipitation with copper sulphate in the following manner:—50 c.c. of the oil are heated in a porcelain basin to 110° C., and then mixed with 12 c.c. of a solution of 100 grms. of pure sodium hydroxide in 75 c.c. of water. The heating is continued with constant stirring until the frothing of the mass has subsided. The temperature should then be about 160° C. and the duration of heating ought not to have exceeded 7 to 10 minutes. The heating is now discontinued and the mass continued stirred until the temperature has fallen to 110° C. at which time the soap is in a granular state. 200 c.c. of hot water



added and the whole continually shaken until the n is cold, after which it is shaken with 100 c.c. of a saturated solution of sodium sulphate and subsequently with 100 c.c. of a 33.3 per cent. solution of copper sulphate, filtered. The filtrate should have a faint green color and if not, should be treated with 0.2 c.c. of the sulphate solution and re-filtered. To 100 c.c. of the filtrate are then added 5 c.c. of a solution, containing 1 part of a 1 per cent. solution of silver nitrate with 5 parts by volume of glacial acetic acid, the whole gently heated to the boiling point, then cooled to cool, and treated with ammonia in slight excess. Olive oils extracted with carbon bisulphide give a precipitate, which may either collect at the bottom of the beaker or leave a black deposit on the paper when filtered. The author states that he has never obtained a reaction with any olive oil not extracted with carbon bisulphide, but has invariably observed it even when only a small quantity of such oil had been mixed with expressed oil. The method, of course, is only conclusive in the case of oils of cruciferous plants, which as is well known, contain sulphur.—C. A. M.

#### ORGANIC—QUANTITATIVE.

*Glucose Syrups: Fermentation Methods for Examination of*— von Raumer. Z. Unters. Nahr. u. Genußm., 1905, 9, 705—726.

The author finds that the ordinary German top-fermentation "yeast" is unreliable for the determination of dextrin in starch glucose syrups, since the dextrins to a very considerable extent, differ in its behaviour in this respect according to the method by which it has been prepared, e.g., whether thick mash or a clear wort. Bottom-fermentation yeast, on the other hand, at least so far as Germany concerned, is practically a standard product with no properties, since the brewer's interest lies in a fast and rapid fermentation of the free sugars with a minimum loss of dextrins. For the separation of the free sugars from the dextrins of the starch syrup, bottom-fermentation beer yeast is regarded as the only reliable reagent; when it is desired to effect a direct separation of dextrose or invert sugar from maltose and is, a pure culture of *S. Marxianus* should be used if possible, four weeks being allowed for the fermentation. But since this ferment is unavailable in large quantities, approximate determinations of the maltose made by means of yeasts obtained in the manufacture of grape or berry wines. The author's results from direct and indirect determinations, indicate that free sugar is present to the extent of about 12 per cent. in commercial potato starch glucose syrups (rich in dextrins) purified by means of acids.

*Yeast "pressed" and beer yeasts on the dextrins of syrups.*—The experiments show that there is a considerable modification, both quantitative and qualitative of the dextrins of starch syrups by the action of the yeast during the fermentation of the free sugars; these modifications are very variable, and depend apparently on the relative proportions of sugar and dextrin present, and on the concentration of the solutions. When the quantity of sugar is large (e.g., 5—6 times that of the dextrin) and the activity of the yeast is consequently high, large quantities of dextrin (e.g., 51 per cent.) are fermented simultaneously with the sugar. The residual dextrin has an unusually low rotatory power, and is practically free of aldehydic groups (cupric reducing power). In the quantity of sugar is relatively small, as in an invert starch syrup, the quantity of dextrin lost during fermentation of the sugar is small, but since the cupric enzymes of the yeast continue to act upon the dextrin after the fermentative action has practically ceased, the residual dextrin, whilst possessing an intermediate rotatory power, contains a large proportion of aldehydic groups and may have a cupric reducing power greater than that of the dextrin present in the original

The author concludes, therefore, that the cupric reducing

power due to the free sugars in a syrup should be calculated by subtracting from the cupric reducing power of the original syrup, not the reducing power of the unfermentable dextrinous residue, but that of the dextrin isolated from the original syrup by repeated precipitations with alcohol. —J. F. B.

#### XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Radio-active Minerals. Supplementary Note.* R. J. Strutt. Roy. Soc. Proc., 1905, 76, A, 312.

The author has previously (this J., 1905, 693) drawn attention to the fact that all thorium minerals, so far as could be ascertained, contain uranium and radium. Analyses of a number of additional minerals, gave results in agreement with this statement. The proportions of thorium and radium in some of the minerals examined are shown in the following table:—

Mineral.	Locality.	Thorium.	Radium.
		Per cent.	Millionths of 1 per cent.
Thorite .....	Ceylon .....	61.0	1.00
Monazite .....	Johannesberg .....	5.94	1.06
Albite .....	Raade Moss, Norway .....	4.05	1.81
Monazite .....	Nigeria .....	2.98	3.78
Anerodite ? .....	Ceylon .....	2.27	9.80
Monazite .....	Malay Straits .....	1.53	4.02
Fergusonite ? .....	Malay Straits .....	1.31	26.7
Malacothite .....	Hitteroe, Norway .....	1.15	1.40
Allanite .....	Amherst Co., Virginia .....	0.492	1.08
Yttrotantalite .....	Ytterby, Sweden ..	0.437	5.56

—A. S.

*Sulphur: Amorphous*—II. *Two Liquid States of Aggregation of Sulphur,  $S_A$  and  $S_B$ , and their Transition Point.* A. Smith, W. B. Holmes and E. S. Hall. J. Amer. Chem. Soc., 1905, 27, 797—820.

It is known that if molten sulphur be chilled suddenly, a larger or smaller proportion of the solidified substance is amorphous, and insoluble in carbon bisulphide. The authors have previously (this J., 1903, 322) shown that if carbon dioxide, or, preferably, ammonia, be passed through the molten sulphur for a few minutes, then after chilling, the whole of the sulphur is crystalline, and is soluble in carbon bisulphide. Moreover, this crystalline sulphur, if used at once, may be heated to the boiling point and chilled, without any amorphous sulphur being produced. Sulphur melted immediately after recrystallisation also yields no amorphous sulphur. Treatment of the crystalline sulphur with sulphur dioxide restores its capacity of yielding amorphous sulphur. Further experiments have now shown that there are two liquid states of sulphur which are partially miscible, the yellow mobile liquid,  $S_A$ , which predominates from the m.p. (115° C.) up to 160° C., and the brown viscous liquid,  $S_B$ , which prevails above 160° C. As the temperature rises, the saturation of  $S_A$  with  $S_B$  determines the separation of the new phase, whilst, when the temperature falls, the converse is the case. The absorption of heat connected with the transition from one form to the other, occurs at 162.5° C. and upwards, and the liquid becomes viscous at the same moment. The temperature falls to 162° C., and the transition point is therefore not higher than this temperature. These phenomena take place in the same way, and at the same temperature, whether the sulphur is such as by chilling gives insoluble sulphur, or, having been treated with ammonia, does not. The two modifications have different solubilities in triphenylmethane and other solvents; that of  $S_A$  increases, whilst that of  $S_B$  decreases with rise of temperature. On dissolving, for instance, 18 grms. of sulphur in 10 grms. of triphenylmethane, and cooling the hot solution, liquid sulphur separates at 147° C.; on again raising the temperature, the emulsion first becomes clear, and then at 214.5° C., liquid sulphur again separates.—A. S.

*Clay as a Semi-permeable Diaphragm Material.* P. Rohland. *Z. Elektrochem.*, 1905, 11, 455-456.

NEITHER crystalline kaolin nor poor clay possesses the property known as *semi-permeability*, this being peculiar to the rich plastic clays. This property is, however, only apparent after the clay has been air-dried—in the wet state in which it is dug from the earth, it is impossible even for water to pass through it. The rich plastic clays, in their natural state, are characterised by a high loss of weight on ignition, this being due partly to their water contents, and partly to organic compounds. A typical clay gave the following figures:—

Loss on ignition 13.4 per cent.,  $\text{SiO}_2$  52.5 per cent.,  $\text{Al}_2\text{O}_3$  20.0 per cent.,  $\text{Fe}_2\text{O}_3$  3.4 per cent.,  $\text{CaO}$  1.0 per cent.,  $\text{MgO}$  0.02, alkalis, 1.0 per cent.

Such a clay will allow crystalline substances in solution, such as sodium and barium chlorides, copper sulphate, and potassium bichromate, to pass through it, whilst colloids, like ferric hydroxide, silicic acid, starch solution, and iron saccharate, will be held back. The action of this clay when used as a diaphragm in solutions of carbonates, is peculiar. With sodium carbonate, the clay acts as a non-permeable material; the anion being held back, while the cation enters the diaphragm and displaces the lime in its chemical combination. The clay diaphragm in this case, thus brings about a chemical change in the diffusion liquid. As explanation of this property of the rich plastic clays, the author states that they contain colloidal constituents partly of organic and partly of inorganic origin, and that it is a law that colloids subject to coagulation, cannot take up or allow to pass through them, colloidal substances in solution; while they will allow crystalline substances and water, to diffuse quickly.

As regards the special application and value of these rich plastic clays, the author states that they may be of considerable importance in connection with plant nourishment—by means of soluble crystalline bodies—since the clays may assist the plant in conjunction with osmotic pressure in obtaining a supply of these bodies from the soil.—J. B. C. K.

alphabetical index of subjects. The subject matter with the laws of the German Empire relating to the of Inventors and Originators of patents, trade literary and art productions, designs, &c., and establishment and protection, &c.

VERFLÜSSIGTES AMMONIAK ALS LÖSUNGSMITTEL. M. ALIEN ÜBER DIE CHEMISCHEN EIGENSCHAFTEN VERFLÜSSIGTEN AMMONIAK-GASES. Gesammelt J. BROUX. Julius Springer's Verlag, Monbijou 3, Berlin. Price M.6.

Svo volume, containing 217 pages of subject matter, 18 illustrations, and followed by 23 pages of table indexes of names and subjects. The subject is under the following heads:—I. Physical properties of liquefied Ammonia. Carriage (export) and Test the Same. II. Liquefying action of Ammonia and the absorption of Ammonia by different Substances. A. E. Divers' Experiments. B. Absorption of Ammonia Gas. c. Formation of Ammoniacal Addition products. III. Liquefied Ammonia as Solvent for Metals, &c. Metalammonium—and Metallo-amino Compounds. Liquefied Ammonia as Solvent (more recent work). Solvent Capacity of liquefied Ammonia. n. Behaviour of Metalloids in liquefied Ammonia. c. Metals and Liquefied Ammonia. VI. Changes undergone by various substances in liquefied Ammonia. VII. P. Chemical Investigations with Liquefied Ammonia. APPENDIX—Attempts to isolate Ammonium.

TWENTY-NINTH ANNUAL REPORT OF HIS MAJESTY'S INSPECTORS OF EXPLOSIVES: BEING THEIR REPORT FOR THE YEAR 1904. (See page 1.) Darling and Son, Ltd., 34-40, Bacon Street, E. E. 1905. Price 2s. Wyman and Sons, Ltd., Lane, London, E.C., and 32, Abingdon Street, Westminster, S.W.; Oliver and Boyd, Edinburgh. Pensonby, 116, Grafton Street, Dublin.

## New Books.

DIE GESETZE, VERORDNUNGEN UND VERTRÄGE ZUM SCHUTZE DER GEWERBLICHEN, KÜNSTLERISCHEN UND LITERARISCHEN URHEBERRECHTE. Vollständige Textausgabe mit ausführlichem Sachregister und verweisenden Anmerkungen. Von DR. GUSTAV RAUTER. Verlag von Gebrüder Jänecke. Hannover, 1905. Price M.8.

Svo volume containing 429 pages of subject matter, and an

## Trade Report.

### I.—GENERAL.

GERMANY; TRADE OF —.

For. Off. Ann. Series, No. 3445.

The following table shows the value of certain imports and exports for the year 1904, as compared with those of the years 1902-03:—

Articles.	Value in 1000 Marks (50 <i>l.</i> ).					
	Imports.			Exports.		
	1904.	1903.	1902.	1904.	1903.	1902.
Lead and leaden goods .....	15,571	13,331	9,085	16,357	17,809	14,441
Drugs and dyes .....	291,350	274,376	263,392	416,685	393,975	380,000
Iron and iron goods .....	62,892	56,310	51,828	606,338	634,361	693,000
Ores, flue metals, asbestos, &c. ....	745,049	533,076	355,661	165,108	189,775	206,000
Glass and glassware .....	9,904	9,255	8,699	55,037	51,450	48,000
Hides .....	334,822	329,838	258,995	161,217	148,966	137,000
Caoutchouc, gutta-percha, and goods thereof ..	101,966	93,605	73,263	63,635	62,888	59,000
Copper and copper goods .....	171,028	132,242	109,011	168,009	156,437	129,000
Leather and leather goods .....	66,893	69,433	64,378	176,705	172,766	153,000
Candles .....	247	187	194	740	864	800
Oils, not otherwise mentioned, and fats .....	244,820	228,926	261,102	52,724	46,916	47,000
Paper and cardboard goods .....	24,755	18,067	15,207	134,083	121,903	109,000
Petroleum .....	100,372	110,581	93,100	2,138	1,728	1,000
Soap and perfumery .....	2,954	2,810	2,706	13,965	14,104	17,000
Stones and earthenware .....	45,719	43,708	45,154	35,764	37,981	38,000
Coal, brown coal, coke, and peat .....	170,070	162,274	163,231	297,916	287,983	267,000
Tar, pitch, resin and asphaltum .....	44,228	43,343	31,834	13,841	13,516	10,000
Oilcloth .....	860	925	863	3,200	3,129	2,000
Zinc and zinc goods .....	11,457	11,191	9,870	46,307	42,454	39,000
Tin and tinware .....	37,475	36,270	34,952	14,270	12,664	13,000



Some classes of chemical products exports have declined, partly owing to an unfavourable development of the market. Thus the value of quinine alkaloids was, in 1903, 300,000 marks; in 1904 7,000,000 marks. The value of tar colours maintained its position; the export of salts, Alizarin, artificial indigo and caustic potash considerably increased. Exports of the following articles has also increased:—

Articles.	Increase in 1,000,000 Marks.
And skins .....	18.5
One .....	6.0
.....	4.2
.....	4.0
.....	2.8
.....	2.7
.....	2.0

## II.—FUEL, GAS, AND LIGHT.

### COAL BRIQUETTES IN JAPAN.

*Eng. and Mining J., July 15, 1905.*

A plant for the manufacture of briquettes in Japan has been started at Tokuyama, and commenced operations on July 1, under the ownership and control of the Japanese Government, which also owns the Omine mine, from which it is taken for the manufacture of the briquettes. To convey the coal to the factory a railway has been built, 10 miles in length, connecting the mine with the line of the Sanyo railway system. The capacity of the factory under normal conditions is said to be about 10 tons per annum, its full capacity being, however, 40 tons. The estimated cost of the briquettes is 10 sh. per ton. The total expense incurred in starting

present there are 11 manufactories capable of producing 40,000 tons of calcium carbide annually. The demand is far from corresponding to the means of production, and the total output sold during 1904 may be closely estimated at 18,000 tons.

The average yield of gas is 300 litres per kilo. of carbide. The French manufacturers are completely protected against importations by the Bullier patent, and manufacturers of carbide and of acetylene have reached an understanding whereby an average price has been established which enables both industries to exist. The production of 1904 was disposed of at 200 francs per ton, the standard accepted and declared being 300 litres of gas per kilogram. The retail price is 350 francs per ton.

## III.—TAR PRODUCTS, PETROLEUM, Etc.

### PETROLEUM PRODUCTION OF THE UNITED STATES IN 1904.

*Bd. of Trade J., July 20, 1905.*

According to statistics collected by the United States Geological Survey, the production of crude petroleum in the United States last year amounted to 117,063,421 barrels valued at 101,170,466 dol., as compared with 100,461,337 barrels valued at 94,694,050 dol. in 1903. The average value of the oil per barrel fell from 0.94 dol. in 1903 to 0.86 dol. in 1904, a decrease of 8 cents. a barrel.

## VII.—ACIDS, ALKALIS, Etc.

### NITRATE OF SODA STATISTICS.

*W. Montgomery and Co., June 30, 1905*

*Shipments, Consumption, Stocks and Prices, from 1903 to 1905.*

	1903.	1904.	1905.
Imports from South American ports to all parts for the six months ending 30th June .....	550,000	578,000	685,000
do. for the twelve months ending 30th June .....	1,315,000	1,463,000	1,583,000
for Europe on 30th June .....	221,000	199,000	226,000
in U.K. ports:—			
	1903.	1904.	1905.
Liverpool .....	2,000	5,800	4,500
London .....	1,600	800	1,800
at ports .....	2,500	4,400	4,900
Imports in Continental Ports on 30th June .....	31,000	21,000	36,800
Imports in U.K. for the six months ending 30th June .....	77,000	78,000	67,000
Do. in Continent do. ....	754,000	749,000	820,000
Do. in U.K. for the twelve months .....	112,000	111,000	110,000
Do. in Continent do. ....	1,003,000	1,012,000	1,081,000
Do. in United States do. ....	246,000	286,000	267,000
Do. in other Countries do. ....	19,000	32,000	55,000
Do. in the World do. ....	1,380,000	1,441,000	1,513,000
Stock supply on 30th June (including the quantity afloat for Europe and stocks in U.K. and Continent) .....	258,000	231,000	274,000
on 30th June .....	9/5	9/10½	11/-

The plant was about £100,000. The machinery was raised in England. The output of the factory of the Nippon Kaisha, which manufactures briquettes at Nagasaki, was 50,000 tons in 1904. The capacity of the plant has been increased from 70,000 to 120,000 tons per annum, and the Japanese Admiralty continues to take the output at 10 sh. per ton.

### CALCIUM CARBIDE INDUSTRY OF FRANCE.

*U.S. Cons. Rep. No. 2310, July 17, 1905.*

The principal centres of the calcium carbide industry in France are in the Alps and the Pyrenees, particularly in the towns of Bellargue, Grenoble, Nice, and Toulouse. At

## X.—METALLURGY.

### MINES AND QUARRIES: GENERAL REPORT FOR 1903: PART IV.

*Colonial and Foreign Statistics. [Cd. 2,600.] Price 1s. 9d.*

The report contains statistics relating to persons employed, output, and accidents at mines and quarries in the British Empire and in foreign countries, each country and possession being treated separately.

From the summary of output for 1903 the following table has been compiled:—

	British Isles.	British Empire, excluding British Isles	Foreign Countries.
	Met tons	Met tons	Met tons
Coal .....	231,030,784	26,584,114	620,388,038
Copper .....	545	61,320	548,120
Iron .....	4,573,202	529,555	39,446,205
Lead .....	20,278	149,741	722,880
Petroleum .....	—	416,000	25,816,099
Salt .....	1,917,274	1,076,537	9,824,442
Tin .....	4,751	56,621	87,323
Zinc .....	9,430	15,558	545,452
	Kilos.	Kilos	Kilos
Fine gold .....	154	284,684	206,835
Fine silver .....	5,440	499,432	4,492,619

#### IRON AND STEEL PRODUCTION OF CANADA. IN 1904.

*Bd. of Trade J., July 13, 1905.*

The "Bulletin" of the American Iron and Steel Association publishes statistics, received direct from the manufacturers, of the production of steel ingots and castings and of all finished rolled iron and steel in Canada in 1904, from which the following table is compiled:—

	1903.	1904.
	Tons of	Tons of
	2,240 lbs.	2,240 lbs.
Steel ingots and castings .....	181,514	148,784
Bessemer and open-hearth steel rails ..	1,243	36,216
Structural shapes .....	1,983	447
Cut nails* .....	118,686	99,000
	Kegs.	Kegs.
	2,456	3,102
Plates and sheets .....	118,541	135,243
All other finished rolled products .....	118,541	135,243
All kinds of iron and steel rolled into finished forms .....	129,516	180,038

\* Made by rolling mills and steel works having cut-nail factories connected with their plants.

The production of iron ore in Canada in 1904 amounted to 312,286 tons, against 235,977 tons in 1903, and the production of coal to 6,705,232 tons, against 6,824,999 tons in 1903.

#### MINING IN NORWAY.

*For. Off. Ann. Series, No. 3425.*

In the Sulitjelma copper mines about 1,400 men were employed in 1904. From about 20,000 tons turned out in 1894, the quantity produced by these works has risen from year to year until it reached about 80,000 tons in 1904. Of this amount about 64,000 tons of copper pyrites, containing 45 per cent. sulphur and  $3\frac{1}{2}$  to  $4\frac{1}{2}$  per cent. copper were exported, and also about 15,000 tons of ore for smelting. 11,350 tons of pyrites went to Norwegian sulphite works. An output of 100,000 tons is projected for the current year, 85,000 tons of pyrites for export, and 15,000 tons of smelting ore. The Alten Copper Works in Finmarken and the Krængen mine have employed about 360 men; copper ore has been produced containing 390 tons of copper. The Bossmo pyrites mine in Moi Raen produced 26,100 tons of pyrites containing 49.5 or 50 per cent. of sulphur, and employed about 240 men. The Røros Copper Works produced about 18,000 tons smelting ore and 11,000 tons pyrites: 733 tons of copper were sold during the year. The Killingdal mine, north of Røros, produced 14,000 tons pyrites and employed about 100 men. The prospects of this mine have been improved by the discovery of a continuation of the main lode. The mining of iron pyrites, principally for export, has increased from 105,000 tons in 1900 to about 120,000 tons in 1904.

Italian sulphur, which has hitherto been used in Norwegian sulphite-cellulose factories, is now being replaced by Norwegian pyrites: 12,000 or 13,000 tons of sulphur were formerly imported, but the factories build roasting ovens for Norwegian fine pyrites, saving about 5 kr. per ton of cellulose. When factories have carried out this plan, the home consumption of pyrites is estimated to rise to 30,000 tons per year compared with 15,000 tons in 1904. The production of pyrites in 1905 is expected to rise to about 160,000 tons on account of the extended workings at Sulitjelma Kjøl.

Between 3,000 and 3,100 men were employed in the Norwegian copper ore mines, and the gross value of the products, delivered at a Norwegian port, amounted to about 264,000 kr., which is over 26 per cent. more than the average for the five years ending in 1900.

The Evje Nickel Works, which are the only works have been used of late, produced 5,352 tons of nickel in 1904: 4,819 tons of ore and regulus ("grus") were smelted. The exports were 166 tons of stone and 4 tons of copper stone, containing 72 tons nickel and 43 tons of copper; the prospects of the mine are very good. It has been discovered during the year that the comparatively high percentage of nickel in the ore from this mine is due to the presence of even microscopic, iron nickel pyrites containing 33 per cent. of nickel.

39,000 tons of iron ore (about the same quantity in 1903) was exported from the Fehn mines in Nordsjø, where about 230 men were employed. The total export of iron ore from Norway in 1904 amounted to about 45,000 tons, compared with 41,570 tons in 1903.

From Narvik 1,188,500 tons of Swedish iron ore to Kiruna were exported. 760,900 tons of the ore went to Germany and 286,500 tons to the United Kingdom.

Without taking apatite, feldspar, &c., into consideration, about 3,900 workmen were employed in the past year in Norwegian mines, and the gross value of the products (those exported being calculated as delivered at a Norwegian port) is estimated at about 300,000 kr. The mining industry is increasing on account of the development of Northern Norway. If apatite, feldspar, granite, labradorite, roofing slates and cement are included, the gross value of the products of stone and minerals, estimated at 585,000 kr. for the past year, which shows an increase on former years. About 1,570,000 kr. worth of mining products were shipped from Norwegian ports in 1904, of which nearly 1,200,000 tons were transported via Narvik: the balance, about 370,000 tons, came from Norwegian sources.

#### XII.—FATS, FATTY OILS, Etc.

COTTON-SEED OIL; AUSTRALIAN "METHYLATION"  
*Bd. of Trade J., July 27, 1905.*

The "Commonwealth of Australia Gazette" of 11th May last, contains the following Customs by-law which came into force on 8th May, 1905, regulating the "methylation" of cotton-seed oil within the Commonwealth.

1. Imported cotton-seed oil, or cotton-seed oil manufactured from imported cotton-seed, delivered in pursuance of departmental by-laws, may be methylated in pursuance of these by-laws.

2. Prior to removal from the wharf, if imported, or from the place of manufacture, if not imported, the oil shall be sealed by an officer.

3. After the oil has been sealed it shall only be removed from the wharf or place of manufacture by an officer.

4. Immediately after the oil has been opened, it shall be methylated in the presence and to the satisfaction of an officer.

5. In this by-law "methylated" means mixed with a substance approved by the Collector, in such a manner as to render the oil unfit for use as a beverage, or for any other purpose, or incapable of being converted to that use.

The above By-law repeals the By-laws of 3rd Dec. 1901, and 3rd April, 1903.



# OLIVE OIL PRODUCTION OF LECCE.

For. Off. Ann. Series, No. 3427.

The olive crop of the province of Lecce suffered much ravages of the *Mosca oleacea*, the 1904 crop being reduced to be only one-tenth of a normal crop. The prospects for 1905 are not promising. The exports of the province amounted to 12,347 tons, of which 6 tons was sent to other Italian ports (including Sardinia); the oil export of 1903 amounted to 12,347 tons, and in 1902 to 9,594 tons, of which quantities, 12,347 tons and 7,168 tons respectively were shipped to other ports.

## XIII. C.—INDIA-RUBBER, Etc.

### INDIA-RUBBER TRADE OF PARÁ.

For. Off. Ann. Series, No. 3436.

The director of the local botanic gardens reports in the report of the Pará Museum, that it has been recently ascertained that a latex obtained from a tree entirely different from the "Heveas" has been employed not only to produce rubber, but even in some cases to replace gutta-percha. The substitute is said to be slightly less elastic than the genuine article. It seems that the demand has led to the practice for some years past. Trees in question are plentiful and exist over a very large area, and are known in the State of Amazonas by the name of "Tapurú," and in the neighbourhood of Pará as "Murupita," "Seringa-Rana," &c. Botanists are of opinion that these trees belong to a species of *Hevea*. The advantages of the "Tapurú" and its substitutes consist in their being more plentiful than the "Heveas" and in their more rapid reproduction. The output of Amazonian rubber from July, 1903—July, 1904, amounted to 30,533 tons, valued at 11,000,000*l.*; of which quantity 11,362 tons, value 2,807,741*l.*, was exported to the United Kingdom, compared with 11,327 tons, value 3,059,000*l.*, in the previous year. The export of rubber of all kinds from Pará during 1903 amounted to 11,362 tons, as against 27,100 tons in 1902; of these quantities, 12,228 tons (1903) and 11,794 tons (1902) were exported to the United Kingdom.

## —TANNING; LEATHER; GLUE, Etc.

### QUEBRACHO EXPORTS FROM ARGENTINA.

For. Off. Ann. Series, No. 3434.

The export of quebracho extract from Argentina amounted in 1904 to 20,111 tons. It goes mostly to the United Kingdom. The export of quebracho sleepers decreased from 374 to 6301 sleepers. It is likely to be almost nil in 1905 as the price has gone up in the past year by quite 50 per cent, and the supply is for the moment not equal to demand; the railway companies are also applying to the Government for permission to use other wood or sleepers instead. The durability of red quebracho for sleepers is unrivalled, no creosoting being necessary. The export of quebracho logs in 1904 increased by 100 per cent to 252,723 tons. Most of these are used for tanning leather, the quebracho from the eastern part of the country being far the best for this purpose. The best red quebracho for sleepers comes from the province of Santiago del Estero.

## Patent List.

N.B.—In these lists, A., means "Application for Patent," and C.S. "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of said date.

## I.—PLANT, APPARATUS, AND MACHINERY.

- [A.] 14,700. Gasquet. Apparatus for washing and cleaning casks, vats, carboys, &c. July 17.
- .. 14,809. Humphrey. Process and apparatus for separating gases. July 18.
- .. 14,811. Haddan (Rowland). Machines for separating granular, powdered and other materials.\* July 18.
- .. 14,854. Cooke and Kelly. Process and apparatus for dehydrating animal and vegetable substances.\* July 19.
- .. 14,855. Cooke and Kelly. Process and apparatus for dehydrating animal and vegetable products.\* July 19.
- .. 14,856. Cooke and Kelly. Air drying apparatus.\* July 19.
- .. 14,868. Boschmeyer. Vacuum pan. [U.S. Appl. July 28, 1904.]\* July 19.
- .. 15,015. Gratrix and Brocklesby. Apparatus for heating and drying. July 21.
- .. 15,296. Treat. Tilting furnaces.\* July 25.
- .. 15,371. Covell. Distilling and apparatus therefor.\* July 26.
- .. 15,514. Hannig. Apparatus for separating matters in suspension from liquids.\* July 28.
- [C.S.] 14,042 (1904). Parsons. Production of high vacua and cooling by evaporation. Aug. 2.
- .. 16,354 (1904). Shields. Means for removing dust from gases. Aug. 2.
- .. 18,978 (1904). Huillard. Drying apparatus. July 26.
- .. 20,184 (1904). Thompson (Matricardi). Furnaces. July 26.
- .. 21,778 (1904). Callow. Crucibles. Aug. 2.
- .. 6055 (1905). Löffler and Weidle. Filtering material and method of producing same. Aug. 2.
- .. 6391 (1905). Clarke. See under IX.
- .. 11,172 (1905). Fairweather (Lauders, Frary and Clark). Mixing vessels. Aug. 2.

## II.—FUEL, GAS, AND LIGHT.

- [A.] 14,687. Langhans. Manufacture of incandescing media for lighting purposes.\* July 17.
- .. 14,783. Otto-Hilgenstock Coke Oven Co. (Otto and Co.). The coking of coal and similar substances in coke ovens. July 18.
- .. 14,898. Crawford. Manufacture of filaments for incandescing electric lamps. July 19.

- [A.] 14,972. Brit. Thomson-Houston Co. (Gen. Electric Co.). Process of obtaining a substance particularly adaptable for making incandescent electric filaments thereof. July 20.
- .. 15,194. Tully. Manufacture of gas suitable for heating and illuminating purposes. July 24.
- .. 15,226. Parry and Pillinger. Manufacture of coal gas and furnaces therefor. July 25.
- .. 15,507. Koppers. Process for the separation of carbon from hydro-carbons.\* July 28.
- .. 15,576. Hiby. Coke ovens. July 28.
- [C.S.] 11,971A (1904). Clay and Goodall. Production of combustible fluids for power purposes. Aug. 2.
- .. 16,008 (1904). Koppers. Gas delivery and purifying apparatus for coke ovens and gas generating plant. July 26.
- .. 16,069 (1904). Smith. Manufacture of producer gas applicable both to pressure and suction plants. July 26.
- .. 15,87 (1905). Marconnet. Producing gas from pulverulent fuel. Aug. 2.
- .. 4291 (1905). Knops. Manufacture of artificial fuel. July 26.

### III.—DESTRUCTIVE DISTILLATION. TAR PRODUCTS. PETROLEUM, AND MINERAL WAXES.

- [C.S.] 16,756 (1904). Lyndall and Costley-White. Process for rendering benzine or the like non-inflammable. Aug. 2.

### IV.—COLOURING MATTERS AND DYESTUFFS.

- [A.] 14,787. Ransford. (Cassella und Co.). Manufacture of trisazo dyestuffs. July 18.
- .. 15,170. Abel (Act.-Ges. f. Anilinfabr.). *See under XIII.A.*
- .. 15,295. Imray (Meister, Lucius und Brüning). Manufacture of *o*-oxymonoazo dyestuffs. July 25.
- [C.S.] 25,901 (1904). Imray (Soc. Chem. Ind. in Basle). Manufacture of brown monoazo dyestuffs developed by chroming. July 26.
- .. 1817 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of new compounds of the anthracene series. July 26.

### V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 14,849. Rheinische Webstuhl- und Appretur-Maschinenfabr. Process of dyeing textile fabrics and the like in graduated depths of shade or tone. [Ger. Appl., Jan. 6, 1905.]\* July 19.
- .. 14,866. Asher. Method of dyeing sponges.\* July 19.
- .. 15,029. Dietl. Manufacture of artificial silk.\* July 21.
- .. 15,233. Wilkinson. Apparatus for gassing or cleansing silk and other threads. July 25.
- .. 15,372. Douge. Apparatus for regaining the solvents of nitrocellulose in the manufacture of artificial silk. [Fr. Appl., April 21, 1905.]\* July 26.
- .. 15,444. Haigh and Wheeler. Means of rendering certain substances and materials non-inflammable and waterproof. July 27.
- .. 15,518. Pomortzeff. Treatment of all kinds of woven fabrics and paper for increasing their durability and rendering them waterproof. July 28.

- [A.] 15,524. Johnson (Badische Anilin und Soda Fabrik). Discharging dyed materials and to be employed therein. July 28.
- .. 15,532. Venter. Apparatus for dyeing, more or less bleaching loose materials, spun tops, knitted goods, and the like.\* July 28.
- [C.S.] 16,503 (1904). Wild. Dyeing textile fabrics. Aug. 2.
- .. 20,665 (1904). Kenworthy and Ward. Perforated beams or cylinders on which textile fabrics or materials are treated with liquids. Aug. 2.
- .. 21,509 (1904). Mather and Platt, Ltd., and others. Roller printing machines for fabrics. Aug. 2.
- .. 1686 (1905). Vittenet. Manufacture of artificial silk. Aug. 2.
- .. 4947 (1905). Kübler. Method and apparatus for producing mottled colouring effects in textile fabrics. July 26.
- .. 4971 (1905). Walker. Compounds and process for fireproofing textile fabrics and paper. July 21.
- .. 5244 (1905). Fletcher. Dyeing machines.

### VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 15,308. Lake (Rowley). Manufacture of hydroxide of lead and apparatus for use therein. July 25.
- .. 15,353. Monson. *See under XV.*
- [C.S.] 16,353 (1904). Shields. Treatment of the effluents from pyrites burners. Aug. 2.
- .. 20,012 (1904). Davis and Davis. Plant for the manufacture of sulphuric acid. Aug. 2.
- .. 4245 (1905). Schmatolla. Kilns for burning stone, dolomite and the like. July 26.
- .. 7032 (1905). Cie. des Prod. Chim. d'Alain Camargue. Calcination of hydrated lime. Aug. 2.
- .. 11,180 (1905). Wetter (J. D. Riedel, A.G.). Salts of mercury. Aug. 2.

### VIII.—GLASS, POTTERY, AND ENAMELS.

- [A.] 15,440. Jones. Ornamentation or decoration of pottery ware. July 27.
- .. 15,452. Bundy. Process for producing decorative effects on glass, porcelain and like materials. July 27.
- [C.S.] 9211 (1905). Sievert. Manufacture of sheet glass. Aug. 2.

### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 14,709. Walden. Asphaltic cement. July 19.
- .. 14,970. Hannay. Treatment of timber. July 24.
- .. 15,325. Rosenbaum. Compositions relating to the manufacture of artificial marble. July 25.
- [C.S.] 19,385 (1904). Bower. Manufacture of surfaces for lithographic stones. Aug. 2.
- .. 6391 (1905). Clarke. Grinding apparatus for manufacturing cement. Aug. 2.
- .. 9766 (1905). Toyn. Jointing cements, mortars, coverings or like compositions. Aug. 2.

### X.—METALLURGY.

- [A.] 14,688. Kingsley and Mally. Process and apparatus for treating sulphide and oxide ores. July 17.
- .. 14,733. Wilkins. New alloy. July 18.



15,055. Ganz und Co. *See under XI.*

15,123. Richardson. Smelting and refining metals. July 22.

15,367. King. Methods of purifying and nodulizing metalliferous materials. [U.S. Appl., Nov. 14, 1904.]\* July 26.

15,375. Timm. Process for dissolving solid fluxes in fluid slag. [Ger. Appl., July 29, 1904.]\* July 26.

15,423. Churchward. Hardening and toughening metals.\* July 27.

8677 (1904). Hyatt. Gold extraction. July 26.

13,578 (1904). Elmore. Separating certain constituents of subdivided ores, &c., and apparatus therefor. July 26.

15,793 (1904). Buss. Apparatus for concentrating and separating ores. July 26.

19,464 (1904). Reinke. Process for briquetting friable ores and ore waste. Aug. 2.

19,653 (1904). Ellis and Highton. Apparatus for extracting gold from slimes, tailings or the like. Aug. 2.

20,300 (1904). Ogle, Sulman and Picard. Treatment of ore slimes and the like. Aug. 2.

961 (1905). Dekker. Treatment of metallic compounds of sulphur, arsenic and antimony. July 26.

11,073 (1905). Casman. Process of extracting and refining the copper and alloys of copper contained in ashes, sand, and waste from foundries and other works. July 26.

#### -ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

14,955. Johnson (Badische Anilin und Soda Fabrik). Production of long stable electric arcs. July 20.

15,055. Ganz und Co.. Eisengiesserei und Maschinenfabrik Akt.-Ges. Process for extracting metals from ores and other metalliferous material by electrolytic means, and apparatus therefor. [Ger. Appl., Aug. 26, 1904.]\* July 21.

15,257. Gardiner and Stringfield. Storage batteries.\* July 25.

15,458. Burn-Murdoch and the Sherardizing Syndicate, Ltd. Deposition of metals or compounds. July 27.

18,042 (1904). Imray (Meister, Lucius und Brüning). Oxidation and reduction in an electrolytic bath. July 26.

18,356 (1904). Bartelt. Electrolysers. Aug. 2.

20,809 (1904). Brit. Thomson-Houston Co. (Gen. Electric Co.). Electric furnaces. Aug. 2.

20,810 (1904). Brit. Thomson-Houston Co. (Gen. Electric Co.). Electric furnaces. Aug. 2.

6650 (1905). Schenk. Galvanic cells. Aug. 2.

12,291 (1905). Classen. Electrolytic production of lustrous metallic coatings upon metals. July 26.

#### -FATTY OILS, FATS, WAXES, AND SOAP.

15,023. Balthasser-Weygang. *See under XVIII.A.*

15,231. Ridgill. Apparatus and method of extracting oil and fatty matters from substances containing them. July 25.

#### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

##### (A.)—PIGMENTS; PAINTS.

[A.] 15,088. Carroll. Paint. July 22.

.. 15,170. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new colour lakes and of dyestuffs therefor. July 24.

.. 15,398. Bennett and Mastin. Manufacture of pigments.\* July 27.

.. 15,582. Hoffmeister, Hundt, Eifer and Winther. New paint or composition. July 29.

##### (B.)—RESINS, VARNISHES.

[C.S.] 12,460 (1905). Wachendorf. Manufacture of varnishes for producing mat surfaces. July 26.

##### (C.)—INDIA-RUBBER.

[A.] 14,681. Alexander. Production of aqueous colloidal caoutchouc solutions and the regeneration of caoutchouc waste.\* July 17.

#### XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

[C.S.] 18,267 (1904). Baily. Treatment or preserving of skins. July 26.

#### XV.—MANURES, Etc.

[A.] 15,333. Monson. Process for rendering natural phosphates readily assimilable by plants. July 26.

[C.S.] 15,709 (1904). Boutan. Manufacture of manure. July 26.

#### XVI.—SUGAR, STARCH, GUM, Etc.

[A.] 14,662. Vincent and Gengnagel (Witty). *See under XVIII.A.*

.. 15,023. Balthasser-Weygang. *See under XVIII.A.*

.. 15,403. Williams. Glaze starch. July 27.

[C.S.] 20,166 (1904). Gonville and Jarvis. Caramelisation of carbohydrates. July 26.

#### XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 14,678. Suden and the Berliner Act.-Ges. f. Eisengiesserei und Maschinenfabrik. The malting of grain. July 17.

.. 14,679. Suden and the Berliner Act.-Ges. f. Eisengiesserei und Maschinenfabrik. Malting apparatus. July 17.

.. 15,250. Schneible. The art of brewing. [U.S. Appl., Aug. 1, 1904.]\* July 25.

#### XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

##### (A.)—FOODS.

[A.] 14,662. Vincent and Gengnagel (Witty). Production of saccharine cattle food from molasses and sugar syrups. July 17.

.. 15,023. Balthasser-Weygang. Process for producing foodstuffs, glycerine and saccharine like substances and other products. July 21.

.. 15,304. Badde. Sterilisation of articles of food. July 25.

- [A.] 15,311. Mann. Manufacture of butter substitutes. [Ger. Appl., Nov. 30, 1904.]\* July 25.
- .. 15,391. Wuthrich. Method of condensing milk in a vacuum.\* July 26.
- [C.S.] 17,818 (1904). Bouma and Selhorst. Production of milk free from sugar. July 26.
- .. 20,339 (1904). Hatmaker. Milk food. Aug. 2.
- .. 20,340 (1904). Hatmaker. Milk food. Aug. 2.
- .. 20,793 (1904). Van Gülpen. Process and apparatus for making coffee extracts. Aug. 2.
- .. 3284 (1905). White. Manufacture of coffee essence. July 26.

(B.)—SANITATION; WATER PURIFICATION.

- [C.S.] 16,689 (1904). Tuckfield and Garland. Regenerative heating apparatus for use in the purification of water and sewage and for like purposes. Aug. 2.

XIX.—PAPER, PASTEBOARD, ETC.

- [A.] 14,789. Dobler. Sizing paper or card.\* July 18.
- .. 15,417. Lockett and Baker. Method of and means for applying size to paper during manufacture. July 27.
- .. 15,518. Pomortzeff. *See under V.*
- [C.S.] 19,178 (1904). Beadle and Stevens. Manufacture of blotting and other waterleaf papers. Aug. 2.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 15,118. Nicolaidi. Manufacture of an official preparation of phosphoric acid. July 22.
- .. 15,456. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of benzoyl-alkylaminoethanols. July 27.

- [A.] 15,375. Imray (Meister, Lucius und B.) Manufacture of  $\Delta_4$ -cyclogeranic acid derivatives thereof. July 28.
- .. 15,517. Fabr. Prod. Chim. Organique de France. Manufacture of products of condensation of phenol alcohols. [Fr. Appl., Sept. 16, 1905.] July 28.
- [C.S.] 24,990 (1904). Imray (Meister, Lucius und B.) Manufacture of alkylbarbituric acids. Aug. 2.
- .. 713 (1905). Anderson. Medicinal preparations. Aug. 2.
- .. 1503 (1905). Lake (California Product Co.). Process of producing cream of tartar. Aug. 2.
- .. 10,201 (1905). Chem. Fabr. von Heyden & Co. Manufacture of guanildialkylbarbituric acids. Aug. 2.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 15,185. Brasseur. Multicolour photographic plates. July 24.
- .. 15,214. Gillard and Molyneux. Manufacture of emulsions and other materials sensitive to light. July 25.

XXII.—EXPLOSIVES, MATCHES, ETC.

- [A.] 14,958. Deutsche Sprengstoff Act.-Ges. Manufacture of nitroglycerine explosives. [Appl., Dec. 10, 1904.]\* July 20.
- .. 15,564. Cocking, and Kynoch, Ltd. Explosive powders. July 29.
- .. 15,565. Cocking, and Kynoch, Ltd. Explosive powders. July 29.
- .. 15,566. Cocking, and Kynoch, Ltd. Explosive powders. July 29.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

- [A.] 15,160. König. Titration apparatus.\* July 22.



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### SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

Sixth International Congress of Applied Chemistry held in Rome in April, 1906, during Easter week. Communications should be addressed to the Secretariat, Prof. E. Paternò, Via Panisperna, 89 Rome.

### Changes of Address.

When notifying new addresses, members are requested to state distinctly, and state whether they are temporary or permanent. Multiplication of addresses is to be avoided as tending to create confusion. When changing subscriptions, the use of the form attached to the Journal helps in the verification of addresses, on the safe delivery of the Journal depends.

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### Deaths.

Duncan, James, 1/o Benmore; at Spean Bridge, Inverness-shire. August 12.

Taylor, Jas. Davis, of 9, Mineing Lane, E.C.; at The Oaks, Ditton Hill. Aug. 18.

### Changes of Address Required.

Patterson, Wm. Hamilton; 1/o Karlsruhe, Bavaria.

Smith, Chas. E.; 1/o Herold's Institute, Bermondsey, S.E.

### Annual General Meeting.

(Continued.)

MONDAY, JULY 17TH.

On Monday morning the American and Canadian visitors accompanied by a number of home members, about 70 in all, started on their tour of the British Sections. At Nottingham, their first stopping place, they were received by Mr. J. T. Wood (Chairman of the Section), Mr. S. F. Burford (Vice-Chairman), Mr. S. R. Trotman (Hon. Local Secretary) and other members of Committee. Here a party was detached for Burton-on-Trent, while the remainder lunched at the Victoria Station Hotel, Nottingham.

One Burton party was conducted over Messrs. Bass' Brewery, where they were entertained at luncheon by the firm, Mr. C. O'Sullivan, F.R.S., in the chair. The toasts, proposed by Dr. H. W. Wiley and Prof. C. F. Chandler, were drunk in "King's Ale." This brew of 400 barrels, which King Edward started in February, 1902, contains 14 per cent. alcohol, and will reach maturity in about 40 years. The visitors were then shown the various stages of brewing, stress being laid on the chemical side and precautions for preventing impure fermentations pointed out.

Another party visited Messrs. Allsopp's Brewery and was received by the Chairman of the Company, Mr. C. J. Stewart, and the General Manager, Mr. H. Mead-Taylor. After lunching at the Brewery, the party was conducted through the works by Mr. John Hutton, one of the Assistant Brewers. Particular interest centred in the firm's recent development as brewers of a light lager beer. Allsopp's lager beer shows pretty much the same composition as the light beers brewed in Germany and elsewhere. It is stated to contain alcohol, by weight 3.41 per cent., by volume 4.28 per cent., extractives, 4.45 per cent.; mineral matter, 0.17 per cent.; sugar, 0.74 per cent.; and volatile acidity calculated to acetic acid, 0.078 per cent. The stout contains alcohol, by weight 6.71 per cent., by volume 8.36 per cent., extractives,

6.67 per cent.; mineral matter, 0.33 per cent.; sugar, 0.357 per cent.; proteid, 0.52 per cent.; and volatile acidity calculated as acetic acid, 0.024 per cent. Samples of the lager beer, the stouts and strong ales were put before the party and greatly appreciated.

A third party was conducted over the lace making and finishing manufactory of Messrs. Thos. Adams, Ltd., Nottingham, by Mr. S. J. Pentecost.

Sir John Turney opened his works (Messrs. Turney Bros., Ltd.) where the preparation of various kinds of light leather was shown. The Company treat sheep and goat skins: of the former 2000 dozen English pelts are dealt with weekly. The pelts come to the works shorn of their wool and are steeped in lime water for three weeks before being tanned. Three-fourths of the skins are split after liming, and the lower leathers dressed with cod oil into chamois, the upper being tanned with sumach into split skins ("skivers"). After tanning they are dried and dyed. The degreasing plant, devised by Mr. F. N. Turney, consists of an apparatus on the principle of the Soxhlet extractor; it is capable of dealing with about 36 dozen skins at each operation, the grease being extracted by petroleum spirit, which is subsequently completely recovered. The bacterial process of bating with *erodin* was also shown by Mr. J. T. Wood, its inventor (this J., 1894, 218; 1897, 510; 1898, 1010, and 1899, 990). Refreshments were then served.

Several members were conducted round the city of Nottingham and shown the principal objects of interest by Mr. H. Potter Briscoe (City Librarian): the following places were visited:—St. Mary's Church, the Flying Horse, with adjoining birthplace of Kirke White, Bridlesmith Gate, Wilford, Mrs. Seaver's grounds (with caves of the prehistoric cave dwellers), the Castle Gateway and the Arboretum, a public park of some 17 acres.

A fourth party visited Southwell Cathedral with Dr. Caven as leader. Southwell is about 15 miles from Nottingham, and is the seat of a bishopric. The present cathedral, commenced in 1110 on the site of a Saxon church, became the mother church of the county in the twelfth century, and its Norman nave and transepts still exist. It has a central and two western towers. The choir is in the early English style, and the Chapter House, erected about 1300, is considered the most beautiful in the Kingdom. The partially ruined palace of the Archbishops of York adjoins the cathedral. Tea was taken at the Saracen's Head Hotel, the history of which can be traced back to the reign of Richard II. It claims to be the oldest licensed house in England.

In the evening the Mayor of Nottingham, Alderman Joseph Bright, and the Mayoress, supported by the Sheriff, Councillor Dabell, and the Chairman and members of the Nottingham Section of the Society held a reception in the Castle, at which all the visiting members and ladies were present. The dungeons, Mortimer's hole, and other places of interest in the Castle were illuminated and inspected by the guests.

## TUESDAY, JULY 18TH.

### HADDON HALL AND CHATSWORTH.

Leaders: Messrs. L. ARCHBUTT, F. J. CARULLA, S. R. TROTMAN, AND J. T. WOOD.

On Tuesday morning, the party left Nottingham for Rowsley, whence they drove to Haddon Hall (by special permission of His Grace the Duke of Rutland), pausing on the way to photograph the famous Peacock Inn at Rowsley. After being photographed on the famous staircase in the garden of Haddon Hall, the interior was visited and much admired. Luncheon was served in a marquee in the park, and afterwards brakes were resumed for the drive to Chatsworth. At Chatsworth the house and grounds were visited by special permission of His Grace the Duke of Devonshire. The sculpture gallery is a special feature of Chatsworth, and contains Canova's bust of Napoleon I. In the gardens is the famous palm house of Sir Joseph Paxton, which suggested the Great Exhibition of 1851, and the cascades and fountains, replicas of which may be seen at the Crystal Palace, were put in action for the occasion.

The water supply comes from a reservoir on the top of the hill, which also works turbines for dynamos to give the current for lighting the house. Tea was taken at Rowsley, and the party then drove to Bakewell and resumed their journey to Manchester through the beautiful district.

In the evening, by permission of the Lord Mayor and Council of Manchester, Dr. G. H. Bailey, Chairman of the Manchester Section, and Mrs. Bailey, assisted by Mr. J. Hübner, Hon. Local Secretary, and other members of the Local Committee, received the visitors at the Art Gallery, which is well-known for its fine collection of paintings.

## WEDNESDAY, JULY 19TH.

### WORKS OF MESSRS. JOHN RILEY & SONS, HATTON, NEAR ACCRINGTON.

Leader: Dr. R. S. HUTTON.

On arrival at Hatton, Mr. J. E. Riley and Mr. C. P. Riley received the visitors and Messrs. C. P. and J. E. Riley assisted in taking them in small parties through the various processes. The neatness and cleanliness of the works are well known. Sulphuric acid bleaching powder and alkali are the staple manufactures. Members were shown the Glover and Gay-Lussac towers from the Gay-Lussac tower the acid is taken to the evaporators in which hot air is bubbled through it, extracts the water without boiling the acid. A pure 96 per cent. strength is thus obtained. The salt cake soda processes were next inspected. The salt cake is of thick iron and last from nine to twelve months. The Kessler evaporators, the black-ash revolvers, the Chance sulphur recovery process received particular attention. The party was afterwards entertained to lunch at the Hall close by. Mr. J. E. Riley, in a speech, explained how improved methods of manufacture had enabled the L-blanc process to hold its own against more recent electro-chemical methods. Mr. Parker and Dr. Russell W. Moore returned thanks on behalf of the visitors.

### TANNERY OF MESSRS. JOHN ORMEROD & SONS, CASTLETON.

Leader: Mr. FRANK SCUDDER.

The party was received by Messrs. Wm. H. James and John Ormerod, Messrs. John Ormerod, Jr., Mr. R. M. and G. T. Ormerod, and ex-Councillor Hogg of Rochdale. The works were founded by John Ormerod and his two sons in 1868, they forming the whole of the works for some time. The manufacture of leather belting was first undertaken; in 1874, the roller leather branch was added, and now the works manufacture a greater variety of leather mill stores than any other firm in the country.

The roller skin department shows the whole process from the raw lamb skin after the wool has been removed to the finished leather ready to place on the spindles of cotton mills. The raw material consists entirely of English lamb skins, which must be not more than six months old and be delivered fresh into the tannery. Experiments with other skins have always failed to loss. The lamb season is June to October.

The liming shed has a capacity of 60,000 lamb skins. The skins are carefully sorted, treated in 66 lime pits with milk of lime, and handled frequently till sufficiently softened or swelled. The waste edges are then cut off and are used for making glue, while the loose fleshy parts are removed by special machinery designed and built on the premises.

*Purging.*—Skins are washed with clean water, 20 cwt. in a tumbler at a time, to remove lime as much as possible, then a pail of dog dung is added, which further acts on the lime, and depilates or softens the pelts, so that the lime and natural dirt can be removed, by a process termed *scudding*, this being performed on a wooden beam by a suitable knife. The firm claims that this process is as effective as the bacterial process and is more disagreeable to handle.

*Drenching.*—After scudding, skins are well washed and transferred to a bran drench, in which they ferment.



and other acids being formed, which further cleanse bleach the skins. When sufficiently drenched, they are gone over with a razor edged knife to remove all this being an absolute requisite for spinning purposes, *finishing*.—The pelts or skins are now ready for tanning, which is effected in paddle vats. When partly tanned, they are placed, 60 dozen at a time, in large hydraulic presses in layers between plates and a pressure of two tons square inch applied to remove all natural grease. The pressure makes the skins very hard, and before using out they are softened by being soaked in water then placed in stocks and beaten. They are then dried thoroughly, drained and hung up to dry. Up to this point the capacity is 20,000 to 25,000 skins per week. The stock rooms often contain 10,000 to 12,000 skins.

*Finishing Department, shaving*.—The first important part of finishing is shaving. Skins dried in the rough are soaked before shaving. They are then stretched on special machines and dried to suitable conditions. Shaving is done by new machinery of American make, and the leather must be of absolutely uniform thickness throughout. After shaving, the skins are wetted down, struck out by machinery, and finally dried off by hand labour. They are then nailed on boards to dry, thus retaining all stretch and lying flat. This leaves skins hard and stiff, and to reduce this stiffness they are put through a softening machine using a special attachment designed by the firm. They are then passed through the fluffing or emery wheel to smooth the flesh side and then given a final brush to clear all the grain. Skins are now ready for "finishing proper," and are carefully sorted to suit the various requirements of quality, thickness and colour. For self colours, a dye and seasoning is given and then glazed by machine. Skins are stained to shade and prepared for glazing, which is done by hand.

*Stock room*.—Glazed skins are again carefully sorted to comply with the brands sold, all waste cut off, sorted into the seven various sizes and placed to stock, awaiting sale. Stocks usually kept are 4,000 to 5,000 dozens. The *bell department* was next shown, and after that the *rather loom stores* with the various styles of pickers, straps and straps used on looms. The leather unsuitable for belting is made use of here. *Buffalo pickers* are made from dry buffalo hides imported from Batavia, Singapore and cured raw after liming. These pickers are required of all shapes and sizes for every variety of belting. The hides are soaked until soft, cut to size, and then folded by hand, and then pressed and punched into shape, after which they are dried, soaked in oil under pressure in large iron tanks for weeks, drained, and hung up to season.

After the inspection of the tannery, lunch was served in the Board Room, and afterwards, on the motion of Mr. W. Wiley, seconded by Mr. Charles G. Creswell, a vote of thanks was accorded to the firm for their reception and entertainment. The party was then driven to Rochdale (where the Town Hall and the grave of John Bright were inspected) to Littleborough. Here a man road in excellent preservation crossesa Black Edge. A short paper descriptive of this was read by a member of the firm, and, after a careful examination of the method of paving employed by the Romans, the party returned to Manchester.

#### VISIT TO MESSRS. SALIS, SCHWABE & CO.

Leader: Dr. J. BÜRGER.

A party of members availed themselves of the invitation of the Directors of the Calico Printers Association, Ltd., to inspect the works of Messrs. Salis & Co., Ltd., Rhodes, near Manchester. Under the guidance of Mr. Crighton, chief chemist to the firm, visitors were enabled to see the different processes of printing, viz., bleaching, preparing, printing (both machine and block), dyeing (indigo and colours), mercerising and finishing in addition to the engraving of the copper and rollers which attracted most attention. A hearty vote of thanks was passed to the Directors of the Calico Printers' Association and duly acknowledged by Mr. Crighton.

#### VISIT TO THE SHIP CANAL AND THE MANCHESTER CORPORATION SEWAGE WORKS.

Leader: Dr. G. J. FOWLER.

After lunch a party went to the Pomona Dock on the Ship Canal, where, by the courtesy of the Ship Canal Company, through Mr. Latimer, General Superintendent, they were provided with a large steam tug. Mr. Congreve, Resident Engineer and Messrs. Lowe and Johnston, of the Dock Offices, accompanied the party. The chief point of interest on the way was the large new dock recently opened by the King, and the new transit sheds built in armoured concrete. Time did not permit of a visit to the Salford Sewage Works, but the striking effect of a large area of sewage sprinklers in active operation was pointed out to the visitors. Much interest was shown in the famous Barton aqueduct, where the Bridgewater Canal crosses the Manchester Ship Canal on a swing bridge. The party disembarked at Barton Locks after having passed a hearty vote of thanks to the Ship Canal Company for providing the steamer and to the officials who had accompanied them.

Barton Locks are close to the outlet of the main sewage works of the Manchester Corporation at Davyhulme. At these works the whole of the sewage of Manchester and certain outlying districts, i.e., of a total population of 575,000, is treated in open septic tanks and contact beds. The average dry weather flow amounts to 25,000,000 gallons, the total average flow to upwards of 30,000,000. The works are designed to treat a maximum flow of 126,000,000, or six times the strict dry weather flow as estimated from the water supply. The total tank space has a capacity of about 21 millions. Four tanks of over one million gallons each are reserved for the settlement of storm water, the rest being open septic tanks. There are 46 acres of primary contact beds, in half-acre units, and 26 acres of storm-water beds. A beginning has been made with a provision of secondary beds for a further treatment of the filtrate from the primary beds, chiefly with the object of removing the suspended matter present in the latter. The sludge from the settlement tanks, and the residual sludge from the septic tanks is taken to sea in a specially constructed sludge steamer. The total area of the estate at Davyhulme is 183.5 acres. The visitors entered the works at the outlet end and first inspected the effluent from the secondary bed, which has recently been started, and were thus able to realise the excellence of the effluent which can be obtained when bacterial treatment is fully carried out. This effluent more than fulfils the requirements of the Mersey and Irwell Joint Committee who control the various works on the watershed. Passing up the centre of the works, and viewing the large extent of bacteria beds and tanks on either side, the visitors at the end of their journey were entertained to tea by the Rivers Committee of the Manchester Corporation, who were represented by Mr. Councillor Johnston, Chairman of the Construction Sub-Committee. Dr. Fowler, Consulting Chemist to the Rivers Committee, Mr. G. Ardern, Resident Chemist. Mr. A. B. Ogden, Manager, and Mr. G. F. Walter, Secretary, were also present. Mr. Julian F. Baker, on behalf of the members and visitors, cordially thanked the Rivers Committee. The party were then conveyed to Urmston station and arrived in Manchester about 6 p.m.

Besides the above, visits were arranged to the Municipal School of Technology at which luncheon was provided by invitation of the Manchester Section; the Corporation Electrical Power Station (Stuart Street), and the Corporation Gas Works in Bradford Road (Leaders: Messrs. B. Hart and W. H. Coleman); the Engineering Works of Mather & Platt, Ltd. (Leader: Mr. R. H. Clayton); the Manchester University; and, for the ladies, the Town Hall, Art Gallery, Cathedral, the Cheetham Hospital, and Libraries. Sir Thos. Wardle also kindly conducted a party over the Whitworth Institute, where the Art treasures and fabrics for which it is famed were inspected.

In the evening, the visitors were entertained at dinner at the Grand Hotel. Dr. G. H. Bailey (Chairman elect) presided, and the guests included the Lord Mayor (Sir Thomas Thornhill Shann), Dr. Wm. H. Nichols, Alderman

Sir James Hoy, Sir Wm. H. Bailey, Dr. Hopkinson (Vice-Chancellor of the Victoria University), Mr. J. K. Bythell (Chairman of the Manchester Ship Canal), and Alderman Thompson (Chairman of the Art Gallery Committee).

Mr. Ivan Levinstein, in proposing "The City of Manchester and the Borough of Salford," said that these two centres of industry must in time become one city. Manchester possessed the finest modern university and the best school of technology in Great Britain. The Journal of the Society of Chemical Industry was first printed in Manchester, and its first President, Sir Henry Roscoe, had represented a division of Manchester in Parliament.

The Lord Mayor, in replying, promised the Society a hearty welcome on the occasion of their visit to Manchester next year.

Sir Wm. H. Bailey replied for the Borough of Salford, and followed by proposing "Our Educational Institutions," which was responded to by Dr. Hopkinson and Sir James Hoy.

The remaining toasts were "The Manchester Section," proposed by Mr. Thos. Tyrer and Mr. A. Gordon Salomon, responded to by Mr. Julius Hübner, and "Our Guests," proposed by the Chairman and replied to by the President.

#### THURSDAY, JULY 20TH.

The Manchester Section accompanied the visitors to Chester by the Cheshire Lines route, passing through Knutsford, Northwich with its salt mines, and Delamere Forest. At Northgate, Chester, the party was met by Mr. Eustace Carey (Chairman of the Liverpool Section), Mr. Max Muspratt, Mr. and Mrs. Alfred Smetham, and other members. Under the guidance of Mr. Henry Taylor, F.S.A., Mr. Robt. Newstead, Dr. Stollerfoht and Mr. Ferguson Irvine, F.S.A., they traversed the city walls and then the city itself. Several old houses, the "Rows," and an old crypt of the twelfth century, now used as wine cellar to an inn, were visited. After inspecting the carvings of Bishop Lloyd's house in Watergate Street, they were conducted over the Cathedral by Archdeacon Barber, to whom a cordial vote of thanks was accorded at the subsequent luncheon at Bolland's Assembly Rooms. Some of the party, on the way to the river, seized the opportunity to inspect St. John's Church, a fine example of Norman work, the tower of which fell a few years ago and has not been restored. This church, which with its ruined east end covers a very large area, was the Cathedral of Chester, until the dissolution of the monasteries gave Chester a new Cathedral at the expense of the monks.

After luncheon, a trip was taken up the River Dee by steam launch, as far as the Iron Bridge, Eaton Hall, where some strolled through the Duke of Westminster's park as far as the mansion. Tea was then served, another photograph was taken and the party returned to Chester, where they parted with the Manchester Section, and went to Liverpool *via* Rock Ferry and the Mersey Tunnel.

On arrival, the visitors were entertained by the Liverpool Section to dinner at the State Restaurant. Mr. Eustace Carey presided, the principal guest being the Lord Mayor of Liverpool, the Rt. Hon. John Lea. At nine o'clock the Lord Mayor and Miss Gertrude Lea, who represented the Lady Mayoress, received the Society at the Town Hall. Light refreshments were served in the large ball room and an impromptu dance, for which the constabulary band provided excellent music, took place in the drawing room.

#### FRIDAY, JULY 21ST.

In the morning a party visited the University, and were received by the Vice-Chancellor and Mr. E. K. Muspratt, who conducted the visitors through the buildings. The laboratories, especially that of the Tropical School of Medicine, were of chief interest.

The White Star tender, "Magnetic," lent by the courtesy of Messrs. Ismay, Imrie & Co., awaited the visitors at the landing stage, near which are being erected a huge block of new offices for the Mersey Docks and Harbour Board, on the site of an old dock. By the "Magnetic" a large party went, some to have a sail on the Mersey and to lunch at the New Brighton

Tower, others to disembark at Behington to visit Soap Works of Messrs. Lever Bros. at Port Sun. Brakes awaited the latter party at the landing place, and on arrival at the soap works, they were received by Mr. V. I. Lever, Mr. J. L. Tillotson, Mr. John Gray, and officials.

The printing department, chemical laboratory, manufacture of boxes and picture frames, the former at a rate of 20,000 a day, fireproof timber stores, quays, their electrical transporters, fat, soap boiling, cu stamping and packing departments were visited in. The "Baron" rotary card-box machine receives cardboard from the roll, prints it in five colours, stamps out a perfect box ready to be shaped up, box making, the wood is imported in definite sizes, branded, and is dovetailed by a machine which twelve to twenty pieces at a time. Four pieces are placed upright at right angles to each other in a machine which forces them together, while the bottom is nailed on by machinery. In the soapery there are 33 oil store tanks, each of 500 tons capacity. Veg oil, mainly palm oil, with some resin, is saponified with the aid of steam and caustic soda, the soap salts and the glycerin recovered.

The ventilation of all the newer portions of works is on the "Plenum" system and is considered effective. The central power station was next visited, with its two great engines and electric installation. It is the new soapery, covering  $4\frac{1}{2}$  acres, only started in January last, and now nearly finished. After the fire engines and ambulance, the men's dining with its stage, the library, tennis courts, girls' rooms, auditorium, schools, bath, hostel and canteen were taken in turn. Christ Church, just completed at a cost of £50,000, was presented to his people by Lever last year.

Luncheon was served at the hostel, and after Mr. Lever explained the system by which he co-operates with his workers. He described it as prosperity sharing, as distinguished from profit sharing, which latter he considered a failure. The profits of prosperous enterprises were devoted to the erection of houses in the village which now covered more than 100 acres. The profits were devoted to all social objects, save the religion and politics; the maintenance of gardens, collective action had given better results than individual effort; the employés benefit fund; the widows' pension fund for workmen after 65 years of age, and hearts were wanted as well as hands. As Mr. Lever had remarked, man was not a machine, one only obtained his best value when one appealed to his heart.

Dr. Wm. H. Nichols, in reply, stated that, after a year's experience of profit-sharing, he felt himself in agreement with Mr. Lever's system.

Dr. L. Baekeland proposed Mr. Lever's health, after a few remarks from Dr. Baskerville, the latter returned to the "Magnetic" and sailed up the Ship as far as Ellesmere Port.

In the evening, train was taken to York, by the Carlisle and Dore route through the Peak.

On arrival at York the party was received by Mr. Thos. Fairley (Hon. Secretary of the Yorkshire Section), Mr. S. H. Davies, Mr. Basil Hill, and other members.

#### SATURDAY, JULY 22ND.

Two parties were organised, one visiting the cocoa works of Messrs. Rowntree, Ltd., the other devoting its attention to York antiquities. On arrival at the cocoa works the party was received by Mr. B. Seeborn Rowntree, Mr. Arnold S. Rowntree, and some of the officials, and conducted through the later stages of chocolate manufacture, each lady receiving a memento in the shape of a chocolate. Meanwhile the second party had been received by Dr. Tempest Anderson within the grounds of the Yorkshire Philosophical Society, and were taken to St. Leonard's Hospital, a portion of the Roman and the Hospitium, now turned into a museum of Roman and other antiquities. St. Mary's Abbey Church was next visited, and all were surprised to find that the almost complete destruction of the beautiful church, dated, not from the time of Cromwell



om it is customary to attribute most of the van-  
 in this country, but from the beginning of the  
 entury. The King's Manor House, now occupied  
 a Yorkshire School for the Blind, was next visited,  
 the guidance of Mr. A. B. Norwood, the Super-  
 intendent. This is on the site of the house previously  
 ied by the Abbot of St. Mary's, and was built by  
 / VIII., out of Abbey materials. James I. was  
 ained here by the Lord President of the North  
 way to London in 1603, and Charles I. resided at  
 anor for some weeks during the civil war, and held  
 aiment. Fifty years later it became a Royal Mint,  
 300,000 being coined there. In 1833 it was acquired  
 present purpose as a memorial of William Wilber-  
 the philanthropist.

h parties then united for a visit to the Minster, where  
 ere met by Mr. T. B. Whytehead (Chapter Clerk).  
 rst mention of York Minster dates back to the year  
 hen a small wooden church was built for the baptism  
 King of Northumbria. In 1215 the present Cathedral  
 egun, and it was completed and re-consecrated in  
 1289 a madman set fire to the choir and utterly  
 yed the roof, the organ, the choir stalls, and  
 of the stained glass. Another fire in 1840  
 yed the roof of the nave and the south-west tower  
 ts peal of 10 bells. The crypt contains portions of  
 iapered Norman columns and walls in perfect  
 vation, showing how little hesitation the medieval  
 rs had in overthrowing the work of their pre-  
 cursors. The transepts are Early English (1225-1235),  
 ve and Chapter House are "Decorated" (1280-1340),  
 the choir and the towers are "Perpendicular" (1340-  
 1470). The length of the Minster is 519 ft., the  
 d tower 213 ft. high, the width of the nave 139 ft.  
 widest in the country), and the great east window is  
 rgest Gothic window in the world which contains its  
 al stained glass. There is more than half an acre  
 iaeval glass in the Minster, more than is contained  
 7 similar edifice. The Minster is admitted to be one  
 finest Gothic buildings in the world.

e visitors then drove round the city walls and  
 s" to Clifford's Tower, which was originally  
 keep of York Castle, and stands upon an  
 ial hill, and thence to the Guildhall, originally  
 Common Hall of the ancient guilds of St.  
 topher and St. George, but granted by Edward VI.  
 e City. Here the members were received by the  
 Mayoress, Mrs. Wragge, and were entertained at  
 by Mr. B. Seebohm Rowntree. After lunch, Mr.  
 utree gave an address of welcome to the Society, to  
 the President, and Dr. H. W. Wiley replied. Prof.  
 ry then proposed the "Yorkshire Section," and  
 hos. Fairley replied.

ain was then taken to Ripon, whence the party drove  
 ountains Abbey, which lies some three miles away  
 valley secluded within the park of Studley Royal,  
 eat of the Marquis of Ripon, by whose special per-  
 on the visit took place.

c. S. H. Davies gave an interesting account of the  
 ation and history of the abbey, of which the following  
 summary:—

ne Abbey belongs to the great group of Cistercian  
 ys, founded in the twelfth century, and was an  
 oot from St. Mary's Abbey, York, by monks  
 desired a stricter discipline. The present buildings  
 d the cloister were completed in 1180, and Abbot  
 a of Kent completed the eastern end with its special  
 sept, called the "nine altars," between 1220 and  
 i. Quite at the end of the fifteenth century large  
 ired windows were inserted in the east and west ends  
 he church, and Abbot Huby built the great tower  
 een 1494 and 1526. The Abbey was suppressed in  
 i, but, after being unroofed and dismantled, was other-  
 left intact. It remains the most imposing and  
 ructive ruin of its kind. A little to the west stands  
 picturesque Fountains Hall, built, at the expense of  
 e of the Abbey buildings, about 1600.

a the great cloister the party were photographed, and  
 a partook of tea in the monks' "cellarium," which  
 till intact. Ripon was regained by brake, and the  
 y then left for Newcastle.

SUNDAY, JULY 23RD.

On Sunday morning the members went by train to  
 Durham, and attended service in the Cathedral. Arch-  
 deacon Watkins, in the course of his sermon, offered  
 a welcome to the Society on behalf of the Cathedral  
 authorities. After service, a stroll was taken along the  
 banks of the Wear, round the rock on which the Cathedral  
 stands. At lunch, in the Town Hall, Profs. Chundler and  
 Mabery and Dr. Russell Moore took the opportunity to  
 thank the Newcastle Section for its hospitality. After  
 lunch, Dean Kitchen conducted the party round the  
 Cathedral, telling them its history, and especially dwelling  
 upon the legends of St. Cuthbert and the work of the  
 Venerable Bede. The chapter house and library were  
 also thrown open. The library is chiefly housed in the  
 Monks' dormitory and refectory, and contains a number  
 of MSS.

Durham Cathedral is one of the finest and most com-  
 plete examples of Norman architecture in England. Of  
 the structure, only the transepts at the extreme east,  
 called the Chapel of the Nine Altars, and the upper part  
 of the central tower are of later date, though decorated  
 windows, some of them of poor design, have replaced in  
 some instances the older and smaller Norman ones. The  
 Galilee, a species of Lady Chapel, placed, contrary to rule,  
 at the west end of the Cathedral, and built about 1175,  
 shows traces of Saracenic influence, particularly observable  
 in the light clustered columns and delicate mouldings on  
 the arches.

Durham Castle, on the north of the Cathedral, is now  
 the home of University College, one of the two residential  
 Colleges of the University of Durham.

The members then returned to Newcastle, and in the  
 evening attended service in the thirteenth century church  
 of St. Nicholas, which now serves as the Cathedral, the  
 crowned tower of which, 450 years old, is the pride of  
 Tyneside. Canon Gough, the vicar, preached, and, after  
 service, Mr. J. E. Jeffries, the organist, gave a special  
 recital on a very fine organ.

MONDAY, JULY 24TH.

In the morning the visitors were shown the keep of the  
 "New Castle on Tyne" by Mr. Oliver Heslop, President  
 of the Newcastle Society of Antiquaries. The castle  
 is best approached by the "Black Gate," the lower  
 part of which dates back to Henry III. The castle was  
 "new" in the reign of William Rufus, but the present  
 keep was rebuilt by Henry II., though in Queen Elizabeth's  
 time it had already become "old and ruinous."

Accompanied by Mr. John Pattinson, Mr. J. C. Rollin,  
 Dr. J. T. Dunn and party, Mrs. Henry Louis, Mr. W. H.  
 Sodeau, Drs. Garrett, Smythe and Hall, Mr. Arnold Spiller,  
 Mr. and Mrs. Trobridge and other members of the New-  
 castle section, the party then embarked upon the steamer  
 "J. C. Stevenson," lent for the occasion by the Tyne  
 Commissioners, for a trip down the river to Tynemouth.  
 The visitors were particularly struck with the activity  
 of the shipbuilding industry as they went along, and  
 repeatedly called attention to the number of ships lying  
 in the river. Tynemouth breakwater was reached about  
 noon, and the members then proceeded to the Bath  
 Assembly Rooms for lunch. After lunch Prof. V.  
 Coblentz expressed the gratitude of the American  
 members for their reception, and Dr. Dunn, in the absence  
 of Prof. Louis, Chairman-Elect of the Section, replied on  
 behalf of the Newcastle Reception Committee. Mr.  
 Thos. Tyrer then proposed the health of Mr. John  
 Pattinson, as the representative of the old Newcastle  
 Chemical Society, which had cast in its lot with the  
 Society of Chemical Industry in days when success was  
 by no means assured. Mr. Pattinson, in reply, expressed  
 his gratification in seeing members from a distant shore  
 which he himself, despite his age, by no means despaired  
 of visiting in the future.

The visitors then returned to the steamer and proceeded  
 to Jarrow.

PALMER'S SHIPBUILDING AND IRON CO., LTD.

On arrival the visitors were received by Mr. Malcolm  
 Dillon, General Manager, Mr. Upton, Manager of the Blast

Furnaces and Rolling Mills, and other officials, and were taken to see pig iron tapped from the blast furnaces, several types of which were standing side by side and served to show the evolution which these furnaces have undergone of late years. Then passing through the boiler shop, where water-tube boilers for destroyers were shown, they proceeded to the steel works, where bars were rolled before them. Next came the engine building shops and the shipyard, where lay the "Lord Nelson" battleship, in course of construction. After being photographed, by courtesy of the firm, the party was entertained at tea. Mr. Malcolm Dillon, in offering a welcome, said that at Palmer's iron ore entered at one end and came out a finished ship at the other. Mrs. E. Byrnes and Mrs. M. Toch responded on behalf of the visitors, and then Dr. H. W. Wiley, in expressing appreciation for the reception given to them, said that though shipbuilding might be said to have driven out chemical industry from the Tyne, yet applied chemistry was so integral a portion of the process of building a ship that without its aid no such battleship as they had seen would be possible. It was therefore right and meet that the Society should be entertained at Jarrow, and that it should propose prosperity to Palmer's Shipbuilding Co. They were close to the spot where Glover lived, where Weldon's discoveries were made, and even to the old home of the Washingtons. They came there on a pilgrimage to a shrine hallowed in both countries, and they pledged the old country and their own to stand shoulder to shoulder to secure the peace of the world. The Chairman then gave "England and America," which was drunk with great enthusiasm, and souvenirs of the "Lord Nelson" were presented to each member.

The visitors then returned to Newcastle, and later on took train for Edinburgh, by way of Berwick-on-Tweed and Dunbar, much of the route lying along the sea coast.

On arrival, the party were received by Mr. David Perry (Chairman Elect of the Scottish Section) Mrs. Perry, Dr. Thos. Gray (Hon. Local Secretary), Mr. and Mrs. J. G. Flowerdew Lawson, and other members.

#### TUESDAY, JULY 25TH.

In the morning they drove round the old town, visiting Holyrood Palace, when a photograph was taken in the ruined chapel, and where the room and relics of Mary Queen of Scots roused much interest. Thence, along Canongate with its wynds and closes, they went to St. Giles Cathedral, restored by the munificence of Dr. Wm. Chambers, and then to the Castle. Here were shown the Regalia of Scotland, the room where James I. was born, and a curious small Norman Chapel, almost the sole relic left of the earliest period. The view from the Castle, comprising the Firth of Forth with its gigantic bridge, the coast of Fife, the island of Inchkeith, and the Lothians, was on this occasion unusually perfect and far reaching.

Thence some found their way to the Parliament House, others to John Knox's house, and others to the National Gallery where Raeburn's portraits, now so valuable, abound. After lunch Mr. Perry welcomed the members, and the President and Prof. C. F. Chandler, in responding, acknowledged the hearty way in which the visitors were being received.

Then they drove out to the Forth Bridge, a structure one mile and one fifth long and 450 ft. high, built on the cantilever principle, and returned through Dalmeny Park, by special permission of Lord Rosebery.

In the evening the Lord Provost (Sir Robt. Cranston) and Lady Cranston gave a state reception at the Council Chambers, when a concert was given. Pipe Major Wilson, of the Highland Light Infantry, assisted by Piper Johnstone, gave selections on the bagpipes, and the latter performed Highland dances in honour of the visitors.

#### WEDNESDAY, JULY 26TH.

The visitors went to Callander by rail, passing through Linlithgow with its ruined palace and abbey church, and Stirling, with its famous Castle and Wallace monument. From Callander, brakes took the visitors by Loch Venachar and Loch Achray to the Trossachs Hotel, where lunch was served. Then they drove through the

Trossachs proper, a deep and wooded glen no more than a mile in length, to the foot of Loch Katrine or Loch the Caterans, so named from its robbers, of which Rob was a type. This loch is now Glasgow's water supply, but, beyond a slight elevation in level, there is no change in its appearance. Stronauchlachar was reached by steamer, and then a five miles' drive over the water under the shadow of Ben Lomond, brought the party to Inversnaid on Loch Lomond, where a photograph was taken in front of the waterfall. Steamer was then taken down the Loch to Balloch, whence the Caledonian R.R. brought the party to Glasgow.

#### THURSDAY, JULY 27TH.

The final trip of the excursion started from St. Andrew's Station, Glasgow, for Prince's Pier, Greenock, where the party accompanied by Lady Primrose, wife of the Provost, embarked on the "Juno," a fine new steamer belonging to the Glasgow and South Western Railway. The weather, as indeed it had been throughout the trip, was fine, with a pleasant breeze.

The route taken was up Loch Goil in the first instance as far as the ruins of Carrick Castle. Then the steamer ran rapidly down the Clyde, past the Holy Loch, where some obsolete battleships were seen in the distance Hunter's Quay, with its yachts, Dunoon and Inverclyde, to Rothesay Bay with its view of Loch Striven. Kyles of Bute were neared more obsolete battleships, "Alexandra," "Dreadnought," "Collingwood," "Pareil," and "Iron Duke"—silent and deserted, passed. It is but a short time since some of these looked upon as the strength of the British Navy, required some moral courage on the part of Sir Fisher to place them upon the scrap heap, especially large sums had but lately been spent to make them efficient. Luncheon was served on board, and after meeting took place in the saloon, Dr. Wm. H. Nichols took the chair. Mr. David Perry opened the proceedings by a welcome to the visitors, and then Mr. Bloede, of Baltimore, on behalf of his fellow visitors, returned thanks for the hospitality shown to them both in England and Scotland during their visit. In conclusion, he said the American visitors felt that slight recognition was due to those who had organized the meeting and excursions, and he wished, on their behalf, to present to Mr. A. Gordon Salamon (Chairman of the Executive Committee), Mr. Julian L. Baker (Secretary), Mr. Thos. Tyer and Dr. J. Lewkowitsch (members of the Hotels and Excursions Committee) with handsome flower bowls. Messrs. Baker, Tyer, and Lewkowitsch briefly acknowledged the presentation. Mr. A. Gordon Salamon being prevented from being present, the steamer meanwhile passed through the Kyles and coasted along the Island of Arran, the property of the Duke of Hamilton. Until recently "feuing" has been restricted on this island, but now some building is permitted. Return was made to Greenock by the Fife and Clyde.

In the evening the Corporation of Glasgow gave a reception in the City Chambers, one of the finest Town Halls in the kingdom. The guests were received by the Provost, Sir John Ure Primrose, Lady Primrose, and the magistrates in state. After the reception the Provost, the magistrates, and some of the principal members assembled on the dais in the great hall, while the Provost briefly explained to those invited to meet the Society what purpose the Society of Chemical Industry fulfilled, and why Glasgow delighted to do it. He gave instances of the part which chemistry played in municipal matters, and alluded to the band of workers in the laboratory who investigated day and night the inner alchemy of Nature for the benefit of humanity. Dr. Wm. H. Nichols, in reply, said that the name of the 4,500 members of the Society, he thought, was a tribute to his Lordship for his kind references to the science of chemistry, and they all followed and loved. It was good to select a subject and treat it in such a manner. H.M. the Duke of Hamilton, at an interview which he accorded to some of them, touched upon the same thing very much to their pleasure. From London to Glasgow they had been entertained everywhere, and everything had been done intelligently and well.



anked the Lord Provost. Mr. David Perry also ed the Corporation of Glasgow, and Dr. Russell W. e proposed, and Mr. Paul Rottenburg seconded, of thanks to the Lord Provost. excellent concert followed.

Photographs at nearly all places, with the exception at Jarrow, were taken by Messrs. Walter Baker & Foll Street, Derby Road, Nottingham, from whom may be obtained.

### THE GUIDE BOOK.

a guide was for the most part written by Miss E. ds, B.A. (Lond.), under the supervision of Mr. L. Baker (the Hon. Secretary of the London Section), hom it was edited at the request of the Executive ittee. Every effort was made to collect the informa- contained therein from reliable sources, and, in valuable assistance was received from the various Local Secretaries of the Country and Scottish ns, Mr. T. Tyrer and others. Mr. T. Tyrer, Mr. B. ran, and the Manchester Chamber of Commerce, and s. Methuen & Co. also kindly lent blocks. is hoped that it will form as interesting a souvenir meeting as it was found a useful guide at the time.

## New York Section.

ng held at Chemists' Club, on Friday, May 19, 1905.

DR. RUSSELL W. MOORE IN THE CHAIR.

### EXTRACTION OF TANNIC ACID FROM THE POINT OF VIEW OF THE DYER AND CALICO PRINTER.

BY WALTER S. WILLIAMS.

e tannin materials of the modern dyer and calico er are commercial tannic acid, sumach, catechu, gambier, the first two being by far the most im- nt.

mach is found in the market either as a powder, or n extract. The powder contains 15-20 per cent. e acid and carries as well a certain amount of colour- aatter, which makes it unsuitable as a mordant for ueing either clear or very light shades on cotton fibre. ries from a bright yellow to light green coloured ran, which should be free from lumps and other ations of excessive moisture.

mach should be examined for tannic acid, moisture, and adulteration. For the latter the microscopical ination of the leaf cuticles offers a ready method of ation. This method, due to Lamb (Jour. Soc. s and Colourists, XV., p. 60, and XX., p. 265), also been treated at length in an excellent article by stman, recently published in this Journal (1905, p. 231). Nature and ash may be determined in the usual manner, tannic acid by the analytical methods.

he extract of sumach is also much used, and more or le bleached forms may be had under the name of colour- e extracts of sumach. The general method of rating e acts by gravity offers no criterion as to the actual tin contents; an analytical or practical test is neces- to determine their true mordanting value. As the d: uses sumach principally for dark shades, and usually

with iron salts as a fixing agent, a comparative dyeing test similar to the actual dyeing process will, if carefully conducted, answer all requirements.

Catechu, gambier and a few similar bodies are used by the dyer because of the colouring and other valuable properties they possess, rather than for the tannin they contain. They are best examined by running a small practical trial in the dye house or laboratory.

Commercial tannic acid is most commonly obtained by the extraction of gall nuts, the purest and freest from colouring matter being that derived from Chinese or Japanese galls. There are several varieties to be distinguished, the three most common being obtained respectively by extraction with ether, alcohol and water. Tannin extracted with the aid of ether comes in the form of a light, fluffy powder, and is apt to be purer than that extracted by the other two methods. The extracts made with alcohol or water are evaporated to dryness, and the resulting mass ground to a powder giving the usual tannin of commerce. The latter grade is liable to be much contaminated with colouring matters, fat, and resinous or tarry matter, frequently so much so as to render it unfit for anything but the crudest work. Acetone is also used as a solvent in extracting tannin.

A new tannin extracted in this country by a secret process has recently attracted much attention, both at home and abroad, because of its great purity.

The so-called "Tannic Acid Crystals" owe their crystalline form to the method of drying, being forced in small drops while still moist on to a revolving hot cylinder.

For the qualitative recognition of tannin materials the tables and method of procedure given by Procter (this J., 1894, p. 187) will be found to meet all requirements with any but mixed samples.

Besides gallotannic acid, the commercial article contains varying amounts of glucose, chlorophyll or other colouring matter, volatile oil, resinous or tarry bodies, ellagic and gallic acids, and a certain amount of moisture. Starch and dextrine may be present as a wilful adulterant. The gallotannic acid usually runs from 70 per cent. to 90 per cent., but is frequently found as low as 50 per cent. Allen has mentioned rare samples which, in his experience, have consisted entirely of gallic acid.

Sampling is the first important step in tannin examination, for it will be readily seen that unless the samples are entirely representative of the lot in question the most careful analysis can give only meaningless results. As tannin is almost universally shipped in barrels, it offers a ready means of sampling. If the lot is small a sample should be drawn from each barrel, using a tube which will reach from end to end of the barrel, and inserting it at a point about one-third the diameter from the outer edge of the barrel. From larger lots each third barrel may be selected, and from very large lots one barrel in five may be sufficient. The samples so drawn should be well mixed, worked down to a convenient size by quartering in the well-known manner, and kept in air tight bottles until examined.

Moisture, if strictly accurate work is desired, must be determined by drying *in vacuo* over sulphuric acid. Few works laboratories, however, are fitted with the necessary apparatus, and in lieu of this the results obtained by drying the sample 2-2½ hours at 95° C. will be found sufficiently accurate for most requirements. The sample for drying should not form a layer of more than 7 mm. in thickness in the weighing bottle, and after drying should not be used for the subsequent analysis. The results obtained by using dried portions of tannin will be found to vary among themselves, and from values found by using undried tannin and calculating the dry tannic acid from previous tests.

In using the pure tannic acid for standardisation of solutions, or, when analysing the commercial product, I have found it best to weigh out at one time from a glass-stoppered bottle the several portions needed both for the moisture determinations and for the solutions for tannic acid titration. The dry tannin is then taken as the same percentage in all the weighings. The effect of long drying is shown by the table given below. The results are the averages obtained from two different pure tannic acids, and from one good commercial grade. The

somewhat slower drying of the latter would seem to be explained by its greater compactness.

*Effect of Time in drying Tannic Acid.*

Length of drying.	Weights in percentage of original weights.		
	Pure Tannic Acid A.	Pure Tannic Acid B.	Commercial Tannic Acid.
1 hour	92.2	92.2	—
1 1/2 "	92.1	91.6	94.2
1 3/4 "	92.0	—	—
2 "	92.0	91.4	—
2 1/2 "	91.9	—	—
3 "	—	91.6	94.1
3 1/2 "	92.0	—	—
4 "	92.1	—	—
4 1/2 "	—	—	94.3
5 "	92.2	—	—
5 1/2 "	92.4	91.7	—

Some tannins examined by the author, evidently water extracted, have been found to contain such large quantities of resinous or tarry matter, accompanied with chlorophyll, as to be highly objectionable to either the dyer or printer. A quick test for such bodies may be made by boiling up with an equal weight of acetic acid and setting aside to cool. If present in any quantity, a thick sticky mass will collect on the top of the solution.

The other bodies mentioned as present in tannin are of slight importance to us, with the exception of gallic acid. This acid is by far the most prevalent and least to be desired of the non-tannins found in the tannic acid of trade. Tartar emetic forms with gallic acid a white precipitate, but this compound is entirely devoid of lake-forming properties with basic dyestuffs. Gallic acid is also only slightly absorbed by cotton fibre.

It is therefore on the accurate separation of gallic from the gallotannic acid that the usefulness of a process of analysis depends.

I think all will agree that in spite of the many and diverse methods described for the analysis of tannin materials, no general method has been devised which is both simple in manipulation and reliable. A process for the estimation of commercial tannic acid would appear to be a much simpler problem, but is still apparently far from solution. Those who wish to consult the various methods proposed will find them fully described in Allen's "Commercial Organic Analysis," Vol. III., Part I, page 69, *et seq.*, in the Journal of the Soc. of Dyers and Colourists, or in the files of this Journal.

The standard method of tannin analysis, as adopted by the International Association of Leather Trades Chemists, is the well-known hide-powder method of Simand and Weiss, of Vienna, using the hide-powder filter devised by H. R. Procter. This process is probably the most used, and for the leather industry is undoubtedly the most rational. The separation of gallic acid is not complete, however, and the process is not as accurate in this respect as the gelatin separation. Procter states that hide-powder absorbs 78 per cent. of the gallic acid present in a 1 per cent. solution; this being the strength of tannin solution used for this method of analysis.

An equally important process for the estimation of tannin is the oxidation or permanganate method, first proposed by Löwenthal and modified by Procter, Hunt and others. I will have more to say of this process later.

Many volumetric processes have been proposed which attempted to imitate the practical methods of application of tannic acid in dyeing, as the hide-powder method simulates the tanning of leathers. The first of these was described by Gerland, who titrated the tannin solution with tartar emetic in the presence of ammonium chloride, which prevented the precipitation of gallic acids. Richards and Palmer (Silkman's American Journal Science (3), XVI., 196, 361) improved the process by substituting ammonium acetate for the ammonium chloride, and devised a new method for ascertaining the end point.

F. Becker (Journal Soc. Dyers and Colourists, 1, 1906) describes a method of determining tannin by the use of a solution of methyl violet containing 5 grms. per 50 c.c. of this solution is diluted with 450 c.c. water at 50° C., and titrated with a 1 per cent. solution of tannin.

E. Guenz proposes a method of tannin estimation based on the precipitation of a standard solution containing 12 grms. of tartar emetic and 1 gram. Poirier's 4 J. E. in a litre, by titrating with the tannin solution.

These three methods and many similar volumetric processes have doubtless been used as comparative methods with some success, but the difficulty of finding the end point and the varying reactions under slightly different conditions make the results not accurate, at least, than those from a well-conducted dyeing test.

After numerous trials of promising methods, I found the modification of the permanganate process described by Bertram Hunt (this J., 1885, p. 26) most satisfactory. I will give briefly the strength of solutions found to give the best results with tannin and will refer you for further details to the original article:—

1—1 1/4 gram. of the tannic acid is weighed out and made up to 1 litre. 15 c.c. of this solution, 30 c.c. of a 1 per cent. solution, and 750 c.c. of water are placed in a porcelain evaporating dish and titrated with the permanganate solution drop by drop with constant stirring.

The indigo solution is made by dissolving 5 grms. of pure sodium or potassium sulphindigotate in 100 c.c. of water, adding 50 c.c. concentrated sulphuric acid, and making up to 1 litre. The purest synthetic product should be used, as the presence of indirubin or other impurities prevents the formation of a satisfactory end-reaction.

The permanganate solution contains about 1 gram. per litre. The saturated salt solution is made by adding pure sodium chloride in distilled water and making up each litre 50 c.c. of concentrated sulphuric acid.

For the separation of tannins and non-tannins, 25 c.c. of the tannin solution are run into a flask together with 25 c.c. of a freshly filtered gelatin solution, 2 grms. of barium chloride, and 100 c.c. of water. The flask is well shaken, 50 c.c. of the saturated salt solution run in, and 5 grms. of pure barium sulphate added. The flask is again well shaken, and after five minutes the contents filtered; the filtrate should be perfectly clear and free from tannin. For the titration of non-tannins 60 c.c., equal to 15 c.c. of the tannin solution, are taken. The best gelatin obtainable has been given a slight quantity of oxidisable matter reacting with the permanganate. This necessitates a blank determination in which the 25 c.c. of tannin solution is replaced by the same amount of distilled water.

The permanganate solution may be standardized against oxalic acid and the report given in terms of oxalic acid or the gallotannic value figured by using the equivalent values of Neubauer or Ishikawa (Chemical News, 1906, 274). The more rational method from our standpoint is the use of either pure gallic acid or pure tannic acid which are titrated in the same manner as the tannin and thus cancel errors due to different rates of oxidation. For gallic acid Procter gives the value of 1 gram. as equivalent to 1.35 grms. gallotannic acid. It is important to obtain tannic acid free from gallic acid and other non-tannins, and the results must be corrected for these impurities. Von Schroeder allows for the higher reducing power of gallic acid in tannic acid, found to contain more than 5 per cent. non-tannins, by dividing the (c.c. of permanganate solution) by 1.05. In using gallic or tannic acids as standards the moisture should be determined by the method already described.

The table following shows the values determined by the above methods with the same permanganate solution. The set of figures marked "B" were obtained at an interval of several years with different reagents and solutions throughout, and figured to the same strength of permanganate solution from their oxalic acid equivalent. The exact agreement of the tannic acid value with the tannin made by different firms is more than can be expected from every group of trials.



*Equivalents for 100 c.c. of Permanganate Solution by Different Standards.*

"C.P." Tannic Acid.	"C.P." Tannic Acid corrected by Von Schroeder's Value.	Gallic Acid.	Oxalic Acid.	Oxalic Acid equivalent. Neubauer.	Oxalic Acid equivalent. Ishikawa.
grms. 0.1266	grms. 0.1329	grms. 0.1322	grms. 0.2117	grms. 0.1397	grms. 0.1308
0.1266	*0.1288 0.1329	0.1257	0.2117	0.1397	0.1398

\* This figure is from samples of the same tannic acid which have been previously dried.

accuracy of the gelatin separation when gallic acid is present was tested by a set of experiments strengths of solutions. The first solution contained gallic acid equal in weight to the tannic acid employed, and having a reducing power about 1 greater. The strength of the second solution was 1 per cent. that of the first.

*Gelatin Separation with Pure Gallic Acid.*

Gallic Acid weighed.	Non-tannins found as Gallic Acid.	Gallic Acid found.
os. per litre. 1.146 0.0573	Grms. per litre. 1.091 0.0560	Per cent. 95.2 97.7

A quick comparison of values the dyeing test offers an approximate substitute for the analytical methods. In cases where the tannins are more accurately determined, this test forms a valuable adjunct if conducted with necessary precautions. Besides showing at a glance the mordanting power of the tannin, it gives as to the clearness and brightness of the resulting shade. In the past years I have used an improvement on this test for all preliminary examinations of tannic acid. The process requires a small trial printing machine with a roll engraved for a rather broad stripe. The results are more accurate than those obtained from the dyeing test, and the trials may be quickly and easily made. In describing the process I shall give the temperature and length of different treatments found most efficient for my own use, but these may be changed to suit reason to meet varying conditions, it being only necessary to adopt a definite mode of procedure for all trials which are to be compared.

A printing paste containing the tannin to be tested is spread as below, printed on bleached cotton cloth and

1 oz. of tannic acid is dissolved in 1 oz. acetic acid and 3 oz. water, and the solution added to 12 oz. of water.

Thickening is made by boiling 4—6 lbs. light British starch in 1 gall. of water, the amount of gum necessary being determined on the proportion of unconverted starch it

contains. A consistency is required which will give a full, sharply-cut impression when printed.

All the patches to be compared are then steamed in any convenient manner, and fixed by working 15 minutes at 50° C. in a bath of tartar emetic containing 1 oz. per gall. The swatches are then rinsed two minutes in cold water and two minutes in hot water, and dried. This treatment should wash out practically all of the gum, leaving only the tannate of antimony and such colouring matter as is present in the tannins. A part of each trial being saved for future comparison, the remainder of the swatches are dyed in one bath with an excess of a red shade of methylene blue using the usual dyeing assistants. On completion of the dyeing the patches are removed from the bath, rinsed in cold water and then five minutes in hot water at 90° C., soaped lightly, rinsed, and finally dried.

The printed portions of the cloth will be found well dyed, while the rest of the fabric is only slightly stained. A comparison of the printed parts will give a very fair idea of the mordanting value and clearness of tone to be obtained in practice.

The results by this method have been found to be in perfect accord with the values obtained by analysis, though not of course susceptible to such a fine degree of accuracy. It is not possible in practice to distinguish much nearer than 5 per cent. in colour matching. If desired, a set of standards may be prepared by using a pure tannic acid of known strength, but it will be found even more satisfactory to keep a large sample of a good tannin, previously analysed, in a well stoppered bottle and to test all new tannins directly against this sample.

It may be of interest to state that when the tannic acid in one of these trials is replaced with gallic acid no trace of the basic dyestuff is fixed on the fibre. The statement of W. P. Dreaper that "the total tannic and gallic acids give, from the dyer's point of view the 'mordant value' of the extract" (Jour. Soc. Dyers and Col. XX., 224) can hardly be taken as well founded. I call your attention to this discrepancy only because I wish to commend most highly the Dreaper improved process as a step in the right direction. I am also glad to welcome as an advancement the process of Parker and Payne (this J., 1904, p. 648). These methods, based as they are on the formation of metallic compounds with the tannic and gallic acids, point out the directions in which we must look for future improvements in tannin analysis, namely, the substitution of a more definite reaction for the precipitation with gelatin, hide powder, or other colloid bodies.

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## I.—PLANT, APPARATUS, AND MACHINERY.

### ENGLISH PATENTS.

*Mixing either Granulated Powdered or Similar Substances or Fluids; Apparatus for* —. C. Duckworth, Colne. Eng. Pat. 19,092, Sept. 5, 1904.

THE claims are for improvements in mixing apparatus described in Eng. Pat. 16,230 of 1901 (this J., 1902, 1224). These improvements consist in constructing the mixing cylinder in halves, which may be taken apart for filling or emptying, in providing an internal tube for heating by hot air or steam; and in arranging a valve at one end of the cylinder which automatically opens when that end is uppermost.—W. H. C.

*Extracting Moisture from Air or other Gases for use in the Arts; Method of* —. J. Gayley, New York. Eng. Pat. 865, Jan. 16, 1905.

THE patent refers to apparatus for drying air, described in Eng. Pats. 20,207 of 1894 (this J., 1895, 40) and 13,892 of 1904, in which the moisture is removed from the air by passing it through a series of refrigerating chambers. The claim is for the method of rendering one of the chambers inoperative for a time and passing the whole or part of the incoming warm air through it to melt off the frost deposited on the cooling coils. This air may then, by means of a deflector, be distributed in any desired proportion to the other chambers.—W. H. C.

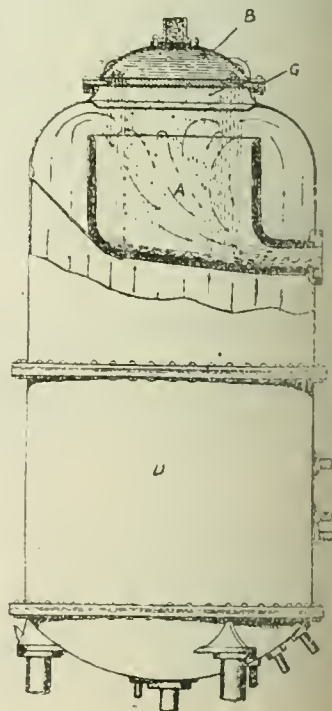
### UNITED STATES PATENTS.

*Vacuum-Pan*. J. Abraham, Assignor to Milwaukee Evaporator Co., Milwaukee, Wis. U.S. Pat. 794,831, July 18, 1905.

A CYLINDRICAL vessel is divided by two tube-plates into three chambers, the upper being the evaporator, the middle the heating chamber, and the lower the settling chamber. The tube-plates are connected by tubes passing through the heating chamber, which is divided into sections by vertical baffle plates, arranged between successive rows of tubes and terminating short of the upper and lower tube-plates alternately. In this way the heating medium, which enters at one side and leaves at the other, is compelled to take a zigzag path. A deflecting plate is placed in the evaporating chamber over the upper ends of the tubes through which the liquid circulates. When several pans are connected in series, the heating

chamber of the first is fed with steam, but the subsequent ones are fed with vapour taken from the upper part of the previous evaporating chamber. The liquid is fed into the first evaporating chamber, and after concentration it collects in the settling chamber, from which it is carried to the evaporating chamber of the next pan. From the last settling chamber the concentrated liquid passes through a strainer, whilst the vapour from the last evaporator passes through a condenser, provided with a pump.—W. H. C.

*Vacuum-Pan and Condenser; Combined* —. Rogers, Detroit, Mich. U.S. Pat. 795,650, July 18, 1905.

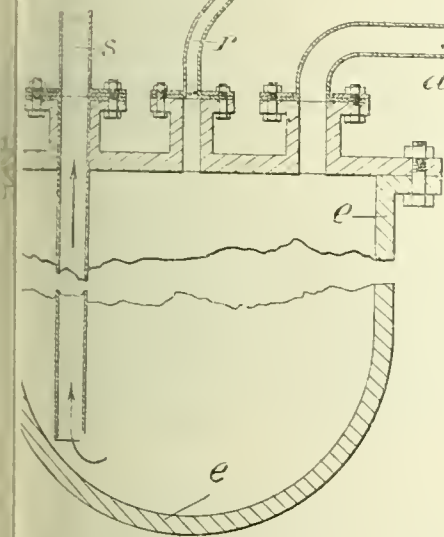




l A acting as a condenser is arranged in the of the vacuum-pan D and has a delivery through f the pan, for the condensed liquid passing, as the fig. Jets of condensing fluid are supplied idenser from a reservoir B situated at the top n. The size of the jets can be regulated by two circular perforated plates C, which can be actively to one another, thus altering the size of rations and consequently of the jets of cond- uid.—W. H. C.

# FRENCH PATENTS.

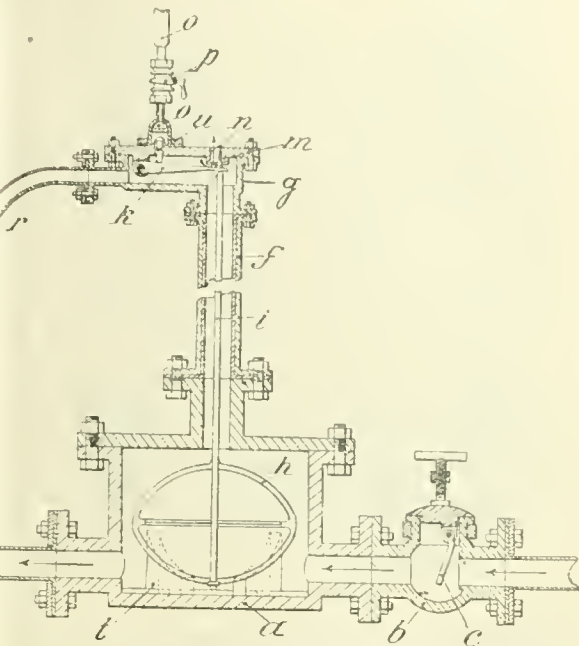
Acid ; Impts. in ——. G. F. D. Ceaglio.  
Fr. Pat. 351,952, Jan. 17, 1905.



liquid (acid) to be elevated enters by the pipe b the back-pressure valve c, and flows through the a and the pipe d into the egg or reservoir e. e latter is full, the acid fills up the pipe d and the a and lifts the float h off the supports t. As the s it closes the air escape opening n by the valve ed by the rod i through the pipe f, which serves ct the float-box a with the valve-box g. At the e the lever k is pressed upwards and opens the ed-air valve u; the compressed air then enters by o and the valve u, and passing to the float-box a egg e by the pipes f and r, forces the acid up the pipe s. The float soon falls back on to its supports e pressure of the air keeps the valve m closed. level of the acid in e falls below the bottom of the when the air escapes and the pressure falls. The then drops and u closes, the air supply is cut off, c-pressure valve c opens and the vessel fills again. —W. H. C.

Heating Drum. Maschinen-Bau-Anstalt, Breslau, G.m.b.H.  
Fr. Pat. 351,523, Feb. 15, 1905.

A ROTARY heating drum, through which the liquid to be heated circulates, has its surface contracted at intervals, so as to form a series of grooves or corrugations. The heating coils, which partially or entirely embrace the drum, are placed in these grooves, and, being surrounded



on three sides by the liquid to be heated, a very economical utilisation of the heat is obtained.—W. H. C.

Centrifugal Separators ; Method of Fixing the Internal Fittings of ——. J. Mélotte. Fr. Pat. 351,529, Feb. 15, 1905. Under Int. Conv., Feb. 20, 1904.

THE claim is for the method of fixing the distributing wings or vanes in the bowl of the machine by means of springs, placed between the feeding cup and the false bottom of the drum.—W. H. C.

Rectifying, Distilling and Concentrating Apparatus H. A. Deroy. Fr. Pat. 351,530, Feb. 15, 1905.

THE claim is for the use of chains, which are placed in the tubes or columns of rectifying, distilling and condensing apparatus. The greatly extended surface presented by the links of the chains is covered by condensed liquid, which washes the vapours very effectively. Equally good results are said to be obtained with much more compact apparatus than is possible with the bubbling columns in general use.—W. H. C.

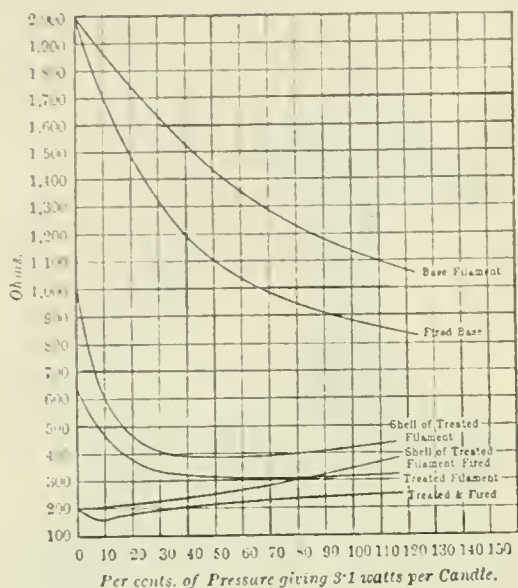
## GERMAN PATENT.

Furnace ; Gas —, for Heating Iron Plates and other Objects. O. Müller. Ger. Pat. 159,910, April 16, 1904.

THE furnace is constructed with two vertical heating channels connected at their ends by transverse channels. The heating channels are provided with niches or recesses having openings, any of which can be placed in communication by connecting tubes with the gas-supply tube or the chimney at will, so that any part of the heating channels can be heated as required. Combustion of the gas takes place in the recesses, and the objects to be heated are not exposed to the direct flame, but only to the hot products of combustion. The gas and air are introduced directly at the place where combustion is effected, so that rapid cooling of the heated objects by the incoming air or gas is avoided.—A. S.

## II.—FUEL, GAS, AND LIGHT.

**Carbon Filament; New** — J. W. Howell. Electrician. 1905, 55, 588–590. Paper read before Amer. Inst. Electr. Eng.



A DESCRIPTION is given of work carried out on carbon filaments baked at a very high temperature. No beneficial change is produced by passing an abnormally high current through an ordinary incandescent filament in an evacuated lamp. The heat must be applied externally by placing the filaments in an electrically heated carbon tube furnace. The "base filament," produced by carbonising the squirted and hardened cellulose, does not undergo any great alteration by baking at these high temperatures. It is only the "treated" filament produced by "flashing," and more particularly the shell of graphite, which is deposited from the hydrocarbon vapour in this process, which by heating to high temperatures (usually 3000° to 3700° C.) becomes "metallised." The chief peculiarity of these "metallised" filaments is shown in the accompanying diagram, which illustrates the variation of resistance of the filament with temperature. The temperature is indicated by the percentage relation of the pressure on the filaments to the normal pressure at which the filament has an efficiency of 3.1 watts per candle. These "metallised" graphite shells, besides giving a marked positive resistance curve, have other physical peculiarities which the author takes to indicate that they consist of a new form of carbon. Lamp filaments taking about 2.5 watts per candle with a useful life of about 500 hours are being produced with a fair degree of uniformity. (See also Eng. Pat. 6959, 1904; this J., 1905, 721.)—R. S. H.

### ENGLISH PATENTS.

**Fuel Briquettes; Process for the Preparation of Compounds for** — B. Wagner, Berlin. Eng. Pat. 351, Jan. 7, 1905.

SEE Fr. Pat. 350,579 of 1905; this J., 1905, 794.—T. F. B.

**Fuel; Process for Manufacturing Artificial** — J. Knops, Aix-la-Chapelle, Germany. Eng. Pat. 4291, March 1, 1905.

SEE Ger. Pat. 158,756 of 1904; this J., 1905, 722.—T. F. B.

**Burners for Liquid Fuel; Impts. in** — J. J. Ker Liverpool. Eng. Pat. 15,269, July 8, 1904. also this J., 1899, 478, 904.)

THE burner consists of three concentric barrels, the inner barrel, steam through the annular space between this and the intermediate barrel, and the air through the space between the latter and the outer barrel. The outer and intermediate barrels mounted together, can be revolved on a screw connection so as to adjust the steam admission valve. The barrel projects beyond this valve, and the oil admission at the rear end of the barrel is controlled by a operated screw valve, the body of which is prolonged side the inner barrel in the form of a spiral scraper. air admission is regulated by a rotary band, provide apertures which can be adjusted so as to correct more or less with the air ports provided round the of the outer barrel. The surrounding hood, through which air is admitted to the firebox, encloses a rotary fitted with internal deflecting vanes, so that in the of a tube bursting in the boiler, and setting up a pressure of steam, the air supply is automatically cut off. The same result may be attained by means of swing opening inwards to the firebox.—C. S.

**Gas; Apparatus for the Manufacture of Generator** — Roberts and H. C. Anstey, Grantham, Lincoln. Eng. Pat. 18,975, Sept. 2, 1904.

IN the producer, one or more pipes are arranged in upright position, passing through the mass of incandescent fuel; the open tops of these pipes are protected by shaped hoods. The fuel which is charged through an ordinary hopper falls on top of the hood and fills the space between the pipe or pipes and the wall of the producer; but leaves a free space beneath the hood. The gas generated passes down the pipes and leaves the producer at the bottom. The hot gas is conveyed through a vertical boiler, thus raising the steam required by the producer. The air, carrying steam with it, is forced through the boiler into a jacket surrounding the producer, where it takes up heat. The apparatus is especially suitable for bituminous coal.—R. L.

**Producer Gas Manufacturing Apparatus.** C. B. Wood. Eng. Pat. 19,183, Sept. 6, 1904.

IN order to prevent an excess of steam and an insufficient supply of air under the grate in a suction gas producer when the engine is working on light loads and the valve is suppressed, the apparatus is fitted with a telescopic sleeve, to regulate and control the relative proportion of air and steam supplied to the producer. The sliding sleeve is adapted to be moved in telescopic fashion on the suction pipe by means of an attached rack and pinion. The sleeve increases the air inlet space, and reduces the steam inlet space when moved towards the air inlet valve *vice versa*.—R. L.

**Gas; Apparatus for Converting Oil into** — for C. Heating, and Illuminating Purposes. W. Oliphant & T. Scott, Glasgow. Eng. Pat. 22,917, Oct. 25, 1904.

THE apparatus is fed with oil from a vessel under pressure, a reducing valve controlling the supply automatically. The pressure must be sufficient to force the oil into the evaporator, where it is vaporised by two jets of steam and mixed with air, which is drawn into the mixing chamber by the suction of superheated gas and heated steam. —R. L.

**Gas, Air and the like Fluids; Apparatus for Testing** J. Milne and H. O'Connor. Eng. Pat. 15,885, July 1, 1904. XXIII., page 904.

**Tetrachlorethane [Acetylene tetrachloride] and Chloroform from Acetylene; Production of symmetrical** — H. K. Tompkins. Eng. Pat. 19,568, Sept. 10, 1904. XX., page 920.

**[Carbon] Filaments for Electric Incandescent Lamps** — Methods of Manufacturing the same. H. C. Schenck. London. From General Electric Co., Schenectady, N.Y. Eng. Pat. 6959, March 22, 1904.

AN ordinary filament which has been "flashed" in



temperature (2300° to 3000° C.) in an electric and thus permanent changes are produced in its characteristics. Instead of decreasing largely as the temperature rises, as do ordinary carbon, such filaments, at the high temperature show as low a value as 50 per cent. of their cold resistance. If fired at the highest temperatures attainable, they even exhibit a higher resistance when hot than in the cold state, thus behaving similarly to metals. The filaments, a suitably jacketed and enclosed tube furnace, traversed by a powerful electric current employed. It is claimed that such filaments have a high efficiency and long life.—R. S. H.

#### UNITED STATES PATENTS.

*Seaweeds; Manufacture of* —. D. M. Balch, Santa Ana, Cal., Assignor to A. P. Stephens, San Diego. U.S. Pat. 794,481, July 11, 1905.

The process consists in first drying the seaweed, and then the dried weed with some alkaline substance, and coated weed is then subjected to a further treatment, which is continued until all the volatile elements are driven off, and the residue commences to char. The charred mass is lixiviated with water, with a mineral acid, and then with water, to remove all the soluble salts, and the residue when dried is suitable for use as fuel. The use of some binding of a combustible character with the residual mass, for the formation of briquettes, is also covered by the claims.—J. B. C. K.

*Apparatus Applicable for Burning Liquid* —. J. H. Cunningham, Birkenhead. U.S. Pat. 795,200, July 18, 1905.

U.S. Pat. 25,706 of 1903; this J., 1905, 71.—T. F. B.

*Regenerative Gas* —. C. Ellis, Assignor to Eldred Process Co., New York. U.S. Pat. 795,259, July 18, 1905.

The combustion chamber in a regenerative gas furnace is lined with two pairs of reversing regenerators, in which the gas and air are separately heated. The gas and air heaters are connected with a part of the air regenerator remote from the combustion chamber, whereby the products of combustion leaving the gas regenerators may be directed opposite to the previous direction of the air flow in a colder portion of the air regenerators. The gas and air heaters are in communication with two auxiliary heaters at each end of the furnace, whereby products of combustion leaving the former may enter the latter. The heaters are provided for passing air through these heaters and regenerators in a direction opposite to the passage of combustion gases upon reversal of the gas flow in the combustion chamber.—R. L.

*Generator*. J. J. Nix, Los Angeles, Cal. U.S. Pat. 795,161, July 18, 1905.

The generator consists of a long horizontal chamber, lined with a series of piers erected on its bottom and extending horizontally. The piers support checkerwork which extends through the greater portion of the chamber, the spaces between the piers and the checkerwork being left above and below the checkerwork, and one end of the chamber, and a partition extends downwards from its end of the checkerwork to the bottom of the chamber. A chimney stack having a damper communicating with the lower part of the chamber opposite the partition, and "a blow-off means" is provided at the top of the stack. On the opposite side of the generator from the chimney stack, more air blowers are provided, with means for forcing, if required, under pressure, jets of liquid fuel into the atomising fluid into the blast discharge pipe through a perforated ring.—R. L.

*Apparatus for the Generation of* —. B. E. Eldred, Assignor to Eldred Process Co., New York. U.S. Pat. 795,208, July 18, 1905.

The gas-producer is fed alternately with air and with the products of combustion from a lime kiln or with carbon dioxide

from a similar source with the aid of a mechanical draught producer. The products of combustion during the admission of air to the generator are discharged into the lime kiln, whilst the combustible gas produced during the passage of the chimney gases through the generator are collected, provision being made for carburizing and superheating them.—R. L.

*Gas Generation; Process for* —. B. E. Eldred and C. Ellis, New York. Assignors to Eldred Process Co., New York. U.S. Pat. 795,257, July 18, 1905.

This process for the generation of combustible producer gas relatively low in hydrogen and nitrogen, consists in continuously passing through a flameless mass of ignited coal, a draught current composed of air and gaseous products from the calcination of lime, in such proportions as will serve to maintain the ignition of the gas generating fire whilst depressing its temperature below the clinkering point of the fuel. The combustible gas so produced is conveyed to the place of consumption without the addition of air, or part of it is returned to the lime kiln to be used for the calcination of lime.—R. L.

*Gas Producer Apparatus*. C. Ellis, Assignor to Eldred Process Co., New York. U.S. Pat. 795,258, July 18, 1905.

A gas engine receiving its gas supply from a generator is connected with the same by a return conduit. The products of combustion, or part of them, are reintroduced into the generator, passing on their way through an air-cooled radiator, where a great amount of their sensible heat is removed. Means are provided for mixing a predetermined quantity of air with these gases to form an endothermic mixture, capable of maintaining the producer at an effective gasifying temperature.—R. L.

#### FRENCH PATENTS.

*Coal Dust; Methods of Firing with* —. J. Mazodier. Fr. Pat. 352,012, March 3, 1905.

The coal dust is blown, by means of a fan, through a distributor into the fire-box. The distributor is of rectangular section and widens laterally but narrows vertically as it approaches the furnace, the mixture of coal dust and air entering the combustion chamber through a narrow horizontal slit. The amount of air delivered by the fan is purposely insufficient for the complete combustion of the coal, and the remainder enters beneath a grate placed in the furnace, below the level at which the coal dust is blown in. Any particles of coal that are too large to be kept in suspension by the current of air, fall on to this grate and burn there. The secondary air which enters below the grate becomes heated during its passage through the hot layer on the bars.—W. H. C.

*Retort Ovens*. Ifö Kaolin and Chamottefabrik Aktiebolag. Fr. Pat. 352,141, March 6, 1905.

CLAIM is made for the arrangement of the flues of the regenerator so that in successive courses the air flue passes between two waste gas flues. By means of suitable valves, a greater or less quantity of waste gas is made to pass beneath the water-pan in the ash-pit in order to regulate the amount of evaporation.—W. H. C.

*Gas Producer*. A. Fichet and R. Heurtey. Fr. Pat. 349,941, May 26, 1904.

INSIDE the upper portion of the producer is arranged an annular beater, through which the air supply is led on its way to the space beneath the fire grate. The fuel hopper is provided below with a downward cylindrical extension, the height of which can be regulated, the fuel being fed on to a distributing cone, the height of which may also be varied.—H. B.

*Gas; Process for Obtaining Producer — from Vegetable Refuse from Oil Factories*. O. Hentschel. Fr. Pat. 351,533, Feb. 15, 1905.

THE process claimed is specially designed for converting the combustible portions of the refuse from vegetable oil

factories, into a gas useful for motive purposes. This refuse under ordinary conditions is obtained in a form which does not permit of its direct use in a gas-generator. The principle of the patent is the conversion of this refuse into briquettes, either alone or after the addition of and mixture with some easily combustible substance.

—J. B. C. K.

*Carburetted Air; Apparatus for the Production of* —. C. Philippe. Fr. Pat. 351,745, Feb. 23, 1905.

In the base of the apparatus is situated an air compressor, consisting of a drum-shaped chamber partly filled with water, in which rotate blades driven by a corl and falling weight. The air passes up into a chamber containing platinised catalytic material, which becomes heated when gasoline is led into the chamber, and thus causes a rapid evaporation of the hydrocarbon; this chamber is constructed so that the air pursues a zig-zag course through it. Above the carburetting chamber is a storage space for the carburetted air, and the whole is surmounted by the gasoline tank, in which four spoon-like arms, mounted on a rotating shaft, dip successively into the gasoline, and deliver it into a cup, from which it flows down a tube into the carburetting chamber. The rotating shafts in the compressor and gasoline tank are geared together, so as to keep constant the ratio of air to gasoline.—H. B.

*Producer for Briquettes; Suction* —. Scheben and Krudewig. Fr. Pat. 351,788, Feb. 24, 1905.

THE briquettes are fed into the producer through a hopper, which extends downwards into the main combustion zone, the air and steam supply being admitted first into the annular space surrounding the hopper and then led down through the fuel to the gas-outlet, which is situated in the producer wall, a short distance above the fire-bars. A mechanical poker, consisting of a series of rods, mounted on a rotatable horizontal bar, is arranged below the fire-bars, and serves to clear the spaces between the latter of cinders. By means of a horizontal worm conveyor, extending along the base of the producer and actuated by an external handle, the cinders can be discharged periodically into a water-sealed receptacle, without interrupting the operation of the producer.—H. B.

*Gas Generators; Impts. in* —. H. G. Hills and C. H. Schill. Fr. Pat. 351,905, Feb. 28, 1905.

SEE Eng. Pat. 11,719 of 1904; this J., 1905, 538.—T. F. B.

*Carbon Dioxide in Combustion Gases; Apparatus for the Determination of* —. A. Schlatter and L. Deutsch. Fr. Pat. 351,442, Feb. 11, 1905. XXIII., page 904.

*Filaments for Incandescence Electric Lamps and Process of Making them.* Cie. Franç. pour l'Exploitation des Procédés Thomson-Houston. Fr. Pat. 349,857, April 15, 1904.

SEE Eng. Pat. 6959A of 1904; this J., 1905, 721.—T. F. B.

*Electrodes for Arc Lamps.* Comp. Générale d'Électricité. Fr. Pat. 349,928. May 20, 1904.

In order to overcome the difficulties attending the use of conductors of the second class, in the construction of arc-lamp electrodes, the rods or the like, composed of refractory oxides (oxides of thorium, zirconium, aluminium, &c.), are provided with a thin coating of difficultly fusible metal (e.g., platinum or iridium) which does not oxidise or fuse at the temperature at which the electrode becomes a conductor. For example, cylindrical rods of refractory oxide, 2 mm. in diameter, are covered with a deposit of platinum weighing 0.01–0.02 grm. per centimetre. A layer of carbon may be superposed upon the metallic plating. Electrodes so constructed may be supported in sliding contacts, as in the case of carbon electrodes.—H. B.

*Coke Ovens; Regenerative* —. H. Koppers. Fr. Pat. 351,962, Jan. 30, 1905.

THE regenerator flues, placed beneath each oven, are

divided into two parts by the central arch, and by suite connections to the gas supply main, the air and waste gas flues can be used alternately for preheat the air or gas.—W. H. C.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

*Toluene and Acetylene Tetrabromide; Reaction between in presence of Aluminium Chloride.* J. Lavi. Comptes rend., 1905, 141, 204–206.

THIS reaction (and no doubt other reactions with aluminium chloride is used) is rendered much more rapid and regular, and the yield is increased, by continuous agitation of the mixture during the reaction. With 500 grms. of toluene and 100 grms. of the tetrabromide 130 grms. of aluminium chloride in powder must be used and the mixture heated to 90° C. till reaction ceases finally to 125° C. for a short while. The cooled mass treated with water and the liquid filtered with the aid of the pump; about 85 per cent. of the hydrocarbon formed is thus obtained pure, and the other 15 per cent. is obtained somewhat contaminated by tar, on evaporating the filtrate and washings. The products are two dimethylanthracenes, melting at 240° and 244°–5 C. respectively (a mixture of these melts at 225° C., the m.p. of the hydrocarbon obtained by Anschütz in studying this reaction), a small quantity of  $\beta$ -methylanthracene, benzene, xylene, and homologues, in addition to the excess of toluene. Considerable quantity of aluminium chloride must be used in this reaction, for it combines with the anthracene derivatives formed. The effect of the agitation is, doubtless, due to the removal of the hydrochloric acid formed as the reaction progresses, and which if not removed limits the reaction by its tendency to produce the inactive one.—J. T. D.

*[Petroleum] Crude Oil from Turkestan; New* —. A. V. Ragosine. Chem. Rev. Fett.-u. Harz., 1905, 12, 182–185.

IN a borehole recently sunk at Tchimon, to the east of Zakany in the Fergana valley, oil was struck at a depth of about 280 metres, and a yield of 150–170 tons of crude oil per diem has since been obtained by spontaneous pumping. Another well close by reached the deposits at a depth of 276 metres, and five other boreholes are being sunk. The fresh crude oil has the sp. gr. 0.860–0.866, and is nearly black in colour, with a green fluorescence. It contains a large quantity of asphaltum partly in solution, so that after standing for two days the sp. gr. increases to 0.875–0.883, which in turn may be raised to 0.895 by heating the oil in an open pan and blowing air through it. In this state the oil has a flashing point 75° C. (Pensky-Martens), and is suitable for locomotive fuel. Distilled with superheated steam the crude oil furnished 14.5 per cent. of light spirit ("benzine"), sp. gr. 0.660–0.760; burning oil (sp. gr. 0.765–0.845), 31.4 per cent.; and a semi-solid residue of sp. gr. 0.924. The lightest fraction was found to contain hydrocarbons boiling below 17° C. (petroleum ether). Cracking experiments raised the proportion of burning oil to 46 per cent., and the residue was found to contain an average of 8 per cent. of paraffin. All fractions of this Tchimon oil have a sp. gr. intermediate between those of American and Bakur oils, the values for the respective burning oils being:—Russian, 0.860–0.866; American, 0.881; Tchimon, 0.813. In addition to the valuable light constituents, burning oil, fuel oil, and paraffin, the oil will also yield vaseline.—C. S.

#### FRENCH PATENTS.

*Ammonia; Process and Apparatus for Recovering from [Coal] Gas.* E. J. Duff. Fr. Pat. 352,100, March 8, 1905.

THE hot gas is led into a washer, in which it is caused



through a limited quantity of water, whereby it contains any solid impurities. The gas, thus charged to saturation with water vapour, then passes up a tower with perforated bricks, down which a constant flow of an absorbing liquid, such as a dilute solution of anion sulphate with a slight excess of sulphuric acid, takes place. From the top of this tower, the gas is led to the bottom of a second suitably packed tower, in which it meets descending streams of cold water to which and to further absorb the ammonia. The water in the second tower is kept in circulation by pumping, or otherwise, in a direction contrary to that of the passage of the gas.

A special cooler is connected with the system of circulation to the second tower. The excess of water in the washings of the second tower is used to supply the first tower into which the gas is first led, and the excess in the washer is led to the tank connected to the second tower, containing the acidulated solution, after being freed from suspended particles in a settling vessel. —E. S.

*and Analogous Substances; Rectifying* —. Pollet. Fr. Pat. 351,519, Feb. 15, 1905.

gases are caused to circulate around a vessel containing the oil to be treated, and the vapours thereby are passed through a superimposed column of metal baffles, which arrest the heavy fractions and enable them to fall back into the oil vessel, whilst the lighter fractions escape to a condensing coil.—C. S.

## —COLOURING MATTERS AND DYE-STUFFS.

*fast to Alkalis; Triphenylmethane* —. L. Rev. Gén. des Mat. Col., 1905, 9, 223—224.

ETHYLDIAMINODIPHENYLCARBINOL hydrochloride, condensed with *o*-methoxyaniline, gives the leuco-base of a bluish-violet dyestuff. On replacing the hydrogen in this by diazo, the diazo compound, which, on replacing the product, a dyestuff is formed which, when reduced, gives wool and silk in bluish-green and is fast to alkalis. By substituting *o*-toluidine for methoxyaniline in the above reaction, the leuco-base of a bluish-violet dyestuff is obtained. This, when reduced and oxidised, yields a dyestuff which dyes silk in bluish-blue shades. It would thus appear that the *m*-position to the carbon atom than it is by the nature of the hydroxyl- or other group which this group occupies in the molecule. —this J., 1904, 603.)

In support of this view, E. Justin-Müller points out that the dyestuff (Fast Green, blue shade), prepared by the process of the patent in 1885 (this J., 1886, 661) and, therefore, the discovery (in 1888) of Patent Blue, which is the latter dyestuff in constitution, but contains in its molecule an  $N(CH_2.C_6H_4.SO_3H)_2$  group, of the hydroxyl-group present in Patent Blue, in the *m*-position to the central carbon atom, also that dyestuff in its properties of shade and fastness to alkalis.—E. B.

### ENGLISH PATENTS.

*[Azo]; Manufacture of New Tetrazo* —. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 347,376 of 1904; this J., 1905, 329.—T. F. B.

*for Wool; Manufacture of Azo* —. O. Newton, London. From Society of Chemical Industry, Ltd., Basle, Switzerland. Eng. Pat. 82, Jan. 2, 1905.

Pat. 351,125 of 1905; this J., 1905, 840.—T. F. B.

*Dyestuffs; [Electrolytic] Manufacture of Leucogalloyaniline* —. G. W. Johnson, London. From the Dyeworks, formerly L. Durand, Huguenin and Co., Basle, Switzerland. Eng. Pat. 7835, April 12, 1905.

THE manufacture of leuco-galloyaniline dyestuff-compounds, which is effected, according to Eng. Pats. 21,415 of 1898, 4551 of 1902, and 3497 of 1905 (this J., 1899, 827; 1902, 609; 1905, 494), by means of chemical reducing agents, may be advantageously accomplished by electrolysis. For example, 30 grms. of Gallamine Blue G M (Eng. Pat. 2941 of 1889; this J., 1889, 981) are suspended in 600 c.c. of water, acidified with 33 grms. of concentrated hydrochloric acid. The mixture is placed in the cathode compartment of a cell divided into two compartments by a diaphragm, the cathode consisting of a sheet of platinum. The anode compartment contains hydrochloric acid and a carbon anode. The reduction is effected at a temperature of 70°–80° C., with a current density of 1–1½ ampères per sq. decm. of cathode surface, the reaction being complete when the whole of the dyestuff has passed into solution and the original violet colour has changed to a brownish-green. The leuco-product is obtained by salting out. Other leuco-galloyanilines are similarly prepared; in some cases being sparingly soluble, they may be separated by filtration.—E. B.

*Indigo; Production of* —. J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 12,854, June 21, 1905.

WHEN air is passed into an alkaline solution of a leuco-compound of indigo, the indigo tends to separate in a finely crystalline condition. It can be obtained in a state of fine division, more suitable for use in dyeing and printing, by oxidising in presence of an alkali salt of a saturated or unsaturated fatty acid, or resin acid. Instead of air other suitable oxidising agents may be used. For example, 100 parts of indoxyl acid are dissolved in 2500 parts of water and the necessary amount of sodium hydroxide, 10 parts of soft soap added, and a current of air passed through the boiling liquid.—E. F.

### UNITED STATES PATENT.

*Dyestuff, Tetrazo; Bisulphite Compound of a* —, and *Process of Making same*. A. Otto, Assignor to Farbwerke vorm. Meister, Lucius and Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 795,958, July 18, 1905.

THE dyestuff produced from 1 mol. of *o*-*o*-tetrazophenol-*p*-sulphonic acid and 2 mols. of  $\beta$ -naphthol is dissolved in a solution of sodium bisulphite, sufficient mineral acid added to just produce an acid reaction, and the mixture evaporated to dryness. The new product is stable and soluble in water. The original dyestuff separates on heating the aqueous solution.—E. F.

### FRENCH PATENT.

*Dyestuffs Derived from Dyestuffs of the Oxazine Series; Production of New* —. Manuf. de Mat. Col., Ancien. L. Durand, Huguenin et Cie. Fr. Pat. 351,658, Feb. 13, 1905.

SEE Eng. Pat. 3497 of 1905; this J., 1905, 494.—T. F. B.

### GERMAN PATENTS.

*[Anthracene Dyestuffs] Anthraquinone and its Derivatives; Process of Preparing Aryl Ethers of* —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 158,531, May 12, 1903.

ARYL ethers of anthraquinone and its derivatives are obtained by the action of monohydric phenols, either in the form of their alkali salts, or in alkaline solution, on negatively substituted anthraquinone derivatives. Thus the phenyl ether of erythrohydroxyanthraquinone is obtained from anthraquinone-*a*-monosulphonic acid, or from *a*-mononitro- or *a*-monobromanthraquinone; the diphenyl and di- $\beta$ -naphthyl ethers of anthraquinone and the phenyl ether of  $\beta$ -hydroxyanthraquinone can also be obtained by this method.—T. F. B.

[*Anthracene Dye-stuffs*] *o*-Monobromo-*a*-aminoanthraquinones; *Method of Preparing* —. Farbentr. vorm. F. Bayer und Co. Ger. Pat. 160,169, Jan. 8, 1904.

By brominating *a*-aminoanthraquinone or one of its substitution products with just the theoretical quantity of bromine, monobromo derivatives are produced. These derivatives are of value for the production of the dyestuffs described in Fr. Pat. 349,606 of 1904 (this J., 1905, 726). —T. F. B.

*Dye-stuffs [Azine]; Process of Preparing Blue Amino-monoazo* —. Farbwerke vorm. Meister, Lucius und Brünig. Ger. Pat. 160,281, Oct. 24, 1903.

CHLOROCHROMOTROPE acid, obtained by treating 1,8-dihydroxynaphthalene-3,6-disulphonic acid with hypochlorous acid or a hypochlorite, is combined with the diazo derivative of *p*-nitraniline, chloro-*p*-nitraniline, or 2,5-nitro-aminohydroquinonedimethyl ether. The nitro-azo dyestuffs thus produced are reduced to aminoazo dyestuffs, which dye wool from acid baths in blue shades. Other monosubstitution derivatives of chromotrope acid are stated to give dyestuffs of little technical value. —T. F. B.

*Dye-stuffs; Process of Preparing Red Sulphide* —. Farbwerke vorm. Meister, Lucius und Brünig. Ger. Pat. 160,395, Feb. 10, 1904.

RED sulphide dyestuffs are obtained by heating resorcinol with sulphur and a formyl derivative of an aromatic base to a high temperature. For example, 2 parts of form-aniline, 4 parts of resorcinol, about 1 part of glycerin and 4 parts of sulphur are heated for five hours at 180–185° C.; the product dyes unmercerized cotton reddish shades from sodium sulphide baths. Formyl-*o*- or *p*-toluidine or formyl benzidine are utilised in a similar manner. The shades produced by the dyestuffs can be modified by altering the proportions of the materials employed, or by varying the temperature. —T. F. B.

*p*-Nitro-*o*-chloro-*o*-cresol ( $\text{OH} : \text{CH}_3 : \text{NO}_2 : \text{Cl} = 1 : 2 : 4 : 6$ ); *Method of Preparing* —. F. Raschig. Ger. Pat. 160,304, Dec. 20, 1903.

ONE HUNDRED kilos. of *o*-cresol are heated with an equal weight of sulphuric acid (monohydrate) for several hours at about 100° C. The product is diluted with 800 litres of water and chlorine is passed in until an increase in weight of 70 kilos. is reached: the product is *o*-chloro-*o*-cresol-*p*-sulphonic acid. After filtering off the small amount of dichlorocresol produced, the sulphonic acid group is replaced by a nitro group by the addition of 80 kilos. of sodium nitrate. *p*-Nitro-*o*-chloro-*o*-cresol ( $\text{OH} : \text{CH}_3 : \text{NO}_2 : \text{Cl} = 1 : 2 : 4 : 6$ ) is thus obtained. This substance is said to be of value in the preparation of sulphide dyestuffs. —T. F. B.

*Trihydroxyphenylrosinduline [Azine Dye-stuff]; Process of Preparing* —. Kalle und Co. Ger. Pat. 160,789, April 12, 1904. Addition to Ger. Pat. 158,077, Dec. 4, 1902 (see this J., 1905, 614).

TRIHYDROXYPHENYLOSINDULINE is said to be obtained in a very pure condition by heating alcoholic solutions of substances which can produce 1,4-naphthylenediamine with hydrochloric acid and *p*-aminophenol, *m*- or *p*-nitraniline. (See also Ger. Pat. 158,100; this J., 1905, 614.) —T. F. B.

*Dye-stuff; Process of Preparing a Red-violet Sulphide* —. Kalle und Co. Ger. Pat. 160,790, April 12, 1904. Addition to Ger. Pat. 152,373, June 12, 1903.

THE trihydroxyphenylrosinduline used for the production of sulphide dyestuffs according to the original patent (this J., 1905, 614) is replaced by the product obtained according to Ger. Pat. 160,789 (see preceding abstract). The resulting dyestuffs are said to produce purer and redder shades than those formerly described. —T. F. B.

*Hydroxyphenylrosindulines [Azine Dye-stuffs]; Method of Preparing* —. Kalle und Co. Ger. Pat. 160,815, April 15, 1904. Addition to Ger. Pat. 158,077, Dec. 4, 1902 (see this J., 1905, 614).

FURTHER modifications are introduced into the processes of Ger. Pats. 158,077, 158,101 (this J., 1905, 614), and 160,789 (above), by the substitution for benzeneazo-*a*-

naphthylamine of benzeneazomonoaryl-*a*-naphthyl or of monoaryl-1,4-diaminonaphthalene. The resulting dyestuffs are stated to produce purer and bluer shades than those mentioned above. —T. F. B.

*Dye-stuff; Process of Preparing a Violet Sulphide* —. Kalle und Co. Ger. Pat. 160,816, April 15, 1904. Addition to Ger. Pat. 152,373, June 12, 1903.

THE hydroxyphenylrosindulines obtained according to Pat. 160,815 (preceding this), are used for the production of sulphide dyestuffs, according to the process described in Ger. Pat. 152,373 (this J., 1905, 614). The shades obtained on cotton with these dyestuffs are purer and bluer than those produced by the dyestuffs of the original patent, and are also faster to washing. —T. F. B.

*p*-Aminophenolsulphonic Acid ( $\text{OH} : \text{NH}_2 : \text{SO}_3\text{H}$ ); *Process of Preparing* —. Act.-Ges. f. Anilin. Ger. Pat. 160,170, Aug. 4, 1904.

*p*-AMINOPHENOL-*m*-SULPHONIC acid, formerly obtained by heating mononitro-acetylmetaniline acid with sodium and reducing the product, can be prepared by diazotizing *p*-phenylenediamine monosulphonic acid with one equivalent of nitrous acid, and boiling the resulting solution. —T. F. B.

## V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

*Cellulose; Solubility of — in Thiocyanates*. J. XIX., page 901.

### ENGLISH PATENTS.

*Nitrocellulose Solutions for Use in the Treatment of* J. P. Kraus, Ilkley, and The Bradford Dyers' Association Ltd., Bradford. Eng. Pat. 18,742, Aug. 10, 1904.

SUITABLE solutions of nitrocellulose are a desideratum for application to fabrics in order to give a "Schröiner finish." Hitherto the use of collodion solutions in amyl acetate has been tried. Collodion solutions are unsatisfactory as the ether-alcohol vapours evolve explosive and unhealthy. Amyl acetate clings to the fabric, even after long drying, causing a disagreeable odour. The patentees use a solution of nitrocellulose in amyl formate. This leaves no objectionable residue behind, its b. pt. being about 15° C. lower than that of the acetate. Also amyl formate solutions are fluid than amyl acetate solutions of the same strength. A 5 per cent. solution is suitable, and is best applied in succession, by spraying or otherwise, the solvent evaporated after each application. The resulting finish should not form a complete skin, but should be sufficient to fix the lustre finish produced. —E. F.

*Threads from Collodion; Apparatus for Producing and Recovering the Solvents Employed*. M. Reims, France. Eng. Pat. 4534, March 4, 1904. Under Int. Conv., March 5, 1904.

SEE Fr. Pat. 341,173 of 1904; this J., 1904, 864.

*Retting and Washing Textile Fibres; Method of* A. J. Boulton, London. From E. Poisson, Aubagne, France. Eng. Pat. 16,313, July 23, 1904.

SEE Fr. Pat. 338,941 of 1903; this J., 1904, 982.

*Ramie and the like; Method and Apparatus for Treating [Decorticating]* —. C. Pissard, Vichy, France. Eng. Pat. 20,757, Sept. 27, 1904.

RAMIE or other similar fibre is steeped in water for several days, and then heated in a dilute alkali solution until the gums are thoroughly softened. The fibre is now cut out in a thin layer on an inclined plane, and subjected to the action of a number of jets of water, when it is found that all the gum and pellicle is removed from the fibre. A suitable apparatus for the latter process consists of a supporting bed of perforated sheet metal or woven mesh, bent to form a roof-shaped structure in an inverted V section; the fibre is laid transversely across the apex of this support. Above it is a tank or receptacle for water of suitable form, the bottom being per-



shaped similarly to the fibre support. Both the support and the water tank may be movable longitudinally and either one or the other may be capable of vertical movement.—T. F. B.

*Cotton Waste; Removing Grease from —*. J. W. Mitchell, Rawtenstall. Eng. Pat. 17,330, Aug. 9, 1904. Cotton waste, in a greasy condition, is placed in an acid apparatus, where it is simultaneously freed from grease, &c., and prepared for bleaching by the following process which is performed without the waste being removed from the apparatus:—(1) Treatment with a solvent, such as "benzine"; (2) steaming, for the purpose of evaporating and expelling from the cotton waste the solvent still remaining in it after as much as possible of it has been recovered by draining; (3) treatment with mineral acid; (4) boiling with an alkali-lye; and (5) rinsing with water.—E. B.

*Woolen Rags, Wool and other Animal Fibres; Method and Means for Removing [Carbonising] Vegetable Impurities from —*. S. Roberts, Liversedge, and J. Crossley, Mirfield. Eng. Pat. 15,729, July 15, 1904. The object of reducing the duration of treatment and of acid used, and of dispensing with the operation of neutralising the acid left in the treated materials, in the process of carbonising the cotton and other vegetable fibres contained in loose wool and woollen fabrics, the materials are treated with hydrochloric acid, in a more dilute solution than that in which this acid has hitherto been used for the purpose, while they are moved about intermittently to bring the acid more intimately into contact with them. In the case of loose wool, an apparatus of the type of McNaught's wool-washing machine, is used in effecting the saturation with acid, the liquor being agitated by agitating forks being constructed of wood, such as wood, which are not readily attacked by dilute acids. The fibres are afterwards passed between squeezing rollers, to remove the excess of the acid solution, and are then deposited upon a revolving apron or fed into a tube, upon or in which they are dried by hot air. Finally, they are conveyed to a sorting-machine, by means of which the charred, vegetable fibres are separated in the form of dust. The apparatus is so constructed and arranged that the whole process described, after the feeding of the fibres into the hopper of the machine, in which the dilute acid is applied, may be continuously and automatically performed.—E. B.

*Woolen Materials; Apparatus for Treating [Felting] —*. C. Marks, London. From G. Goldman, Baltimore, Maryland, U.S.A. Eng. Pat. 27,533, Dec. 16, 1904. Woolen materials, preferably in the form of sheets, into which either liquid or dry binding materials are introduced, are conveyed between endless bands over a hollow, steam-heated table, upon which they are pressed by means of steam-heated rollers. The fibres are thus held together by the combined action of moisture, heat, and pressure. The lower of the two endless bands is composed of absorbent material, and is damped with water when dry binding materials are employed. (See Eng. Pat. 1904, 544.)—E. B.

*Woolen Materials; Apparatus for Dyeing and Bleaching —*. T. de Nacyer, Alost, Belgium. Eng. Pat. 17,333, Dec. 31, 1904. Under Int. Conv., Jan. 30, 1905. Materials to be dyed are placed in a rotating, cubical vat provided at its top and bottom with air-escape apertures for liquor pipes, and false walls, mainly in position by springs, screws, &c., between which the materials are compressed. The dye, &c., liquors are drawn from a boiler to the top of the vat, and after passing through the materials are returned to the top of the vat. The direction of their flow through the materials is reversed by inverting the vat. A second boiler is directly connected with the vat, to receive the liquor thus, while the first boiler is being charged with liquor or with water for rinsing purposes, &c. Three or more vats and as many boilers, with a common boiler in addition, may be connected together, the necessary liquor-pipes and pumps, to enable

the materials to be operated upon by the liquors contained in any of the boilers.—E. B.

*Dyeing Yarns in Cops or Pirns; Apparatus for —*. J. O. O'Brien, Manchester. From H. L'Huillier, Paris. Eng. Pat. 10,448, May 18, 1905. SEE Fr. Pat. 350,981 of 1905, following these.—T. F. B.

*Colouring Effects upon [Raised] Fabrics; Method of and Apparatus for Producing Mottled —*. C. F. Kübler, Elmshorn, Germany. Eng. Pat. 4947, March 9, 1905.

SEE Fr. Pat. 348,398 of 1904; this J., 1905, 495.—T. F. B.

*Fireproofing Textile Fabrics and the like; Compounds and Processes for —*. W. M. Walker, London. Eng. Pat. 4971, March 9, 1905.

AMMONIUM sulphate solution is mixed with ordinary starch or size, and the mixture used for fireproofing textiles for various purposes. Borax may be added to the solution. For fireproofing canvas, a solution of 2 lb. of ammonium sulphate in 1 gall. of water is mixed with 8 lb. of size. Reference has been directed, in pursuance of Sec. 1, Sub-sec. 6 of the Patents Act, 1902, to Eng. Pats. 1657 of 1872; 1458 of 1900 (this J., 1900, 904) and 16,372 of 1902 (this J., 1903, 862).—T. F. B.

*Fabrics; Apparatus for Treating Tubular — with Liquid or Semi-liquid Compositions*. W. R. Smith, Buffalo, New York, U.S.A. Eng. Pat. 26,005, Nov. 29, 1904.

A TUBULAR fabric, such as woven hose-piping for conducting water, is supported upon a hollow mandrel which communicates with a vessel containing a viscid, waterproofing composition, such as a solution of india-rubber. The mandrel has openings in it through which the solution is forced outwards into and through the fabric, which, along with the mandrel and the solution, is heated during the operation. Besides the means for accomplishing this, devices are described and claimed for the application of a rubbing or sliding pressure to the outer surface, and for the lubrication with a suitable preparation, e.g., one containing tallow, of the inner surface of the waterproofed fabric, while this is on an extension of the mandrel. This extension consists of a tube of smaller diameter than the mandrel, with its outer end closed, thus constituting a heated drying-chamber upon which the fabric is dried and finished.—E. B.

*Cork; Treatment of —, for the Manufacture of Cork Fabrics*. R. A. Grimoire-Sanson, Paris. Eng. Pat. 14,839, July 1, 1904. Under Int. Conv., Jan. 15, 1904.

CORK, in very thin sheets, is heated under pressure in a mixture of benzene and carbon bisulphide (or essence of turpentine) containing also glycerin, Para rubber, and hydrochloric acid, and is then applied to cleansed canvas, leather, or other fabrics by means of an agglutinant, obtained by macerating caoutchouc in a mixture of petroleum ether and acetone. The coated fabric is then rolled and stoved.—E. S.

#### UNITED STATES PATENTS.

*Cellulose; Threads of Artificial [Silk] from Solutions of —*. R. Linkmeyer, Herford, Germany. U.S. Pat. 795,526, July 25, 1905.

SEE Fr. Pat. 346,722 of 1904; this J., 1905, 238.—T. F. B.

*Dyeing Machine*. R. P. Smith, Assignor to G. E. Drum, Philadelphia, Pa., U.S.A. U.S. Pat. 794,560, July 11, 1905.

THE combination is claimed of a dye-tank to contain the liquors employed; a perforated receptacle for the materials to be dyed, semi-circular in cross-section provided with a hinged bottom, and movable into and out of the tank; a frame which can be lowered upon or raised from the top of the tank; an agitator mounted in the frame and adapted to be operated on a horizontal axis for the purpose of agitating the materials to be dyed; and means for driving the agitator.—E. B.

#### FRENCH PATENTS.

*Papier-mâché Threads; Manufacture of —*. W. Müller. Fr. Pat. 351,902, Feb. 28, 1905. XIX., page 901.

*Cellulose Threads [Artificial Silk]; Process for Increasing the Lustre of —.* R. Linkmeyer and M. Pollak. Fr. Pat. 350,889, Jan. 20, 1905.

THREADS of artificial silk, especially such as are produced from ammoniacal solutions of cellulose, are said to be rendered more lustrous, when they are stretched to the extent of  $\frac{1}{10}$ — $\frac{1}{5}$  of their length, before and during the operation of drying, in the course of the process of their manufacture.—E. B.

*Wool-washing Machines; Impts. in —.* W. McNaught. Fr. Pat. 351,629, Feb. 20, 1905. Under Int. Conv., Oct. 31, 1904.

Two sets of fork-bearing frames, arranged side by side, are used in the apparatus which forms the subject of this invention. One set has forks at intervals throughout its length; the other is furnished with them only in that part which operates above the delivery end of the apparatus. Both sets are actuated horizontally and vertically in such a way as to cause the loose wool contained in the washing tank, into which the forks descend, to be carried forward from one end of the tank to the other, the wool being moved in an intermittent manner by the first set, when acting alone, and in a continuous manner by the two sets, when these operate together. To collect the dirt, &c., present in the wool, a receptacle is placed below a perforated, inclined plate or board at the exit end of the apparatus. The bottom of the receptacle slopes downwards to one side where a sluice is provided for the removal of the dirt, &c. The receptacle is divided by vertical partitions into a number of compartments, for the purpose of preventing the water in it from moving about and entangling the wool upon the inclined plate.—E. B.

*Textile Fibres [Linen, Ramie, &c.]; Process for Bleaching and Rendering Lustrous —.* A. Haack. Fr. Pat. 351,088, Jan. 28, 1905.

TEXTILE fibres, such as linen, hemp and ramie, after being bleached by a process which consists in boiling with a solution of either sodium "sulphuricinate" or sodium resinate, and then treating with a mixture of sodium carbonate and sodium hypochlorite, are placed in an autoclave and treated, for about two hours, under a pressure of 2—8 or more atmospheres, with a mixture of waxes and oils, &c., such as Japan wax, stearin, paraffin wax, spermaceti, castor oil, and olive oil, to which a little camphor may be added, the whole being "diluted" with alcohol. The excess of oil, &c., is then removed from the fibres by boiling them for about 15 minutes in a dilute solution of sodium carbonate and soap.—E. B.

*Chlorine; Process for Increasing the Chemical Action of —.* B. Margulies and Co. Fr. Pat. 352,196, March 8, 1905. VII., page 892.

*Mercurising; Process and Apparatus for —.* W. Mather, J. Hübner and W. J. Pope. Fr. Pat. 352,233, March 10, 1905. Under Int. Conv., March 16, 1904.

SEE Eng. Pat. 6383 of 1904; this J., 1905, 272.—T. F. B.

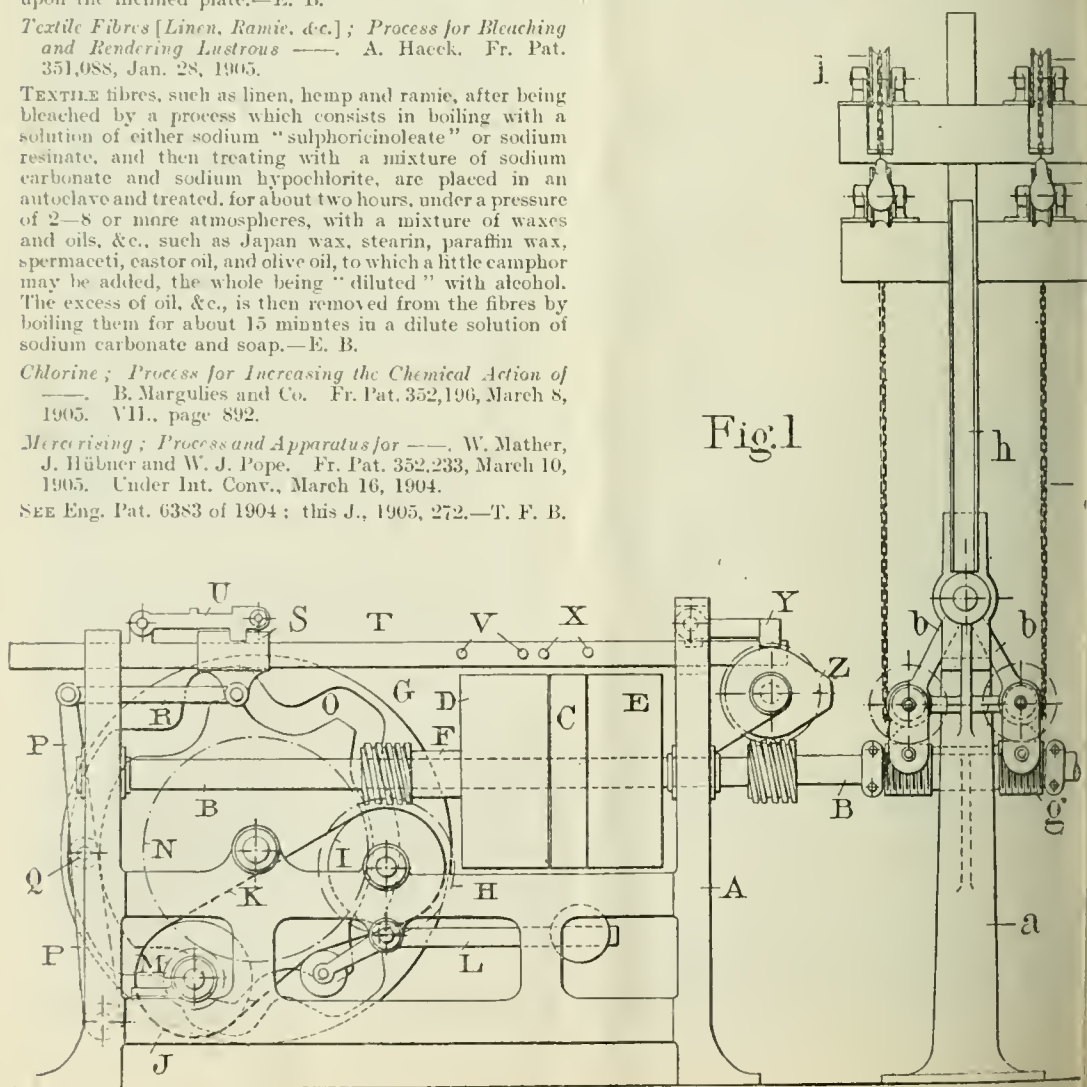
*Silks, and Dyeing Textile Materials in General; Apparatus for Charging —.* C. Lumpp and Co. Fr. Pat. 349,891, May 5, 1904.

THE apparatus forming the subject of this invention consists of an over-driven hydro-extractor, characterized by a special form of construction of cage and cage-bearing mechanism. The latter is a hollow cone or bell, at the upper part of which the cage is balanced, a cushion of air between the two preventing the access of dye, &c. liquors to the cone. When the apparatus is in use, &c., liquors are conveyed from a well into the cage, and this is completely full, the excess running through an overflow pipe back to the well. The cage is then set in rotation and the materials contained in it, dyed, &c.—E. B.

*Yarns in the form of Cops or on Bobbins; Dyeing —.* H. L'Huillier. Fr. Pat. 350,981, Jan. 24, 1905.

THE cops, &c., to be dyed are placed on perforated tubes affixed to pipes laid transversely across and attached to a main pipe, which communicates with a conduit at the bottom of a dye-tank. The latter is closed by means of an air-tight cover during the operation of dyeing. The dye-liquors, as also the water used in rinsing, are drawn by a suction apparatus from a storage-vessel, through a conduit, the system of pipes, and the cops, into the tank. Air is then admitted into the tank, causing the liquor to flow back to the storage-vessel, the passage of the liquor through the cops being repeated in this manner as often as is necessary. The cops, &c., are kept in position on the tubes by means of bands of metal, &c., resting upon the tubes.—E. B.

*Dyeing Skins; Apparatus for —.* B. Oriol. Fr. Pat. 351,717, Feb. 23, 1905.





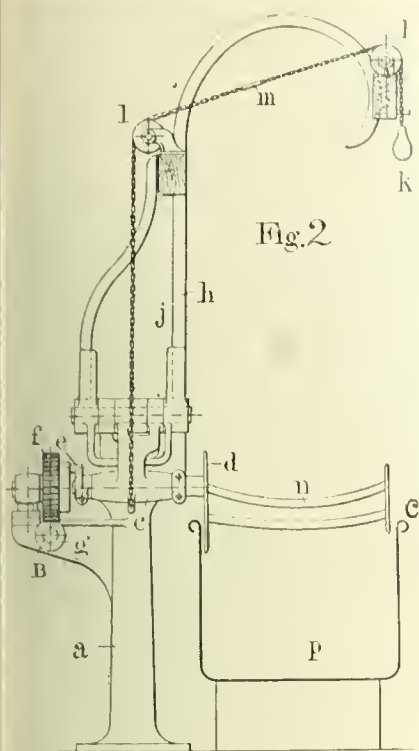


Fig. 2

Hanks are hung from special supports *c, n*, (Fig. 1), consisting of four parallel bent rods fixed between two plates. These supports revolve several times in one direction, then make several partial revolutions, revolve in the other direction, and so on, to ensure even dyeing. The movements are controlled by a lever *P* (Fig. 2), carrying a stud *Q* which moves in a groove on the revolving wheel *O*. The lever *P* is connected up with the rod *T*, carrying two forks at *V* and *X*. These forks guide the running on the pulleys *D, C* and *E*. The movements of these pulleys determine the direction of rotation of the shaft *B*, which, in turn, controls the movement of the hank-supports. There is an arrangement for lifting the individual hanks from the dye-bath. A hank support can be separately thrown out of action.

—E. F.

*Recovery from Spent Dye Baths; Method of Recovering White* — J. Schmitt. Fr. Pat. 349,914, May 13, 1905.

Eng. Pat. 11,317 of 1904; this J., 1905, 330.—T. F. B.

*Acid Compounds; Apparatus for Recovering* — for the Wash Waters of Silk Dyeing and Finishing Works; also applicable to the Recovery of Precipitates General. A. Charrin and P. Bonnet. Fr. Pat. 349,973, Jan. 24, 1905.

Waters containing, in suspension, stannic compounds are forced under pressure into a filtering-vessel, in which soluble matters are separated by upward filtration.

—E. B.

*Dyeing Apparatus [for Textiles]; Mechanical* — J. Heyron et Cie. Fr. Pat. 351,801, Feb. 25, 1905.

A box of square cross-section, revolves on trunnions which is hollow and serves as a feed-pipe. Two opposite sides of the box have longitudinal openings B leading from end to end. These are provided with gratings *D* and *C*, which prevent the liquid employed from flowing out of the vessel and cause it to fall periodically on the fabric under treatment, when the apparatus

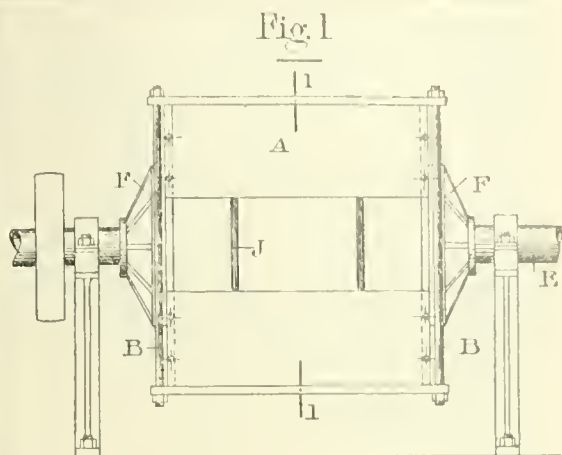
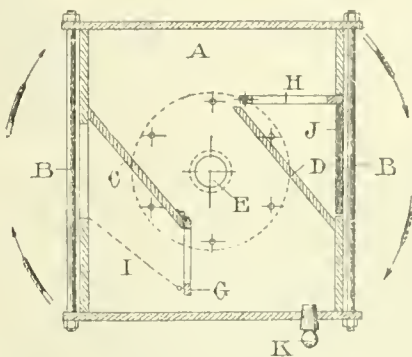


Fig. 1

Fig. 2



revolves in the direction of the arrows. When it is revolved in the opposite direction, the liquid flows away, the fabric being retained by the gratings *G* and *H*. The fabric is inserted through the openings in the sides.—E. F.

*Fabrics or Papers; Engraved Bowls or Rollers for the Production of a Silky Appearance on* — W. J. Pope and J. Hübner. Fr. Pat. 351,720, Feb. 24, 1905. Under Int. Conv., Feb. 29, 1904.

SEE Eng. Pat. 4907 of 1904; this J., 1905, 273.—T. F. B.

*Sizing [Nitrocellulose Solution] for Fabrics*. P. Kraiss and the Bradford Dyers' Association, Ltd. Fr. Pat. 351,844, Feb. 27, 1905.

SEE Eng. Pat. 18,742 of 1904, preceding these.—T. F. B.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

### ENGLISH PATENT.

*Dyeing [Staining] Skins for Glove Making and other uses; Process of* — F. Nuseh. London. From P. Sorel, Grenoble, France. Eng. Pat. 19,989, Sept. 16, 1904.

SEE Fr. Pat. 341,450 of 1904; this J., 1904, 864.—T. F. B.

## VII.—ACIDS, ALKALIS, AND SALTS.

*Sulphuric Acid Manufacture; Contact Process of* — R. Lucas. Z. Elektrochem. 1905, 11, 457—461.

THE author has repeated and extended the experiments of Bedländer and von Köppen (this J., 1903, 1128). He

finds that the absorption of the gases at temperatures above 600° C. which these authors mentioned, does not occur when the platinum used is absolutely free from iridium; and he has modified some of the details of their apparatus so as to make the results of the measurements trustworthy within narrower limits. The experiments were conducted in both directions, the gaseous mixture being in some instances cooled from the temperature of experiment to 400° C., and in others heated from 400° C. to the required temperature. The results of the two series showed satisfactory agreement, but the attainment of equilibrium after dissociation through rise of temperature was much slower than after re-combination through its fall. Detailed examples are given of the mode of calculating *k* from the composition of the original gaseous mixture, and the observed temperatures and alterations of pressure. The results are here tabulated:—

Composition of Gases.			Temp. °C.	Value of <i>k</i> .
SO <sub>2</sub> .	O <sub>2</sub> .	N <sub>2</sub> .		
65.33	32.66	2.00	585	$9.465 \times 10^{-4}$
			680	$2.214 \times 10^{-4}$
			787	$1.310 \times 10^{-3}$
			870	$4.180 \times 10^{-3}$
57.00	42.00	1.00	720	$6.743 \times 10^{-4}$
			820	$3.553 \times 10^{-3}$
			865	$8.870 \times 10^{-4}$
66.66	33.33	—	615	$1.560 \times 10^{-5}$
			680	$1.110 \times 10^{-4}$
			723	$2.520 \times 10^{-4}$
28.15	15.05	56.80	820	$1.640 \times 10^{-3}$
			665	$1.766 \times 10^{-4}$
39.00	61.00	—	680	$2.050 \times 10^{-4}$
			705	$2.590 \times 10^{-4}$
			798	$3.556 \times 10^{-3}$

The three determinations at 680° C. for different mixtures, 2.214, 1.11, and  $2.05 \times 10^{-4}$ , agree within satisfactory limits, and show that *k* is independent of the composition of the original gaseous mixture. The value of *Q*, the molecular heat of formation of gaseous sulphur trioxide, calculated from the figures for each of the five mixtures, comes out as 29875, 17959, 23700, 19320, 21260 calories respectively. The corresponding values from Knietzsch's figures between 18620 and 27125 cal., and from Bodländer and Köppen's between 25455 and 30280. The most probable value calculated by least squares from all these results is 18840 cal., and if from this the values of *k* for different temperatures be calculated, the results are as follows:—

Temp. °C.	<i>k</i>		<i>k</i> Lucas.
	Knietzsch.	B. & K.	
500	$2.026 \times 10^{-6}$	$1.92 \times 10^{-6}$	$1.646 \times 10^{-6}$
600	$6.485 \times 10^{-5}$	$8.56 \times 10^{-6}$	$2.720 \times 10^{-5}$
700	$5.810 \times 10^{-4}$	—	$2.525 \times 10^{-4}$
800	$3.716 \times 10^{-3}$	—	$1.548 \times 10^{-3}$

The author gives also a table similar to that of Bodländer and Köppen (*loc. cit.* 1129), showing the temperatures at which a definite percentage of complete conversion occurs for different mixtures:—

Composition of original mixture.		Yield of SO <sub>2</sub> .						
SO <sub>2</sub> .	O <sub>2</sub> .	98 p.c.	96 p.c.	94 p.c.	90 p.c.	80 p.c.	60 p.c.	
66.66	33.33	415	470	503	665	650	768	
11.69	5.85	—	415	448	490	565	673	
10.0	8.04	445	497	522	564	612	683	
7.0	10.0	467	503	532	570	637	730	
6.0	13.23	477	517	545	585	655	750	
2.0	18.45	490	533	565	604	675	785	

For the mixture, 7 per cent. of sulphur dioxide, 10 per cent. of oxygen, and 83 per cent. of nitrogen, the yields given by the manometric process in the hands of the author are

somewhat higher than those published by Knietzsch. The addition of air to the "ideal" burner gas increases the yield, but lowers the speed of reaction, and the most advantageous mixture must thus be a matter of compromise. —J. T. D.

*Chlorides Anhydrous: Method of Preparing* — Matignon and F. Bourion. *Chem.-Zeit.*, 1905, 29, 780—782.

It is found that by substituting sulphur for carbon in the usual method of chlorinating oxides, a considerable lowering of the temperature of reaction takes place.

For the preparation of chlorides from oxides the following general method may be used. A stream of chlorine after drying over phosphorus pentoxide, is passed into a vessel containing sulphur chloride. The chlorine is thereby saturated with the reducing vapour, and allowed to enter the tube of oxide which is maintained at the requisite temperature (about 350°—400° C., varying with different oxides). It is advisable to use a tube of Jena glass for this purpose. Condensing apparatus connected to the opposite end of this tube, and arrangements are made for the escape of the gases which are evolved.

If the resulting chloride is volatile, great care must be taken not to use excess of sulphur chloride, or an impure product will result. Usually, however, the condensing apparatus is maintained at 80° C., and the volatile sulphur chloride passes off. In this way the following oxides have been converted into chlorides quite readily, silica, alumina, thoria, praseodymium and neodymium oxides, samarium oxide, vanadic acid, tungstic acid, boric acid, chromium and iron oxides. Calcium, barium and samarium sulphates also give chlorides when subjected to this treatment. —B. J. S.

*Silicates of Potassium and other Bases: Method of Making* — Applied to Oxide of Zinc. A. Dubé. *Comptes rend.*, 1905, 141, 254—256.

A QUANTITY of potassium fluoride is fused in a platinum crucible. Silica and precipitated oxide of zinc are then added, and the crucible cooled. The contents are then melted with some potassium chloride, and kept at a heat for three days. The potassium-zinc silicates are separated from the mixture by the use of a hot solution of sodium-mercuric iodide. The first silicate,  $K_2O.6ZnO.4SiO_2$ , has a sp. gr. of 3.68. The second product,  $8K_2O.9ZnO.17SiO_2$ , has a sp. gr. of 2.96. —F.

*Deacon Chlorine Process: Function of the Catalyst* — the —, M. G. Levi and V. Bettoni. *Gaz. chim. ital.*, 1905, 35, 320—342.

IN the authors' experiments a regular current of hydrochloric acid gas mixed with the quantity of air required according to the equation:  $2HCl + O = H_2O + Cl_2$ , was led through a tube of refractory glass containing pieces of pumice impregnated with cupric chloride. The outflowing gases were passed through a washing bottle and then through a standardised alkaline solution of arsenious acid, the relative proportions of hydrochloric acid and chlorine being calculated, after titrating the excess of arsenious acid with iodine solution, and the hydrochloric acid with silver nitrate solution. The experiments were limited to temperatures of up to about 400° C. Up to about 300° C. the yields of chlorine were very small. At 300° C., at the most, only 7—8 per cent. of the hydrochloric acid was decomposed, but at 400° C., the yield (3 per cent.) approached that attained in practice. The yield was lowered by increasing the velocity of the gas much. At the end of the experiment, in every case only cupric chloride was present in the pumice, and cuprous chloride or basic cupric chloride,  $CuO.CuCl_2$ , could be detected. The method of preparing the pieces of pumice was found to have considerable influence on the results; for example, if they are dried for too long a period or at a high temperature, after impregnation with cupric chloride, they become quite inactive. In all experiments, the results of which are quoted above, the pumice was prepared by boiling it for several hours in *aqua regia*, washing, drying, boiling several times.



ion for about two hours in a 50 percent. solution of chloride, allowing to stand over-night in the chloride, and drying at 100°—150° C. Pumice impregnated with cuprous chloride or basic cupric chloride cause any decomposition of hydrochloric acid at 100° C., nor could any transformation of basic chloride into cupric chloride by dry hydrochloric acid be observed under the conditions of the experiment. Since not only cupric chloride, but also copper, nickel, manganese and magnesium chlorides, and even strongly heated pumice alone, are capable of imposing a mixture of hydrochloric acid and air, reduction of chlorine, provided a suitable temperature is chosen, the authors conclude that the catalytic action of all these substances is due solely to their power of absorbing moisture. The facts known with regard to the Deacon process all serve to corroborate this view. Substances capable of acting as catalysers all possess the power of absorbing moisture. At lower temperatures, the action of chlorine is diminished up to a certain limit in the presence of water. The catalyser is completely exhausted at the end of the process. The decomposition of hydrochloric acid proceeds under such conditions as a compound of its constituents with the copper is excluded. Finally, from thermochemical data, the decomposition of gaseous hydrochloric acid is to be expected, because in the system  $2\text{HCl} + \text{O}$ , the tendency to the formation of water, and this tendency is, of course, favoured by the presence of substances capable of absorbing water.—A. S.

*in Solutions of Potassium Bromide.* F. P. Worley. XXIV., page 906.

*Dioxide; Influence of Water Vapour on the Reaction of—by Carbon.* O. Boudouard. Comptes Rendus, 1905, 141, 252—253.

moist carbon dioxide was passed through a tube filled with purified wood-charcoal, and by an electric current. The remaining carbon was removed by caustic soda and the gas passed over heated copper oxide, the resulting carbon dioxide then absorbed and weighed.

Temp.	C.C. per hr.	Percentage of $\text{CO}_2$ reduced.	
		Dry Gas.	Moist Gas.
50	1950	..	0.8
"	1325	..	0.8
"	1275	0.6	..
30	2350	..	11.9
"	1370	..	12.7
"	1350	8.7	..
"	1050	8.1	..
50	2200	..	29.0
"	1150	25.2	..
00	2150	52.3	..
"	3200	..	51.4
"	2500	..	52.6
00	2250	..	92.1
"	1700	93.6	..

—F. S.

*es and Bromates; Volumetric Determination of—* M. Scholtz. XXIII., page 904.

#### ENGLISH PATENT.

*and Alkaline Earth Carbonates; Manufacture of—, and Apparatus therefor.* A. P. Polunowsky, of Ciply, Belgium. Eng. Pat. 18,899, Sept. 1, 1904. A sulphate, obtained from the chloride in the usual way mixed with coal or other reducing agent, and heated to obtain the sulphide, which is dissolved in water or in ammonia solution, or in alcohol. The solution is treated with carbon dioxide in an upright jacketed vessel, provided with a mechanical stirrer, and connected at the bottom by a valve to a second cylinder, in which the liquid is forced by pressure

from the carbon dioxide, through a pipe in the bottom, to return to the upper cylinder for re-treatment, whilst the sodium carbonate or bicarbonate accumulating upon the filter is removed through suitable apertures. The hydrogen sulphide produced in the process is treated with sulphur dioxide to obtain sulphur. E. S.

#### UNITED STATES PATENTS.

*Aluminium Compounds; Process of Making—* L. R. Keogh, Hamilton, Canada. U.S. Pat. 794,413, July 11, 1905.

ALUMINUM materials are acted upon by sulphur gases to form aluminium sulphate; this is mixed with sodium chloride and carbon, and the mixture is heated in a current of steam; the hydrochloric acid gas evolved is collected, and the residual mixture, containing alumina, sodium sulphate and carbon, is heated to reduce the sodium sulphate to sulphide. The product is then heated in the presence of steam and air to form sodium aluminate, sulphurous acid being evolved. From the sodium aluminate, hydrated alumina and sodium carbonate are obtained. (Compare U.S. Pat. 744,765 of 1903, and Eng. Pat. 23,918 and 23,919 of 1903, and 2655 of Feb. 3, 1904; this J., 1903, 1347, and 1904, 370, 186, and 1688 respectively.)—E. S.

*Hydrosulphites; Process of Making Stable Dry—* M. Bazlen, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 795,755, July 25, 1905.

SEE Addition, dated Oct. 25, 1904, to Fr. Pat. 341,718 of 1904; this J., 1905, 333.—T. F. B.

*Nitrogen and Oxygen; Apparatus for Producing Pure—* C. Linde, Munich, Germany, Assignor to C. F. Brush, Cleveland. U.S. Pat. 795,525, July 25, 1905.

SEE Eng. Pat. 11,221 of 1903; this J., 1903, 907.—T. F. B.

#### FRENCH PATENTS.

*Nitrogen; Process for the Oxidation of Atmospheric—by means of Electricity.* D. Helbig. Fr. Pat. 352,090, Jan. 20, 1905. XI.A., page 896.

*Nitric Acid; Process of Making—* Soc. H. H. Nidenführ. Fr. Pat. 351,742, Feb. 23, 1905.

SEE Ger. Pat. 155,095 of 1903; this J., 1905, 497.—T. F. B.

*Caustic Alkalis; Process of Dehydrating—* Badische Anilin und Soda Fabrik. Fr. Pat. 352,076, March 6, 1905. Under Int. Conv., Jan. 4, 1905.

SEE Eng. Pat. 4762 of 1905; this J., 1905, 731.—T. F. B.

*Ammonia; Process and Apparatus for Recovering—from [Coal] Gas.* E. J. Duff. Fr. Pat. 352,180, March 8, 1905. III., page 884.

*Sodium Ferrocyanide; Process for Obtaining—from a Solution of Calcium Ferrocyanide.* Administration des Mines de Bouxwiller. Fr. Pat. 352,246, Jan. 19, 1905.

IN the process for obtaining sodium ferrocyanide from a solution containing calcium ferrocyanide and sodium chloride, described in Fr. Pat. 339,996, of Jan. 28, 1904 (this J., 1904, 714), the solution, according to the present invention, is concentrated by heat at atmospheric pressure, until the double salt, sodium-calcium ferrocyanide, begins to form; the concentration is then continued in a vacuum, at a lower temperature, when the double salt already formed redissolves, and a concentrated solution is obtained, which, on cooling, gives sodium ferrocyanide in large crystals. The mother liquor is then further concentrated *in vacuo*, at about 60° C., and, on cooling, the double salt precipitates. On again concentrating the resulting mother liquor as before, and cooling, another crop of sodium ferrocyanide is obtained. The process is continued until the concentrated solution of the calcium salt

needs to be rejected. Further details are given, and modifications in the process are described, available when evaporation *in vacuo* is dispensed with.—E. S.

*Persulphates; Process for the Electrolytic Manufacture of* —. Consortium für Elektrochem. Ind. G.m.b.H. Fr. Pat. 351,613, Feb. 20, 1905. XI.L., page 896.

*Lead Oxides; Manufacture of Pulverulent* —. C. L. C. Berton. Fr. Pat. 351,812, Feb. 25, 1905.

LEAD, in impalpable powder, dry or moist, and mixed or not with previously formed lead oxide, is roasted for such time as may be needed to produce the oxide (massicot or minium) required. (Compare Eng. Pat. 14,036, of June 20, 1902; this J., 1903, 701.)—E. S.

*Lead Acetates; Preparation of* —. Gebr. Heyl und Co., G.m.b.H., and A. Wultze. Fr. Pat. 352,050, March 4, 1905.

FRAGMENTS of lead are loosely heaped on a superposed succession of screens arranged within an upright closed vessel, adapted to resist considerable internal pressure. The vessel is nearly filled with dilute acetic acid, and air is forced in through a perforated coil in the bottom of the vessel, under a pressure of about four atmospheres. By this method neutral or basic solution of lead acetate can be obtained, as may be desired. On drawing off the solution and recharging with dilute acetic acid, the apparatus is again ready for use.—E. S.

*Seaweed; Treatment of* — for the Extraction of Mineral and Organic Chemical Matters. Mme. Laureau, née J. H. Laureau. Fr. Pat. 352,069, March 6, 1905.

SEAWEED, treated with quicklime or with milk of lime, is made into small heaps, sheltered from rain, and when hardened, is lixiviated to obtain in solution the organic and mineral constituents; or the solution may be evaporated to dryness, and the product charred, which product is then treated by ordinary methods to obtain the salts, and also the iodine, bromine, &c., present.—E. S.

*Sulphur; Producing* —, in the form of very Fine Powder. A. Dementieff. Fr. Pat. 351,981, Feb. 21, 1905.

SULPHUR vapour is brought into contact with water vapour, which may be in the state of superheated steam; or the sulphur may be volatilised directly by the same. The finely divided sulphur thus obtained may be freed from water in a centrifugal separator. A mixture of ordinary flowers of sulphur with the fine powder, may be obtained by conducting the vapour of sulphur into a closed cooling chamber, into which finely-pulverised water is introduced under pressure.—E. S.

*Chlorine; Process for Increasing the Chemical Action of* —. B. Marguies and Co. Fr. Pat. 352,196, March 8, 1905.

A LIGHT rich in ultra-violet rays is caused to play upon the vessel or apparatus in which chlorine is brought into contact with the substance or substances to be acted upon. The apparatus should be wholly or partially constructed of quartz, or of other bodies such as glass very rich in silica, only feebly absorbent of the rays referred to. An example given of the application of the process is to the chlorination of benzene. The bleaching of fabrics may also be effected under the action of chlorine aided by the rays as described.—E. S.

## VIII.—GLASS, POTTERY, AND ENAMELS.

### FRENCH PATENT.

*Rock Crystal (Quartz); Process of Making Molten* — free from Air Bubbles. W. C. Heracus. Fr. Pat. 352,137, March 6, 1905.

SEE Eng. Pat. 3906 of 1905; this J., 1905, 498.—T. F. B.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

### ENGLISH PATENTS.

*Mortar, Cement, Building Composition and Mortar Articles made from like Material; Manufacture of* —. G. B. Brown, York. Eng. Pat. 2467, Feb. 7, 1905.

Dry slaked poor lime, e.g., Lias lime, is mixed with a dross calcium sulphate and finely ground chalk or alkaline earth carbonate, magnesium compounds, coloring matters, and (optionally) with inactive or neutral materials such as sand, sawdust, or the like. The only requires mixing with water to be ready for use.—

*Wood and other Porous Materials; Impregnation of* —. A. J. Boulton, London. From Hülsberg und Co., Löttenburg, Germany. Eng. Pat. 24,451, Nov. 11, 1904.

SEE Addition of Sept. 27, 1904, to Fr. Pat. 319,711 of 1902; this J., 1905, 278.—T. F. B.

*Marble, Dolomite, and the like; Manufacture of Artificial* —. T. M. Thom, Chesbunt, Herts. Eng. Pat. 9221, May 2, 1905.

LIME is mixed with marble waste, a metallic oxide or other ingredients, and is then slaked with a solution containing for every 1 gall. of water, 7 oz. of the following mixture of salts:—25 parts by weight of sodium chloride, 1 of potassium chloride, 5 of magnesium chloride, magnesium sulphate, and 1 of calcium sulphate. The use of this solution imparts an ivory tint to the stone.—A. G. L.

### UNITED STATES PATENT.

*Cement; Process of Manufacturing Portland* —. Slag. C. von Forell, Hamburg. Assignor to J. H. Edmunds, London. U.S. Pat. 795,275, July 25, 1905.

SEE Fr. Pat. 339,316 of 1904; this J., 1904, 663.—T. F. B.

### FRENCH PATENTS.

*Marble, Calcareous and Other Natural Stones, Crystalline or Amorphous; Process for Producing Grain in Colours Fast to Light and to Weathering Influence* —. Chem. Techn. Fabr. Dr. A. R. W. Brand and Co. Fr. Pat. 351,591, Feb. 18, 1905.

THE marble or other stone is first impregnated by immersion in a vessel, from which the air can be exhausted, with a cold saturated ammoniacal solution of a metallic salt, such as copper or nickel chloride. The stone is then dried at a temperature of about 80° C., and is then impregnated with a more dilute neutral solution of an alkali salt, such as an alkali phosphate, chromate, cyanide, borate or complex cyanide. This solution acts on the metallic compounds previously introduced into the stone to produce coloured veins and grains. Neither the ammoniacal nor the alkali salt solution must contain sulphates or oxalates.—A. G. L.

*Colouring Natural Compact and Crystalline Stone, especially Marble; Process for Completely* —. Chem. Fabr. Dr. Alb. R. W. Brand and Co. Fr. Pat. 351,591, Feb. 25, 1905. Under Int. Conv., March 25, 1905.

THE marble or other stone is impregnated with a solution of a metallic soap in a volatile oil to which an organic acid has been added. The stone is then dried, when a coloured precipitate, insoluble in water, will be formed in it consisting partly of a basic metal salt of the organic acid and partly of the carbonate of the metal. For instance, a 30 to 40 per cent. solution of copper oleate in turpentine may be used, the theoretical quantity of acetic acid being necessary for decomposing the copper oleate being added to the solution.—A. G. L.



*Material for Roofs, &c.; Impermeable* — standard Paint Co. Fr. Pat. 351,882, Feb. 28, 1905. — Int. Conv., May 27, 1904.

Pat. 775,636 of 1904; this J., 1904, 1217.—T. F. B.

*Process for Making Very Hard and Dense* — H. Spatz. Fr. Pat. 352,173, March 15, 1905. Under Int. Conv., March 31, 1904.

Pat. 7736 of 1904; this J., 1905, 824.—T. F. B.

*Manufacture of Products similar to — [from Furnace Slag].* A. F. Le Chatelier. Fr. Pat. 21, Feb. 25, 1905.

liquid slag from the blast-furnaces determined of the necessary ingredients, i.e., lime, silica, and aluminium oxides, are added so as to give to the composition of the cement it is desired to. The materials added are pre-heated so as to lowering the temperature of the slag too much. duct is granulated as usual.—A. G. L.

# GERMAN PATENT.

*ard; Process for the Preparation of a Coating on* — Heilpern and Haas. Ger. Pat. 160,660, 3, 1902.

ating solution is prepared by dissolving a resin (resin, Manila copal) which is insoluble in petroleum benzene—in an aliphatic alcohol or ketone, or other solvent in which coal-tar pitch or petroleum is insoluble or but very sparingly soluble. matters may be added to the solution if desired. use of this solution, a very thin elastic film is which, owing to the insolubility of the resins, cannot be penetrated by the tar oils present in the board, whereby, it is claimed, the durability of the product is greatly improved.—A. S.

## X.—METALLURGY.

*um Powder; Oxidation of —.* Kohn-Abrest. XXIV, page 906.

*and Fridium; Separation of —.* L. Quennessen. XXIII, page 904.

# ENGLISH PATENTS.

*Manufacture of —.* J. Y. Johnson, London. J. de Moya, Paris. Eng. Pat. 16,028, July 19,

Pat. 349,233 of 1904; this J., 1905, 677.—T. F. B.

*Recovery of — from Ores and other Materials.* cholas, Waterloo, Lanes. Eng. Pat. 15,577, July 904.

Pat. 348,804 of 1904; this J., 1905, 550.—T. F. B.

*from their Ores; Apparatus for the Separation of Liquids from Solids, particularly applicable to the* — P. J. Ogle and The Cyanide um Filter Co., Ltd., both of London. Eng. Pat. 16, July 15, 1904.

vention is stated to consist in a modified construction of the apparatus described in Eng. Pat. 3962, of Feb. 4 (this J., 1905, 501). A series of filtering elements, having a separate filtering medium, and an enclosed chamber arranged in ring formation, as an endless chain or series. Means are provided for operating and for guiding the elements successively into and out of one or more tanks, so means for exhausting the liquid matter passing through the filtering medium. The solid matter collecting in the filtering medium is discharged into troughs by means of compressed air.—E. S.

*Soldering; Material Applicable for —, for Coating Metals, and for Writing or the like, and Method of Manufacturing the same.* M. Leisel, Cologne, and R. Küpper, Bonn-Endenich, Germany. Eng. Pat. 17,624, Aug. 13, 1904.

SEE Fr. Pat. 345,593 of 1904; this J., 1905, 32.—T. F. B.

*Furnaces; Impts. in Gas [Metallurgical] —.* C. H. Thompson, Stourbridge, from C. L'Hospied, Vallauris, France. Eng. Pat. 19,001, Sept 3, 1904.

THE claim is for the construction of furnaces such as are used for the annealing of malleable iron castings, &c., in which the gas producers are placed on the opposite sides of each furnace chamber. Each chamber has two flues passing through the sole; the flues can be alternately connected, the one to the stack and the other to the atmosphere to admit the necessary air. During the operation of the furnace, the connections are from time to time reversed, so that the flues act as regenerators to heat the incoming air, for which purpose they may, if desired, be provided with chequer brickwork.—W. H. C.

*Ore Concentrators; Impts. in —.* F. Esser, Cologne, Germany. Eng. Pat. 27,034, Dec. 12, 1904.

IN order to improve the separation obtained with a reciprocating table, the force of the stream of wash-water is regulated during the reciprocation of the table. This is effected by increasing or diminishing the inclination of the table towards the delivery side during the forward movement, and bringing it back to its original position during the backward movement. For this purpose the table may be carried on wedge-shaped shoes, mounted on rollers in such a way that those on the feed side incline in an opposite direction to those on the delivery side. Or, parallel guide shoes are provided at the feed-side, and wedge-shaped shoes at the delivery side. Or, the table may be carried on eccentric rollers, the eccentricity of the two on the feed side being oppositely directed to that of the two rollers on the delivery side. Or, the table may be supported on two pairs of stilts, the pair on the feed side being longer than the two stilts on the delivery side, and the fulera of the stilts being located so that the table makes a tilting as well as a reciprocating movement.—A. G. L.

*Metalliferous Minerals; Separation of — from Gangue.* H. L. Sulman, H. F. Kirkpatrick-Picard, and J. Ballot, London. Eng. Pat. 29,374, Dec. 31, 1904.

SEE Fr. Pat. 351,846 of 1905, following these.—T. F. B.

# UNITED STATES PATENTS.

*Chromiferous Iron; Treatment of —.* H. H. Campbell, Steelton, Pa. U.S. Pat. 795,193, July 18, 1905.

THE chromiferous iron is charged in the molten state into a basic-lined converter with loose basic material, and the charge is blown longer than usual, to oxidise the chromium, and cause it to enter the slag. The metal is then separated from the slag, and is then charged into an acid-lined converter with silicious material, together with iron free from chromium, and having a relatively high carbon content, to reduce metallic oxide in the de-chromised metal, as well as to furnish additional heat by the combustion of the carbon.—E. S.

*Ore; Art of Treating —, and Gathering Gold or Precious Metal diffused in the employed Mercury.* G. M. Rice, Worcester, Mass. U.S. Pat. 794,552, July 11, 1905.

TO a mass of ore under treatment by amalgamation with mercury, from 2 to 5 per cent. of the weight of the mercury is added of an amalgamable metal in a finely-divided state. The total amalgam thus formed is collected, and the mercury is expelled. Also, to a body of mercury containing gold, a comminuted metal or metals, other than that sought to be recovered, but capable of forming an amalgam, is added, "that will act as a scavenger or gatherer for the gold when straining or squeezing out the mercury."—E. S.

*Zinc; Process of Removing or Recovering* — from Ores. W. Stewart, Glasgow, Scotland. U.S. Pat. 794,198, July 11, 1905.

THE powdered ores are mixed with an alkali bisulphate and with sodium chloride, and the mixture is furnaceed at a red heat. Zinc salts are recovered from the solution obtained on lixiviating the furnaceed product.—E. S.

*Copper Mattes, White Metal, and Blister-Copper; Method of Producing* — in a Single Furnace. R. Baggaley, Pittsburg, Pa. U.S. Pat. 794,272, July 11, 1905.

A MOLTEN bath is formed from a low grade copper sulphide ore, in a furnace in which the charge is heated by flames from above upon the surface of the bath, whilst air is blown through from below. The slag is drawn off, and addition is made from time to time by small portions of silicious metal-bearing ores to flux the iron of the matte and to increase the yield of metal. The outlet for the gases issuing from the melting chamber is constricted, and is regulated according to the heat requirements of the bath. In the final stage of the process, the enriched and concentrated matte or metal is collected into a non-heat-conducting cavity situated below the bath. (Compare U.S. Pats. 746,241, 746,246, 746,249 and 746,260, all of Dec. 8, 1903; this J., 1904, 23.)—E. S.

*Ore Concentrator.* H. Seovell, H. B. Seovell, L. E. Seovell and W. E. Seovell, Galena, Kans. U.S. Pat. 749,555, July 11, 1905.

A SCREEN, the forward portion of which has a sharp upward curve, whilst the other end has a slight upward inclination, is placed in a tank containing a liquid, and receives the crushed ore from a shoot. A compound vertical and horizontal motion is given to the screen by an arrangement of shafts and cams suitably operated. The concentrate falls through the screen, whilst the waste passes over the tail of the screen.—J. H. C.

*Metalliferous Materials; Process of Purifying and Nodulizing* —. T. C. King, Marion, Ala., Assignor to National Metallurgic Co., Jersey City, N.J. U.S. Pat. 794,673, July 11, 1904.

A "BINDER" which is adhesive at low and volatile at higher temperatures, is mixed with the finely divided metalliferous material, which is then heated in a suitable vessel to temperatures ranging from 1200° F. upwards, so as to volatilise the binder together with certain volatile impurities, the whole mass being agitated so as to form nodules which are finally fused into permanent form.

—J. H. C.

*Slag-Furnace.* O. S. Garretson, Buffalo, N.Y. Assignor to Garretson Furnace Co., Pittsburg, Pa. U.S. Pat. 795,032, July 18, 1905.

ACCORDING to this invention, the heat evolved during the cooling of slag is utilised in raising steam in a boiler, or for similar purposes. The molten slag is delivered on to a series of congealing rollers, through which a cooling agent is passed. These rollers deliver the congealed slag to an upright chamber, where it is further cooled by a continuous current of air which flows through a passage opening into the lower portion of the slag-chamber, and then in succession through the column of slag, through the heating flue of the steam boiler or the like, and back through the passage to the bottom of the slag chamber. The cooled slag is removed from the bottom of the chamber by means of a conveyor. (Compare U.S. Pats. 728,794, and 728,795 of 1902; this J., 1903, 747.)—A. S.

#### FRENCH PATENTS.

*Copper; Process for imparting to —, Resistance and Hardness, without Discoloration.* H. Herreschmidt, L. Renault, and A. Monier. Fr. Pat. 349,902, May 7, 1904.

AN alloy of copper, vanadium and cobalt is obtained by heating a mixture of oxides of these metals with carbon or the like for some hours. The alloy thus obtained is melted with copper in such proportion that the new alloy may contain copper, 94 per cent., cobalt, 4 per cent., and vanadium, 2 per cent.—E. S.

*Minerals; Process of Smelting* —. J. Gayley. Fr. Pat. 352,244, Jan. 16, 1905. Under Int. Conv., Oct. 1904.

SEE U.S. Pat. 779,037 of 1905; this J., 1905, 138.—

*Minerals [containing Nickel and Cobalt]; Tre of —.* J. Savelsberg. Fr. Pat. 351,535, Feb. 1905.

THE treatment is applicable to minerals, such as Caledonian nickel-cobalt ores, which do not contain sufficient sulphur to give a matte by direct smelting. These minerals are mixed with sulphur, or with smelting materials, such as pyrites, sulphate sulphides, together with a little carbon and a flux. The mixture is then treated in a converter in a current of gas, the heat disengaged during the reaction which place being sufficient to maintain the temperature sufficiently high when once the action has been started. A granulated mass is obtained containing the metal in the form of sulphides; this mass is broken up into small pieces which are smelted for matte as usual.—A. G. L.

*Metalliferous Minerals; Process for Separating Gangue from —.* H. L. Suhan, H. F. K. and J. Ballot. Fr. Pat. 351,846, Feb. 27, 1905.

THE powdered mineral or ore, made into a paste with water, is distributed upon a movable table, or an inclined plane, over which currents of, preferably, heated water are passed transversely, whilst air-curtains are directed upon the immersed or floating particles to direct the metallic particles, sustained on the surface by the adhering oil, in one direction, whilst the gangue, which, being comparatively free from oil, sinks, are swept in a contrary direction. In a second apparatus, the ore powder, after treatment with distributed upon a movable concave inclined floor, is subjected to an oscillatory movement, upon which floor no jets of water play, so that the immersed powder is exposed to air towards the margin; the metallic particles to which oil adheres then float downwards, while the gangue which sinks is carried to discharge chutes. (Compare Eng. Pat. 20,419 of Sept. 22, 1903; this J., 1904, 1150.)—E. S.

*Cement; Manufacture of Products similar to — Blast-Furnace Slag.* A. F. Le Chatelier. Fr. Pat. 351,821, Feb. 25, 1905. IX., page 893.

#### GERMAN PATENT.

*Gold; Process for Accelerating the Solution of — in Cyanide Solution.* F. W. Dupré. Ger. Pat. 1,105,105, May 5, 1904.

CLAIM is made for the addition of an alcohol, preferably ethyl alcohol, to the cyanide solution. The power of aqueous cyanide solution for gold depends on the dissolved oxygen it contains; an addition of alcohol, which is capable of dissolving seven times more oxygen than water, thus favours the solution of gold. An addition of even a few parts per cent. of methyl or ethyl alcohol causes a considerable difference in the solvent power of the solution. A larger addition of alcohol has the advantage of diminishing the amount of deleterious gangue constituents dissolved.—A. S.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A.)—ELECTRO-CHEMISTRY.

*Anodes, Magnesium; Behaviour of —.* G. Babo. Z. Elektrochem., 1905, 11, 1865, 482.

THE author has found that the polarisation of magnesium when employed as anode, is marked by the following characteristics:—

1. In neutral solutions of chlorides and sulphates, hydrogen is liberated at the surface of the anode, and



becomes covered with a black powdery deposit, most probably metallic magnesium and not the

or these conditions, the relation between the magnesium dissolved and the current passed is to a fairly constant apparent valency of 1.30 metal, this relation being independent of the re, concentration or composition of the electro-

potential difference at which the magnesium dissolved in neutral solutions, agrees fairly well given by metallic magnesium in a cell in which it is passing. This last-named potential varies 0 to -2.10 volts.

tempts to form the supposed sub-oxide of magnesium the anode failed; only mixtures of the metal cesium oxide ( $MgO$ ) could be obtained.

alkaline solutions three conditions of the surface magnesium anode are to be distinguished—the passive, and the pseudo-active.

in the active and passive conditions the anode liberates oxygen. The apparent valency magnesium passing into solution is about 9.

magnesium anode in solutions containing both hydroxide and potassium chloride in certain degrees of concentration, evolves both oxygen and hydrogen, each of these being localised reactions.

consequence of these special characteristics of it, when used as anode material, the following and reductions are possible:—

neutral solutions, potassium permanganate and can be reduced, while iodine ions are oxidised to molecules.

alkaline solutions, bromine and iodine ions are oxidised to bromate and iodate ions respectively, potassium manganate is reduced (probably to manganate), urine ions remain unaltered.—J. B. C. K.

l; Reduction of — to Stearic Acid by Electrolysis. I. Petersen. Overs. over det Kgl. Danske Vidensk. Selsk. Forh., 1905, 137—149. Chem. 1905, 2, 304—305.

tor has carried out some experiments on the reduction of free oleic acid in hydrochloric sulphuric acid solution. In the first experiments of oleic acid dissolved in 150 c.c. of alcohol and dilute sulphuric acid were used with a nickel wire (in later experiments a cathode of nickel wire was employed), a diaphragm, and a platinum anode into sulphuric acid. With an E.M.F. of 20 volts and a current of 1.35 amperes, a good yield of stearic acid was obtained at 32° C. In alcoholic sulphuric acid solution the best yields were obtained with the smaller proportion of acid. In experiments with hydrochloric acid, 1/1 acid were added to 100 c.c. of the solution acid, and electrolysis effected with a current of 1 ampère. The reduction effected was greater, the solution of oleic acid had been in contact with hydrochloric acid. During the electrolysis the yield of stearic acid gradually diminished. The yields are better with hydrochloric acid than with sulphuric acid. It is preferable to add the acid drop by drop during the electrolysis in order to avoid too great an increase of temperature. At 20 volts, 1 ampère, 30°—35° C. are the best conditions. With increasing current-density, the yield of stearic acid decreases; the temperature is without effect.—A. S.

Carbon; New Carbon —. J. W. Howell. Eng. Pat. 882.

Electrolytic Determination of — for Technical Purposes. K. Jenc. XXIII., page 905.

#### ENGLISH PATENTS.

Electric Incandescent Lamps and Methods of Manufacturing the same. H. C. Lewis. From the Electric Co. Eng. Pat. 6959, March 22, 1904. Eng. Pat. 882.

Heating Water Electrically; Apparatus for —. M. H. Shoenberg, San Francisco, U.S.A. Eng. Pat. 2348, Feb. 6, 1905.

SEE Fr. Pat. 351,449 of 1905, following these.—T. F. B.

Gases; Apparatus for Producing "Electric" Reactions in —, by Aid of Electric Arcs. K. Birkeland, Christiania, Norway. Eng. Pat. 3525, Feb. 20, 1905. Under Int. Conv. Feb. 20, 1904.

This invention relates to a furnace for producing chemical reactions by the aid of electric arcs formed between electrodes arranged in a strong magnetic field. The electrodes are placed near to one end of the furnace, and are provided with long extensions or horns, which extend through the furnace chamber near to opposite sides of the same.—B. N.

Dye-stuffs; [Electrolytic] Manufacture of Leuco-gullocyanine —. G. W. Johnson. From the Dye-works, formerly L. Durand, Huguenin and Co. Eng. Pat. 7835, April 12, 1905. IV., page 885.

#### UNITED STATES PATENTS.

Battery; Electric Storage —. A. Meister and A. Junker, New York. U.S. Pat. 794,240, July 11, 1905.

This invention relates to a means for forming a coating of oxide on a metal anode, such as nickel, the surface of the anode being covered with a porous and absorbing material. The electrolyte consists of dilute caustic potash and carbolic acid, or a phenolate may be used with a suitable cathode.—B. N.

Furnace; Electric —. C. L. Saunders, Cleveland, Ohio. U.S. Pat. 794,255, July 11, 1905.

The hearth of the furnace consists of a horizontal continuous annular trough, with positive and negative electrodes supported on or embedded in opposite sides, the electrodes being adapted to convey current to and from the material. The hearth is rotated continuously, and a series of contact pieces carried by the hearth and connected with the electrodes make temporary contact with stationary contact pieces which are in connection with the source of current. As the hearth rotates, successive currents are passed through the material, thus increasing its heat and decreasing the resistance throughout the whole of the material. Means are provided for charging the hearth and for removing the material. A portion of the hearth is enclosed by a cover, which is provided with an arrangement for leading away the gases generated during the process.—B. N.

#### FRENCH PATENTS.

Accumulator; New Electric —. W. Gardiner. Fr. Pat. 351,884, Feb. 28, 1905.

The positive electrode of the accumulator is composed of a small tube of copper, closed at both ends, and enclosed in a cylinder of perforated sheet copper, the intervening space being filled with a mixture of silver and nickel amalgams. This electrode is insulated from the negative pole which surrounds it, and which consists of copper wire gauze in contact with the walls of the containing vessel, which are of conducting material. The containing vessel has a gas-tight cover in which are openings for the introduction of the electrolyte, these openings having stoppers provided with valves which prevent air entering, but allow any gas evolved to escape.—A. S.

Batteries; Elements for Electric —. W. Gardiner. Fr. Pat. 351,886, Feb. 28, 1905.

The claim is for a battery in which the electrodes are disposed horizontally, in order to prevent the active material deposited on them from being dislodged. The containing vessel is made of conducting material, such as metallic copper, and on its bottom are one or more layers of copper gauze which constitute the negative electrode. A framework of ebonite or other insulating substance separates this electrode from the anode, which consists of two perforated plates, with the active material between.

The plates are of silver, nickel, platinised copper or other metal capable of resisting the action of the electrolyte. On the lower one is stretched a piece of porous fabric, which serves as a support for the active material. The latter consists of a mixture of silver and nickel amalgams; it is held in place by a framework furnished with laths, and by the upper metal plate. The electrolyte consists of a solution of caustic potash to which is added zinc or cadmium oxide.—A. S.

*Battery; Secondary* — W. Gardiner. Fr. Pat. 351,992, Feb. 28, 1905.

SEE Eng. Pat. 27,900 of 1904; this J., 1905, 625.—T.F.B.

*Insulating Material; Electrical* — ("Porphyrite"). A. and L. Parvilić. Fr. Pat. 352,181, March 8, 1905.

THE invention has for its object the preparation of a new product, named "porphyrite," which constitutes a novel electrical insulating material, neutral in colour, absolutely impermeable, of great compactness, and possessing a high mechanical resistance and electrical resistance. It is prepared by combining together 40 parts of clay or kaolin, 30 parts of rock porphyry, and 30 parts of bauxite calcined at a high temperature or melted in the electric furnace. The product is richer in alumina than any other known insulating body. — B. N.

*Nitrogen; Process for the Oxidation of Atmospheric* —, by means of Electricity. D. Helbig. Fr. Pat. 352,090, Jan. 20, 1905. Under Int. Conv., Jan. 21, 1904.

Air, alone or mixed with other gases, is submitted to the action of an electric arc, which is maintained between metallic electrodes, the points of the latter being provided with covering refractory material which ionises the gas at a high temperature. The arc is enclosed by a covering of refractory material which also ionises the gas at a high temperature, and which is so disposed that the whole of the gas traversing the apparatus is submitted to the action of the arc. The cold gas enters through channels surrounding those by which the hot gas makes its exit, and thus the gas receives heat before it reaches the arc.—B. N.

*Liquids; Apparatus for Heating* — Electrically. The Schoenberg Electric Appliance Co. Fr. Pat. 351,449, Feb. 11, 1905.

THE liquid to be heated is circulated through a hollow, vertical, cylindrical vessel, constructed of porcelain or some other insulating material, with ends of metal, to which the wires carrying the current are attached. The current flows through a spiral metallic conductor, immersed in the liquid and connected to the two metal ends of the cylinder. The liquid enters the cylinder at the lower end, by an insulated pipe and passes away at the top by another insulated pipe. The supply of liquid is controlled by a tap, placed on the feeding pipe and so arranged that it must be opened before the circuit is completed, and the circuit must be broken before the tap can be closed; in this way any overheating of the coil, which might damage it, is prevented.—W. H. C.

*Persulphates; Process for the Electrolytic Manufacture of* —. Consortium für Elektrochem. Ind. G.m.b.H. Fr. Pat. 351,613, Feb. 20, 1905.

IT has not hitherto been possible to obtain good yields of potassium and sodium persulphates by the electrolytic process. The patentees have found that the yield of persulphate increases concurrently with the potential at the anode, and that the latter can be raised by the addition of certain substances, notably, hydrofluoric acid, to the electrolyte. The favourable action of the hydrofluoric acid, however, gradually diminishes as electrolysis proceeds, owing to the production of monopersulphuric acid (Caro's acid). To prevent the formation of this acid, the rate of its production under the working conditions is determined by a preliminary test, and then during the electrolysis the necessary quantity of a reducing agent is added continuously to the electrolyte. Suitable reducing agents are sodium bisulphite or sulphite, hydrochloric acid, or sodium chloride, the two latter exerting a specially favourable influence as the chloric ions dis-

engaged raise the potential at the anode and thus increase the yield of persulphate. (Compare Müller, this J. 1904, 987.)—A. S.

### (B).—ELECTRO-METALLURGY.

*Silver; Electrolytic Separation of* —. R. C. Snowden. J. of Phys. Chem., 1905, 9, 392—398. Chem. Centr. 1905, 2, 106.

THE author determined the influence of current-density and concentration of the electrolyte on the nature of electrolytically deposited silver. It was found that the size of the silver crystals decreased with increasing current-density. It is advantageous to rapidly rotate the cathode (2000 revolutions per minute), and to separate the anode and cathode compartments. The size of the individual crystals is only slightly less in nitric acid solution than in neutral solution. If gelatin be added to the electrolyte the silver is deposited in an amorphous condition.—A. S.

*Nickel; Electrolytic Deposition of* — on Nickel. R. Snowden. J. of Phys. Chem., 1905, 9, 399—404. Chem. Centr., 1905, 2, 105.

IT is known that an adherent deposit of nickel on nickel can only be obtained under certain conditions. The deposit is always non-adherent when the support is composed of electrolytic nickel. It has been generally thought that this is due to the formation of a hydride or to the occlusion of hydrogen by nickel. The author's view, however, is that it is due to the formation of a layer of oxide. The surface of the support can be rendered capable of receiving an adherent deposit by reduction, for example, by cathodic polarisation. This action is, however, very unstable, and the reduction must, therefore, be effected immediately before use.—A. S.

*Chromium; Electrolytic* —. H. R. Carver and B. E. Curry. J. of Phys. Chem., 1905, 9, 353—358. Chem. Centr., 1905, 2, 102—103. (See this J., 1905, 625.)

IN the electrolytic separation of chromium from solutions of alkali chromates, it has not hitherto been definitely ascertained whether the chromium exists only in the form of anions, or whether hexavalent cations are also present. On electrolysing solutions of commercial chromic acid, using a high current-density, a metallic precipitate is obtained, which contains a large quantity of occluded hydrogen. With pure chromic acid the yield is very small, but is better in presence of sulphuric and other mineral acids. In strongly acid solutions chromium trioxide behaves as a base, hexavalent chromium cations being split off. In all solutions in which reduction has taken place, the cathodic liquid will give the reactions of chromic salts. If the solution be alkaline, a brown precipitate of chromic chromate is produced. Under suitable conditions more than half of the total chromium can be separated electrolytically from chromic acid.—A. S.

### ENGLISH PATENTS.

*Oxidation and Reduction [by means of Vanadium compounds] effected in an Electrolytic Bath; Process of* —. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Höchst a/Main. Germany. Eng. Pat. 18,042, Aug. 19, 1904.

SEE Fr. Pat. 345,701 of 1904; this J., 1905, 33.—T. F. B.

*Electro-deposition; Impts. in Processes of* —. The British Thomson-Houston Co., Ltd., London. Invented by the General Electric Co., Schenectady, N.Y. Eng. Pat. 18,840, Aug. 31, 1904.

AN alternating current is passed between suitable electrodes immersed in an electrolyte containing a metal, such as platinum, thereby depositing metal on both electrodes. The electrolyte is of such a nature that the negative reaction, liberated by the current, will not corrode the deposited metal.—B. N.



*lie Coatings upon Metals; Process for the Electro-ic Production of Lustrous —*. A. Classen, Aachen, rmany. Eng. Pat. 12,291, June 13, 1905.

Fr. Pat. 350,964 of 1905; this J., 1905, 806. —T. F. B.

*hur, Arsenic and Antimony: Method and Apparatus - the Treatment of Metallic Compounds of —*. H. M. Dekker, Paris. Eng. Pat. 961, Jan. 17, 1905. rder Int. Conv., Aug. 13, 1904.

Fr. Pat. 345,834 of 1904; this J., 1905, 97.—T. F. B.

# UNITED STATES PATENT.

*ace; Metallurgical —*. G. H. Benjamin, New York, N.Y. U.S. Pat. 794,212, July 11, 1905.

The furnace consists essentially of a roasting chamber, heating chamber, an electrically heated chamber and oxidising chamber, arranged at progressively lower levels. The ore is moved along the inclined bottom of the roasting chamber by means of a rake, and passes into the heating chamber, in which a reducing atmosphere is maintained. This chamber discharges into the top of the vertically electrically-heated chamber, as also does an adjacent, rotating chamber in which the fluxes, &c., are heated. The mixture of ore, fluxes, &c., in passing down the vertical chamber is subjected to the heat in electric arc. The molten material flows out at the bottom into a basin or well, in which a separation of the different components is effected by gravity. The molten metal flows from the basin to the hearth of an oxidising chamber, where it is subjected to the action of a blast of air. The flues leading from the basin to the oxidising chamber discharge around the rotary heating chamber and into the reducing chamber, the latter being provided with an exit flue.—A. S.

# FRENCH PATENT.

*z, Magnesium and other Substances in Acid or Neutral Solution; Electrolytic Recovery of —*. Decker Manufacturing Co. Fr. Pat. 352,029, March 3, 1905.

The invention relates to an apparatus comprising a tub containing the electrolytic solution, the vessel being closed by a partition pierced with one or more openings, in each of which is lodged a trough. The ends of each trough are furnished with projecting pieces fitting into the ends of the trough below, and the sides are sloping, the bottom being inclined towards the outside. The troughs contain mercury, which closes the openings of the partition. The troughs are all connected together electrically. The troughs are also provided with overflow pipes, so that mercury poured into the upper trough passes down successively from one trough to the next below.—B. N.

# GERMAN PATENTS.

*for Soldering Metal Objects; Electrical Process for —*. V. Fuhrmann. Ger. Pat. 159,718, Dec. 28, 1902.

The process is for the purpose of soldering metal objects having a large superficial area, but only a small soldering face. An auxiliary electrode is used, and this is placed in contact with the part or parts to be soldered and also with the solder, and the soldering is effected with the aid of an electric current.—A. S.

*for Copper; Process for the Direct Electrolytic Preparation of Pure —, using Copper Ore as Anode in an Electrolyte consisting of an Acid Solution of Copper Sulphate*. W. Borchers, R. Franke and E. Günther. Ger. Pat. 160,946, Oct. 5, 1904.

Copper ore used as anode is subjected to a preliminary leaching of concentration until its percentage of copper is above 72 and as nearly as possible 78—80. It is stated that only by maintaining the proportion of copper in the electrolyte between these limits does the direct electrolytic manufacture of copper become remunerative. The chief difficulty in the direct electrolytic process is the deposition

of sulphur at the anode, but by working under the conditions mentioned, it is stated that with a current-density of about 50 amperes per sq. m. of cathode or anode surface, and with the usual agitation of the electrolyte, it is possible to keep the P.D. below 1 volt at the ordinary temperature even after deposition of a tolerably thick layer of sulphur at the anode.—A. S.

# XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*Bean Oil [Soja Bean Oil]; Characteristics of Chinese —*. W. Korontschewski and A. Zimmermann. Chem.-Zeit., 1905, 29, 777—778.

SOME 20 different species of these beans are sold under the name "doutsai," some being used as human food, others as fodder for cattle, and others again for the extraction of the oil. A kind of vermicelli is also prepared from certain species. The oil is expressed by means of a primitive plant in the Chinese factories and exported in large quantities to Japan and Korea. The method of extraction consists in first crushing the beans into caked masses by means of mill stones, then heating them on stone slabs until the appearance of vapours, and finally expressing them in an iron receptacle. As first obtained the oil is turbid, but after some time becomes clear, the deposit consisting of sand particles and vegetable fibres. Only the clear oil is exported, but the turbid oil is sold locally. It has a faint odour recalling that of Chinese wood (tung) oil, is bland to the taste, and of a dark brown colour. Four commercial samples examined by the authors (one being obtained direct from the factory in Kharbin) gave the following results:—Water, 0.3 to 1.80 per cent.; sp. gr. at 15° C., 0.9264 to 0.9287; solidification point, —14.6° to —15.3° C.; saponification value, 207.9 to 212.6; ester value, 203.9 to 207.7; insoluble fatty acids, 93.6 to 94.28 per cent.; iodine value (Hübl), 114.8 to 137.2; solidification point of fatty acids, 16° to 17.3° C.; m.p. of fatty acids, 20° to 21° C.; Maumené test, 192° to 116° C. and acid value 1.86 to 15.46. It was concluded that the oil contained a large proportion of olein. Practical tests showed that the oil was readily absorbed by the system and possessed a high food value.—C. A. M.

*Oleic Acid; Reduction of — to Stearic Acid, by Electrolysis*. J. Petersen. XIA., page 895.

# ENGLISH PATENT.

*Soap; Process of and Apparatus for Producing Bars of —*. K. E. Markel, Warrington. Eng. Pat. 23,187, Oct. 27, 1904.

THE liquid soap is forced into intermittently revolving cooling tubes, and solidified by immersing these in a cooling medium, after which the solid bars are expelled by a further quantity of liquid soap, which, in turn, is treated in the same way. The bars are pressed out of the tubes against a spring piece, so as to minimise the difference between the outer and inside friction, and to counteract the decrease of friction as the bars issue from the tubes. The face of the spring piece is a solid block, to keep the ends of the bars level. The soap is delivered to the tubes through a jacketed pipe, and cut-offs are provided at each end of each cooling tube, and at the end of the delivery pipe.—C. S.

# UNITED STATES PATENT.

*Oil and Moisture from Materials; Apparatus for Extracting —*. S. E. Wilson, Cincinnati, Ohio. U.S. Pat. 795,183, July 18, 1905.

A STEAM-TIGHT telescopic casing is arranged around a press so as to enclose the material being pressed. The casing stands in a pan carried by the bottom plate or "platen," and is provided with a telescopic door. By means of pipes steam can be introduced into the casing so as to act directly upon the material in the press.

—W. H. C.

## FRENCH PATENTS.

*Oils or Fats; Treatment of — before Saponification with Castor Oil Seeds or the Cytoplasma of Oleaginous Seeds.* M. Nicloux and E. Urbain. Fr. Pat. 349,942, May 26, 1904.

THE presence of acids in the oils to be treated causes irregularities in the enzymic process, and claim is made for the removal of such acids either by washing the oils first with acidulated water and then with pure water, or, preferably, by neutralising the free acids with sodium carbonate and removing the soap. This treatment greatly increases the yield of fatty acids within a given time. Thus a coprah oil, which only yielded 70 per cent. of fatty acids, gave 95 per cent. after removal of the free acids. The glycerol solutions obtained from the purified oils are perfectly colourless. — C. A. M.

*Gas; Process for Obtaining Producer — from Vegetable Refuse from Oil Factories.* O. Hentschel. Fr. Pat. 351,533, Feb. 15, 1905. II., page 883.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

#### (A.)—PIGMENTS, PAINTS.

*Ultramarine Blue.* K. A. Hofmann and W. Metzner. Ber., 1905, 38, 2482—2486.

THE authors find that ultramarine blue is not decolorised, and remains practically unchanged in composition, by the action of strong sulphuric acid or glacial acetic acid. Strong sulphuric acid actually exercises a protective effect against the action of nitric and nitrous acids on ultramarine. Ultramarine is also unattacked in presence of acetic anhydride by glacial acetic acid saturated with hydrochloric acid. In absence of acetic anhydride there is gradual decomposition, but the silicious part of the substance is mainly attacked and the blue colour remains. Ultramarine blue is also unaltered by a solution of bromine in a mixture of glacial acetic acid and acetic anhydride. The authors conclude that ultramarine blue probably owes its blue colour to compounds of similar nature to sulphur sesquioxide,  $S_2O_3$ , described by R. Weber (Pogg. Ann. 156, 531), and not to groups of similar character to those present in polysulphides and thiosulphates. — E. F.

## FRENCH PATENTS.

*Lead Carbonate [Pigment]; Preparation of —.* Gebr. Heyl and Co., G.m.b.H., and A. Wultze. Fr. Pat. 352,049, March 4, 1905.

CARBON dioxide is led into a solution of lead acetate in such manner that the gas, on reaching the solution and for a fraction of a second afterwards, is under a certain pressure. This may be effected by causing the gas to issue into the solution through a wide, valved outlet from a vessel containing the gas under a pressure of from three to four atmospheres, so that the pressure rapidly diminishes as the gas passes out. The lead carbonate thus obtained is stated to be non-crystalline, and to be specially suitable for use as a pigment. — E. S.

*Antimony; Process and Apparatus for Treating Minerals Containing —, and for Obtaining a Pigment by Aid of such Minerals.* J. S. MacArthur. Fr. Pat. 352,136, March 6, 1905.

SEE Eng. Pat. 11,123 of 1904; this J., 1905, 801. — T. F. B.

#### (C.)—INDIA-RUBBER, Etc.

*Balata.* A. Tschirch and E. Schereschewski. Arch. Pharm., 1905, 243, 368—377.

BALATA which is obtained from *Mimusops globosa*, Gärtn., is the most important technical substitute for gutta-percha. It occurs in commerce in the form of leathery, elastic sheets that soften at  $49^{\circ}$ — $50^{\circ}$  C., then become

plastic, and melt at  $149^{\circ}$ — $150^{\circ}$  C. The material examined by the author contained 5.7 per cent. of matter soluble in boiling water, 41.5 per cent. soluble in boiling alcohol, 42.5 per cent. in boiling acetone, 87.0 per cent. in boiling ether, and 86.8 per cent. soluble in chloroform. Analysis it gave 1.72 per cent. of moisture, 0.96 per cent. of ash, 41.5 per cent. of "resin" (extracted by boiling alcohol), and 45.3 per cent. of "gutta" (extracted by chloroform from the product after removal of the "resin"). 500 grms. of the balata were cut into small pieces exhausted successively with boiling water, boiling alcohol, and chloroform, and the solutions examined separately. From the aqueous solution, an albuminoid substance separated by precipitation with tannic acid, and the "gum" by treatment with alcohol. The yield of the latter was 1.5 per cent. of the weight of balata; it contained 6.47 per cent. of ash, was optically inactive, but susceptible to reactions for carbohydrates and for furfural. From alcoholic solution it is stated that there were isolated  $\alpha$ -balaban,  $C_{27}H_{42}O_2$ , m.p.  $230^{\circ}$ — $231^{\circ}$  C.;  $\beta$ -balaban,  $C_{27}H_{46}O_2$ , m.p.  $108^{\circ}$ — $109^{\circ}$  C.; and balafuavil,  $C_{10}H_{16}$  (yield, about 1.5 per cent.). The resinous constituent of balata do not contain esters of cinnamic or other acid. Examination of a number of specimens of gutta-percha of different origins showed that the presence or absence of esters of cinnamic acid does not afford a means of distinguishing balata from gutta-percha, some specimens of the latter yielding cinnamic acid on hydrolysis with alcoholic caustic potash, whilst others do not (see this J., 1904, 1103). From the chloroform extract of balata, balagutta,  $C_{10}H_{18}$ , which rapidly changes when exposed to the air, and balaban,  $C_{27}H_{42}O_2$ , m.p.  $55^{\circ}$ — $56^{\circ}$  C. were isolated. Table given in which the behaviour of the alban, fluavil, albanan from balata when subjected to different chemical reactions is compared with that of phytyl (See also this J., 1905, 627.) — A. S.

*Gum Chicle; The So-called —.* A. Tschirch and E. Schereschewski. Arch. Pharm., 1905, 243, 378

GUM chicle, the concentrated latex of *Achras Sapota*, is obtained chiefly from Mexico, and is used exclusively in the United States for the preparation of "chewing gum." The specimen examined by the author contained 16.8 per cent. of matter soluble in boiling water, 59.7 per cent. soluble in boiling alcohol, 61.7 per cent. in boiling acetone, 76.2 per cent. in boiling ether, and 86.8 per cent. soluble in chloroform. It was treated in the manner described in the preceding abstract for. The compounds isolated were:—An optically inactive gum (yield, 9 per cent.) containing 3.76 per cent. of water,  $\alpha$ -chicalban,  $C_{24}H_{40}O$ , m.p.  $219^{\circ}$ — $221^{\circ}$  C.;  $\beta$ -chicalban,  $C_{18}H_{30}O$  or  $C_{17}H_{28}O$ , m.p.  $158^{\circ}$ — $159^{\circ}$  C.;  $\gamma$ -chicalban,  $C_{15}H_{25}O$ , m.p.  $86^{\circ}$ — $87^{\circ}$  C.; chicalfluavil,  $C_{10}H_{16}$ , m.p.  $66^{\circ}$ — $67^{\circ}$  C.; chicalgutta,  $C_{10}H_{16}$  or  $C_{11}H_{18}$ ; and chicalalbanan, m.p.  $57^{\circ}$  C. (See also this J., 1902, 438; 1903, 1358.) — A. S.

## ENGLISH PATENT.

*Fabrics; Apparatus for Treating Tubular — with Liquid or Semi-liquid Compositions.* W. R. Eng. Pat. 26,005, Nov. 29, 1904. V., page 887.

### XIV.—TANNING, LEATHER, GLUE, S E.

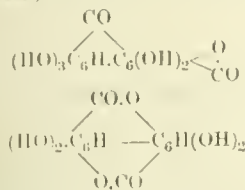
*Quebracho Tannin.* M. Nierenstein. XXIV., page 1

*Tanning Materials; Study of some — capable of producing "Bloom."* M. Nierenstein. Collegium, 1905, 21—23, 197—200.

TANNIN substances which are pyrogallol derivatives possess the characteristic property of producing a surface of leather tanned with them, so-called "bloom," which consists essentially of ellagic acid. With regard to this deposition of ellagic acid on the fibres of the leather the author is of the opinion that the acid exists



ning material in the form of a soluble glucoside, and as gallic acid according to the two formulæ which have been proposed for it by Barth and Goldschmidt (Ber., 9, 12, 1253), viz.,



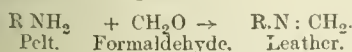
by Gräbe (Ber., 1903, 36, 212) has the power of giving a tanning action on hides, owing to the presence of a "tannophor" group,  $\text{O.CO.}$ , a number of pyrogallol tanning materials were subjected to a detailed examination. (The groups designated "tannophors" by the author are  $\text{CHO}$ ,  $\text{CO}$ , and  $\text{CO}_2\text{O}$ ).

*Myrobalans* (*Terminalia Chebula*).—Thirty grms. of myrobalans were extracted first with a litre of cold water, then with a litre of hot water, and the solution was allowed to stand. The ellagic acid which separated had a faint yellow colour. After filtering, the solution was treated with 15 c.c. of sulphuric acid, boiled for 20 minutes, cooled, and again filtered. The ellagic acid separated in this way was of a dirty grey colour. The residue was extracted first with ether and then with ethyl acetate, and the two extracts and also the residual aqueous solution were examined separately. In the etheral solution, gallic acid and tannin were detected; in the ethyl acetate solution, gallic acid; and in the aqueous solution, dextrose.

*Algarobilla* (*Caesalpinia brevifolia*).—Algarobilla beans contain about 40–45 per cent. of a tannin of the pyrogallol type, which, if fermentation be prevented, gives a light-brown leather, the cross-section of which has a bluish tint. The author has observed that the methyl ester of gallic acid when treated with excess of milk of lime, gives a deep blue colour which disappears on shaking in presence of air. Since algarobilla beans contain this ester of gallic acid, it is probable that the blue tint mentioned above is caused by the formation of the blue lime compound in the interior of the hide where it is protected from oxidation. This view was confirmed by the fact that skins tanned with myrobalans (which do not contain this ester) in presence of 3 grms. of the methyl ester of gallic acid, acquired a bluish tinge during the tanning process. 145 grms. of algarobilla beans were extracted with 100 litres of hot water and the solution allowed to stand for three days, in the course of which about 20 grms. of a red, crude ellagic acid separated. In the aqueous solution by suitable treatments, the presence of gallic acid, the methyl ester of gallic acid and a glucoside (dissolving tannin and dextrose) was detected. The red, crude ellagic acid was extracted with alcohol to remove its colouring matter. From the alcoholic solution crystals were obtained, which, after fusing with caustic potash at  $185^\circ\text{C}$ ., gave reactions for phloroglucinol and ellagic acid.—A. S.

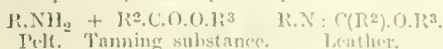
*Other; Formation of* —. Preliminary Communication. M. Nierenstein. Collegium, 1905, 159–160.

PIECE of hide which had been treated with formaldehyde was boiled several times with water, until the presence of a free aldehyde could no longer be detected. The leather is then boiled for three hours with 25 c.c. of water and 2 c.c. of N/25 sulphuric acid, and it was found that formaldehyde could now be detected in the solution, having evidently been liberated from chemical combination. The group  $\text{CHO}$  is accepted as a "tannophor" (see following abstract), the tanned hide or leather may be regarded as having a formula similar to that of Schiff's tannin, according to the equation:—



the vegetable tanning materials be regarded as tannone-carbonic acids, in which either the  $\text{CO}$  or the  $\text{CO}_2\text{O}$  group

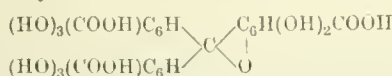
acts as a "tannophor," the formation of vegetable-tanned leather may be expressed by the equation:—



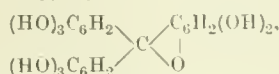
—A. S.

"Tannophor."  $\text{C} \begin{smallmatrix} \diagup \\ \diagdown \end{smallmatrix} \begin{smallmatrix} \text{O} \\ \text{O} \end{smallmatrix}$ ; The —. M. Nierenstein. Collegium, 1905, 221–222.

IN 1872 (Ber., 5, 25, 280, 1096) von Baeyer found that pyrogallol when condensed with formaldehyde, yields an amorphous compound soluble in water, which precipitates gelatin from its solutions, and has, in general, properties resembling those of tannin. Caro (Ber., 25, 947) and also Kahl (Ber., 31, 144), who repeated the experiments, found that phenols or phenol-carboxylic acids when condensed with formaldehyde, form diphenylmethane derivatives, pyrogallol yielding hexahydroxydiphenylmethane,  $(\text{HO})_3\text{C}_6\text{H}_2\text{CH}_2\text{C}_6\text{H}_2(\text{OH})_3$ , but do not mention the formation of the compound observed by von Baeyer. Having regard to the fact that diphenylmethane compounds contain no "tannophor" group (see preceding abstracts) and therefore do not possess a tannoid character, the author repeated von Baeyer's experiments on the one hand, with pyrogallol, and, on the other, with gallic acid. It was found that in both cases, together with insoluble diphenylmethane derivatives, soluble compounds, capable of forming insoluble precipitates with gelatin, were also formed. The soluble compound produced from gallic acid proved to be the hexahydroxyaurincarboxylic acid of Caro,



whilst that from pyrogallol was probably the compound,



both of which substances contain the "tannophor" group  $\text{CO}$ .—A. S.

#### UNITED STATES PATENT.

*Tanning Substances; Process of Extracting* —. G. F. Bögel, Altona, Germany. U.S. Pat. 794,847, July 18, 1905.

SEE Fr. Pat. 318,160 of 1902; this J., 1902, 1405.—T. F. B.

#### FRENCH PATENTS.

*Tanning; Rapid Process of* —. R. Berthon. Fr. Pat. 351,661, Feb. 16, 1905.

SKINS which have been saturated with a solution of chromic acid and common salt are tanned very quickly by vegetable tanning materials, chromium oxide being deposited on the fibres of the hide, and the fixation of the tannin being accelerated by the action of the chromic acid, so that a kind of double tanning by bark and by chrome is effected. Free chromic acid, however, has an injurious action on the hides, and claim is made therefore for the use of a mixture capable of yielding free chromic acid for the preliminary treatment of hides to be tanned by the "tanno-chromic" process. A suitable mixture consists of water, 100; sodium bichromate, 5; sodium bisulphate, 10; and sodium chloride, 15 parts.—A. S.

*Bone; Product Obtained by the Treatment of* —. J. R. Hunter. Fr. Pat. 351,754, Feb. 7, 1905.

SEE U.S. Pats. 781,880, 781,882, and 781,883 of 1905; this J., 1905, 245.—T. F. B.

#### XV.—MANURES, Etc.

*Phosphatic Slags; Detection of Natural Phosphates in* —. L. Ledoux. XXIII., page 904.

## ENGLISH PATENTS.

*Manures; Manufacture of* — J. J. Boutan, Soisy Montmorency, France. Eng. Pat. 15,709, July 14, 1904. Under Int. Conv., Aug. 13, 1903.

SEE FR. Pat. 338,981 of 1903; this J., 1904, 1037.—T. F. B.

*Distillery or like Refuse Effluents; Purification of* — J. L. Hawliczek. Eng. Pat. 18,484, Aug. 26, 1904. XVIII.B., page 901.

## XVI.—SUGAR, STARCH, GUM, Etc.

*Cane Sugar Works; Steam in* — P. Bouvier. Bull. Assoc. Chim. Sucr. Dist., 1905, 22, 1149—1155.

RESULTS obtained at a cane sugar factory, working cane of the average richness of 14 per cent. of sugar and with well-served furnaces, show that extraction by mills is the only process which allows of the whole of the heating being done exclusively with bagasse. In a factory working with mills, no other fuel than bagasse is needed, and this result may be attained by either improving the heating apparatus or drying the bagasse, or both. The combustion of relatively dry bagasse shows a considerable advantage and the practical realisation of mechanical drying should be regarded as a necessity. The above conclusions relate to bagasse containing 33 per cent. of moisture: in certain cases a reduction in the moisture may be of advantage.

—L. J. DE W.

*Sugar Syrups; Viscosity of* — G. Fouquet. Bull. Assoc. Chim. Sucr. Dist., 1905, 22, 1186—1206.

THE viscosity of syrups increases very greatly with the concentration, particularly above 50° Brix. There is an enormous increase in the viscosity when the temperature of the syrups falls below 60° C.; it varies inversely as the cube of the temperature. Comparing syrups of the same density, the viscosity diminishes with diminished purity and the diminution is proportional to the weight of non-sugar per 100 grms. of syrup. The viscosity at the crystallising point increases with the impurity of the syrup. Of two syrups of the same quotient of purity, the more viscous is the one in which the ratio of organic matter to sugar is higher, and the same holds good at the point of crystallisation. The viscosity of the mother syrup of a massecuite when cooled increases, but not in a great proportion, provided always that the syrup merely remains saturated. When it becomes supersaturated, the viscosity increases enormously. If the supersaturation varies from 1 to 1.14, the viscosity varies from 1070 to 2434. Sulphiting and other such processes appear to produce only a very slight diminution in viscosity.—L. J. DE W.

*Disaccharide; Synthesis of an Octamethylated* — from Dextrose. Methylation of Sucrose and Maltose. T. Purdie and J. C. Irvine. XXIV., page 906.

*Sugar; Influence of Invert Sugar on the Determination of Crystallisable* — M. Carmantrand. XXIII. page 905.

*Smoke; Antiseptic Properties of* — Experiments on Disinfection by the Gases formed on Burning Sugar. A. Trillat. XVIII.C., page 901.

## FRENCH PATENTS.

*Sugar Juices; Manufacture of* — F. Dobler. Fr. Pat. 349,930, May 20, 1904.

THE process described is for disinfecting beet pulp and sugar juices, and is based on the extraction of the sugar juice in presence of chlorides or hypochlorites, which are added to the cosettes or juice during diffusion in either a solid or dissolved state.—T. H. P.

*Sugar Solutions; Continuous Boiling of* — in Two Vacuum Pans for the Formation of Crystals. W. Witkowiec. Fr. Pat. 351,836, Feb. 27, 1905.

THE continuous boiling of the sugar solution is effected

by distributing the heating surface between two vessels the bottoms of which are connected by means of a pipe and one of which serves for the preliminary, and the other for the final boiling. In both these vessels the heating is carried out, as far as is possible, by low-pressure steam.—T. H. P.

## XVII.—BREWING, WINES, SPIRITS, Etc.

*Beers; Percentage of Alcohol in German* — H. Woch. f. Brau., 1905, 22, 432—433.

REVIEWING the results of the analysis of several hundred samples of German beers examined during the last years, the author summarises the percentages of alcohol contained in the different types of beer. Out of samples of bottom-fermentation beers from North Central Germany, 79.7 per cent. of the pale beers contained 71.6 per cent. of the dark beers contained between 34 per cent. of alcohol by weight; the average alcohol content of the pale beers was 3.55 per cent., and of dark beers 3.70 per cent. The 112 samples of fermentation beer examined are divided into six different classes. The proportion of alcohol in these varied considerably than in the case of the bottom-fermented beers, but in nearly all of them it was comprised between the limits of 1 and 3 per cent.—J. F. B.

*Alcohol, Ethyl; Spontaneous Oxidation of* — L. Mathieu. Bull. Assoc. Chim. Sucr. Dist., 1905, 22, 1283—1293.

IN wines or alcoholic solutions of the same strength the alcohol is converted into aldehyde by simple contact with the air at the ordinary temperature, without the contact of porous bodies or the agency of micro-organisms. The action is markedly accelerated when the solution contains oxidisable bodies like sulphurous acid, ferrous sulphate, ferrous oxide, manganous oxide, &c., and by exposure to sunlight. Green glass is less favourable to the oxidation than white glass. These conclusions confirm the experience of Roesser on the influence of aeration on the production of aldehyde in fermentation and show that account should be taken of the possible formation of this compound by simple contact with air.—L. J. DE W.

*Fermentation, Lactic and Alcoholic, in the Tissues of Plants, and Enzymes causing this Fermentation* — J. Stocklase. XXIV., page 907.

## ENGLISH PATENT.

*Distillery or like Refuse Effluents; Purification of* — J. L. Hawliczek. Eng. Pat. 18,484, Aug. 26, 1904. XVIII.B., page 901.

## XVIII.—FOODS; SANITATION; WATER PURIFICATION, &amp; DISINFECTANTS

## (A.)—FOODS.

*Caffeine; Coffees without* — G. Bertrand. Compt. Rend., 1905, 141, 209—211.

SINCE his discovery (this J., 1901, 271) that *Coffea habitiana* contained no caffeine, the author has examined many species, but has found them almost invariably contain from 10 to 15 grms. per kilo. One species, *C. mauritiana*, contained only 0.7 gm. per kilo. Recently he has received three new species, *C. gallienii*, *C. boissieri*, and *C. mogenetii*, all from a district to the south of the island of Diego Suarez in Madagascar; none of these contain any caffeine, and all contain a bitter principle identical with or analogous to the *cafamarine* (this J., 1901, 271) contained in *C. humblotiana*. All the species examined which contain no caffeine come either from Madagascar or from its immediate neighbourhood.—J. T. D.



*Oil [Soja Bean Oil]; Characteristics of Chinese* ——. Korentschewski and A. Zimmermann. XII., page 897.

*Chicle; So-called* ——. A. Tschirch and E. Scherschewski. XIII.C. page 898.

## B).—SANITATION; WATER PURIFICATION.

### ENGLISH PATENT.

*Slurry or like Refuse Effluents; Purification of* ——. L. Hawliczek, Liverpool. Eng. Pat. 18,484, Aug. 26, 1904.

FILLERY or similar refuse effluents are treated with lime, agitated and filtered, the albuminous prelates being treated for the recovery of ammonia or used as manure. The filtered liquor is then treated with a sulphite or bisulphite of an alkali or alkaline earth again filtered; the effluent is then sufficiently pure to be discharged into streams.—J. F. B.

### UNITED STATES PATENT.

*for Respiration Purposes; Process and Apparatus for Regenerating* ——. M. Bamberger, F. Böck and W. Wanz, Vienna. U.S. Pats. 795,678 and 795,679, July 25, 1905.

Eng. Pat. 8865 of 1904; this J., 1904, 833.—T. F. B.

### (C).—DISINFECTANTS.

*Antiseptic Properties of* ——. *Experiments in Disinfection by the Gases formed in Burning Sugar*. Trillat. Comptes rend., 1905, 141, 215—217.

When heated to 105° C. gives off, after some hours, considerable amounts of formaldehyde, and as the temperature which it is heated is raised, the evolution of the aldehyde becomes more rapid. The gases from burnt sugar contain in percentages 0.2 to 5.7 of formaldehyde; 0.1 to 0.5 of ethyl alcohol; 0.1 to 5.0 of acetone; 1.0 to 3.0 of acetic acid; 1.0 to 3.0 of phenols and their derivatives; 0.5 to 1.0 of benzaldehyde. The formaldehyde is thus accompanied by substances which intensify its antiseptic action, either directly or by retarding its polymerisation. Direct experiment showed that by burning 6 kilos. of sugar (or better, 6 kilos. in two successive portions) in a room of 100 cb. m. content, even very resistant germs were destroyed. While this treatment is as efficient as that with formaldehyde itself, yet its simplicity and availability recommend it as a method of disinfecting likely to be often of service.—J. T. D.

### UNITED STATES PATENT.

*Formaldehyde Product [Disinfectant] and Process of Making Same*. H. S. Blackmore, Mount Vernon. U.S. Pat. 795,757, July 25, 1905.

A compound of use for disinfecting is produced by passing the air from a receptacle containing a mixture of powdered talc, alumina, and paraldehyde, and then passing the mixture, whereby the formaldehyde produced is to be absorbed by the mineral matter. A fragrant oil may be subsequently added to the product.—T. F. B.

### FRENCH PATENTS.

*Cryptogamic Preparations with a Copper Base; Manufacture of* ——. E. A. Campagne. Fr. Pat. 349,929, July 20, 1904.

PREPARATION intended for preventing cryptogamic diseases of the vine (mildew, black rot) is obtained by using the basic hydroxide or carbonate of copper (obtained electrolytically) with water. The addition of a suitable proportion of a calcium salt, such as the sulphate, renders the product more capable of adhering to the vine and also prevents the presence of an excess of caustic substances without action upon the cryptogams, though injurious to the vine.—C. A. M.

*Deodorising Rooms*. E. Fournier. Fr. Pat. 351,518, Feb. 14, 1905.

To destroy the odour remaining in rooms disinfected with formaldehyde or its products (after the disinfectant has been neutralised with ammonia), benzoic acid or an analogous substance is vaporised or sprayed into the closed room, so as to neutralise the amines produced by the action of the ammonia.—C. S.

## XIX.—PAPER, PASTEBOARD, Etc.

*Cellulose; Solubility of* ——. in *Thiocyanates*. Duboscq. Soc. Industr. de Rouen. Chem.-Zeit., 1905, 29, 823.

THE solution of cellulose in thiocyanates forms a kind of collodion, which is adapted to form threads and may be used in making artificial silk.—J. T. D.

### ENGLISH PATENT.

*Nitrocellulose Solutions for Use in the Treatment of Fabrics; Impts. in* ——. P. Kraiss and The Bradford Dycers' Assoc., Ltd. Eng. Pat. 18,742, Aug. 30, 1904. V., page 886.

### UNITED STATES PATENTS.

*Drum-Filter [for Waste from Paper Factories]*. E. Füllner, Warmbrunn, Germany. U.S. Pat. 794,173, July 11, 1905.

A hollow drum is supported so that it can be rotated in a tank, in which the liquid to be filtered, such as waste water from paper manufactures, is contained. A number of separate filtering cells are arranged around the surface of the drum and covered with a filtering medium. Each cell is provided with a discharge tube to deliver the filtrate into the interior of the drum, these tubes being bent away from the interior surface of the drum, in the direction opposite to that in which it rotates, whilst each tube has a valve which opens during the descent and closes during the ascent of the cell. The deposit on the filter cloth is removed by a system of scrapers and rollers.—W. H. C.

*Nitrocellulose or Similar Substances; Making Compounds of* ——. D. Bachrach, Baltimore, Md. U.S. Pat. 794,581, July 11, 1905.

CLAIM is made for a non-inflammable or slow-burning compound of nitrocellulose, &c., produced by adding to the usual constituents non-aqueous ethyl, methyl and amyl silicates, and similar silicates known as silicic esters, and a free acid.—G. W. McD.

### FRENCH PATENTS.

*Lustre of Cellulose Threads [Artificial Silk]; Process for Increasing the* ——. R. Linkmeyer and M. Pollak. Fr. Pat. 350,889, Jan. 20, 1905. V., page 888.

*Papier-mâché Threads; Manufacture of* ——. M. Müller. Fr. Pat. 351,902, Feb. 28, 1905.

THE threads are first immersed for a short time in a bath of dextrin, starch, gelatin, or other glutinous substance, oil or soap being added when a supple product is required. As soon as the threads are impregnated they are immediately transferred to a machine where they are brushed with paraffin, fat, wax, &c., with the object of increasing their strength and resistance to moisture.—C. A. M.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Lead in Pharmacopœial Chemicals; its Occurrence and Determination*. C. A. Hill. Chem. and Drug., 1905, 66, 388—391.

THE method usually employed for determining the amount of lead in pharmacopœial chemicals, viz., the colorimetric

method was the one used, the modifications necessary in various cases being observed (see Warington, this J., 1893, 97; Budden and Hardy, Analyst, 1894, 169, and Teed, Analyst, 1902, 142). In cases where the colorimetric method was not available (e.g., in coloured solutions), incineration was resorted to with satisfactory results, providing the ash were present in sufficient quantity, and not reduced to a white ash, but treated with nitric acid and sulphuric acid, in order to avoid volatilisation of the lead. The electrolytic method, however, is preferred to this latter, the operation being carried out in presence of ammonium oxalate, and at a temperature of about 75° C.—T. F. B.

*Formaldehyde, and Production of Formates.* H. and A. Euler. Ber., 1905, 38, 2551—2560.

THE formation of sodium or barium formate by the action of sodium or barium hydroxide on formaldehyde is a reaction of the second order, but proceeds practically according to the first order if large excess of the aldehyde be present. The reaction is not one of oxidation, as it takes place as readily in an atmosphere of hydrogen as in one of oxygen. Formate is produced much quicker by the action of calcium hydroxide than with sodium or barium hydroxide, and the reaction is evidently caused by the action of calcium hydroxide on a calcium-formaldehyde complex. The power of the different bases to condense formaldehyde to sugar bears no relation to the velocity of production of formate.—T. H. P.

*Quinine Formates.* H. Lacroix. J. Pharm. Chim., 1905, 22, 99—103.

THE normal salt, quinine diformate, crystallises in long white shining needles, readily soluble in water; this salt is unstable; it melts at about 95° C., and loses some of its formic acid at a temperature below 50° C.; its solutions have an acid reaction.

The basic salt, quinine monoformate, is prepared by combining quinine with the calculated quantity of formic acid in presence of water at 50° C. It crystallises in the anhydrous state as fine white silky needles, melting at 132° C. This salt appears to be one of the most convenient forms of the drug; it is very stable, and it is the richest in alkaloid of any of the usual quinine salts, containing 87.36 per cent. of quinine. Its solutions are neutral to litmus; it is soluble in water at 16° C. to the extent of 5.14 per cent., and is very soluble in boiling water. It is readily soluble in alcohol and chloroform, very sparingly soluble in ether and insoluble in vaseline and olive oil. The optical properties of aqueous solutions at 21° C. are  $[\alpha]_D = -141.1$ ; index of refraction = 1.236; the solutions are non-fluorescent.—J. F. B.

*Quinine Acid Hydrochloride; Note on —.* W. Garsed. Brit. Pharm. Conf., Brighton, 1905. Pharm. J., 1905, 75, 138—139.

IN the B.P. the formula  $C_{20}H_{24}N_2O_9 \cdot 2HCl \cdot 3H_2O$ , is given for quinine acid hydrochloride, and it is required that (1) not more than 12 per cent. of water shall be lost at 100° C.; and (2) that not more than 2.5 e.c. of N/1 sodium hydroxide solution shall be required to completely neutralise one grm. of the alkaloid salt. Determinations of the moisture in five samples showed that the commercial quinine acid hydrochloride is practically an anhydrous salt. In the titration of the acid, the most satisfactory results were obtained by using N/10 or N/5 alkali with phenolphthalein for determining the total acid, and with litmus for determining the amount of acid hydrochloride, the titration being continued in the latter case until no shade of red was left. Of the five samples examined, three contained notable quantities (18.8, 19.8, and 46.5 per cent.) of the neutral hydrochloride.

—A. S.

*Mercuric Zinc Cyanide.* D. B. Dott. Brit. Pharm. Conf., Brighton, 1905. Pharm. J., 1905, 75, 136—137.

THE author discusses the composition of the so-called mercuric zinc cyanide (see Dunstan, this J., 1890, 211; 1892, 367), which is used to a considerable extent as an antiseptic in surgical dressings. Dunstan found that the

amount of mercuric cyanide contained in the product varied according to the quantity of water used in preparation, the maximum amount obtainable being 38.5 per cent. Since, however, some decomposition always occurs, the pure product would contain a somewhat larger proportion of mercuric cyanide, and from a number of experimental results, Dunstan concluded the proportion of mercuric cyanide in the pure product was 40.5 per cent., "a number which agrees almost exactly with the percentage (40.65) required by the formula  $Zn_2Hg(CN)_{10}$ ." The author points out that the formula given by Dunstan requires not 40.65 but 35.0 per cent. mercuric cyanide, so that the argument based on number 40.5 is invalid. Further, variations of temperature, of the manner of mixing the mercury and solutions, of the time of contact of the water with the precipitate, &c., all cause marked differences in the composition of the product, and, until further evidence of the existence of a definite double cyanide of mercury and zinc is brought forward, the product should be simply "zinc and mercury cyanide," although it may be convenient to specify that it should contain a certain proportion of mercuric cyanide, say, 20 per cent.—

#### ENGLISH PATENTS.

*Tetrachlorethane (Acetylene Tetrachloride) and Acetylenes from Acetylene; Production of Symmetrical Acetylenes.* H. K. Tompkins, Glasgow. Eng. Pat. 19,568, Sep. 1904.

THE explosive tendency of the reaction between acetylene and antimony pentachloride is due to the presence of excess of chlorine in the latter, and can be prevented by ensuring the presence of a certain proportion of antimony trichloride during the passage of the acetylene. The best yields are obtained by adjusting the quantity of acetylene so that the liquor at the end of the absorption has the composition  $SbCl_5 \cdot C_2H_2 + SbCl_3 + xSbCl_3$ . This liquor is distilled in small quantities at a temperature of 120° C. during the passage of acetylene, in which case the acetylene tetrachloride is produced directly. Acetylene dichloride is produced together with the tetrachloride when the saturated acetylene is carried to the point of completion of chlorination. Acetylene tetrachloride is prepared by the action of ammonia upon acetylene tetrachloride.—J. F. B.

*Salicylglycolates; Manufacture of Crystallised Salicylglycolates, and a Product for use in Medicine.* O. Imray, London, from Soc. Chem. Basle, Switzerland. Eng. Pat. 24,672, Nov. 1904.

SODIUM salicylate is heated with dry methyl chloracetate for 24 hours at a temperature of 160° C. under a reflux condenser. After cooling, the mixture is filtered off, and the product is purified by fractional distillation *in vacuo*. The methyl ester, m. pt. 29° C., and the ethyl ester, m. pt. 30° C., when together in the form of the pure crystals, yield a mixture which is liquid at temperatures above 0° C. This mixture is claimed as a liquid therapeutic agent, suitable for external application.—J. F. B.

*Alkylbarbituric Acids; Manufacture of —.* O. Brüning, London, from Farbwerke vorm. Meister, Lucius, & Brüning, Höchst a/Main, Germany. Eng. Pat. 24,672, Nov. 17, 1904.

SEE U.S. Pat. 795,495 of 1905; following these.—

*Camphor; Manufacture of —.* Chem. Fab. Actien, vorm. E. Schering, Berlin. Eng. Pat. 24,672, May 5, 1905. Under Int. Conv., May 17, 1904.

THE vapours of isoborneol may be oxidised to camphor by means of oxygen or air, with or without the aid of catalytic agents. Isoborneol (10 kilos.) is heated to 150° C., and gradually volatilised by passing a stream of oxygen over it: the resulting mixture of gases is passed over platinised asbestos heated to 150° C.; a mixture of camphor and isoborneol is obtained.



phor, camphene and isoborneol results, from which phor can be isolated by known methods.—T. F. B.

# UNITED STATES PATENTS.

*bon Tetrachloride; Process of Making* —. J. L. anziger, New York, Assignor to Castner Electrolytic Kali Co., Virginia. U.S. Pat. 794,789, July 18, 1905.  
*bon tetrachloride is produced by heating carbon lphide with twice the theoretical quantity of sulphur ride in presence of aluminium amalgam.*—T. F. B.

*bon Tetrachloride; Process of Purifying* —. J. L. anziger, New York, Assignor to Castner Electrolytic Kali Co., Virginia. U.S. Pat. 794,970, July 18, 1905.  
*bon tetrachloride containing carbon bisulphide is fied by digesting it with a solution of an alkali or line earth sulphide containing free alkali, thus separat- the bisulphide in the form of a thiocarbonate. The carbonate solution is subsequently decomposed into on bisulphide and hydrogen sulphide by addition of acid.*—T. F. B.

*lbarbituric Acids; Process of Making* —. A. nborn, Munich, Assignor to Farbwerke vorm. Meister, leus und Brüning, Höchst-on-the-Maine, Germany. S. Pat. 795,495, July 25, 1905.

*YLAAARBITURIC acids are obtained by heating alkyl- namides with diaryl carbonic acid esters. Thus ylbarbituric acid may be produced by heating ylmalonamide with diphenylcarbonate for a com- able time at a temperature of 190 —250° C.*—T. F. B.

# FRENCH PATENT.

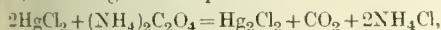
*ylbarbituric Acids; Process of Making New Deriva- es of* —. Act.-Ges. f. Anilinfabr. Fr. Pat. 9,922, May 17, 1904.

*Eng. Pat. 11,259 of 1904; this J., 1905, 512.*—T. F. B.

## XL.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*curic Oxalate (Eder's Solution); Photochemical haviour of* — in Absence of Oxygen and in Presence Fluorescent Substances. A. Jodlbauer and H. v. appeiner. Ber., 1905, 38. 2602—2609.

*interaction of mercuric chloride and ammonium ate, according to the equation:*



*takes place to an appreciable extent in the light. number of non-fluorescing compounds examined by authors, none exerts any accelerating influence on this tion, towards which, however, the following fluorescent tances act as sensitisers:—fluorescein and its chloro-, ao- and iodo-derivatives, anthracenedisulphonic and raquinonedisulphonic acids, acridine, benzoflavine, ylquinaldine, quinine and possibly also resculin. he other hand, phenosafranine, fluorindinedisulphonic , methylene blue and harmaline are without influence. e exceptions are more numerous than in the action of resent compounds on cells, enzymes and potassium le; and further, those substances which do possess ence on the latter have an order of activity different i that shown in their action on mercuric oxalate.*

*ne fluoresceins (sodium salts) have a sensitising ence on Eder's reaction also in an atmosphere of ogen, and the reaction can be made extraordinarily tive in presence of eosin.*—T. H. P.

# ENGLISH PATENT.

*ographic Plates and Films; Impts. in* —. Sandell lms and Plates, Ltd., South Norwood, and L. Smith, ydon. Eng. Pat. 9246, May 2, 1905.

*YTIBLE support is coated first with a "slow" emul- rendered sensitive by addition of a suitable dyestuff*

*(e.g., Erythrosin), and this emulsion, when dry, is coated with one or more layers of emulsion of gradually increasing speed and sensitiveness, so that the fastest and most highly colour-sensitive layer (i.e., that sensitised to reproduce the least actinic rays of the spectrum) is uppermost. The upper layers may be impregnated with, for example, a mixture of Erythrosin and Nitrophenine. Such films are stated to be quite free from halation, and to reproduce colour values more correctly than the plates or films prepared with a single layer of emulsion (see also U.S. Pat. 746,594 of 1903; this J., 1904, 35).*—T. F. B.

# FRENCH PATENT.

*Photographic Compositions; Base or Support for Sensi- tive* —. J. Findlay. Fr. Pat. 352,046, March 4, 1905.  
*Under Int. Conv., March 11, 1904.*

*SEE Eng. Pat. 5948 of 1904; this J., 1905, 512.*—T. F. B.

## XXII.—EXPLOSIVES, MATCHES, Etc.

# UNITED STATES PATENT.

*Matches; Igniting Composition for* —. O. Dieffenbach and E. C. Marburg, Griesheim, Assignors to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pat. 795,587, July 25, 1905.

*SEE Fr. Pat. 333,816 of 1903; this J., 1904, 36.*—T. F. B.

# FRENCH PATENTS.

*Explosives possessing High Disruptive Power.* N. Ceipek. Fr. Pat. 351,667, Feb. 16, 1905.

*SEE Eng. Pat. 14,480 of 1904; this J., 1905, 456.*—T. F. B.

*Glycerin; Process for Nitrating* —. Dynamit Act.-Ges. vorm. A. Nobel and Co. Fr. Pat. 351,454, Feb. 11, 1905.

*The waste acids from nitroglycerin manufacture usually contain so low a proportion of nitric acid that they are not regenerated, but denitrated. Claim is made for a method of regeneration whereby the yield of nitroglycerin is sensibly increased. 200 grms. of a fresh nitrating acid of the composition: sulphuric acid, 60 per cent.; nitric acid, 30 per cent.; water, 10 per cent., gives with 100 grms. of glycerin a yield of 201 grms. of nitroglycerin. If 450 grms. of spent acid from a previous nitration be mixed with the same weight of fresh acid so that the mixture has the composition indicated above, a yield of 228 grms. of nitroglycerin is obtained with this 900 grms. of acid from 100 grms. of glycerin. Acid which has been used and regenerated three times gives under similar conditions a yield of 226 grms. 1200 grms. of a regenerated acid of the composition: sulphuric acid 56.7 per cent., nitric acid 28.3 per cent., water 15.0 per cent. gives with 100 grms. of glycerin a yield of 218 grms. of nitroglycerin. It is also stated that the process of nitration is rendered less dangerous by the use of regenerated acids.*—G. W. McD.

*Nitroglycerin Explosives; Method for Preventing the Freezing of* —. Westfälisch-Anhaltische, Sprengstoff Act.-Ges. Fr. Pat. 351,805, Feb. 25, 1905.

*THE addition of from 15 per cent. to 25 per cent. of dinitromonoehlorhydrin to nitroglycerin explosives is claimed in order to prevent freezing at low temperatures. For this purpose it is said to be superior to dinitroglycerol. There is no danger in manufacture, and the compound is very stable.*—G. W. McD.

*Safety Explosives [Chlorate and Perchlorate]; Method of Manufacture of* —. G. Grobet. Fr. Pat. 351,793, Feb. 24, 1905.

*CLAIM is made for the use of volatile hydrocarbons (turpentine, benzene, petrol) in explosives of the chlorate type. Volatilisation of these bodies is prevented by mixing them with tallow and resin. The tallow is melted and is then mixed with an equal weight of a solution consisting of equal parts of colophony and petrol. From 8 to 12*





tic acids, and is probably in the form of an oxide, precipitate while still moist, or after drying at 100° C., as a yellow solution gradually changing to violet with sulphuric acid, and a green solution with acetic acid. After being heated in air at 440° C., it dissolves sulphuric acid with a violet colour, and after heating 300° C., it gives a blue solution.—A. S.

*Electrolytic Determination of — for Technical Impurities.* K. Jeno. Chem.-Zeit., 1905, 29, 803—804.

adaptation of the method devised by v. Foregger-Hoffmann, the principle of which is the electrolysis of strong sodium hydroxide solution of the zinc, to ores, dusts, &c. The author's process is as follows:—1 gram. of the substance is dissolved in *aqua regia*, the solution evaporated to dryness, 1—2 c.c. of 1:1 sulphuric acid added, and the mixture evaporated till white fumes appear. After cooling, the solution is diluted with water, heated to boiling, and the lead and insoluble matter filtered off. It is possible, with practice, to keep the filtrate and washings down to 100 c.c. Solid sodium hydroxide (4—7 grms.) is then added, and allowed to dissolve completely, the solution is heated to 50° C., and used into a coppered platinum basin for electrolysis (nickel basin may be used). The temperature is kept at 50° C. by a small burner, and the solution is electrolysed for 1½—2 hours, with a current of 1 ampère at 3—8 volts. The end is shown by hanging a small copper plate in the liquid in contact with the basin for some minutes, when no zinc should be deposited on it. The basin is first washed without interrupting the current, then with water and acid-free alcohol, dried in the air for a couple of minutes, and left in the desiccator for weighing. It may be advantageous to add from time to time a few drops of water to allow for evaporation, thus avoid exposure of the upper edge of the zinc deposit. The deposit can be removed by very dilute hydrochloric acid without affecting the copper. Duplicate analyses agree very closely, and the maximum difference between this method and the gravimetric (weighing as residue in Rose crucible), in a large number of ores consisting from 12 to 35 per cent. of zinc was 0.3 per cent. In an experiment, in which compounds of iron, aluminium and manganese were added to pure zinc sulphate, we observed that the precipitated hydroxides do not interfere with the electrolysis.—J. T. D.

*Found in Pharmacopoeial Chemicals; Occurrence and Determination.* C. A. Hill. XX., page 901.

### ORGANIC—QUALITATIVE.

*Guaiacum Resin; Reactions of — [with Ferric Salts].* P. Petit and Mayer. Comptes rend., 1905, 141, 193—195.

When in hydrogen, guaiacum gives a blue colour with excess of ferric or manganic salts, or with silver salts; but action to ferrous or manganous salt, or to metallic iron occurs. Ferrous chloride does not give the blue colour, which appears, however, if the liquid be exposed to air; manganous chloride does not give it even in absence of air, but addition of sodium hydroxide causes it to appear, or the substitution for manganous chloride of the lactate or acetate. Citric acid completely prevents the production of the colour by ferric salts. Tincture of guaiacum in an atmosphere of hydrogen dissolves ferrous, manganous and manganic oxides; the ferrous solution turns blue in the air, the manganous solution only in presence of hydrochloric or acetic acid, the manganic solution if a trace of hydrogen peroxide be added. When ferric oxide is dissolved in tincture of guaiacum, the blue colour is only produced if the solution be rich in alcohol or if a great deal of it be used. It seems as though there was a blue compound of ferric oxide and guaiacum, soluble in alcohol, but only slightly in water. The blue colouring matter, whether obtained with ferric, manganic, or silver salts, is soluble in alcohol, chloroform, but only slightly in benzene; the solutions lose their colour. The sensitiveness of the reaction with all these salts is greatly reduced by the presence of albumin, and then depends on the acidity; the

addition of lactic acid diminishes the amount of ferric salt needed to produce a given depth of colour.—J. T. D.

### ORGANIC—QUANTITATIVE.

*Sugar; Influence of Invert Sugar on the Determination of Crystallisable —.* M. Carimantrand. Bull. Soc. Chim., 1905, 33, 795—799.

The author has found, contrary to the opinion expressed by A. Girard, Lepage and C. Barty, that uncrystallisable sugar diminishes the rotatory power of crystallisable sugar with which it is mixed in low products and particularly in cane molasses, and that there is an analogy between the crystallisable sugar inverted by means of an organic acid and that contained normally in cane sugars. The method consists in preparing a syrup of invert sugar of known strength and mixing it with pure sugar syrup. The mixture is then subjected to examination by the polarimeter. The invert sugar is made by dissolving 5 grms. of tartaric acid in 500 c.c. of water, which is maintained at the boiling temperature, while 1 kilo. of sugar is dissolved in it and the heating continued for half an hour, the water evaporated being replaced by cold water. At the end of this time the inversion is complete. As in invert sugar produced with mineral acids, the rotatory power diminishes with increase of temperature. The inversion of pure sugar by tartaric acid is most rapid and complete when the solution is about 35°—36° B. It is slow with 10 per cent. solutions and nil with cane molasses containing a large proportion of invert sugar. A solution containing 20 grms. of sugar treated with 5 grms. of tartaric acid per litre on June 1st, at 20°—25° C., was completely inverted on Aug. 3rd. The proportion of uncrystallisable sugar in raw sugars being almost always below 5 per cent., the inversion with hydrochloric or tartaric acid is useless, since this quantity does not modify the rotation of sugar. On the contrary, when the proportion reaches 10 to 20 per cent., the Clerget method must be used, after defecation with basic acetate of lead.—L. J. DE W.

### XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Radio-Activity; Further Notes on —.* W. H. Martindale. Brit. Pharm. Conf., Brighton, 1905. Pharm. J., 1905, 75, 149—152.

AFTER reviewing recent work on radio-activity, the author draws attention to the desirability of paying more attention to the comparatively cheap radio-active uranium and thorium compounds. Commercial thorium hydroxide is usually very active, more so than the nitrate. The author has prepared the following organic salts of thorium:—Salicylate ( $\text{HO.C}_6\text{H}_4\text{COO}$ )<sub>2</sub>ThO, cinnamate ( $\text{C}_6\text{H}_5\text{CH:CH.CO}$ )<sub>2</sub>Th, orthocoumarate ( $\text{HO.C}_6\text{H}_4\text{CH:CH.CO}$ )<sub>2</sub>Th, oleate, lactate, paraphenylsulphonate, camphorsulphonate,  $\text{Th(C}_{10}\text{H}_{15}\text{O.SO}_3)_4 \cdot 9\text{H}_2\text{O}$ , glycerylphosphate, quinate and acid urate. The salicylate, cinnamate, orthocoumarate, glycerylphosphate and acid urate were prepared by double decomposition between thorium nitrate and the sodium salt of the acid in question; the other salts were obtained by the action of the acid on thorium hydroxide. The relative radio-activity of the different compounds is shown in the following table:—

	Scale Division.	Minutes.
Thorium lactate .....	3	3½
„ hydroxide (moist) .....	3	5
„ paraphenylsulphonate .....	3	6
„ salicylate .....	3	7
„ oleate .....	3	15
„ orthocoumarate .....	3	15
„ acid urate .....	3	16
„ cinnamate .....	3	19

—A. S.



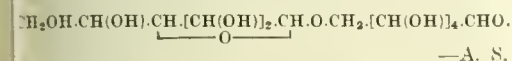


On heating a solution of tetramethyldextrose in benzene containing 0.33 per cent. of hydrochloric acid in a sealed be at 105°—115° C., water was separated, the rotatory power of the solution gradually increased, and the cupric-reducing power almost entirely disappeared. The rap obtained from the solution was purified by distillation under reduced pressure, the octamethylated mecharide produced distilling at 180°—190° C. at mm. pressure. Analysis of the compound showed it to be an octamethylidextrose anhydride. It had a specific rotation of 135.9° in methyl alcoholic solution, and had practically no action on hot Fehling's solution, was readily hydrolysed by dilute hydrochloric acid with production of tetramethyldextrose. The case with such the compound is hydrolysed by dilute acid and the sense of cupric-reducing power indicate that the constitution of the compound is best represented by Formula

This formula may represent three stereoisomeric forms, namely, the  $\alpha\alpha$ -,  $\beta\beta$ - and  $\alpha\beta$ -modifications, since each of the glucoside groups can exist in the so-called  $\alpha$ - and  $\beta$ -forms. The authors' product is probably a mixture of the three modifications.

Further experiments on the methylation of sucrose by the method previously described (*loc. cit.*) confirmed the view that the product obtained is an octamethylsucrose, which on hydrolysis yields a mixture of the tetramethyl compounds of dextrose and levulose, although the pure compounds, except tetramethyldextrose, were not isolated.

By the methylation of maltose, a neutral, rather viscous and devoid of cupric-reducing power was obtained, it is probable that the free aldehyde group in maltose is oxidised by the silver oxide during the methylation, and is subsequently methylated. From the products of hydrolysis of the methylated compound by dilute hydrochloric or sulphuric acid, tetramethyldextrose was isolated and this serves to confirm the correctness of Fischer's formula for maltose.



*fermentation; Lactic and Alcoholic* — in the *Tissues of Plants, and Enzymes which cause this Fermentation*. I. Stocklasa. Congrès Chim. Pharm. Liège, 1905, 35—141.

The enzymes obtained from mangolds and potatoes when led to sterilised solutions of glucose, gave rise to lactic acid alcoholic fermentation. The amounts of lactic acid, carbon dioxide, alcohol and acetic acid produced, were determined, and are given in a table. Formic acid and hydrogen are also produced.

In the breaking down of glucose, carbon dioxide is eliminated with production of lactic acid, after which methyl alcohol, acetic acid, methane and formic acid are produced, along with carbon dioxide and hydrogen, the hydrogen being oxidised to water. The fermentation is due to the enzymes alone, without co-operation of bacteria. —N. H. J. M.

*Quebracho Tannin*. M. Nierenstein. Collegium, 1905, 69—71.

Quebracho (*Loxopterygenium Lorenzii*, Sr.) contains, besides ellagic and gallic acids, about 20 per cent. of a valuable tannin substance of the catechol series. From the results of an examination of this tannin substance, the author concludes that it probably consists of a mixture of three catechol-tannins having protocathechuic acid as a common component. One gram. of the tannin substance was fused at 210°—220° C. with 5 grms. of caustic potash for 35 minutes. The product was neutralised with sulphuric acid, and, after filtering, extracted with ether. The residue left, after evaporating the ether, was dissolved in a little hot water, treated with acetic acid, the precipitate decomposed with dilute sulphuric acid, and the solution extracted with ether. The residue left, after expelling the ether, was dissolved in water and the solution allowed to crystallise, when small needles of protocathechuic acid were obtained. The

red solution was extracted with ether, the ether solution evaporated and the residue dissolved in water. In the solution the presence of phloroglucinol was detected. After some time, crystals separated, which after recrystallisation from benzene were identified as resorcinol. Quinol (hydroquinone) was probably also among the decomposition products formed on fusion with caustic potash. An attempt was next made to separate the different constituents of the quebracho tannin by means of their bromine derivatives. Ten grms. of the tannin were dissolved in three litres of water and the colouring matter was precipitated by 25 c.c. of a 30 per cent. solution of lead acetate. To the filtrate, bromine water was added, drop by drop, and, after standing for 24 hours, the precipitated bromine compound was collected and purified by crystallisation from a mixture of one part of acetone and two parts of alcohol. The compound had a composition corresponding to the formula  $\text{C}_{16}\text{H}_{14}\text{BrO}_8$  and contained two methoxyl groups. One gram. of the bromine compound was dissolved in 30 c.c. of alcohol and boiled for five hours under a reflux condenser with 7.5 grms. of caustic potash dissolved in 50 c.c. of alcohol. The alcohol was then expelled by steam, the solution neutralised with dilute sulphuric acid, and extracted with ether. The ether solution was evaporated, the residue dissolved in a small quantity of water, and the solution treated with lead acetate. The precipitate was decomposed by sulphuric acid, the solution extracted with ether, and the ether solution evaporated. The residue, after crystallising from water, was separated into two portions by treatment with chloroform, the insoluble portion being free from bromine and consisting of isovanillic acid, whilst the solution contained the monobromo derivative of an acid which the author terms *quebrachylic acid*. Monobromoquebrachylic acid,  $\text{C}_8\text{H}_7\text{BrO}_4$ , crystallises from chloroform in small needles, melting at 119°—120° C., soluble in sodium carbonate solution, and giving no coloration with ferric chloride. When fused with caustic potash it yields monobromoresorcinol. —A. S.

## New Books.

A SYNOPSIS OF THE PRINCIPAL CHANGES IN THE UNITED STATES PHARMACOPOEIA EFFECTED BY THE 8TH DECENNIAL REVISION, 1900—official from September 1st, 1905, compared with that of 1890, and the British Pharmacopoeia, 1898. By W. HARRISON MARTINDALE, Ph.D. H. K. Lewis, 136, Gower Street, London, W.C. Price, 2s.; post free, 2s. 1d.

CROWN 8vo pamphlet with preface, three pages, and text filling 36 pages.

METHODS OF CHEMICAL CONTROL IN CANE SUGAR FACTORIES. By H. C. PRINSEN GEERLIGS, Director of the West Java Sugar Experiment Station, Pekalongan, Java. Norman Rodger, Altrincham, Manchester. 1905. Price 3s. 6d. net.

8vo volume containing preface and text with numerous tables, filling 86 pages. The scheme of the work will appear from the following headings:—I. DAILY REPORT. Analytical Methods. (i) Cane. (ii) Bagasse. (iii) First and last Mill Juice. (iv) Mixed Juice. (v) Clarified Juice and Filter Press Juice. (vi) Filter Press Cakes. (vii) Syrup. (viii) Massecuites. (ix) First Molasses. (x) Exhausted Molasses. (xi) Sugar. Calculations. II. MONTHLY REPORT. Analysis. III. FINAL ACCOUNT OF SUCROSE EXTRACTED AND LOST. Laboratory Requirements. IV. TABLES. V. MODELS OF BOOKS (to be kept). VI. PLATE AS TABLE FOR THE QUOTIENT OF PURITY OF MASSECUITES AND MOLASSES.

ON SILK AND THE SILKWORM. M. ARBOUSSET. Translated by ELIZABETH WARDLE, and Edited by her Father, Sir THOMAS WARDLE, President of the Silk Association of Great Britain and Ireland. W. H. Eaton, The Moorlands Press, Derby Street, Leek. 1903. Price, 2s. 6d. net.

SMALL Svo volume containing frontispiece portrait of Laurent de l'Arbousset. Preface by Sir Thos. Wardle, and 283 pages of subject matter, with a table of contents as index. The work is a practical treatise on sericulture.

MONOGRAPHIEN UEBER ANGEWANDTE ELEKTROCHEMIE. Bd. XIX. I. DIE ELEKTROLYTISCHE CHLORAT-INDUSTRIE. von JOHN B. C. KERSHAW. Ins Deutsche übertragen von Dr. MAX HUTH, Chemiker der Siemens und Halske A.-G., Berlin. Wilhelm Knapp's Verlag. Halle a. S. 1905. Price, M. 6.

Svo volume containing preface by the author, and 123 pages of subject matter, illustrated with 39 engravings. The subject is subdivided as follows:—I. Historic review. II. Chemical and electrochemical phenomena in the Electrolytic preparation of Chlorates. III. Processes and Apparatus employed in the Manufacture of Chlorate, &c. IV. The Crystallising Process. Properties and Employment of Chlorate. V. Production, Yield, Costs. VI. Preparation of Sodium Chlorate, Perchlorates, Bromates and Iodates by electrolysis. VII. Analysis of the Chlorate liquors and Final Products.

ELEKTROLYTISCHE VERZINKUNG. von SHERRARD COWPER-COLES. Ins Deutsche übertragen von Dr. EMIL ABEL. Wilhelm Knapp's Verlag, Halle a. S. 1905. Price, M. 2.

Svo volume, containing 37 pages of subject matter, with 36 illustrations. The subject is subdivided as follows:—I. Introduction. II. Preparing of the metal for zinc plating. III. Arrangement, &c., of the Electrolytic cells, and the Electrolysis.

INDEX TO REPORTS OF H.M. DIPLOMATIC AND CONSULAR REPRESENTATIVES ABROAD ON TRADE AND SUBJECTS OF GENERAL INTEREST (WITH APPENDIX), 1904. [Cd. 2578.] Price 1s. 3d. Wyman and Sons, Fetter Lane, E.C.

The index, which is a volume of 292 Svo pp., covers the various consular reports issued by the Foreign Office during 1904. It concludes with an appendix giving a list of the Reports and the price of each.

ANNUAL STATEMENT OF THE TRADE OF THE UNITED KINGDOM WITH FOREIGN COUNTRIES AND BRITISH POSSESSIONS, 1904. Vol. II. [Cd. 2626.] Price, 4s. 3d.

This is the second volume of the Annual Statement of Trade, the first volume having been noticed on p. 520 of the *Board of Trade Journal* of the 15th June. This volume contains statements of the trade of the United Kingdom with each foreign country and British Possession

during the years 1900—04, and of the imports and exports at each British port during the same period, as well as accounts of transshipment, warehousing, and goods passing in transit.

## ROYAL COMMISSION ON COAL SUPPLIES.

FIRST REPORT OF THE ROYAL COMMISSION ON COAL SUPPLIES. Vol. II. MINUTES OF EVIDENCE AND APPENDIX, 1903. Price, 3s.

CONTAINS Table of Contents, List of Witnesses, Questions Addressed to Witnesses on the Limit of Depth in Mining with list of Witnesses who gave evidence thereon; List of Questions on the Minimum Thickness of Workable Seams of Coal, and list of Witnesses thereon; Lists of Questions on Waste in Working, and Witnesses thereon. Subject matter (evidence given) filling 344 pages, and Alphabetical Index.

SECOND REPORT OF THE ROYAL COMMISSION ON COAL SUPPLIES. Vol. I. THE REPORT, 1904. Price, 1d.

Royal Warrant, Appointment of Additional Commissioner and Report, 3 pages.

SECOND REPORT OF THE ROYAL COMMISSION ON COAL SUPPLIES. Vol. II. MINUTES OF EVIDENCE AND APPENDICES. Printed for His Majesty's Stationery Office by Wyman and Sons, Ltd., Fetter Lane, London E.C., 1904. Price, 3s. 5d. Eyre and Spottiswood, East Harding Street, Fleet Street, E.C. Oliver at Boyd, Edinburgh, or E. Ponsonby, 116, Grafton Street, Dublin.

THIS Report contains (1) List of Witnesses examined (2) Scheme adopted by the Commission for dealing with the question of possible economies; (3) Minutes of Evidence, filling 367 pages; and seven Appendices, follows:—I. List of Witnesses. II. Letter from Board of Agriculture and Fisheries with reference to the possible effect of increased production upon the price of Ammonium Sulphate. III. Memorandum by Mr. Bennett H. Brown on the Use of Blast Furnace Gas. IV. Analysis of Natural Gas at Heathfield, Sussex, by Prof. H. B. Dix and Dr. W. A. Bone. V. Report on the Cost of Ruani Producer Gas Plant at Messrs. Cadbury's Works, Bournville. VI. Briquettes. VII. Feet. The volume ends with an Alphabetical Index of Subjects.

## Trade Report.

### I.—GENERAL.

MEXICO; CUSTOMS TARIFF OF —.

*Bd. of Trade J., Aug. 3 and 10, 1905.*

The following is a list of some of the items in the Customs Tariff of Mexico:—

No.	Articles.	Unit.	Duty.
14	Animal fats, not specified .....	Kilo. gross.	Pesos. ct.
28	Hides and skins, untanned, not specified .....	100 kilos. gross	0 0
46	Animal wax .....	Kilo. net	3 5
47	Glue .....	Kilo. gross	0 5
51	Stearine in cakes .....	Kilo. gross	0 0
52	Glycerin .....	Kilo. gross	0 1
62	Calf skins, patent leather, kid skins, chamois and other common skins tanned, not specified .....	—	Free
63	Sole leather .....	Kilo. legal	1 6
82	Candles of wax .....	Kilo. legal	1 0
83	Candles of spermaceti, stearine, and of tallow, pressed or not .....	Kilo. gross	0 7
107	Oleaginous seeds and fruits, not specified .....	Kilo. gross	0 2
125	Sugar, common, candy sugar, and refined sugar of all kinds .....	Kilo. gross	0 0
134	Gums, resins and natural balsams, not specified .....	Kilo. gross	2 6
136	Cocoa-nut oil, linseed oil, maize and cottonseed oil, in ship tanks or cart tanks .....	100 kilos. gross	0 1
137	Cocoa-nut oil, linseed oil, maize and cottonseed oil, in drums or tins .....	Kilo. legal	0 1
140	Oil of turpentine and turpentine .....	100 kilos. net	5 5
141	Vegetable tar and colophony .....	Kilo. gross	0 C
144	Gum arabic, copal, damar, pounce or sandarac, lac, senegal and tragacanth .....	Kilo. legal	0 1



	Articles.	Unit.	Duty.
1	Gold, silver or platinum in ores, in bullion for coining or in dust .....	—	Free
5	Bronze, brass and white metal, in ingots or granulated .....	Kilo, gross	0 05
6	Copper in ingots or granulated, ores of copper, unworked, and copper matte .....	—	Free
7	Copper, brass, bronze and white metal, in bars .....	Kilo, gross	0 13
7	Tin in bars or in the rough .....	Kilo, legal	0 10
8	Ingots and alloys of lead and antimony, for printing type .....	—	Free
8	Lead in bars, pigs or ingots .....	Kilo, gross	0 04
1	Zinc in ingots, filings, granulated or wire .....	—	Free
2	Manufactures of tin, zinc, and of alloys of zinc, lead and tin, not specified .....	Kilo, legal	0 30
3	Manufactures of lead, not specified .....	Kilo, legal	0 10
3	Ferromanganese, containing 25 per cent. or more of manganese .....	100 kilos, gross	1 50
4	Asbestos in fibre or powder, emery in powder or lumps, marble or alabaster, in the rough or in powder, pumice stone, lava in the rough, gypsum and stucco .....	Kilo, gross	0 01
5	Clay, sand or moulding sand, fire clay, rottenstone, and tripoli .....	—	Free
5	Jet, unwrought .....	Kilo, legal	0 25
7	Sulphur .....	—	Free
7	Lime, hydraulic lime, cement (Roman or Portland), and carbonate of lime or Spanish white .....	100 kilos, gross	0 55
9	Coal .....	—	Free
9	Carbonates of lime, of barytes, or of strontia, and peroxide of manganese .....	100 kilos, gross	3 30
9	Spar .....	Kilo, gross	0 10
9	Marble and alabaster sawn into slabs, not polished .....	Kilo, gross	0 05
9	Mineral stone of all kinds .....	—	Free
9	Plumbago .....	Kilo, gross	0 06
9	Talc .....	Kilo, legal	0 04
9	Mineral oil, unrefined .....	100 kilos, net	3 30
9	Mineral oil, refined, benzine, mineral wax, and paraffin .....	Kilo, legal	0 09
9	Coal tar and asphalt .....	Kilo, gross	0 04
9	Coke .....	—	Free
9	Vaseline .....	Kilo, gross	0 11
9	Paving stones and slabs .....	—	Free
9	Manufactures of earthenware, cement, and lava, not specified .....	Kilo, gross	0 05
9	Paraffin candles .....	Kilo, gross	0 20
9	Crayon and chalk .....	Kilo, legal	6 15
9	Bricks, slabs, tiles, ridge tiles, ventilators, and tubes of earthenware .....	Thousand	2 75
9	Slabs of cement or artificial stone, even with coloured designs .....	Kilo, gross	0 01

# V.—TEXTILES, YARNS, AND FIBRES.

## SILK; EXCESSIVE WEIGHTING OF —.

*U.S. Cons. Rep. No. 2312, July 19, 1905.*

Japanese Government has adopted stringent regulations to prevent the continuance of excessive weighting, and recently issued an order on the subject, referring particularly to the silk fabric known as "habutai," quantities of which are exported from Japan. The order is as follows:—

Weight of habutai intended for export must not be used by dampening. In the manufacture of habutai of the following articles may be used: Magnesium, sugar. The minister of commerce and industry is required to extend this list of prohibited materials. Manufactured contrary to these regulations may be sold, transferred, or exported. The manufacturer attach to every piece a label bearing the name of the factor, where and when made, giving the year, month, and day, also the number of the piece. Each factor is required to keep a record of every piece made, giving the year, month, and day of delivery, of piece, and weight of the unfinished habutai, the year, month, and day when finished, the weight of habutai after the process of finishing, and the weight of the goods when offered for sale. Each book be kept at least a year after the last entry in it has been made. The firms engaged in the export of habutai are required to submit their books and stock to the inspection of officers authorised for that duty. Whoever violates any of these regulations or makes false entries in his books will be punished by a fine of at least 25 yen (about \$12.50). The proprietor of an establishment will be responsible for the acts of his agents or employees.

## X.—METALLURGY.

### PIG IRON PRODUCTION IN AMERICA.

*Eng. and Mining J., Aug. 5, 216.*

Production of bituminous coal and coke pig iron in the first six months of 1905 was 10,162,488 gross tons; of anthracite and coke mixed, 815,028 tons; of anthracite and coke, 15,147 tons; of charcoal iron, 170,512 tons. Production of spiegeleisen ferro-manganese, ferro-phosphorus, and ferro-bessemer in the first half of 1905 was 29,040 gross tons, against 105,882 tons in the last half of 1904 and 114,510 tons in the first half of 1904.

The production of ferro-manganese alone in the first half of 1905 amounted to 35,221 tons, against 30,535 tons in the last half of 1904 and 26,541 tons in the first half of that year. The production of spiegeleisen alone in the first half of 1905 amounted to 90,113 tons, against 74,705 tons in the last half of 1904 and 87,665 tons in the first half of that year. The production of ferro-phosphorus in the first half of 1905 amounted to 1206 tons, against 642 tons in the last half of 1904 and 304 tons in the first half. In the first half of 1905 there were made 2,500 tons of ferro-bessemer pig iron, but in neither half of 1904 was iron of that character reported to the association.

The whole number of furnaces in blast on June 30, 1905, was 294, against 261 on Dec. 31, 1904, and 216 on June 30, 1904. The number of furnaces idle on June 30, 1905, was 138. Of the active furnaces on June 30, 1905, 229 used bituminous fuel, 39 used anthracite coal and coke mixed, three used anthracite coal alone, and 23 used charcoal alone.

During the first six months of 1905 the number of furnaces actually in blast during a part or the whole of the period was 334, as compared with 297 during the last half of 1904 and 295 during the first half of that year.

On June 30, 1905, there were 11 furnaces in course of construction, of which 10 will use bituminous fuel when completed and one will use charcoal. Of the bituminous furnaces two are being built in New York, two in Pennsylvania, one in Virginia, one in Tennessee, one in Alabama, two in Ohio, and one in Colorado. The charcoal furnace is being built in Michigan.

### LEAD; PRODUCTION OF—IN BRITISH COLUMBIA.

*U.S. Cons. Rep. No. 2318, July 26, 1905.*

The total production of lead in British Columbia for the fiscal year ending June 30, 1905, is 27,871 tons. For the year 1904 the production was 18,323 tons; 1903, 9044; 1902, 11,268; 1901, 25,791; 1900, 31,674. The figures tell of an industry which had dwindled to less than one-third of its top production in three years and which, in two years more, through the bounty, has almost regained its old position.

Of the 27,871 tons produced this year, 11,090 tons have been exported, while the remainder, nearly 17,000 tons, has been smelted in British Columbia. The rate of bounty paid varies with the London price, and is less for exported lead than for that treated locally, viz., 10 dols. a ton in the first case, 15 dols. in the second. The value of the total production of lead in British Columbia in 1904

amounts to 1,421,374 dols., while the combined product of lead in all the other Provinces of Canada is given as 215,546 dols.

## XII.—FATS, FATTY OILS, Etc.

### OLIVE OIL AT MALAGA, SPAIN.

*For. Off. Ann. Series, No. 3458.*

The quantity of olive oil shipped from Malaga during 1904 was greater than in any previous year since 1898. This is attributable to the poor crops experienced in all oil-producing countries, with the exception of Spain, where the yield was good both as regards quantity and quality. The oil shipped from this port is used chiefly for manufacturing purposes, being shipped to the United Kingdom, all European countries and the United States.

There is an increasing demand for olive oil foots (aceite de orujo), that is oil obtained by the treatment of the orujo or remains of the olives after the oil has been expressed by the ordinary processes. The oil produced here is said to be superior to that placed on the market hitherto, being almost neutral and free from sulphurous odour. The oil, which is used principally in the manufacture of soap, finds its chief market in the United States, the demand from there being alone three times as great as the present production of the whole of Andalusia. Germany also takes considerable quantities, but very little is exported to the United Kingdom, where other fats seem to have the preference in connection with the manufacture of soaps.

## XVII.—BREWING, WINES, SPIRITS, Etc.

### DUTY FREE SPIRITS.

*Inland Revenue Report, Aug., 1905.*

The amount of spirits used free of duty in connection with arts and manufactures under the Finance Act, 1902, increased considerably during the year 1904-5, as the following table shows:—

Year ended March 31.	Use.	Spirit.
		Proof galls.
1902-03	Arts and Manufactures .....	341
	Scientific (Universities, Hospitals, &c.) .....	358
		699
1903-04	Arts and Manufactures .....	206,452
	Scientific (Universities, Hospitals, &c.) .....	2,272
		208,724
1904-05	Arts and Manufactures .....	267,706
	Scientific (Universities, Hospitals, &c.) .....	2,680
	Proof galls. ....	270,386

## Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

### I.—PLANT, APPARATUS, AND MACHINERY.

- [A.] 15,781. Beynon. Machinery for pulverising, crushing and the like. Aug. 2.  
 „ 15,808. Wüstenhöfer. Disintegrating mills.\* Aug. 2.

- [A.] 15,818. Le Maitre. Manufacture of agglomerated paint material, fuel, briquettes and the like. Aug. 2.  
 „ 15,828. Radford (Currie). Filter presses. Aug. 2.  
 „ 15,838. Sieurin. *See under* 11.  
 „ 15,932. Hunter. Method of and means for treating or purifying certain liquids or substances. Aug. 3.  
 „ 16,035. Hargreaves. Heating and evaporating solutions and apparatus therefor. Aug. 5.  
 „ 16,087. Hausmann. Crucible furnaces.\* Aug. 1.  
 „ 16,144. Nicholas. Rotary filtering apparatus for the separation of liquids or solutions from tailing slimes, sewage, and the like. Aug. 8.  
 [C.S.] 17,097 (1904). Wills. Furnaces. Aug. 10.  
 „ 17,098 (1904). Wills. Furnaces. Aug. 10.  
 „ 17,435 (1904). Heymann, Hey, Smith, Mitche and Askham. Apparatus for separating and condensing the vapours of volatile liquid. Aug. 16.  
 „ 17,437 (1904). Heymann and others. Method of plant for removing grease and other impurities from woollen and other materials. Aug. 16.  
 „ 18,488 (1904). Lennox. Evaporators, also applicable for smoke washing. Aug. 16.  
 „ 18,922 (1904). Komata Reefs Gold Mining Co. (Brown). Apparatus for mixing or circulating materials in a liquid or semi-liquid state. Aug. 10.  
 „ 21,644 (1904). Howatson and Boby. Filter. Aug. 10.  
 „ 6235 (1905). Zagst. Temperature alarm for liquids. Aug. 10.  
 „ 10,947 (1905). Sauerbrey. Vacuum evaporator with heating and evaporation in separate chambers. Aug. 10.

### II.—FUEL, GAS, AND LIGHT.

- [A.] 15,818. Le Maitre. *See under* I.  
 „ 15,838. Sieurin. Rotary kilns for generation of gas, roasting and the like. Aug. 2.  
 „ 15,907. Samner. Liquid fuels. Aug. 3.  
 „ 15,961. Adeock. *See under* XII.  
 „ 16,018. Reeser. Incandescent bodies and method of making the same. Aug. 4.  
 „ 16,050. Davis. Apparatus for generating gas from gasolene. [U.S. Appl., Aug. 8, 1904.]\* Aug. 10.  
 „ 16,182. Soc. Anon. des Combustibles Industriels. Oxidation of hydrocarbons. [Fr. Appl., Dec. 1904.]\* Aug. 8.  
 „ 16,298. Forbes. Prepared carbides for acetylene lamps, generators and the like. Aug. 10.  
 „ 16,386. Koppers. Treatment of gases obtained from dry distillation or gasification of fuel. Aug. 11.  
 [C.S.] 18,488 (1904). Lennox. *See under* I.  
 „ 20,138 (1904). Galloway. Absorbent non-combustible material for burning hydrocarbon and other liquid fuels. Aug. 16.  
 „ 3245 (1905). Schmidt and Desgray. Producer furnaces. Aug. 10.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [C.S.] 15,646. Brunck. *See under* VII.

### IV.—COLOURING MATTERS AND DYE-STUFFS.

- [A.] 15,763. Johnson (Badische Anilin und Soda Fabrik). Manufacture of intermediate compounds and colouring matters containing sulphur. Aug. 10.



- [A.] 16,012. Deutsche Gold- und Silber-Scheide-Anstalt, vorm. Rössler. Manufacture of indigo leuco bodies. [Ger. Appl., Aug. 13, 1904.]\* Aug. 4.
- " 16,227. Inray (Farbw. vorm. Meister, Lucius und Brüning). Manufacture of blue colouring matters of the quinoline group and photographic surfaces sensitised therewith. Aug. 9.

- [C.S.] 21,638 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters and of intermediate products. Aug. 10.
- " 22,735 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture and production of azo colouring matter. Aug. 16.
- " 23,198 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture and production of rhodamine colouring matters and of intermediate products relating thereto. Aug. 16.
- " 853 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of a new compound and of colouring matters therefrom. Aug. 10.
- " 1675 (1905). Newton (Bayer und Co.). Manufacture of azo dyestuff and of intermediate products. Aug. 10.
- " 1818 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture and production of colouring matters of anthracene series. Aug. 16.
- " 2228 (1905). Shillito (Aniline Colour and Extract Works, formerly J. R. Geigy). Manufacture of azo colouring matters. Aug. 10.

#### V.—PREPARING, BLEACHING, DYEING, RINING AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 16,159. Quackenbos. Process for cleaning wool and recovering the elements.\* Aug. 8.
- [S.] 17,437 (1904). Heymann and others. *See under I.*
- " 18,056 (1904). Rhodes. Apparatus for dyeing and otherwise treating with liquids, wool, yarn, and other fibrous materials. Aug. 10.
- " 18,488 (1904). Lennox. *See under I.*
- " 8160 (1905). Blanck. Finishing machine for textile and like fabrics. Aug. 10.
- " 12,246 (1905). Moore. Sheets of embossed fibrous material and method of making same. Aug. 10.
- " 12,247 (1905). Moore. Apparatus for forming designs on opposite surfaces of a sheet of fibrous material. Aug. 10.

#### I.—COLOURING WOOD, PAPER, LEATHER, ETC.

- [A.] 16,316. Kornmann. Method of colouring wood.\* Aug. 10.
- " 16,327. Davies and Ewing. Means for use in applying colour to woven fabrics or colour or paint to other surfaces. Aug. 11.

#### VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 15,646. Brunck. Extraction of ammonia from distillation gases.\* July 31.
- " 15,747. Latham. *See under IX.*
- " 16,035. Hargreaves. *See under I.*
- [S.] 20,241 (1904). Fryklind. Process of producing ammonia or ammonium salts from nitrogenous organic substances containing a high percentage of water. Aug. 10.
- " 22,323 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture and production of stable hydrosulphites. Aug. 16.

- [C.S.] 22,540 (1904). Johnson (Badische Anilin und Soda Fabrik). Production of technically pure cyanogen compounds. Aug. 16.
- " 6693 (1905). Pölling. Process for producing shape blocks of silicon or boron carbide. Aug. 10.

#### VIII.—GLASS, POTTERY, AND ENAMELS.

- [A.] 15,630. Fredel. Process for producing a molten mass of rock quartz at a relatively low temperature.\* July 31.

#### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 15,747. Latham. Utilisation of old plaster casts and other hydrated sulphate of lime and apparatus therefor. Aug. 1.
- " 15,796. Jaspert, and Watson and Co., Ltd. Manufacture of artificial stone and tools thereof for working marble, granite, glass, &c. [Fr. Appl., May 16, 1905.]\* Aug. 2.
- " 15,954. Morgan. Utilisation of slate waste. Aug. 4.
- " 16,426. Ford. Manufacture of artificial stone or sand-lime bricks. Aug. 12.
- [C.S.] 13,886 (1905). Colloseus. Process for the treatment of blast-furnace slag for production of materials similar to trass and the like. Aug. 16.

#### X.—METALLURGY.

- [A.] 15,675. Davies and Clarke. Welding or coating iron or steel with other metals or alloys. July 31.
- " 15,703. Beilby. Improving the tenacity of ductile metals and alloys. Aug. 1.
- " 15,809. Taylor and Mudford. Treatment of steel. Aug. 2.
- " 16,090. The Morgan Crucible Co., Ltd., and McCourt. Separation of the constituents of ores, &c., and apparatus therefor. Aug. 5.
- " 16,144. Nicholas. *See under I.*
- " 16,169. Tresidder. Manufacture of steel. Aug. 8.
- " 16,230. Thompson (Chas. W. Merrill). Treating precious metal-bearing materials. Aug. 9.
- " 16,232, 16,233, and 16,234. Wedge. Preparing iron oxide for treatment in furnaces.\* Aug. 9.
- " 16,385. Hadfield. Manufacture of steel. [U.S. Appl., Aug. 13, 1904.]
- [C.S.] 20,842 (1904). Crosthwaite. Alloy employed in the manufacture of firebars. Aug. 10.
- " 21,088 (1904). Wilkins, Overend, Marsh and Hawthorn. Puddling and heating furnaces. Aug. 10.
- " 6388 (1905). Bergendal. Furnaces for calcining and burning briquettes of ore, and for similar purposes. Aug. 10.
- " 7131 (1905). Weiller and Weiller. Process for extracting copper from copper ore, more particularly from poor copper ore. Aug. 16.
- " 13,886 (1905). Colloseus. *See under IX.*

#### XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- [A.] 15,606. Gibbs. Manufacture of metal articles by electro-deposition. July 21.
- " 16,074. Loeb. Electric cells.\* Aug. 5.
- " 16,132. Haswell, Cridge, and Bashforth. Electric furnaces. Aug. 8.
- [C.S.] 18,937 (1904). Hargreaves. Means and appliances for operating electrolytic cells. Aug. 16.

- [C.S.] 21,672 (1904). Lake (Sec. Anon. Le Carbone). Electric batteries. Aug. 10.  
 „ 14,214 (1905). Kjellm. Electric furnaces. Aug. 10

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

- [A.] 15,961. Adecek. Wicks or substances used in the production of light in association with oleaginous or mineral materials. Aug. 4.  
 „ 16,371. Gesner and Brandly. Process of, and apparatus for extracting oils.\* Aug. 11.  
 „ 16,406. Armstrong, Armstrong, and Armstrong. Manufacture of soap and detergent compounds. Aug. 12.  
 [C.S.] 17,437 (1904). Heymann and others. *See under I.*

## XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

### (A.)—PIGMENTS, PAINTS.

- [A.] 15,818. Le Maître. *See under I.*  
 „ 15,912. Bindewald. Colours or varnishes. Aug. 3.  
 [C.S.] 21,062 (1904). Bennett and Mastin. Manufacture of pigments. Aug. 10.  
 „ 24,733 (1904). Bennett and Mastin. Manufacture of pigments. Aug. 16.  
 „ 13,455 (1905). Alberti. Process for the preparation of lithophones. Aug. 16.

### (B.)—RESINS, VARNISHES.

- [A.] 15,912. Bindewald. *See under XIII A.*

## XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

- „ 16,251. Fell. Treatment or finishing of hides or skins. Aug. 10.  
 „ 16,312. Rivière, Verroul, and Bouvier. Tanning of hides or skins. Aug. 10.  
 „ 16,432. Luther. Manufacture of glue. Aug. 12.  
 [C.S.] 2477 (1905). Hutchinson. Hide working machines. Aug. 10.

## XV.—MANURES, Etc.

- [C.S.] 23,045 (1904). Bollé (C. Schmidt und Co.). Process of and apparatus for manufacturing manure from offal and the like. Aug. 10.

## XVI.—SUGAR, STARCH, GUM, Etc.

- [A.] 16,269. Stewart and Wishart. Evaporators for sugar and the like. Aug. 10.  
 [C.S.] 1651 (1905). Littmann and Littmann. Compressed starch. Aug. 10.

## XVII.—BREWING, WINES, SPIRITS, Etc.

- [A.] 16,071. Wittemann. Process of fermentation in relation to brewing beer and other beverages. [Ger. Appl., Aug. 6, 1904.]\* Aug. 5.  
 [C.S.] 18,488 (1904). Lennox. *See under I.*

## XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

### (A.)—FOODS.

- [A.] 15,667. Weil. Manufacture of baking powder. July 31.

### (B.)—SANITATION; WATER PURIFICATION.

- [A.] 15,987. Cameron and Commin. Process for treatment of sewage and other such waste products and means for carrying same into effect. Aug. 4.  
 „ 16,121. Horsfall. Washing and cleansing fluid for domestic purposes. Aug. 8.  
 „ 16,144. Nicholas. *See under I.*  
 „ 16,177. Clark (American Water Purifying Co.). Method and apparatus for purifying water. Aug. 8.  
 [C.S.] 18,488 (1904). Lennox. *See under I.*  
 „ 19,444 (1904). Adams. Filter beds for sewage and other purposes. Aug. 10.  
 „ 21,558 (1904). Fryssing and Roehle. Sterilising and purifying water and other liquids. Aug. 10.  
 „ 23,045 (1904). Bollé (Schmidt und Co.). *See under XV.*  
 „ 8366 (1905). Pulinx and Pulinx. Decanting apparatus for purifying water. Aug. 16.

## XIX.—PAPER, PASTEBOARD, Etc.

- [C.S.] 7140 (1905). Hölken. Improving paper by Aug. 10.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 16,151. Heinrici. Process for preparing a stable solution of hydrogen peroxide.\* Aug. 8.  
 „ 16,348. Ewan and Young. Manufacture of guanine salts. Aug. 11.  
 [C.S.] 16,996 (1904). Boehm (Merck). Manufacture of new oxyeyanamide derivatives of pyrimidine. Aug. 10.  
 „ 9656 (1905). Griese. Preparation of *m*-iodoxyquinoline-*ana*-sulphonic acid readily soluble in the stomach, and internal disinfectants containing the same. Aug. 10.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 16,227. Imray. *See under IV.*  
 [C.S.] 21,208 (1904). Brasseur. Photographic carbon transfer paper. Aug. 10.

## XXII.—EXPLOSIVES, MATCHES, Etc.

- [A.] 16,002. Upton. Explosive compounds. Aug. 10.  
 „ 16,290. Kings Norton Metal Co., Bayliss and L. Fuses for lyddite shells and other explosive projectiles. Aug. 10.  
 „ 16,320. Nathan, Thomson and Thomson. Manufacture of nitrocellulose. Aug. 10.  
 [C.S.] 27,706 (1904). Mikolajczak. Manufacture of nitroglycerine. Aug. 16.  
 „ 8746 (1905). Thomas. Manufacture and production of chlorated explosives. Aug. 16.



# JOURNAL OF THE Society of Chemical Industry.

A RECORD

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### SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

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## London Section.

Meeting held at Burlington House, on Monday, April 3 1905.

### THE FORMATION OF SULPHURIC ESTERS. THE NITRATION OF CELLULOSE AND THE INFLUENCE ON STABILITY.

BY C. NAPIER HAKE AND R. LEWIS.

(This J., 1905, 374—381.)

#### AUTHORS' REPLY TO DISCUSSION.

The discussion which followed the reading of our paper on April 3rd, 1905, appears to us to embody strong practical evidence in confirmation of our results. We do not think that an extended reply is called for, but would like to be allowed a few brief remarks on some of the points raised by those who took part in the discussion.

Dr. Dupré, in a written communication read by the Chairman, says:—

1. "The authors favour, I think, the production of subsequent retention of an undue proportion of sulphuric esters," &c.

The object of our research was not to produce, in first instance, a stable nitro cotton, but to determine the presence of sulphur compounds and their influence on stability.

2. "In spite of this the highest proportion of sulphuric acid, presumably in the form of sulphuric esters, was 0.79 per cent."

The conditions most favourable to the formation of sulphuric esters may not have been observed by the question requires further research.

Dr. Dupré also remarked that:—

3. "In the first place, the guncotton involved was of very recent manufacture, and, in the second place, the amount of free sulphuric acid found in one 8 oz. disc (nearly 0.5 per cent.) would imply the production of 1.5 per cent. of sulphuric acid from esters present in a guncotton, which had passed, as far as the evidence went, all the then accepted stability tests."

The explosion occurred on August 12th, and, according to the evidence, "on July 28th, or exactly a fortnight before the explosion, a quantity of impure gun cotton narrowly escaped introduction into the magazine."

Mr. Prentice† stated that he believed at the time that the poacher full of cotton, which had accidentally omitted to be subjected to the usual tests, had, by mistake, been put before the purification was complete.

We do not for a moment doubt that if the nitro cotton had been submitted to "the then accepted stability tests" it would not have been passed. Dr. Dupré appears to have overlooked the opinion expressed by Captain Majendie on the "arrangements for sampling," which we quoted in our paper.

The deduction drawn by Dr. Dupré as to the quantity of sulphuric esters which would have been present in the discs is in accordance with our maximum results (0.8 per cent.  $H_2SO_4$ ) and those of Messrs. Cross and Barlow. In regard to the rate of decomposition of the sulphuric ester, we clearly stated in our paper that, so long as moisture is present in the nitro cotton, decomposition takes place slowly, even at a raised temperature, but as soon as the moisture is driven off the rate of decomposition increases rapidly; free sulphuric acid is formed which reacts on the nitro cotton, liberating nitro-sulphur compounds which again continue the chain action. This would explain the uneven distribution of the free sulphuric acid in the discs. The method adopted at the time of the investigation was, we gather from the evidence, simply washing the guncotton with water. This was

\* Report on the explosion of guncotton at Stowmarket, August 11th, by Vivian Dering Majendie, Captain Royal Artillery, page 24.

† Ditto, page 25.



course, not remove a sulphuric ester. This view is confirmed by the evidence at the inquiry. Dr. Dupré states with regard to the unfinished cotton which had passed the beaters, in other words, that had not yet been pulped or washed, that, as of course was to be anticipated, it contained some free acid, but the quantity was very small (0.007 per cent.). Dr. Odling found in cotton similarly treated 0.025 per cent. sulphuric acid. Messrs. Cross and Bevan have referred us to their paper published in the Berlin Berichte. We must admit that, though a careful search was made at the time of writing our paper, we overlooked their work and were really ignorant of its existence. For the omission we express our regret.

Mr. H. de Mosenenthal calls attention to an omission in our part in stating experiments to which he attaches considerable importance. His statement of the results of his experiments, to which he calls attention, is inaccurate and, therefore, misleading, as the following extracts from official publications will show.

"A very exhaustive chemical examination of these consignments was made with a view of coming to a final decision as to their disposal. The results obtained led me to the conclusion that the explosive which, on arrival, reacted by the heat test in six minutes had considerably improved, showing reactions in from 10 to 25 minutes, that the explosive which originally reacted under five minutes had not improved. The contentions of the experts of the material, viz., that it would improve on ageing, was, therefore, to some extent substantiated." "*Blasting Gelatine*."—"The 35 samples referred to, selected in the above table, represent consignments which were imported in 1896, and which have since that time been under observation. The general conclusion arrived at from repeated experiments is that blasting gelatine, possessing an abnormally low heat test does improve (in this country at least) by keeping."

Sydney Section.

Meeting held at Sydney, on Wednesday, July 12th, 1905.

PROF. LIVERSIDGE, F.R.S., IN THE CHAIR.

CAUSE OF EXUDATION OF NITROGLYCERIN FROM "GELATIN COMPOUNDS."

BY C. NAPIER HAKE.

The rejection of explosives on account of exudation, in the area of my jurisdiction in Australia, has, within a few years, been a comparatively rare occurrence. One particular brand of imported explosives, however, appeared to be specially liable to exudation. The explosive was otherwise of excellent quality in regard to chemical and physical properties.

On carefully examining the cartridges with a magnifying glass, the pearls of nitroglycerin were observed on the outside of the wrappers: the wrappers were also found to be of an absorbent nature. On removing one of these from the cartridge, and placing it under a falling weight, it was found to be so. On analysis the wrapper was found to contain 20 per cent. of nitroglycerin.

The following experiments were made with the object of ascertaining that the exudation was due to the quality of the paper.

In each experiment four cartridges were selected from the brands of "gelatin compounds." The wrappers on the cartridges were marked "A," "B," "C," and "D," and the explosives "x," "y," "z" respectively. "D" represented wrappers which were submitted to me by the agents of the "Ax" brand, and approved of in lieu of wrappers of quality.

The "x" cartridges were exuding, and explosives "x" were reloaded in new wrappers of the same quality as the

originals ("A"). The other cartridges were taken in their original form as no exudation was visible.

Four cartridges of each series were then placed in separate boxes, specially made for the purposes of the experiment, and subjected to a direct pressure of 5 lb. for 72 hours. The temperature of the air during the experiment varied between 66° and 68° F. The cartridges were examined every 24 hours.

TABLE I.

Duration of experiment, in hours.	"x" explosive folded in "A" wrapper.	"y" explosive folded in "B" wrapper.	"z" explosive folded in "C" wrapper.
24	Wrapper stained outside with nitroglycerin	no exudation	no exudation
48	Pearls of nitroglycerin on outside of wrapper.	no exudation	no exudation
72	In and outside of wrapper covered with nitroglycerin	no exudation	no exudation

The explosive and wrappers were then interchanged. "x" explosive being folded in "B," "C" and "D" wrappers, and "y" and "z" explosive in "A" wrappers, and the same conditions applied as the former experiment. The following results were obtained:—

TABLE II.

Duration of experiment, in hours.	"x" explosive folded in "B," "C," "D" wrappers.	"y," "z" explosive folded in "A" wrappers.
24	no exudation	Wrappers stained, slight exudation extending to outside of wrappers.
48	no exudation	exudation increased.
72	no exudation	in and outside of wrappers covered with nitroglycerin.

The above experiments were repeated four times under similar conditions, and the first result confirmed in each case.

Wrappers belonging to series "A," "B," "C," and "D" respectively were then examined, with the results tabulated below:—

	"A."	"B."	"C."	"D."
Ash	1.22 per cent.	0.47%	0.70%	0.50%
Immersed in milk of lime for 4 hours.	yellow, brown tint	practically no reaction.		
Immersed in an aqueous solution of ferric chloride and potassium ferriyanide for five minutes.	dark blue tint	practically no reaction.		

A pine-wood paper gave the same tint of blue as in "A," after immersion in a solution of ferric chloride and ferriyanide of a similar strength and for the same time (five minutes).

The above reactions indicate that "A" wrappers represent a ligno-cellulose paper, or a paper containing a large proportion of ligno-cellulose.

Lotter,\* in a paper on "Parchment Paper for Osmoses and other Purposes," says: "Parchment paper is prepared by the action of sulphuric acid upon unsized paper, preferably that made from cotton rags and free from such admixtures as wood meal (ground wood), which would become charred by the acid, forming small holes in the finished product." This interesting observation appears to explain the origin of the porosity of "A" wrappers, to which property the cause of exudation from the explosive folded in them must be assigned.

This view receives further confirmation from the fact

\* Report of the Chief Inspector of Explosives (Victoria) on the 12 of the Explosives Act during the year 1897.  
\* Report of the Chief Inspector of Explosives (Victoria) on the 12 of the Explosives Act during the year 1898.

\* This J., 1895, p. 53.

that since the above experiments were completed, over 200,000 lb. of explosive folded in "D" wrappers have been imported, and only in one instance has exudation been observed in a few cartridges, and at the end folds only; and thus, I concluded, after careful examination, was due to the fresh explosive being too tightly folded in the wrappers.

That the freedom from exudation of nitroglycerin of "Dx" brand was not due to any manufacturing change in the explosive was shown by folding the explosive in "A" wrappers and subjecting the cartridges to pressure under conditions above recorded; exudation was induced at the same rate and to the same extent as in "Ax" tabulated above (Table I).

#### DISCUSSION.

Mr. T. STEEL suggested that, as the unsuitability of the wrapping papers referred to was said to be due to their porosity, a microscopical examination might have shown the pores. He thought the chemical tests applied were hardly conclusive that pine cellulose was the cause of the defect.

Mr. W. A. DIXON thought that many of the accidental explosives of nitroglycerin were probably a result of exuding drops, as described in the paper. It seemed as if manufacturers often did not pay sufficient attention to the details of their work.

The CHAIRMAN asked whether, if porosity was caused by the charring action of sulphuric acid on cellulose

particles, it would not be possible to detect black spots where this had occurred. Might the porosity not be due to capillary action in the cellular structure of the paper? With Mr. Steel, he regretted the absence of microscopical examination.

Mr. HAKE wrote, in reply, that perhaps, in his note, failed to state clearly that the wrappers used for folding nitroglycerin compounds were made of parchmentised paper. In the process of parchmentising, the paper was attacked, the fibres swelled and gelatinised, and on treatment with water hydrate of cellulose was formed and deposited in the pores of the paper, rendering it impervious to the flow of liquids through it. In the absence of original samples of the paper (before parchmentising) for the purpose of comparison the microscopical examination was not sufficiently conclusive. The wrappers, marked "A," showed considerably more erosion than "B," "C," and "D" wrappers. The examination was not referred to in the note as practical experiments, and the chemical tests appeared to him to fully prove his point.

The chemical tests, to which exception was taken, were well recognised tests. The reaction with ferric chloride ferriyanide was highly characteristic of lignocellulose.

No explosive which exuded badly was allowed to go into consumption; and the cause of exudation was formed the subject of his note was evidently of very occurrence, as it was the only instance which had come under his notice during the last fifteen years.

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### I.—PLANT, APPARATUS & MACHINERY.

#### ENGLISH PATENTS.

*Drying Apparatus; Impts. in* —. A. Huillard, Suresnes. Eng. Pat. 18,978, Sept. 2, 1904.

The apparatus, which is specially suitable for drying pasty and liquid bodies, consists of an endless band of metallic netting, the individual strands of which are wire spirals. This endless band travels over rollers through a series of drying chambers, a current of heated air being

drawn through the chambers in the opposite direction. The band passes first through a vessel containing material to be dried, and becomes coated with it; passing through the drying chambers it enters a depositing chamber, and passes between rotating wheels whereby it is repeatedly bent back upon itself and the dried substance is detached. The band then passes over a rotating frame, which imparts a shaking motion and causes it to strike against a grating wheel, whereby material still remaining on the band is detached. The band then leaves the depositing chamber and passes through the vessel containing the material to be dried to take up a fresh supply.—W. H. C.

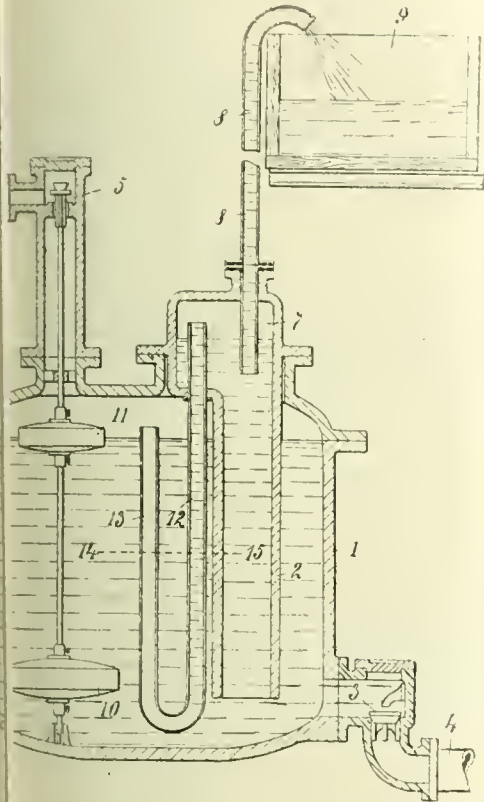


*for Crushing and Grinding; Impts. in ——. S. B. Posteloff, London. Eng. Pat. 7618, April 10, 1905.*

The invention relates to cone grinding mills having the cone built up of annular rings. The claim is for constructing the inner convex rotating cone with the grinding surface set at a more obtuse angle than the outer concave stationary cone or shell. The latter has two "conicities" the lowest ring being more obtuse than that of the upper, but both less than that of the rotating cone. The rotating cone or shell is enclosed in a hollow cylindrical outer casing, through which a cooling fluid can be circulated.  
—W. H. C.

*Lift-Raising Apparatus Operated by Steam or Compressed Air; Impts. in ——. V. Schwaminger, Oggenstein, Germany. Eng. Pat. 11,784, June 5, 1905.*

The apparatus consists of a vessel 1, which is fed with the

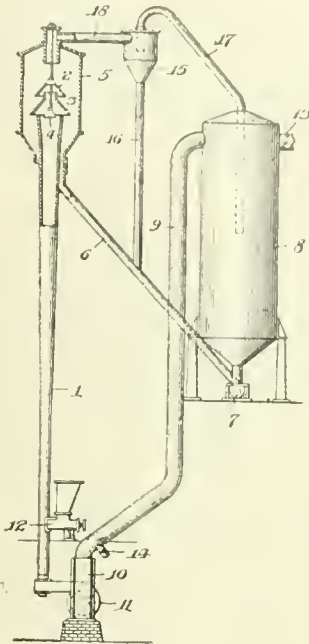


to be raised through the pipe 4 and the valve 3. When as the bottom of the pipe 2 is sealed by the rising liquid, the air in the vessel 1 becoming condensed, forces the liquid in the siphon 12, which is at about the level shown by the dotted line 14, 15, the limb 12 and finally the air bubbles through the siphon and escapes by the pipe 8. As soon as the level of the liquid reaches the upper float 11, it rises and opens the valve 5 and allows steam or condensed air to enter through the pipe 6. The pressure of air forces the liquid up the pipe 2 into the chamber 7, pressing the air above until the bottom of the pipe 8 is filled, when the liquid is driven up the pipe 8 into the chamber 9. As soon as the level falls below the float 10, the liquid drops, the valve 5 closes and shuts off the condensed air. The air in the vessel 1 escapes by the pipe 8, the liquid in the siphon falls to its original level, and the siphon begins to fill again. The floats 10 and 11 are so arranged that when both are raised, the valve 5 opens, but the bottom float 10 is held open until the bottom float 10 sinks again.  
—W. H. C.

UNITED STATES PATENTS.

*Treating [Drying] Material; Apparatus for ——. E. N. Trump, Syracuse, N.Y. U.S. Pat. 788,741, May 2, 1905.*

The claim is for improvements in the apparatus



described in U.S. Pat. 748,893 of 1904 (this J., 1904, 111). The material to be treated (dried or treated chemically by a gas) is fed from the hopper 12 into the upright column 1, into the bottom of which a current of "treating agent," hot air, for example, is blown by the fan 11. The upward current of air carries with it the material to be dried, but as its velocity gradually decreases owing to the increasing cross-sectional area of the column 1, only the lighter or more completely treated particles are carried to the top of the column; the heavier or less completely treated particles falling back and becoming re-treated. The upward current, carrying with it the finished material, strikes against the baffles 2, 3, 4 and is deflected into the chamber 5, where the greater part of the finished material separates and is conveyed by pipe 6 to the conveyor 7. The treating agent passes by pipe 18 through a second or supplementary separator 15 (which may in some cases be dispensed with) and pipe 17 into the dust chamber 8. Here a final separation takes place, and the treating agent is led by pipe 9 to the heater 10, and is again injected into the bottom of the column 1 by the blower 11. Any surplus treating agent is conducted away by pipe 13, while fresh supplies can be introduced through pipe 14. The material separating in 15 passes by pipes 16 and 6 to the conveyor.—W. H. C.

*Treating [Drying] Materials; Apparatus for ——. E. N. Trump, Syracuse, N.Y. U.S. Pat. 789,109, May 2, 1905.*

The apparatus is very similar to that described by the same patentee in U.S. Pat. 788,741 of 1905 (see above) with the following exceptions. The material is fed into the upright column through an opening in the top and distributed by rotating blades. The separation takes place in a "cyclone separator" placed between the treating column and the dust chamber and into which the mixture of material and treating agent is delivered tangentially.  
—W. H. C.

*Drying Moist Material; Apparatus for* — E. N. Trump, Syracuse, N.Y. U.S. Pat. 790,102, May 16, 1905.

CLAIM is made for improvements in apparatus described in U.S. Pat. 748,893 of 1904 (this J., 1904, 111).

The apparatus is similar in construction to that described in U.S. Pat. 788,741 of 1905 (see above). The material is fed into the apparatus in a similar manner, but the upper part of the column contains a conical collecting or separating chamber for the dried material, with a delivery pipe passing from the bottom of the cone through the side of the upright column. The dust chamber and supplementary separator are dispensed with and the drying agent is conveyed through a valved pipe, provided with inlet and outlet connections for introducing fresh, and withdrawing exhausted drying agent, back to the heater and blower.—W. H. C.

*Evaporating Apparatus; Multiple Effect* — S. M. Lillie, Philadelphia, Pa. U.S. Pat. 789,159, May 9, 1905.

A CIRCULATING pump is bolted directly on to the under side of the tank or evaporator so that it is supported entirely by the latter. The pump is of the paddle-wheel type, the wheel rotating in a casing and being carried by a shaft passing through stuffing-boxes and journals attached to the casing. The intake of the pump opens directly into the evaporator, and a deflecting plate is arranged within the latter over the intake opening, to cause the fluid to take a circuitous passage to the pump. The pumps are so attached, that they can be removed without interfering with the internal construction of the evaporators, and, when two or more evaporators work together, they are arranged in line so that the pumps may all be driven from one shaft.—W. H. C.

## II.—FUEL, GAS, AND LIGHT.

*Internal Combustion Engines.* Dugald Clerk. Cantor Lectures. J. Soc. Arts, 1905, 53, 870—880, 888—899, 906—913, 923—932.

LECTURE 1 treats of the fundamental principles of internal combustion engines, with some remarks on the thermodynamics of air engines; then follow theory of compression; efficiencies without heat or other losses; gaseous explosions and measurement of temperature in such by various methods, coal gas, petrol, alcohol, and producer gas explosions. LECTURE 2 deals with indicator diagrams and power tests; diagrams are given for engines using various gases. Irregularities in diagrams, pre-ignitions, exhaust-explosions, and missed ignitions are also discussed. In LECTURE 3 various types of gas engines are described and discussed. LECTURE 4 touches briefly on petrol engines, and then proceeds to discuss suction gas producers, blast-furnace gas and producer gas and their utilisation for various purposes, air supercompression and exhaust supercompression, concluding with a short description of marine gas and oil engines, and a few suggestions as to the lines along which advance in gas engines will probably be made; under this last heading it is pointed out that lighter producers are necessary, and that they should be capable of utilising any fuel, bituminous or non-bituminous.—T. F. B.

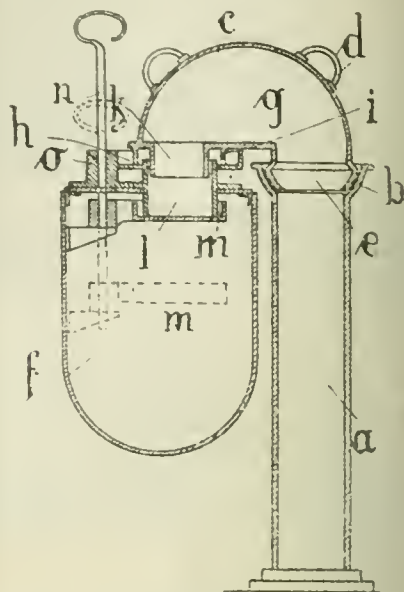
*Coal; Examination of* — O. Pfeiffer. XXIII., page 943.

### ENGLISH PATENTS.

*Coke Ovens and Gas Generating Plant; Gas Delivery and Purifying Apparatus for* — H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 16,008, July 19, 1904.

THE ascension pipe *a*, which is attached to the coke oven or gas retort mouthpiece has an expansion *b* into which the end *e* of the arch pipe or bend *c* fits by a ribbed "spherical joint." This allows any displacement, caused by the expansion of the pipe *a* by heat, to take place without injuring the joint. The other end *k* of the arch pipe *c* dips into the cup *h* which is kept full of water to form a hydraulic seal. The extension *i* projecting a short distance

into the pipe *l*, which rests on the top of the gas collecting main *f* by the flange *g*, serves to prevent any tar or pit from falling into the seal cup *h*. When it is necessary



remove the pipe *e*, the cup *m*, which has normally the position indicated by the dotted lines, and serves to collect tar or pitch dropping from *k*, is raised by the rod *n*, past through the guides *o*, into the position shown by the tinuous line. The end of the pipe *l* being sealed by cup *m*, *c* may be safely removed and any pitch that collected in *m* can be cleaned out.—W. H. C.

*Gas; Manufacture of Producer* — applicable to Pressure and Suction Plants. H. E. Smith, Lor Eng. Pat. 16,069, July 20, 1904.

By means of an expansion chamber connected to exhaust pipe of a gas engine and a suitable arrangement of valves, any desired proportion of the exhaust gas mixed with air and passed beneath the grate of generator. The carbon dioxide in the exhaust gas combines with the carbon of the fuel to form carbon monoxide and thus effects a saving of fuel. It also enables a portion of the steam, which is passed into the generator for purpose of cooling it and rendering clinkering possible to be dispensed with.—W. H. C.

### UNITED STATES PATENT.

*Gas; Process of Producing* — C. Ellis, Assn. to the Eldred Process Co., New York. U.S. Pat. 790,155, July 25, 1905.

THE process for the production of combustible gas having a high content of carbon monoxide, and a low content of carbon dioxide, consists in introducing into the producing mass of fuel an air-blast containing an endothermic constituent only carbon dioxide, approximately equivalent in amount to that which would be produced by the passage through the fuel of a current containing no constituent which has an endothermic reaction, "and thereby artificially create within the fuel mass the carbon dioxide partial pressure, whereby a relatively large amount of fuel is converted into combustible gas."—W. C. H.

### FRENCH PATENTS.

*Coal; Method of Recovering Solid Material in the Residual Water from the Washing of* — R. Zörner. Fr. Pat. 352,409, March 15, 1905.

THE residual water is conducted into a tank through a pipe opening into a space between two strainers, and



with the upper strainer is a third movable one, which can be lowered into the deposited sludge. Above the lower strainer is a mechanical agitator (or agitators) to stir the regular deposition of the solid matter. The material carrying the fine clay, &c., passes through the lower strainer and the upper strainers, and leaves the tank by an outlet at the top, whilst the coarse deposit can be withdrawn through openings in the bottom of the tank. —C. A. M.

*Waxes Capable of being Completely Consumed; Manufacture of —.* J. Dürwald. Fr. Pat. 352,242, March 1, 1905. XII., page 933.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

*Heptanaphthene (Methylcyclohexane) and some of its derivatives.* W. Markownikow. Annalen, 1905, 341, S—150.

The author first reviews previous work on the synthesis of naphthenes or polymethylenes and also the isolation of compounds of this class from petroleum. Attention is drawn to the importance attaching to the preparation of methylcyclohexanone or heptanaphtheneketone (pulegone) by Wallach (Annalen, 289, 337; see also Mann and Schmidt, this J., 1897, 257), as this led to the possibility of obtaining derivatives of the heptanaphthene series in a pure condition and in considerable amounts, whereas up till that time the chief difficulty had been the preparation from petroleum of the pure hydrocarbon in sufficient quantity for adequate examination. The author then describes the results of a comparison of anaphthenes and some of its halogen derivatives obtained, on the one hand, from petroleum, and, on the other, from  $\beta$ -methylcyclohexanol. (See also this J., 18730; 1893, 32; and 1897, 606.)—A. S.

#### ENGLISH PATENT.

*Efficient Mixture for Sprinkling on Roads and the like.* J. M. Hahn. Eng. Pat. 11,620, June 2, 1905. IX., page 933.

#### FRENCH PATENTS.

*Hydrocarbon Oils; Emulsifying — by Marine Algae.* M. L. D'Azémar. Fr. Pat. 352,100, Feb. 15, 1905.

Equal parts of hydrocarbon oil—coal-tar, bitumen, oil, petroleum, resin oil, shale oil—are mixed with water and emulsified in a centrifugal machine with a 1 per cent. aqueous extract of marine algae (*Fucus crispus*) in sufficient quantity to furnish a pasty mass, miscible with water. A 15 per cent. mixture of the mass with water is said to be suitable for laying dust on roads.—C. S.

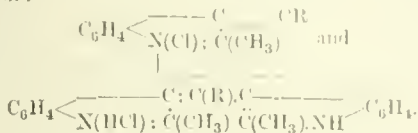
*Copper, Lead, Zinc, Nickel and Silver Ores; Concentration — [Use of Crude Acid from Wood Distillation].* Laurent. Fr. Pat. 352,430, March 16, 1905. XII., page 930.

### IV.—COLOURING MATTERS AND DYESTUFFS.

*Dyestuffs; Indole —.* M. Freund and G. Lebach. Ber. 1905, 38, 2640—2642.

**ETHYLKETOLE.**  $C_6H_4 \begin{smallmatrix} \diagup CH_2 \\ \diagdown N: \end{smallmatrix} \begin{smallmatrix} CH_2 \\ CH_3 \end{smallmatrix}$  can be condensed with either one or two molecules of an aromatic aldehyde in alcoholic solution in presence of hydrochloric acid, giving leuco-compounds which are oxidised by anthranilic acid in presence of alcoholic hydrochloric acid to form dyestuffs. The dyestuffs formed with one molecule of ethylketole are blue, whilst those from two molecules are red in shade. They are almost insoluble in water and in acids, but dye silk, wool and tanned cotton from

alcoholic solutions which have been largely diluted with water. Substituents in the benzene nucleus of the aldehyde have not much effect on the shade. The author ascribes to the two series of dyestuffs the following constitution:—



The products from methylketole and *N*-ethyl- $\alpha$ -methylindole with benzaldehyde, *p*-dimethylaminobenzaldehyde, *o*-chlorodimethylaminobenzaldehyde, *o*- and *p*-nitrobenzaldehyde, *m*-hydroxybenzaldehyde, salicylaldehyde and piperonal are described.—E. F.

#### ENGLISH PATENTS.

*Dyestuffs [Azo Dyestuffs] developed by Chroming; Manufacture of Brown Monoxo —.* O. Imray, London. From the Society of Chemical Industry, Basle, Switzerland. Eng. Pat. 25,901, Nov. 28, 1904.

Brown monoazo dyestuffs, developed by chroming, are produced by combining an *o*-diazophenol derivative with a derivative of 1:2:4- or 1:2:6-triaminobenzene of the general formula  $R.NH.C_6H_2(X)(NH_2)_2$ , where R is a radical of the benzene or naphthalene series and X is hydrogen,  $SO_3H$  or  $COOH$ , obtained by condensation of a base of the benzene or naphthalene series or its sulphonic or carboxylic acids with 1:2:4-chlorodinitrobenzene or dinitrochlorobenzene sulphonic or carboxylic acid ( $NO_2:NO_2:Cl:SO_3H$  or  $COOH=1:3:4:5$  or  $2:6:1:4$ ) and subsequent reduction. The combination of the diazo-compounds with the triaminobenzene derivatives occurs, in part, even in mineral acid solution, but better in acetic acid or sodium carbonate solution. For example, the diazo-derivative obtained in the usual manner from 20 kilos. of picramic acid is mixed with a concentrated solution of 30 kilos. of sodium diaminodiphenylamine sulphonate (from 2,6-dinitro-1-chlorobenzene-4-sulphonic acid and aniline, and subsequent reduction). 30 kilos. of sodium acetate are added with stirring, the mixture is heated to 40° C. for one hour and 20 kilos. of sodium carbonate are slowly introduced. The product dyes wool from an acid bath in reddish-brown shades, which become deep brown when subsequently chromed, and are satisfactorily fast to fulling.—E. F.

*[Anthracene Dyestuffs] Anthracene Series; Manufacture of New Compounds or Derivatives of the —.* J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 1817, Jan. 30, 1905.

REDUCTION products of anthraquinone or its derivatives, such, for example, as anthranol, are condensed with aldehydes of the aromatic or aliphatic series. The new compounds so obtained are used for the production of dyestuffs. For example, 10 parts of anthranol are introduced into 300 parts of 82 per cent. sulphuric acid, and 15 parts of benzaldehyde are added. After a short time the mixture assumes a deep red colour. It is allowed to stand for 24 hours at 30°–35° C., is poured into water and extracted with ether. After distillation of the ether an oily product is left, which solidifies on standing.—E. F.

#### UNITED STATES PATENTS.

*[Anthracene Dyestuff] Anthracene Series; Compound of the —, and Process of Making same.* O. Bally, Mannheim, Germany. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 795,751, July 25, 1905.

SEE Eng. Pat. 1817, Jan. 30, 1905; preceding these.—E. F.

*Colouring Matter; Anthracene —, and Process of Producing the same.* O. Bally, Mannheim, Germany. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 796,393. Aug. 1, 1905.

NEW dyestuffs can be obtained by acting with a nitrating

agent, for example, nitric acid, on the dyestuffs obtained by acting with alkali hydroxide on compounds containing a benzanthrone group, for instance, on benzanthrone-quinoline. The products are insoluble in water, but soluble in alkali hydrosulphite solution to form a vat dyeing vegetable fibres in shades becoming green on exposure to air. The dyestuffs obtained by reduction of the new products are also claimed. The product obtained by treating with nitric acid the dyestuff obtained from benzanthrone-quinoline and alkali hydroxide, dyes vegetable fibres in shades which become yellowish-green on exposure to air. (See this J. 1905, 192, 726, 840, 841.)—E. F.

#### FRENCH PATENT.

*Indophenol Sulphonic Acids; Production of* —. K. Oehler. Fr. Pat. 352,200, March 8, 1905.

*p*-PHENYLENE-DIAMINE-SULPHONIC acid is oxidised with 1 mol. of a phenol in alkaline solution. For example, 47 parts of *p*-phenylenediamine-sulphonic acid and 27.2 parts of *m*-cresol are dissolved in 500 parts of water and 70 parts of sodium hydroxide solution of 35° B., cooled by ice and oxidised with a sodium hypochlorite solution equivalent to 8 parts of oxygen. The temperature may rise to 5° C. without serious alteration of the yield, which is almost quantitative. Products obtained with *o*-cresol, phenol and  $\alpha$ -hydroxynaphthoic acid are also described. The products are very pure and are useful for the production of sulphide dyestuffs.—E. F.

### V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

*Dyeing of Animal Fibres; Phenomena accompanying the* —. P. Gelmo and W. Suida. Monatsh. f. Chem., 1905, 26, 855–878.

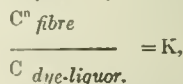
By treating purified wool with sulphuric acid, and afterwards washing with water, the affinity of the fibre for basic dyestuffs is considerably diminished, whilst its affinity for acid dyestuffs from a neutral bath is increased. If hot water be used for washing, the affinity of wool which has been previously treated with alcoholic sulphuric acid, is rather greater for basic dyestuffs than when cold water is used for the washing, whilst if the wool has been previously treated with aqueous sulphuric acid the reverse is the case. The affinity of wool for acid dyestuffs is considerably increased by washing with hot water, after treatment with either aqueous or alcoholic sulphuric acid. The behaviour of hydrochloric acid is quite analogous to that of sulphuric acid. Wool treated with acetic acid and then thoroughly washed, behaves exactly like the untreated fibre. Wool treated with tartaric acid, and subsequently washed, is dyed both by basic dyestuffs and by acid dyestuffs from a neutral bath. On boiling wool for one hour with an aqueous solution of aluminium sulphate, dilute sulphuric acid, or water, the authors found that it had undergone a very considerable loss of weight, due to partial hydrolysis, with formation of soluble amino-acids. Experiments were made on the action of cold N/10 solutions of sulphuric acid, hydrochloric acid and ammonia on wool and on silk, the liquids being afterwards titrated, using methyl orange as indicator. After five minutes the reaction had proceeded as far as in two hours. Wool absorbs 2 equivalents of mineral acid for each equivalent of ammonia, whereas silk absorbs 6.4 equivalents of ammonia to 1 of hydrochloric and 2 of sulphuric acid.

Purified wool was dyed with the pure free colour acids of Crystal Ponceau, Lithol Red, Fast Red R and Alizarin Yellow GGW. The intensity of the dyeings was not increased by adding mineral acids to the dye-bath, and the authors consider that any excess of mineral acid, above the amount needed to liberate the colour acid, which may be necessary in practice, is merely utilised to neutralise alkali of lime combined with the acid groups of the wool

and derived from alkali or hard water used in its purification. Wool was also treated with alcoholic potassium hydroxide solution, afterwards with slightly acidified water and then washed. After this treatment, the fibre which was yellowish in colour, showed increased affinity for Benzopurpurin 6B and Bordeaux Extra, showing that alkali had entered into combination with it. The action of alcoholic potassium hydroxide was quite analogous to that of aqueous potassium hydroxide used in previous investigations. Wool treated with alcoholic zinc chloride solution (0.1 per cent.) and washed, showed less affinity for basic dyestuffs and more for Azofuchsine G neutral solution, than when treated with aqueous zinc chloride solution. Wool was treated with alcoholic with aqueous sulphuric acid, then mordanted with a minimum, chromium or iron sulphate, and finally dyed with Alizarin Red S, or Anthracene Blue WG, soaped and washed. The initial treatment with sulphuric acid produced no effect in the case of chromium sulphate. In the case of aluminium sulphate stronger dyeings, and with iron sulphate weaker dyeings were obtained than when the wool was not initially treated with dilute acid. Wool is mordanted with aluminium, chromium, or iron sulphate, without previous treatment with acid, it entirely loses its affinity for basic dyestuffs, whereas its affinity for Azofuchsine is increased. If it be treated, after mordanting with dilute ammonium carbonate solution, it acquires strong affinity for basic dyestuffs and almost loses its affinity for Azofuchsine. Wool mordanted with aluminium acetate almost loses its affinity both for basic and for acid dyestuffs from a neutral bath, whereas, when mordanted with aluminium tartrate, it acquires very considerable affinity for the latter. The behaviour of the various products of hydrolysis of wool towards mordants and dyestuffs was also studied. The aminobenzoic acid behaved very differently from the aminocarboxylic acids of the fatty series. The former cause the wool to take up Azofuchsine from an otherwise neutral bath, whereas the latter do not. The presence of peptone causes dyeings with basic dyestuffs to be very unstable to dilute solutions, and does not promote the dyeing of acid dyestuffs from a neutral bath, but does not hinder them from dyeing from a weakly acid bath. The soluble decomposition products obtained on boiling wool with water or dilute acids show all the reactions of a peptone and production of dyeings not fast to soaping or rubbing for basic dyestuffs may thus be accounted for. Further experiments showed that dyeings of acid dyestuffs on wool previously treated with  $\frac{1}{2}$  per cent. alcoholic sulphuric acid were faster to soaping than similar dyeings on untreated wool, wool previously treated with  $\frac{1}{2}$  per cent. of aqueous sulphuric acid, or on wool from a sulphuric acid bath. The general conclusion of the authors is that the dyeing of wool is accompanied by a gradual hydrolytic disintegration of the wool-substance, soluble decomposition products being formed; that decomposition is promoted by mineral acids, and is necessary for satisfactory dyeing; that the primary decomposition products resemble peptones and have a bad effect on the fastness of the dyeings in absence of mineral acids, and that these peptones are further dissociated, forming amino-acids.—E. F.

*Dyeing Process; Theory of the* —. W. Biltz. Naturges. Wiss. Göttingen, 1905, 46–63. Chem. Zeit., 1905, 2, 524–525.

THE first portion of the paper relates to dyeing tests in which coloured colloidal inorganic substances and inorganic hydrogels were used as substitutes for organic dyestuffs and fibres respectively. The ordinary dyeing process may be represented by the equation—



where  $C$  fibre is the concentration of the dyestuff in the dyed fibre and  $C$  dye-liquor the concentration of the dyestuff in the dye-bath, whilst the index  $n$  is greater than 1 and is frequently a whole number. Comparative experiments in which the organic dyestuff used was Benzopurpurin 6B and the inorganic hydrogel used was



purin, and the inorganic colloids were Molybdenum and vanadium pentoxide, showed that there is no essential difference between the dyeing properties of the purified inorganic colloidal substances and organic dyes. In both cases the composition of the coloured matter after dyeing at a given temperature depends upon the conditions of the dyeing process, the concentration of the stuff and of the salts added to the dye-liquor. In further set of experiments the hydrogel of alumina was used in place of an organic fibre, and here again, it was found that the substitution of the inorganic colloid for an organic substance had no effect on the quantitative relations observed in the dyeing process. The author considers that the results of these experiments prove the correctness of the view that the dyeing of textile fibres with dyestuffs of the type of Benzopurpurin proceeds according to the "adsorption theory" (see this J. 1904, 4).

In the second portion of the paper, the results of some experiments with Immedial sulphur dyestuffs, made jointly with P. Behre, are described. By dialysis of solutions of the dyestuffs in alkali sulphides, clear colloidal solutions, free from alkali, were obtained, which were regulated by electrolytes in a similar manner to other colloidal solutions. The coagulating-power of the electrolytes on the dyestuff solutions, increased with the valency of the cation; nitrates were not so active as chlorides. Dyeing tests with solutions of Immedial dyestuffs, as used in practice, showed that the adsorption compounds of the dyestuffs with cotton have, as in the case of other colloids, a composition depending upon the concentration of the dyestuff in the solution. Similar results were obtained with the hydrogels of alumina, zirconium dioxide, ferric oxide and stannic oxide were substituted for the textile fibre.—A. S.

*Sulphur [as Discharge]; Action of Alkali on —.* Pomeranz. Z. Farben- u. Textil-Ind. 1905, 4, 392-393.

The author considers that, in the reaction between sulphur and alkali hydroxides, the production of polysulphides and sulphates is preceded by that of monosulphides and esulphides. Paranitraniline Red being dischargeable by hydrosulphite, the effect of sulphur and sodium hydroxide was tried. A thickened mixture of precipitated sulphur and sodium hydroxide ( $3\text{NaHO}$  and  $2\text{S}$ ) was printed on cotton tissue dyed with Paranitraniline Red and washed, when a fairly white discharge was obtained after severe soaping.—D. B.

#### ENGLISH PATENT.

*Manufacture of Artificial —.* H. E. A. Vittenet, Rouen-Montplaisir, France. Eng. Pat. 1686, Jan. 27, 1905. Under Int. Conv., Dec. 8, 1904.

The invention consists in the use of pyroxylin dissolved in acetone, to which sulphurous acid is added. The solution so made is used to produce the threads. Or, the threads can be formed from an acetone-collodion in a moist or dry atmosphere containing sulphurous acid. The acetone can be recovered by passing the mixture of pyroxylin and acetone vapour through a solution of caustic soda or sodium carbonate. (See this J. 1905, 3 and 799.)—F. S.

#### FRENCH PATENT.

*Printing or Decorating Tissues, Paper, etc.; Process and Apparatus for —.* C. L. Burdick. Fr. Pat. 2,220, March 9, 1905.

The fabric is passed below, or above, sprays which work intermittently and are fed by various coloured liquids. The apparatus used, consists of rollers, between which the fabric is passed, and several groups of sprays, the operation of which is electrically or mechanically controlled; the object may be attained by electromagnets, controlling the supply of liquid and air to each spray; the magnets are intermittently supplied with electric current from a dynamo, the circuit being automatically made and broken

by the action of circular ridges on the ends of the pressure rollers, these ridges being discontinuous and actuating small levers. The sprays are fixed on bars which have an automatic to and fro movement.—E. F.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

### FRENCH PATENT.

*Dyeing Skins; Continuous Machine for —.* R. Martinet and A. Dulac. Fr. Pat. 352,095, Feb. 7, 1905.

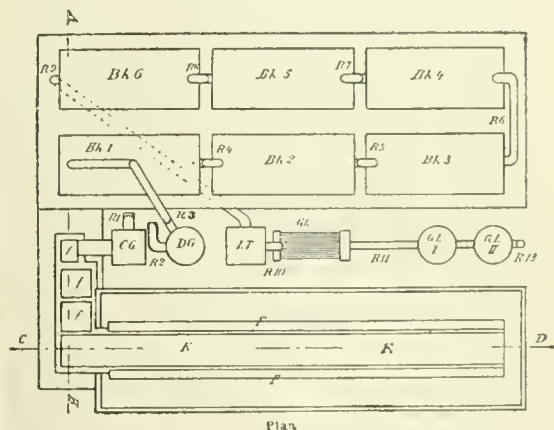
The skins are carried forward on an endless band, coated with india-rubber, which makes periodic movements in a forward direction. A frame, containing transverse partitions lined with india-rubber below, is raised at each forward movement of the endless band and lowered when it is at rest, then forming a series of separate compartments. Above each of these compartments is fixed a spray which describes a circular movement in a lateral plane in order to distribute the liquid. The supply of liquid from each spray is automatically stopped while the endless band is moving. Each skin traverses the various compartments in order, is sprayed in succession with a different liquid (mordant, dye-liquor, &c.) in each, and is finally rinsed with water in the last compartment.—E. F.

## VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

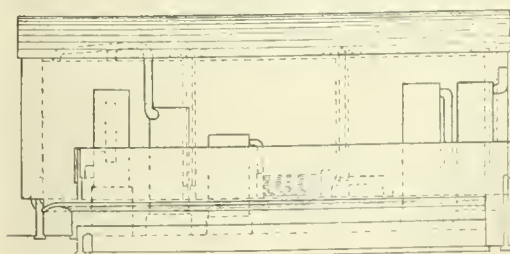
*Chamber Process; Latest Progress in the —, and its Influence on the Economy of Sulphuric Acid Manufacture.* F. Lütty. Z. angew. Chem., 1905, 18, 1253-1264.

IMPROVEMENTS in details in the chamber process during the last 10 years have enormously increased the yield from chambers of a given capacity, and hence lessened the cost of production.

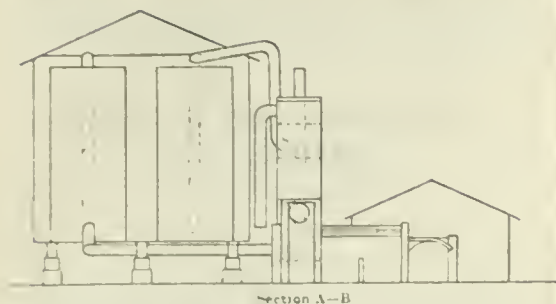
*Kilns.*—Mechanical burners for smalls (Herreshoff, Humboldt, O'Brien) have of late been extensively introduced. The cost of working these, however, does not



Plan



Section C-D



Section A-B

always compare favourably with that of hand-burners; indeed, hand-worked burners are cheaper than mechanical burners, if the cost of labour be below 4s. per man per shift.

The chief advantage of the mechanical burners is that they minimise the number of men needed. *Glover Towers.*—Changes in detail here have effected considerable improvement in output. The nature and form of the filling-material is not of very much moment, provided that the interstices in the lower layers be sufficiently great (3—4 in.), so that the tower is not readily choked. A useful improvement in construction, introduced by Rohrmann and Niedenführ, is to have a second floor only a short distance above the bottom of the tower, so that the small quantity of material in the lower compartment can be readily renewed and changed without disturbing the main body of the filling. The Glover towers are now built of greater area and height than formerly, and are placed on a higher level relatively to the pyrites-kilns, so as to ensure a stronger draught from the kilns, and allow of more throttling behind the Gay-Lussac tower. *Gay-Lussac Towers.*—These are of larger size than formerly; for a daily out-turn of 50 tons of chamber acid there should be not less than 10,000 cb. ft. of space, divided among two or more towers, the last of which should be filled with coke. If a fan be used, the upper layers of coke may safely be of 2-in. size. *Chambers.*—By far the greater number of plants have rectangular chambers, long and nearly square in section, but tending to be higher and narrower than used to be the case. The chief innovations are Meyer's tangential chambers, and the introduction between or behind the chambers of Lunge's plate-towers. Over a very long period, one of these towers of 3000 cb. ft. gross capacity, placed at the end of a chamber-system of 285,000 cb. ft. capacity, gave a yield of 26.9 kilos. of chamber acid per cb. metre (say, 3 cb. ft. per lb. of sulphur burnt). *Fans.*—The use of fans has rendered the process much more controllable, and has, in consequence, greatly increased the yield, though for the most part the fan has had to be placed where it is of least service—either immediately before or after the Gay-Lussac tower. *Heat Removal.*—The increased intensity of reaction due to these improvements has necessitated the removal of some of the heat generated by the reaction; this has been accomplished largely by substituting water-spray for steam in the chambers, and by the introduction of plate-towers fed with a stream of cold acid.

By all these means, the output of the chambers has been increased from 3 or 4 to 6 or 7 kilos. of chamber acid per cb. metre of chamber-space (from 20—27 to 12—14 cb. ft. per lb. of sulphur burnt) per day, in systems working without plate-towers.

A recent patent of Niedenführ's (Ger. Pat. 140,825) marks a further important advance, by which the working of the pyrites burners is rendered independent of that of the rest of the process. The Glover tower is divided into two—a concentrating tower, in which the gases from the burners are cooled and freed from fine-dust by acid which has already been denitrated, and a denitrating tower, in which acid from the Gay-Lussac tower, which is denitrated by these cooled gases. For complete denitration the nitrous vitriol must be diluted by chamber acid water (and steam, if need be) to a sp. gr. of 1.61; but a dilution to 1.65 ensures the issue of the acid with a content of not more than 0.2 per cent. of nitric acid (1.33 sp. gr.), which is completely removed in the concentrating tower, while the acid is brought up to sp. gr. 1.71—1.73. Between these two parts of the Glover tower is placed the fan, which satisfactorily resists the action of the cooled and very faintly nitrous gases with which it is thus brought into contact. The gains by this arrangement are—that the burners and the chambers are independent; the system may be severely throttled behind the Gay-Lussac tower, and yet the draught of the burners not be interfered with. Thus very concentrated burner-gas may be used, and the burners themselves may be worked with larger charges without increasing the percentage of sulphur in the burnt ore. Again, different systems of burners may be used in combination to form one set of chambers, and variations in the number of burners simultaneously at work cause practically no disturbance in the process, whilst the negative pressure up to the fan prevents the possibility of loss of gas leakage. On the other hand, the uniform *plus* pressure in the chambers is favourable to the reaction, ensuring better utilisation of the chamber space, and lessens the liability of the occurrence of dead spaces, the gases being more thoroughly and intimately mixed. In each of the three installations worked on this system the output of acid was 9—11.5 kilos. of chamber acid per cb. m. (9—7 cb. ft. per lb. of sulphur burnt), and the nitre used equivalent to 0.6—0.7 kilo. of nitric acid of sp. gr. 1.33 per 100 kilos. of chamber acid. As to pressure, it would seem that, for a given amount of gases, as the pressure is increased by throttling the exit from the Gay-Lussac tower, the process is transferred more and more towards the earlier part of the system, and finished in a smaller space; but there is room for more gas in the unused portions of the chambers, and the yield is increased. The pressure is not increased beyond the point at which the whole of the chamber space is just used for the complete reaction of the amount of gases entering, or the Gay-Lussac towers will work properly (possibly through formation of nitrous peroxide.) Tables are given showing actual pressures in the three installations above mentioned, expressed in mm. of water-column. The details of the installations are as follow:—1. Two Glover towers, 12 ft. diameter, 32 ft. high; four chambers, 18 ft. wide, 33 ft. high, and respectively 113, 70, 33 and 53 ft. long. Total capacity, 162,000 cb. ft.; three Gay-Lussac towers, 6½ ft. by 4½ ft. high. 2. Two Glover towers, 11 ft. sq. by 32 ft. high; four chambers, 31 ft. wide, 28 ft. high, 124 and 65 ft. long; one tower between the chambers, 4740 cb. ft., and two plate-towers after the second chamber, 2700 cb. ft. each. Total capacity, 170,000 cb. ft.; two Gay-Lussac towers, 11 ft. by 42 ft. high. 3. Two Glover towers, 10 ft. sq., 33 ft. high; two tangential chambers, 38 ft. diameter, 43 ft. high, followed by three plate-towers, 2550 cb. ft. each; total capacity, 108,000 cb. ft.; two Gay-Lussac towers, 10 ft. diameter, 40 and 50 ft. high.

SYSTEM 1.—Pressure Above or Below Atmosphere.

Entrance to Glover 1	Fan.		Entry to Chamber 1.		Exit from Chamber 4.		Entry to Gay-Lussac 1.	Exit from Lussac 21 ft. throat
	Entry.	Exit.	5 ft. from floor.	Roof.	5 ft. from floor.	Roof.		
1.4	—20.7	16.6	14.0	18.0	10.0	11.5	6.0	—
1.3	—	—	16.0	19.0	12.0	13.6	6.8	—
1.7	—19.0	16.5	14.7	—	10.3	—	5.5	—9.3
1.8	—19.5	16.3	14.9	—	11.5	—	4.6	—8.8



SYSTEM 2.—*Pressure Above or Below Atmosphere.*

Entry to Glover 1.	Fan.		Entry to Chamber 1.		Exit from Chamber 2.		Exit from Gay-Lussac 2 before throttling
	Entry.	Exit.	5 ft. from floor.	Roof.	5 ft. from floor.	Roof.	
0.8	— 9.4	8.2	5.6	5.9	5.4	5.7	2.8
4.0	— 19.0	16.5	8.2	8.1	8.0	8.8	5.6

SYSTEM 3.—*Pressure above or below atmosphere.*

Entry to Glover 1.	Chamber 1.	Chamber 2.	Roof of Plate tower 1.	Entry to Gay-Lussac 1	Roof of Gay-Lussac 2.
1.3	7.0	5.8	5.4	3.5	0.6

The first table shows the effect of the resistance caused by the very narrow Gay-Lussac towers. In the second table, the first row of figures represents a state of things in which the whole space is utilised for the process; the second in which, by undue throttling, the reaction is concentrated in the earlier portions, and nitrous gases escape considerable quantities from the Gay-Lussac towers. The very satisfactory results obtained from such widely different systems are only to be attributed to the position of the fan. Examination of the working of these systems has convinced Niedenführ that the theoretically best form of chamber is one resembling a tower, in which the process of the gases is from top to bottom: with natural draught, this would have not been easily practicable, but with the pressure from the fan it presents no difficulty. The author gives details of a system working on Niedenführ's plan, designed for a daily production of 50 tons of oil vitriol (say 80 tons of chamber acid), and shown in plan and sections in the figures.

The burners F, for smalls, hand-worked, and built so that the pyrites can be run directly from stock to the hoppers, whilst the burnt ore is elevated to a store in which it can be run down directly into the railway trucks,—contain 44 divisions of 200 sq. ft. area each in 11 stages. The gases collect in the flue K, and then reverse (twice downward and once upward) the dust-chambers J, before reaching the concentrating Glover tower G<sub>1</sub>. Thence they go by the pipe R<sub>1</sub>, 28 in. diam., to the fan, which is below the chambers, returning by the pipe R<sub>2</sub> (28 in.) to the denitrating Glover tower DG. From there they go by R<sub>3</sub> (28 in.) to the top of the first chamber, which they enter by two 24 in. branches. They pass through each chamber about 3 ft. from the bottom, and enter next at the top; the chambers are 47 ft. long, 20 ft. wide, 14 ft. high, and the connecting pipes 26 in. diam. The pipe R<sub>0</sub> (27 in.) leads from the last chamber to the plate tower LT, 13 ft. sq. and 28 ft. high, whence by R<sub>10</sub> (26 in.) the gases go to the cooler GL, and then by 26 in. pipes through the Gay-Lussac towers and a throttle-valve to the atmosphere. The capital outlay for this installation will be:—Land, 1800 sq. m. at 20 M. (2150 sq. yds. at 9d.) 36,000 M.; buildings, 78,000; machinery, 500; pyrites burners and appurtenances, 72,500; chambers and towers 116,000; total 320,000 M. (£16,000). The installation will need 16 h.p., and 24 men (16 for the burners, 4 for transport of pyrites and burnt ore, 4 for chambers and machinery). Repairs will cost 12,000 M. annually. Calculating all these, with interest and depreciation as above, and the cost of pyrites, on the basis of chamber acid containing 100 kilos. of monohydrate, the costs are:—pyrites 1.28 M.; nitre 0.21; power 0.0307; repairs 0.144; interest and depreciation 0.0667; total 1.9386, say, 1.94 M., a saving of 17 per cent. on the figure quoted in 1902 (2.33 M., this J., 1902, p. 15). Using this new figure, the cost of 93 per cent. acid produced by Kessler's apparatus, is estimated as 9 M. instead of 2.56 M., for 100 kilos. The author finally states that if water-spray be adopted and electric power supplied, a steam generator is superfluous.—J. T. D.

*Chamber Process; Theory of the —.* F. Raschig. Z. angew. Chem. 1905, 18, 1281—1323.

1. NITRIC oxide mixed with excess of oxygen forms at once the trioxide, and this slowly oxidises further to peroxide; the relative speeds of the two reactions are roughly as 100 : 1. Both reactions are of course retarded when the oxygen is diluted by an indifferent gas; and in a mixture containing the same proportion of oxygen as exists in the chambers, the oxidation to trioxide is complete in about three seconds, whilst the oxidation to peroxide requires about five minutes. From this fact alone it seems necessary that the substance which reacts in the chamber on sulphur dioxide should be nitrogen trioxide—peroxide could not be reduced and reformed with the necessary frequency. 2. The same conclusion is reached, when the behaviour of nitrogen trioxide and peroxide towards sulphur dioxide in presence of water is examined; the former at once reacts, but the latter, as such, does not react at all—it dissolves in the water to form a mixture of nitric and nitrous acids, only the latter of which reacts. Thus a molecule of nitrogen trioxide converts twice as much sulphur dioxide into sulphuric acid as does a molecule of peroxide. 3. Nitrogen trioxide, or nitrous gases approaching it in constitution, dissolve readily in strong sulphuric acid, and from the analysis of the solution the composition of the gas can be accurately deduced; but when these gases are absorbed by water or by sodium hydroxide, a portion always breaks up into nitric oxide and nitrogen peroxide, the former escaping, and the latter yielding nitrite and nitrate in equimolecular proportions—the analytical error resulting from this amounts with pure trioxide to 17—20 per cent., but in presence of diluting gases may be as low as 5 per cent. On the other hand, gases near to nitrogen peroxide in composition dissolve readily and completely in sodium hydroxide, forming nitrate and nitrite, and their composition can be accurately determined by analysis of the solution; but in strong sulphuric acid they dissolve with difficulty, and undergo partial decomposition and loss of both oxygen and nitrogen. 4. The product formed when nitrogen trioxide dissolves in sulphuric acid (chamber crystals) is not nitrosylsulphuric acid NO.O.SO<sub>3</sub>H, but nitrosulphonic acid O<sub>2</sub>N.SO<sub>3</sub>H. By reducing agents it is converted into "nitrosulphonic acid" ON(OH)SO<sub>3</sub>H. This substance dissolves in strong sulphuric acid with a bright blue colour, in weaker acid with a faint red colour, which becomes bright violet on addition of a few drops of copper sulphate solution. It is very unstable, readily breaking up into sulphuric acid and nitric oxide. The determination of nitrogen in the nitrometer depends upon the formation and decomposition of this substance. Nitrosulphonic acid forms with copper and iron salt-like compounds, much more stable than the acid itself. These salts are not decomposed in the nitrometer, which, therefore, cannot be used to determine nitrogen in substances containing copper and iron. 5. Nitrosulphonic acid is formed when nitrosulphonic acid and sulphurous acid react; not, however, directly, but by the decomposition

of the nitro-acid into sulphuric acid and nitrous acid, the latter of which then reacts on the sulphur dioxide, forming nitrosulphuric acid, which with a second molecule of nitrous acid yields nitrosulphuric acid and nitric oxide. These are the reactions in the Glover tower: the nitrosulphuric acid then breaking up into sulphuric acid and nitric oxide, and the whole of the nitric oxide then oxidising again to nitrogen trioxide, to repeat the cycle of operations. 6. The reactions in the chamber are the same as those in the Glover tower (except, of course, the breaking up of the nitrosulphuric acid); the whole cycle is represented by the equations:—

1.  $\text{ON.OH} + \text{SO}_2 = \text{ON.SO}_2.\text{OH}$
2.  $\text{ON.OH} + \text{ON.SO}_2.\text{OH} = \text{NO} + \text{ON(OH)SO}_2.\text{OH}$
3.  $\text{ON(OH)SO}_2.\text{OH} = \text{NO} + \text{H}_2\text{SO}_4$
4.  $2\text{NO} + \text{O} + \text{H}_2\text{O} = 2(\text{ON.OH})$

In aqueous solution nitrosulphuric acid tends to decompose even in presence of nitrous acid, yielding sulphuric acid and nitroxyl (or nitrogen monoxide). But when for water is substituted sulphuric acid, this tendency is lessened and the tendency towards reaction (2) increased as the strength of the sulphuric acid is increased; and in presence of chamber acid the reaction (2) proceeds with even greater speed than (1), so that the moment nitrosulphuric acid is formed it is all converted into nitrosulphuric acid. Ordinarily the whole of the nitrosulphuric acid is again decomposed, but in certain states of the chambers, when their working is disturbed, its presence in small quantity in the chamber acid can be demonstrated. 7. The reaction in the chamber-process is accelerated by rise of temperature; and in the Glover tower both the intensity of the reaction (yield per cb. ft.) and the strength of the acid are higher than in the chambers. It is however, necessary to cool the chambers, because the reactions are reversible, and the final product must, therefore, be removed; were the temperature allowed to rise the opposing tendency of the gaseous sulphuric acid to decompose would soon more than counterbalance the increased speed of reaction. The mixture in the chambers is also very different from that in the Glover tower; hence, although much has been done of late years, especially by great increase in the amount of nitrous compounds present, to increase the intensity of reaction in the chambers, they are still, and must be, in this respect far behind the Glover tower. 8. The reaction (3) occurs the more readily as the temperature is higher; if the chamber-working be disturbed, so that not the whole of the sulphur dioxide is converted into sulphuric acid in the chambers, and the reactions (1) and (2) occur in the cold Gay-Lussac tower, reaction (3) may not occur at all. In this case the nitrous vitriol runs away "purple," and some loss of nitrogen compounds occurs through escape of nitric oxide between the Gay-Lussac and the Glover, or even in the Gay-Lussac tower itself. This state of things, however, is by all good makers considered preferable to that in which all the sulphur dioxide is oxidised before the whole of the chamber space is traversed, and when, consequently, there is time for nitrogen peroxide to be formed at the end of the chambers, and to escape as such from the Gay-Lussac tower; and if chambers be worked so as to render the first rather than the second disadvantage more likely to occur, any loss thus arising would be lessened if the nitric acid required to make up the unavoidable losses in the system, were fed in at the Gay-Lussac instead of at the Glover tower; for the nitric acid would convert any nitrosulphuric acid into the much more stable nitrosulphuric acid.—J. T. D.

*Nitric Acid; Manufacture of*.—F. Winteler. Chem.-Zeit. 1905, 29, 820—823.

THE stringent demands of the modern consumer of nitric acid are very difficult for the manufacturer always to comply with. The chief use of nitric acid is in the explosives industry, and there, a highly concentrated acid, very free from nitrous acid, is needed. A similar acid is needed for the artificial silk and celluloid industries, while the manufacturer of organic dyestuffs is content with an acid more easily obtainable. Analyses of two samples of mixed acid for nitroglycerin or gun-cotton manufacture are given by the author:—

Total acid	96.303	97.267
Total nitrogen acids	34.28	36.257
Nitric acid	34.18	36.18
Nitrous acid	0.137	0.077
Sulphuric acid	62.01	61.01
Solid residue	0.132	0.05
Lead sulphate	0.033	—
Water by difference	3.56	2.68

These are American samples; the mixed acids are there usually made by adding "oleum" (sulphuric acid containing anhydride) to highly concentrated nitric acid sulphuric acids. In making such a mixture the nitric acid must not contain too much water, or the heat evolved will cause decomposition with formation of nitrous acid.

Pure nitric acid cannot be distilled at the atmospheric pressure without decomposition. Volney, in 1898, publishes the following figures showing the extent to which the reaction  $2\text{HNO}_3 = \text{N}_2\text{O}_3 + \text{O}_2 + \text{H}_2\text{O}$  occurs at different temperatures:—

* C.	Per cent.	* C.	Per cent.
86	9.53	100	49.34
100	11.77	220	72.07
130	18.79	250	93.03
160	28.96	256	100.00

Hence dry nitre and concentrated sulphuric acid will give the most concentrated nitric acid unless the temperature of distillation be carefully kept low; while, by keeping it low enough, highly concentrated acid may be prepared from materials containing more water. It is to be remembered that the hydrates of nitric acid boil at higher temperatures than the acid itself, and are formed with evolution of heat; so that rise of temperature above the b. pt. of the pure acid may easily occur, with decomposition of the acid, and formation of these hydrates and of nitrous acid, unless the distillation be very carefully watched. Vacuum distillation has been often attempted but the difficulties in the way seem to have prevented from being generally adopted. The best yield of highly concentrated acid is obtained in practice, if 92 per cent sulphuric acid, not a stronger acid, be used in the distillation. The same remark applies to the distillation of mixed (nitrosulphuric) acid. The conditions are summarised as follows:—1. The distillation-temperature must be kept as low as possible, and, to avoid overheating the distillation must be conducted slowly; the time necessary will be determined by the size and form of the retorts. 2. With dry nitre, the sulphuric acid used should be of the strength of 92 per cent. 3. Introduction into the retort of atmospheric oxygen improves the yield. 4. The issuing vapours should be condensed as rapidly as possible.

To complete the decomposition, and leave a nitrogen-bisulphate in the retort, the temperature must be raised to obtain a free-flowing bisulphate  $160^\circ\text{--}170^\circ\text{C}$ . is the best temperature. Even at  $250^\circ$ , however, traces of nitrate or nitrite still remain; and these traces are increased, contrary to what might be expected, if excess of sulphuric acid be added. If the bisulphate be used to produce hydrochloric acid, excess of sulphuric acid makes it very hygroscopic, almost impossible to store, and difficult to grind. Moreover, it causes evolution of hydrochloric acid even in the cold on mixing with sulphuric acid and hence nuisance and loss. The traces of nitrogen acid in the bisulphate produce chlorine in the hydrochloric acid; and through the continual regeneration of higher oxides with the aid of atmospheric air, the amount of chlorine gradually increases in the acid when stored, and may render it useless for some purposes. The sudden foaming of the bisulphate at about  $150^\circ\text{C}$ ., when the water of hydration is given off, is another difficulty of the process, and can only be overcome by using sufficiently capacity retorts and exit tubes.

The chief impurities in nitre are chlorides and small amounts of iodine compounds. The chlorides yield chlorine and nitrosyl chloride; and if the mixture of nitre and acid be made before putting it in the retorts, which case closed vessels with a draught must be used, these gases escape, and produce no effect beyond the



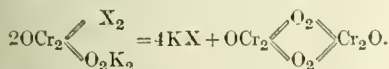
nitric acid corresponding to the nitrosyl chloride. Most of the iodine remains in the retort as sodium iodate; but some goes over, and give a yellow tint to the acid. The iodine in the retort is in turn the source of iodine in the hydrochloric acid made from the bisulphate. Selenium arsenic in the sulphuric acid become sodium selenate and arsenate, and do not contaminate the nitric acid. They go over, however, from the bisulphate into the hydrochloric acid, and the selenium colours the acid brown or reddish. Hydrochloric acid containing selenium attacks and dissolves copper, the selenium acting catalytically. In condensing the vapours issuing from the retort, fractional cooling is a promising plan as a means of separating the more easily condensable hydrates of iodine acid from the less easily condensable anhydrous iodine.—J. T. D.

*Carbonate; Decomposition of — by Alkali Chlorides in Presence of Water.* A. Cantoni and J. Passamanik. *Ann. Chim. anal. appl.*, 1905, 10, 258—262. *Chem. Zentr.*, 1905, 2, 535—536.

IRON and Goguelia (this J. 1904, 440; 1905, 88) have previously studied the decomposition of alkaline-earth carbonates by aqueous solutions of alkali chlorides. The investigation has now been extended to the case of zinc carbonate. The action of ammonium chloride solution on zinc carbonate is almost independent of the duration of the action, but increases very rapidly with the temperature and with the concentration of the solution. Zinc carbonate is only slightly attacked by solutions of potassium chloride or sodium chloride, but is much more soluble in these solutions than in pure water. A N/1 solution of ammonium chloride dissolves at 14° C. 0.0586 gm., and a N/1 solution of potassium chloride, 0.04768 gm. of zinc carbonate per litre; whereas Essen found that water at 14° C. only dissolves 0.01 gm. of zinc carbonate per litre. —A. S.

*Ammonium Salts; Variation of Basic function in —.* A. Colson. *Comptes rend.*, 1905, 141, 331—333.

The author considers that the hydroxide precipitated from chromic acid is  $\text{O} \cdot \text{Cr}_2(\text{OH})_4$ . This is confirmed by the fact that one molecule of it, dissolved in molecules of acetic acid behaves thermochemically, adding successive molecules of potassium hydroxide, as though it contained two molecules of acetic acid, and on evaporation *in vacuo* over phosphorus pentoxide, the residue has the composition  $\text{O} \cdot \text{Cr}_2(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$ . This reaction is not at once decomposed on addition of the requisite amount of potassium hydroxide; at 0° C. the residue remains clear for many days, at 20° for several hours, at 30° for some minutes. The hydroxide so precipitated is dark green and gelatinous, quite different from that precipitated from chromic acid, which latter, too, is a strong base, liberating from a solution of potassium salt enough hydroxide to make the liquid alkaline to litmus or nolphthalein. Possibly the addition of potassium hydroxide to the tetracetate gives at first potassium compounds which then react on one another



the dissolved salts of chromium, as well as the hydroxide, exhibit these changes; the green sulphate, for example, obtained by reducing chromic anhydride by sulphurous acid, slowly changes in density, and in heat of decomposition by potassium hydroxide.—J. T. D.

*Carbonates; Electrolytic Formation of —.* F. Foerster and E. Müller. *XIV.*, page 930.

*Nitrates; Electrolytic Production of — from Nitrates, specially with Silver Cathodes.* E. Müller and F. Spitzer. *XIV.*, page 930.

*Ammonium Salts; Acid Ammonium —.* P. T. Walden. *XXIV.*, page 945.

*Oxalates of Lithium, Sodium, Potassium and Calcium.* I. W. Foote and J. A. Andrew. *XXIV.*, page 945.

*Ammonium Salts; Alleged Double —.* H. W. Foote and J. A. Andrew. *XXIV.*, page 945.

*Ammonium Oxalate; Formula and Stability of — [Use in Explosives].* P. V. Dupré. *XXII.*, page 940.

*Sulphur; Action of Alkali on —.* H. Pomeranz. *V.*, page 921.

# ENGLISH PATENTS.

*Gases Issuing from Pyrites Burners; Treatment of —. Gases; Means for removing Dust from —.* J. Shields. London. Eng. Pats. 16,353 and 16,354, July 23, 1904.

THE gases, especially those from pyrites burners, are conducted beneath or into a constantly replenished heap of porous or granular material, such as coke, crushed slag, or the like, which, as it collects the dust, is drawn away from the bottom of the heap by a conveyor, and is elevated to pass into a separator for the removal of the dust, and then restored through a funnel hopper in a clean, hot state, to the top of the heap. The receptacle for the filtering material is of conical shape, with its apex downwards, and about the centre of the heap the gases are led in through a pipe immediately under a horizontal disc, beneath which a cavity is thus maintained. Another form of apparatus is also shown, in which the filtering material falls slowly between sets of inclined shelves arranged in a cylindrical or rectangular form.—E. S.

*Sulphuric Acid; Construction of Plant for the Manufacture of —.* G. E. and A. R. Davis, Manchester. Eng. Pat. 20,012, Sept. 16, 1904.

THE flues connecting the chambers in sulphuric acid plant, instead of being made as is usual, large in sectional area, are under the present invention, constructed in series of 40, more or less, and of diameter varying from two to three inches, their number, length and diameter being, however, proportioned to the work required from them, and the pressure under which they are to be worked. Such tubes, being exposed to the atmosphere, are stated to be efficient coolers.—E. S.

*Kilns for Burning Limestone, Dolomite and the like.* E. Schmatolla, Berlin. Eng. Pat. 4245, March 1, 1905.

THE kiln is mainly characterised by the arrangements for the introduction and distribution of the gas from a producer, and of air. The gas passage communicating with the generator extends through the base of the kiln, and is closed by a plug. Branches lead from this passage into lateral ducts, whence the gas passes to inlets in the walls of the kiln shaft. The supply of gas is regulated by dampers in the ducts; outside these are other ducts for admission of air, opening at their upper ends into air spaces having gratings or regenerative passages, formed by rhomboid projections on the firebrick lining of the shaft. The air thus cools the lining while being itself heated. A funnel-shaped iron ring is arranged in the lower part of the kiln shaft, projecting towards the centre. Air enters the annular cavity below this ring, from which, thus heated, it rises into the burning zone, whereby a long flame is obtained.—E. S.

# FRENCH PATENTS.

*Hydrochloric and Hydrobromic Acids; Manufacture of —.* E. F. J. Hoppe. Fr. Pat. 352,419, March 15, 1905.

THE elements of hydrochloric or of hydrobromic acid are brought together in a moist and heated state in the presence of such metal chlorides or bromides as are decomposed by heat in the presence of water. Aluminium, zinc, and tin chlorides (or bromides) are mentioned, among others, as suitable agents for effecting the required synthesis. A temperature of about 100° C. is usually (but not in all cases), suffices for the reaction.—E. S.

*Sulphur Dioxide and Carbon Dioxide; Processes for the Recovery of —, in the Treatment of Sulphide Ores, of Sulphates, or of Sulphur Compounds generally; as well as Methods for the Production of Nitrogen.* H. S. Elworthy and D. Lance. Fr. Pat. 352,254, Feb. 18, 1905.

SULPHATES of the heavy, alkaline-earth, or alkali metals,

are heated with carbon in a closed vessel, in a complete or partial vacuum, and the mixture of carbon monoxide and dioxide formed, is led, for instance, through copper oxide heated to redness, as directed in Eng. Pat. 25,007, of 1897 (this J., 1898, 908) whereby the carbon monoxide is oxidised, and the copper oxide is reduced to metal, with recovery of pure carbon dioxide. Air is then led through the heated metal, to reproduce the copper oxide. The nitrogen remaining from the reaction between air and heated copper is claimed as being available in the synthesis of ammonia and of cyanides, &c.

Sulphides, natural or artificial, are heated in a closed vessel, into which air is injected, to produce sulphur dioxide, which may be liquefied, or converted into sulphuric acid. But, preferably, the sulphides are heated in a converter, lined with magnesia or the like, while air is passed in, whereby sulphur dioxide is produced, and fixed oxides are formed. A combination of processes is adopted in certain described cases. Reference is made to Fr. Pat. 342,865, of 1904 (this J., 1904, 1032).—E. S.

*Lencite; Industrial Treatment of* — [for Obtaining Aluminium Hydroxide, &c.], Soc. Romana Solfati. Fr. Pat. 352,275, March 10, 1905.

THE main object of the invention is to obtain from lencite and like minerals the aluminium as hydroxide, with a potassium salt as an accessory product. The mineral is mixed with sodium hydroxide, carbonate or nitrate, and quicklime, and the mixture, after roasting at a dark red heat, is leached, and steam is passed through the solution to oxidise any ferrous salt. The solution, containing sodium aluminate and potassium carbonate (the silica having combined with the lime to form an insoluble silicate) is treated by any usual process to obtain aluminium hydroxide as a precipitate, and the alkali carbonate in solution. The residue, containing the double silicate of sodium and calcium, is treated with sodium bisulphate to dissolve out the soda as sodium sulphate. (Compare U.S. Pat. 744,765 of 1903; Eng. Pat. 23,919 of 1903; and Eng. Pat. 3776 of 1904; this J., 1903, 1347; 1901, 186, and 1905, 276.)—E. S.

## VIII.—GLASS, POTTERY, AND ENAMELS.

### ENGLISH PATENT.

*Glass; Manufacture of Sheet* —, P. T. Sievert, Dresden, Germany. Eng. Pat. 9211, May 2, 1905. Under Int. Conv., April 12, 1905.

THE process consists in drawing sheets from a uniformly heated mass of glass. The uniform mass is obtained by supplying glass from a tank to a smaller reservoir, evenly heated on all sides and top and bottom, which is separated from the actual drawing chamber by a partition, and communicates with it at a point below the surface of the molten glass. The actual drawing chamber is covered, and in the cover is a slot, through which the sheet is drawn by suitable means, and which is at such a level that the molten material just enters it.—W. C. H.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

*Firebrick; Action of Blast-Furnace Gases on* —, T. Ludwig. X. (see below).

*Cement; Detection and Determination of Free Blast-Furnace Slag in* —, M. Gary. XXIII., page 942.

### ENGLISH PATENTS.

*Kilns for Burning Limestone, Dolomite and the like*. E. Schmatolla. Eng. Pat. 4215, March 1, 1905. VII., page 925.

*Cement; Grinding Apparatus for Manufacturing* —, E. J. Clarke, Greenhithe, Kent. Eng. Pat. 6391, March 25, 1905.

THE invention relates to an apparatus for grinding

"slurry," namely, the liquid mixture of chalk, clay and water. It consists of a brush of stiff wires, which is made to rotate by suitable means over the surface of a block. A cup-like opening is provided at the centre of the brush into which the material to be ground is fed. A casing surrounds the brush and block and has an opening for the exit of the material treated. Means are also provided for raising the block to allow for the wearing away of the brush. The grinding and mixing are effected by the passage of the material through the brush and over the block.

—W. C. H.

*Oleaginous Mixture for Sprinkling on Roads and the like*. R. M. Hahn, London. Eng. Pat. 11,620, June 2, 1905.

A *SPRINKLE* oil is first mixed with  $\frac{1}{2}$  to 1 per cent. carbolic acid, which produces an emulsion, and is then heated to, say, 150° F., and mixed with about 5 per cent. of asphaltum, 10 to 15 per cent. of tar, and, say, 5 per cent. of the residue from the distillation of glycerol. Using the mixture the road is first sprinkled with the product diluted with 3 parts of water, whilst for subsequent treatment the water may be increased to 10. It is claimed that a sprinkling once a month in summer and once in three months during the remainder of the year, keeps a road moist and absorbent of dust, with level, compact surface like asphalt.—C. A. M.

### UNITED STATES PATENTS.

*Asbestos Composition*. H. C. Todd and C. Mayr, Chicago, Ill. U.S. Pat. 796,164, Aug. 1, 1905.

*SHEETS* or articles are prepared by making a mixture powdered aluminium silicate, sodium silicate, and water, which is used to impregnate, and fill the spaces between asbestos fibres, and the articles formed are dried, and finished at a temperature of about 800° F. or less.—W. C. H.

*Stone; Process for Treating* —, H. Ryan, Seattle, Wash. U.S. Pat. 796,253, Aug. 1, 1905.

THE invention relates to a process for strengthening or improving the colour or quality of stone. Stone, when permeated with iron-rust, is subjected to the action of more or less dilute phosphoric acid for any length of time that may be necessary, and the excess of acid is afterwards removed by washing with water. Stone may then be subjected to the action of "sugar of lead" which is allowed to dry, and then a solution of phosphoric acid is applied and finally the excess of "sugar of lead" phosphoric acid is removed by washing.—W. C. H.

### FRENCH PATENTS.

*"Artificial Trass"; Manufacture and Application of a New Industrial Product called* —, A. Cajot. Pat. 352,354, March 14, 1905.

A *NEW INDUSTRIAL* product called "Artificial Trass," is made by adding a certain quantity of lime or carbonate of lime to blast-furnace slag while in an incandescent state; quantity of lime, &c., added depends upon the composition of the slag, and varies inversely with the content of lime and alumina in it. The product is then granulated by a dry process. The claims also include this process of manufacture of the new product, and its use in place of natural trass in different mortars.—W. C. H.

*Hydrocarbon Oils; Emulsifying* —, by Marine Al. H. M. L. D'Azémar. Fr. Pat. 352,100, Feb. 15, 1905. III., page 919.

## X.—METALLURGY.

*Blast Furnace Calculations*. J. L. Stevenson. Engin., 1905, 100, 177—178.

CALCULATIONS are given for designing a new blast-furnace plant, as also for the power required. A summary of the power required for any output per furnace is likewise given.—A. S.

*Firebrick; Action of Blast-Furnace Gases on* —, T. Ludwig. Stahl u. Eisen, 1905, 25, 870—872.

*FIRESTONE* (this J. 1904, 442) recently drew attention to the case of the destruction of firebrick by blast-furnace gases.



I published some analyses of the brick. The author puts out that at the relatively moderate temperatures attained in the blast furnace, it is highly improbable that alumina would be lost or gained by the firebrick, by ion or vaporisation, and that consequently more light should be thrown on the problem by regarding the amount of alumina in the brick as fixed, and calculating the relative increase or decrease of the other constituents on this basis. This method was applied to Firmstone's analytical figures, with the following results:—

	Brick before use. Col. 4 in Firmstone's table.	Brick after use. Col. 2 in Firmstone's table.	Glazed skin on brick Col. 1 in Firmstone's table.
Alumina .....	1.000	1.000	1.000
Silica .....	2.453	3.096	5.597
Iron oxide .....	0.153	0.167	1.099
Magnesia .....	0.011	0.014	1.591
Calcium oxide .....	0.016	0.009	0.899
Sodium oxide .....	0.027	0.089	0.834
Hydrogen oxide .....	0.012	0.027	1.135

In the body of the brick there was thus a notable increase in the proportions of silica and alkali, but the content of alumina and magnesia had not appreciably altered. The glazed surface, on the other hand, there was a considerable increase in the proportions of all the constituents other than alumina. With respect to the alkalis, magnesia and iron oxide, Seger and Cramer have shown that these substances are volatile to quite an appreciable extent at the temperature of the blast-furnace, but the case of silica cannot be so readily explained. The author suggests that possibly a volatile cyanogen compound of silicon is formed, analogous to the halogen compounds of silicon.—A. S.

*d; Absorption of — by Wood from Potassium Cyanide Solution.* S. Herbert Williams. Inst. of Mining and Metallurgy, Bulletin No. 11, Aug. 17, 1905.

900 TONS of solution (strength=0.007 KCN) from precipitating boxes, containing gold of a total value of 10 dols., flowed through a wooden launder 75 ft. long, 12 in. deep, 8 in. wide, inside measurement, during a period of seven months. On being discarded, the launder was burnt and the ashes, cleared from nails and screws, weighed 159 lb., and contained 2.766 oz. of gold and 464 oz. of silver, equal to 941.11 dols. per ton. The final launder contained 15.5 cb. ft. of wood and thus had an average value of 60.65 dols. per cb. ft.—J. H. C.

*[Cyanide-Process] Use of Sodium Bisulphate in the Cleanup.* J. E. Thomas and G. W. Williams. J. Chem. Met. and Mining Soc. of S. Africa, 1905, 5, 334—337.

The authors have made a lengthy series of experiments with a view to determining the following points:—

- 1) Comparative rates of solution of zinc in equivalent solutions (i.e., as expressed in grms. of sulphuric acid + 100 c.c.) of sulphuric acid and sodium bisulphate.
  - 2) Maximum working strength of the bisulphate solution.
  - 3) Maximum strength of the stock solution.
  - 4) Effect of temperature, electrolytic couples, &c.
- Tables are given showing that "within limits" the bisulphate is slightly more efficient than commercial sulphuric acid of equal strength; stock solutions containing up to 20 grms. of free acid per 100 c.c. could be readily prepared, and working solutions, containing grms. of free acid per 100 c.c., could be used without any fear of crystallisation of the sodium bisulphate. The effect of the presence of metallic electrolytic couples was shortened the time required for solution of the zinc. Rise in temperature above 33° C., had the effect of lowering the solubility of the salt, and so putting an end to the solvent action.—J. H. C.

*[Cyanide Process] Cyaniding of the Tailings: Some Suggestions on the —.* A. Prister. J. Chem. Met. and Mining Soc. of S. Africa, 1905, 5, 338—341.

The author having experimented on a scale of 280 tons of

sand at a time with a view of ascertaining how the gold is actually dissolved in the tanks, proposes a new method of circulating the solutions based upon the fact that the gold is mainly dissolved by the strong solutions, the weaker solutions following serving mainly to wash out the dissolved gold. By the method proposed, the same (or better) extraction is obtained, together with richer zinc-gold slimes, by the use of a quantity of solution one-third less than that generally employed.—J. H. C.

*[Cyanide Process] Cyaniding of Concentrates by Percolation.* Notes on the —. A. L. Edwards. J. Chem. Met. and Mining Soc. of S. Africa. 1905, 5, 345.

210 tons of concentrates assaying 60 dwt. to the ton, at the Clutha Gold Mines, Barberton, were ground in a ball mill so as to pass through a 1600-mesh standard screen and leached by percolation after addition of 4 lb. of lime per ton of concentrates; a 0.05 per cent. potassium cyanide solution was run through and then a 0.1 per cent. solution. The concentrates were afterwards turned over and a 0.75 per cent. cyanide solution was run on and allowed to remain for 12 hours. This solution was then drawn off and all dissolved gold washed out as rapidly as possible; the treatment was repeated on three subsequent occasions during 40 days, whereby an extraction of 93 per cent. was secured. Had the concentrates been more finely ground 30 days would have been sufficient.

The cost for cyanide was 12s. per ton, zinc 4d., lime 3d., labour (exclusive of power costs) 5d. The high consumption of cyanide was owing to the unroasted state of the concentrates. The author concludes that concentrates can thus be treated locally for 40s. per ton, as compared with £6 18s. per ton, the cost of chlorination (including freight, £1 per ton).—J. H. C.

*Alloys; Gold-Tin —.* R. Vogel. Z. anorg. Chem., 1905, 46, 60—75.

The author has made a study of gold-tin alloys similar to that previously made of gold-lead alloys (this J., 1905, 518). The alloys containing from 0 to 20 per cent. of tin when rapidly cooled, contain three distinct structural elements, viz., grains of gold enclosed in mixed crystals of gold and tin, and an eutectic consisting of mixed crystals and the compound AuSn. If the alloys be cooled slowly, no separation of gold occurs. In the alloys containing from 20 to 60 per cent. of tin, the compound AuSn separates first, whilst the eutectic consists either of a mixture of mixed crystals and AuSn, or of AuSn and AuSn<sub>2</sub>, according to the amount of tin present. When the proportion of tin in the alloys is from 60 to 80 per cent., the compound AuSn<sub>2</sub> separates first, and the eutectic consists of AuSn<sub>2</sub> and AuSn<sub>4</sub>. In the alloys containing from 80 to 90 per cent. of tin, crystals of the compound AuSn<sub>4</sub>, and in those containing from 90 to 100 per cent. of tin, crystals of metallic tin separate, the eutectic in both cases consisting of AuSn<sub>4</sub> and tin. With most of the alloys an abnormal crystalline structure is produced by rapid cooling.

The compound AuSn can be prepared by fusing together the necessary amounts of gold and tin; its formation is accompanied by slight expansion. It melts at 418° C. It has a bright, silver-grey fracture and is distinguished from its components, gold and tin, by its brittleness and hardness. It resembles gold in its resistance to the action of acids, and its electric conductivity surpasses that of all other gold-tin alloys, with the exception of those containing from 0 to 5 per cent. of tin. The compound AuSn<sub>2</sub> melts at 308° C. with decomposition into crystals of AuSn and a liquid, according to the equation:—



The crystals of AuSn<sub>2</sub> are as resistant to acids as those of AuSn. [The compound AuSn<sub>4</sub> is softer and less resistant to acids than AuSn<sub>2</sub>, but more so than pure tin. When heated to 252° C. it decomposes into crystals of AuSn<sub>2</sub> and a liquid, according to the equation:—



—A. S.





the hardest and most brittle of the compounds is  $\text{Sn}_2$  (its hardness is between that of cadespar and that of narspar), whilst the toughest and softest is  $\text{NaSn}_2$ . —A. S.

*alium; Hardness of Wrought* —. Werner v. Alton. Z. Elektrochem, 1905, 11, 503–504.

author gives details of further tests upon the hardness is metal in the purest form that has yet been attained, after hammering out into sheets at a red heat.

the results obtained show that tantalum, containing very small amounts of oxide as impurity, after being into sheets at a red heat, is equal in hardness to the best and most carefully finished steel. Tantalum, however, greatly exceeds this hard steel in toughness, whilst these hard tool steels are brittle, tantalum can be rolled into sheets without injury. The new metal in its rest state, unites, therefore, the hardness of best steel with a greater toughness and ductility than is known to be possessed by any other metal.—J. B. C. K.

*Deposition; Chemistry of* —. Precipitation of Copper by Natural Silicates. E. C. Sullivan. J. Amer. Chem. Soc., 1905, 27, 976–979.

author carried out a series of experiments on the deposition of copper from its solutions by finely divided solid substances. The solid substances used kaolin, a shale from Arizona, consisting largely of quartz and glauconite, two specimens of orthoclase from Diego County, California, well-crystallised albite from Amelia Court House, Virginia, crystalline microcline from Wilmington, Delaware, and pyrites. Twenty-five per cent. of the finely powdered solid substance were added to the copper solution (in most cases a 1 per cent. solution of copper sulphate crystals), and after the mixture stood for some time in a stoppered flask with occasional shaking, it was filtered and the filtrate analysed. It was found that the reaction between the silicates and copper solution was mainly an exchange of bases, the copper being removed from the solution and an equivalent quantity of other bases (chiefly the alkali and alkaline earth bases) being dissolved. If “adsorption” takes place it is only in comparatively insignificant amount (see this J., 1905, 335). The amount of copper removed from the solution by a given solid substance depends upon the condition of fineness of the latter. The amount removed in one case 95 per cent. and in another case 100 per cent. of the copper from the solution. The feldspars, albite, and microcline, removed from 60 to 100 per cent. of copper from 50 c.c. of a solution containing 1 gram of copper. Kaolin and pyrites were not so effective.—A. S.

*the Solutions; Assaying* —. A. M. Henderson. XXIII., page 942.

#### ENGLISH PATENTS.

*Extraction [by Amalgamation]*. W. H. Hyatt, Wick, Middlesex. Eng. Pat. 8677, April 15, 1904.

old-bearing ore is delivered in fine powder into a hopper, from which it is fed into the pockets of a rotating cylinder within a casing excluding contact with the atmosphere. As the cylinder rotates, its pockets come successively opening in an amalgamating chamber or pipe below, through which opening the ore falls, and is swept forward and discharges along the pipe, which has downward and upward curves (U and J successively), mercury being introduced into the hollow of each downward bend. The ore is only under the influence of the air-blast from the bottom of the cylinder as it enters the amalgamating channel. The exit channel is provided with a device for trapping any excess of mercury that may be carried forward. Reference made to Eng. Pats. 24,782 of 1894, and 16,032 of 1895; see this J., 1896, 119, and 1897, 805.—E. S.

*Apparatus for Concentrating and Separating* —. J. H. Nass, London. Eng. Pat. 15,793, July 15, 1904.

upper frame, carrying a travelling endless sheet or conveyor upon a diagonal grating, forming the conveying table, is mounted upon a lower frame by

resilient supports, so that the two frames form a single self-containing frame of which the top is capable of receiving longitudinal movement, while the inclination of the whole may be adjusted to requirements. The top frame rests against adjustable buffers supported by a standard, a cam mounted on which gives a percussive or bumping movement to the travelling table, a tension rod with spring, adjusting screw and hand wheel being attached at one end of the belt-frame. Or, a reciprocating motion may be imparted by means of an eccentric or “toggle” arrangement. An even sheet of water is supplied from a launder, which sheet passes over the transversely-inclined belt, and washes the lighter particles of the ore towards its lower longitudinal edge, whereby the ore becomes separated into bands of varying density.—E. S.

*Copper and Alloys of Copper contained in Ashes, Sand and Waste from Foundries and other Works where Copper is dealt with; Process for Extracting and Refining the* —. C. Casman, Brussels. Eng. Pat. 11,073, May 26, 1905.

THE proportion of silica present in the copper waste having been determined, the quantity of sodium carbonate necessary to form therewith sodium silicate is added; or sodium chloride may partially or entirely replace the carbonate. The mass is then heated until the copper present fuses and sinks, the silicates produced forming a surface slag.—E. S.

#### UNITED STATES PATENTS.

*Converters; Method of Lining* —. C. M. Allen, Lolo, Mont., Assignor to R. Baggaley, Pittsburg, Pa. U.S. Pat. 796,169, Aug. 1, 1905.

THE method consists in distributing silicious material on the interior of the converter, while its surface is covered with molten viscous slag or matte, and then applying molten slag or matte, as a cementing agent, and permitting the same to set, and cooling if necessary with an air-blast.—W. C. H.

*Converter-Lining*. C. M. Allen, Lolo, Mont., Assignor to R. Baggaley, Pittsburg, Pa. U.S. Pat. 796,170, Aug. 1, 1905.

CLAIM is made for a copper converter having air tuyères, and a distributed unpacked adherent interior lining of material containing silica.—W. C. H.

*Copper-Converter*. R. Baggaley, Pittsburg, Pa., and C. M. Allen, Lolo, Mont. U.S. Pat. 796,174, Aug. 1, 1905.

THE claim is for a copper converter having a compacted silica lining and an interior lining of unpacked material containing ore.—W. C. H.

*Matte; Converter for Bessemerizing* —. R. Baggaley, Pittsburg, Pa. U.S. Pat. 796,175, Aug. 1, 1905.

THE invention refers to a converter for Bessemerizing matte, which has an adherent lining, distributed and loosely arranged, of silicious material, sintered together throughout its mass.—W. C. H.

*Matte; Method of Converting* —. R. Baggaley, Pittsburg, Pa. U.S. Pat. 796,282, Aug. 1, 1905.

THE method described for converting matte, consists in distributing the lining of unpacked silicious material, or ore, over the working area of the interior of the converter, sintering the same *in situ*, introducing matte into the converter, and then blowing air through the mass. (See also preceding abstracts, and U.S. Pat. 789,618 of May 9, 1905; this J., 1905, 624.)—W. C. H.

*Metals; Pulverising* —. H. Maxim, New York. U.S. Pat. 796,338, Aug. 1, 1905.

THE metal to be pulverised is melted and run into a hopper discharging into a horizontal passage, in which it descends immediately in front of a blast of a highly heated inert gas, and the metallic spray formed is driven forward into a closed chamber, in which the spray is cooled by expansion of the gas, and also by a cooling liquid traversing the chamber in a pipe coiled, or bent to

and fro. The gas is pumped out of the chamber, part to be reheated, and part to be compressed for continued use to assist in cooling the chamber by its expansion. The "atomised" metal is collected.—E. S.

#### FRENCH PATENT.

*Copper, Lead, Zinc, Nickel and Silver Ores; Concentration of — [Use of Crude Acid from Wood Distillation].* V. Laurent. Fr. Pat. 352,430, March 16, 1905.

The acid liquors obtained in the distillation of wood, are saturated with carbonate or oxide ores to form acetates. In the case of copper and silver acetates being obtained, these are distilled at about or under 300° C., to obtain crystallisable acetic acid, and a residue of the metal. Lead, zinc and nickel acetates thus produced are transformed into carbonates by an alkali carbonate, and the alkali acetate formed is treated by known means to recover acetic acid.—E. S.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A).—ELECTRO-CHEMISTRY.

*Electrolysis with Alternating Currents.* E. Wilson. Paper read before the Faraday Soc., July 3, 1905. [Advance Proof.]

The author in this paper gives an account of some experiments made to determine the effects of electrolysis with alternating currents, upon certain metals and electrolytes. The potential differences between the electrolyte and one electrode were observed by means of a method described in the paper, and the curve of current intensity was also obtained by a special method suited to the conditions of the experiment. The results are exhibited in the table on page 931.—J. B. C. K.

*Iron Salts; Oxidation and Reduction Processes in the Electrolysis of Solutions of —.* Z. Karaslanoff. Z. Elektrochem., 1905, 11, 489—496.

The author has investigated the oxidation and reduction processes in the electrolysis of iron salts, especially with regard to their relation to the construction and reliability of a voltameter or coulomb-meter in which iron salts are used in place of the usual copper or silver salts. The principle of such a cell for use as a current measurer consists in the titration of the ferrous salt formed by cathodic reduction and present at the end of the period of use, by means of potassium permanganate solution. The author's experimental trials of this cell related to the influence of concentration, temperature, cathode material and position, time, and movement of the electrodes upon the reduction occurring at the cathode. A series of tests carried out with this form of cell, gave a mean error of +0.23 coulomb as compared with a silver voltameter in the same circuit. The author, therefore, concludes that the iron titration coulomb-meter is sufficiently accurate for laboratory use.

—J. B. C. K.

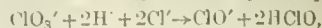
*Chlorates; Electrolytic Formation of —.* F. Foerster and E. Müller. Z. Elektrochem., 1905, 11, 502—503

The authors reply to a recent communication by H. Sirk (see this J., 1905, 544). Sirk's experiments dealt with the influence of platinum as electrode material, when free hydrochloric acid is present; and to the preponderance of the second of the two reactions, given in earlier papers by Foerster and Müller, namely—

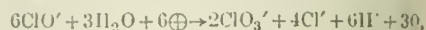


or the production of chlorate in the electrolytic cell (see this J., 1902, 1235; 1903, 417). The authors here assert that Sirk is in error, in considering that his experi-

mental proof that the presence of platinum will accelerate the speed of the reaction represented by the equation:



applies to the reverse reaction, and they re-assert the correctness of their originally expressed views as to changes occurring in the electrolytic chlorate cell. Their views are based upon the results of direct experiment, and prove that the formation of chlorate is primarily to the reaction:—



and is only secondarily due to the reaction investigated by Sirk.—J. B. C. K.

*Nitrites; Electrolytic Production of —, from Nitrate especially with Silver Cathodes.* E. Müller and A. Spitzer. Z. Elektrochem., 1905, 11, 509—515.

CONTINUING their former work (this J., 1905, 445) authors have investigated the cathode potential of the electrolysis of alkaline solutions of sodium nitrate, sodium nitrite, and mixtures of the two, with each of spongy copper, silver and gold. The method of experiment was to record the cathode potential at successive intervals of time, using, in the first instance, a platinum cathode, then coating the platinum with a smooth deposit of the metal in question, and adding successive quantities of the metallic substance dissolved in a liquid of the same composition as the electrolyte, and continuing the observations after such addition. The results with silver are in general similar to those formerly obtained with copper, to say, with the smooth cathode the potential required for the reduction of the nitrate, at first below that for the reduction of the nitrite, soon rises above the latter, whilst with the spongy cathode the potential needed to reduce the nitrate is uniformly below that needed to reduce the nitrite. The difference in the case, however, is very much greater with silver than with copper, so that the reduction of the nitrate to nitrite be carried very much nearer to completion before reduction of nitrite to ammonia occurs. In an experiment with a cathode of spongy silver between anodes, nearly 4 grms. of nitrite were formed in three hours in a solution originally containing 23.1 grms. of nitrate and 27.5 grms. of nitrite, 96 per cent. of the current thus utilised; and when the original solution contained only 7.9 grms. of nitrate and 45 grms. of nitrite, of nitrite corresponding to 48.5 per cent. of the current was still obtained. Elevation of temperature was favourable to the yield of nitrite. A previously proposed spongy electrode did not work as well as one of silver during the process in the manner above described, removal of this disability in the previously formed electrode is of importance, for there are great difficulties in the way of adding silver solution and forming the cathode of electrolysis, if the process is to be worked industrially. A fairly complete conversion of the nitrate present to nitrite is necessary, as otherwise the isolation of nitrite by crystallisation is impracticable. Gold cathodes, whether smooth or spongy, are not suitable for nitrite reduction, as with them the reduction of the nitrate to ammonia occurs at the same potential as and coincides with the production of the nitrite.—J. T. D.

*Electrolysis [Electrolytic Analysis]; Methods of —.* N. Puschin and R. Trechinski. XXIII., page 942.

*Cyanide Solutions; Assaying —.* A. M. Heller. XXIII., page 942.

### ENGLISH PATENTS.

*Solid Bodies or Bodies of Uniform Solid Structure [Brushes, &c.]; Method of Producing Homogeneous —.* The British Galvanic Metal Packing Co. Ltd. Glasgow. From Papier-Fabrik Act.-Ges., Berlin. Pat. 9225, April 22, 1904.

The claim is for the process of producing bodies of uniform solid structure.



Experiment.	Metal.	Solution.	Duration of Test in Hours.		Frequency.		Spec. gr. of Solution.		Temperature of Electrolyte °C.		A. M. Z. Amperes per sq. cm.	Max. Coulombs per half period.	Weight of Plates in Grams.		Difference in weight of plates after rinsing in water and drying.	Difference in weight after rubbing with wash-leather.	Average results, per hour after rinsing in water and drying.	Remarks.	
			Before.	After.	Before.	After.	Before.	After.	Before.	After.									
1	Lead	H <sub>2</sub> SO <sub>4</sub> dil.	15	21.5	1.050	1.049	17.0	—	0.0236	0.0394	{ 401.019 { 397.065 { 382.834	385.050 382.834 390.651	—30.2	—	0.00344				
2	"	"	15	92.5	1.050	1.049	17.5	—	0.0236	0.0094	{ 402.190 { 398.977 { 390.651	394.016 389.977 390.651	—16.5	—	0.00629				
3	"	"	8	92.0	1.050	1.036	21.0	32.0	0.0847	0.0335	{ 389.900 { 383.105 { 348.825	346.155 348.825 348.825	—87.9	—	0.03230				
4	Zinc (Amalgamated)	"	14 <sup>1</sup> / <sub>2</sub>	25.5	1.038	1.068	17.6	19.1	0.0240	0.0345	{ 1110.58 { 1116.67 { 103.05	103.05 110.58 97.98	—26.10	—	0.00530				
5	"	"	18	92.6	1.038	1.054	21.3	22.0	0.0253	0.00956	{ 1101.724 { 99.073 { 96.647	96.647 101.724 96.647	—10.72	—	0.00159			(Same solution as in experiment 5.)	
6	"	"	7	92.0	1.054	1.060	19.5	27.5	0.0923	0.0340	{ 99.073 { 96.647 { 88.939	88.939 96.647 91.629	—15.15	—	0.00695				
7	"	"	8	92.0	1.048	1.055	21.0	25.0	0.0889	0.0335	{ 1115.155 { 1109.865 { 104.780	112.952 107.776 104.780	—4.20	—	0.00160				
8	"	"	8	32.0	1.050	1.058	—	23.0	0.0307	0.0334	{ 97.935 { 94.500 { 105.147	94.500 94.500 103.810	—87.55	—	0.00674				
9	"	"	8	92.0	1.050	1.064	—	25.5	0.0389	0.0335	{ 101.457 { 113.135 { 113.300	103.133 113.135 113.300	—2.061	—	0.00205				
10	Zinc	Zinc chloride	12 <sup>1</sup> / <sub>2</sub>	25.5	1.255	1.260	15.0	20.5	0.0247	0.0345	{ 1114.505 { 109.800 { 115.237	114.780 109.800 105.785	+ 0.450	—	—				
11	"	Zinc sulphate (saturated)	14 <sup>1</sup> / <sub>2</sub>	25.5	—	—	—	—	0.0240	0.0345	{ 1115.237 { 106.708 { 111.747	105.785 106.708 111.841	—	+ 0.146 (+ 0.035)	—			(Same solution as in experiment 13.)	
12	"	Sodium sulphate	18	92.0	1.100	1.104	20.0	22.5	0.0241	0.00956	{ 64.188 { 61.199 { 59.786	59.786 61.199 59.786	—2.427	—	0.000179				
13	Iron	Ferrous sulphate	18	92.0	1.114	1.122	21.5	21.0	0.0273	0.00956	{ 63.008 { 59.407 { 60.085	92.537 59.407 55.490	—0.940	—	0.000535				
14	"	"	7	92.0	1.122	1.125	19.5	29.0	0.0979	0.0346	{ 59.786 { 60.085 { 61.330	59.407 55.490 56.280	—0.645	—	0.00389			Tap water used.	
15	"	"	8	92.0	1.174	1.186	20.6	25.0	0.0929	0.0335	{ 62.464 { 59.319 { 53.526	57.211 53.526 53.526	—11.946	—	0.00445			Tap water used.	
16	"	"	8	92.0	1.174	1.186	20.6	25.5	0.0929	0.0335	{ 55.430 { 56.242 { 66.242	54.460 55.381 66.312	—1.851	—2.012	0.00157			Distilled water used	
17	"	"	8	32.0	1.066	1.102	18.5	21.4	0.0340	0.0334	{ 67.168 { 66.242 { 67.141	67.168 66.312 67.225	+ 0.092	—	—				
18	"	Sodium chloride	18	92.0	1.138	1.134	22.0	21.0	0.0262	0.00956	{ 66.312 { 66.312 { 66.977	66.312 66.312 57.130	+ 0.092	+ 0.173	—			(Same solution as in experiment 15.)	
19	"	"	7	92.0	1.134	1.128	19.5	23.5	0.0929	0.0345	{ 1090 { 1096 { 1090	1090 1096 1090	+ 0.102	—	—				
20	"	"	8	32.0	1.086	1.090	19.5	21.0	0.0312	0.0334	{ 1096 { 1090 { 1096	1096 1090 1096	+ 0.102	—	—				
21	Copper	Copper sulphate	12 <sup>1</sup> / <sub>2</sub>	25.5	—	—	1.105	16.25	17.3	0.0205	0.0345	{ 138.013 { 140.162 { 134.235	138.013 140.162 134.157	—0.180	—	—			
22	"	"	8	92.0	1.060	1.092	19.0	30.5	0.1440	0.0335	{ 133.500 { 133.500 { 133.500	133.500 133.500 133.500	—0.181	—	0.000137				
23	"	Sodium chloride	18	92.0	1.138	1.132	21.5	21.0	0.0241	0.00956	{ 134.235 { 133.500 { 133.500	134.235 133.500 133.500	—0.165	—0.276	0.000137				
24	"	"	8	32.0	1.066	1.093	18.4	20.3	0.0340	0.0334	{ 134.235 { 133.500 { 133.500	134.235 133.500 133.500	—0.633	—	0.000560				
25	"	Sodium phosphate	18	92.0	1.042	1.050	21.2	21.5	0.0241	0.00956	{ 134.235 { 133.500 { 133.500	134.235 133.500 133.500	—0.014	—	—				
26	Th	Protocloride of tin	12 <sup>1</sup> / <sub>2</sub>	25.5	1.110	1.120	16.0	16.8	0.0214	0.0345	{ 119.401 { 119.401 { 119.401	119.401 119.401 119.401	—0.26	—	0.000112				
27	Aluminium	Potash alum (solution sat.)	2	92.0	—	—	20.6	98.0	0.6900	0.0335	{ 119.401 { 119.401 { 119.401	119.401 119.401 119.401	—	—	—			not taken	

solid structure, by subjecting the materials to which they are composed to pressure and at the same time to the action of heat so as to render them incandescent. The process may be applied in the manufacture of electric dynamo or motor brushes of pure carbon or of brushes consisting of carbon and of copper films interleaved, or of carbon combined with metal cores, netting or strips.

—W. D. C.

*Electrolysers; Impts. in* —. F. L. Bartelt, Bristol. Eng. Pat. 18,356, Aug. 24, 1904.

A RECTANGULAR tank is divided into a number of compartments by transverse partitions, each compartment containing a series of suitable anodes and cathodes. The form of electrode described consists of an ebonite plate with a rectangular portion cut away at the bottom, the interior edges of the cut being grooved for the insertion of a sheet of platinum foil. The latter is held in position by a wire which is attached to the foil, and threaded through a hole in the top of the ebonite plate. The partition between each compartment is provided on one side near to the top with a recess or cut-away portion, from which one or more vertical passages lead downwards through the centre of the partition, and are turned at right angles into and near the bottom of the adjacent compartment. The end wall of the first compartment is provided with similar passages, which are supplied with electrolyte from a suitable pipe, and an outlet pipe leads from near to the top of the last compartment through the base of the latter; this arrangement promotes a good diffusion of the electrolyte. (See this J., 1905, 678.)—B.N.

*Furnaces; Impts. in Electric* —. The British Thomson-Houston Co., Ltd., London. From The General Electric Co., Schenectady, N.Y. Eng. Pat. 20,810, Sept. 27, 1904.

A CARBON tube, in the bore of which the articles to be heated are placed, is made with two end pieces of larger diameter, and with an intermediate portion smaller in diameter. The larger end pieces are covered with a roll of paper, and the space between the paper and the inner smaller carbon tube is filled with powdered titanium carbide. The larger end pieces fit into sockets in massive graphite or carbon pieces, which are connected to the source of electricity. The tube and layer of carbide are finally surrounded with a packing of refractory material, such as coke. When the furnace is heated, the paper chars, and the carbide sinters together forming a refractory non-oxidisable shell of considerable mechanical strength, which is a good conductor of electricity, non-hygroscopic, and which materially increases the life of the carbon tube.

—B. N.

*Cells; Impts. in Galvanic* —. W. Schenk, Berlin. Eng. Pat. 6650, March 29, 1905.

THE positive electrode, which is hollow, contains a quantity of the solid exciting material, and is provided with openings, the upper acting, when the electrode is in position, as an inlet for the solvent, and the lower as an outlet for the dissolved exciting material. The space between the two electrodes is divided into two chambers by an insulating partition arranged between the inlet and outlet openings in the hollow electrode, the solvent being introduced into the upper chamber, and the dissolved exciting material passing into the lower chamber which contains the depolarising material. An absorbent layer of blotting paper is placed between the electrodes, and projects into the filling chamber so that it becomes impregnated with the solvent as soon as the latter is introduced.—B. N.

#### (B).—ELECTRO-METALLURGY.

*Alloys; Some Observations on the Deposition of* — from Mixed Solutions. C. B. Jacobs. J. Amer. Chem. Soc., 1905, 27, 972–976.

THE author recently had occasion, in the preparation of an

alloy intended to receive a lithographic transfer, to effect a simultaneous deposition of two metals, zinc and nickel, in definite proportions and in the form of strong adherent, finely crystalline metal, under conditions which the use of cyanide solutions or alkaline solutions precluded. Neutral sulphate solutions of the two metals with the addition of varying proportions of ammonium sulphate and ammonium chloride, were found to form the most suitable electrolyte for the purpose, with two anodes of zinc and one of nickel, and with a rotating cathode. The chief difficulty was that of maintaining the proper difference in voltage between the two anodes and the cathode, in order that the amounts of the two metals deposited on the cathode might be regulated. This was accomplished by the use of two generators running at different voltages, namely, one at high voltage for the zinc which is the more electro-negative metal, and one at low voltage for the nickel anode, the current returning through the cathode and a common return wire to the generators. By means of this arrangement, and by varying the distances between the zinc anode and nickel anode respectively and the cathode, it was found possible to deposit the two metals in any desired relative proportions with no more than the ordinary attention required in electro-plating.

Some experiments on the deposition of copper and nickel from a cyanide solution with the aid of the arrangement described above, showed that it was possible from the bath to obtain at will brasses varying in colour from light yellow.—A. S.

*Electric Disintegration; Mechanism of* —; of Carbon; Decomposition of Alloys. F. B. XXIV., page 945.

#### ENGLISH PATENT.

*Ores and like Substances [Electrical]; Process for separating Certain Constituents of* —, and Apparatus therefor. F. E. Elmore, London. Eng. Pat. 13, June 15, 1904.

THE ore is pulped with a liquid, and the pulp is electrolysed by being, for instance, fed into a vat between pairs of converging electrodes, of which a number are arranged in series vertically, there being devices for deflecting the rising particles from the descending. The liquid if non-conducting may be rendered conducting by addition of, for instance, sulphuric acid. The bubbles of gas given off during the electrolysis attach themselves to certain particles of the ore, which float and become separable. As an alternative, the pulp may be contained in a vat having vertical electrodes near its bottom, in which case a stirrer is used. (See also Eng. Pat. 1903; this J., 1904, 22.)—E. S.

#### UNITED STATES PATENTS.

*Electrolytic Pots containing Fused Baths; Stopper for* —. C. M. Hall, Niagara Falls. U.S. Pat. 796,325, 2, 1905.

THE tap-hole of the vat is provided with a plastic body of carbon, which is baked around a metal plug. The tapering metal plug projects some distance outside the vat and can be removed from the plastic body to close the tap-hole.—R. S. H.

*Aluminium; Making* —. A. G. Betts, Troy, N.Y. U.S. Pat. 795,886, Aug. 1, 1905.

THE process consists in refining an alloy containing aluminium, using a fused electrolyte specifically heavier than the alloy, but heavier than pure aluminium. The alloy forms the anode at the bottom of the bath, and the cathode is pure fused aluminium floating on the surface. The method is applied to the manufacture of aluminium from its ores by first reducing in presence of iron or



oxide and submitting the alloy thus obtained to refining process described above.—R. S. II.

*er*; *Electrolytically Refining* ——. A. G. Betts, Troy, N.Y. U.S. Pat. 795,887, Aug. 1, 1905.

*OLUTION* of a monobasic non-oxidising acid containing over salt of the same acid and an agent to prevent growth of nodules is used as electrolyte. The impure containing bismuth forms the anode, and the silver is deposited on the cathode.

ie bismuth which dissolves is precipitated with illic lead, and the electrolyte regenerated by preatation of the lead and dissolving silver to the required ant.—R. S. II.

*Sand, Iron Oxide, and other Suitable Substances*; *apparatus for the Reduction of* ——. D. R. S. Galath, Assignor to W. Steuart, New Zealand. U.S. Pat. 796,312, Aug. 1, 1905.

Fr. Pats. 336,726 and 336,727 of 1903; this J., 378.—E. S.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*ing Points of Fats*; *Apparatus for Determining* ——. L. Ubbelohde. XXIII., page 941.

*ase*. F. L. Dunlap and W. Seymour. XXIV., page 945.

*rd*; *Comparison of Method of Determining* — in *dilled Glycerins, Crude Glycerin and Soap Leys*. Schulze. XXIII., page 943.

### ENGLISH PATENT.

*inous Mixture for Sprinkling on Roads and the*. R. M. Hahn. Eng. Pat. 11,620, June 2, 1905., page 933.

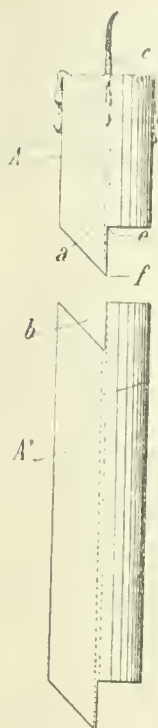
### FRENCH PATENTS.

*are for Continuous Saponification and other Pur-*. L. Rivière. Fr. Pat. 352,182, March 8, 1905. *er Int. Conv.*, March 9, 1904.

autoclave claimed is constructed of several comating vessels of small capacity, instead of the usual large one, together with the necessary steam coils, s, means for injecting air, &c. The apparatus can pt alternately closed and open to the atmosphere ervals, regulated according to the nature of the nee and the pressure employed, so that new quan- of material can be introduced and the operation l out as a continuous process under any required re. Very much larger quantities can be saponified ven time and, therefore, at a lower price than in al autoclaves. Claim is made for the application aratus constructed on these lines to any industrial s involving chemical reactions under variable re.—C. A. M.

*One" and "Stearine" in Mixed Fatty Acids*; *Process* *eparating* ——. F. Lanza. Fr. Pat. 352,337, March 1, 1905.

is made for a process of treating the mixed fatty with sulpholeic acid. The fatty acids are first divided, and then introduced into a bath of acidu- water (1° B.) into which has previously been intro- 10 per cent. of an aqueous solution of sulpholeic . The mixture is agitated for 30 minutes and allowed nd for the same length of time, during which the rises to the surface, whilst the solid fatty acids a deposit of fine crystals at the bottom. The



sulpholeic acid prepared by agitating 100 kilos. of filtered oleic acid with 50 kilos. of sulphuric acid (66 B.), which is added little by little with precautions to keep the tem- perature constant, and the pro- duct is subsequently diluted with 4000 kilos. of water. A special form of apparatus in which the process may be carried out is also claimed.—C. A. M.

*Candles capable of being com- pletely consumed*; *Manufacture of* ——. J. Dürwald. Fr. Pat. 352,242, March 10, 1905.

With the object of preventing the waste of the ends left in the candlesticks, claim is made for a form of candles which can be placed one upon another in such wise that the flame is communi- cated from one wick to the other without interruption. The origi- nal candle A is placed in the candlestick, and when partially consumed is replaced by a new one, A', on to the top of which it is fitted by means of the joint a, b. The wicks c, c', are reduced in diameter at the point of junc- ture in order to prevent any variation in the size of the flame. —C. A. M.

## XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

### (B.)—RESINS, VARNISHES.

*Rosin Spirit, Pine Oils, and Oil of Turpentine. Examination of Oils of Turpentine*. E. Valenta. Chem.-Zeit, 1905, 29, 807—808.

THE author has examined several specimens of rosin spirit as to their refractive index and rotatory power, and gives figures for two of them. The first was a crude oil, too dark for optical examination, which, after treat- ment with caustic soda, gave 91 per cent. of a golden- yellow distillate passing over up to 298° C. This had at 20°-5 C. a refractive index of 1.48168, and gave a rotation in a 100 mm. tube of +1.0. On fractionating, it gave the following results:—

Temp.	Vol. of Dist.	Refr. Index.	Rotation in 100 mm. tube.
168°—178°	45	1.47488	+ 0.0°
178°—188°	19	1.47799	+ 0.3°
188°—210°	17	1.48640	+ 2.3°
210°—275°	8	1.50251	+ 5.0°
275°—288°	2	1.52268	+ 16.0°

The colour deepened as the b. pt. rose. The second sample was a refined pinolene; this contained 41 per cent. of fractions boiling between 115° and 166° C. The original oil had a refractive index of 1.47809 and a rotation of +0.2°; the eight fractions gave refractive indices rising from 1.45509 to 1.50774, the rotations from—2.2° to —4.6° at 176° C. b. pt., then lower lævo-, and finally dextro-rotations. Treating the fractions with caustic soda made practically no change in these figures. The fractions from 115° to 166° C. when used to adulterate oil of turpentine, could not be recog- nised by their optical characteristics, which are not far enough removed from those of turpentine. They give, however, a yellow coloration on shaking with aqueous sulphurous acid, whilst turpentine and petro- leum oils do not. Pine oils and rosin oils give

this reaction, however, and though the latter do not come over below 160° C., the former do. To distinguish between pine oils and pinolene as adulterants of oil of turpentine, the author recommends treating the distillate below 160° C. with acetic anhydride and a drop of sulphuric acid, when pinolene gives an intense green colour; or, mixing one part with 1–2 parts of 6 per cent. solution of iodine in carbon bisulphide or carbon tetrachloride, and heating on the water-bath. An intense green to olive-green colour is struck by pinolene, none by pine oils, petroleum distillates, camphor- or rosin-oils.

Pine oils (Kienöle) are inferior oils of turpentine, made from roots, oaks, pine wood, &c., by partial destructive distillation. They are yellowish oils with a sharp smell, not removed by treatment with alkali, contain much free acid, and irritate the skin much more than oil of turpentine does. They dissolve asphaltum which has been exposed to light much more readily than oil of turpentine does, even when they have been refined and re-distilled. They have, on the whole, a higher refractive index than oil of turpentine, but act similarly to the latter on polarised light: they are chemically similar to oil of turpentine, but contain, in addition, empyreumatic products. These latter afford reactions by means of which pine oils can be detected in oil of turpentine. If equal volumes of oil of turpentine and a 1 per cent solution of auric chloride be shaken in a test-tube, before and after one minute's heating in the water-bath, pure oils of turpentine show separation of gold in the oily layer only, but pine oils and pinolene completely decolorise the aqueous solution. Another useful test consists in mixing 10 c.c. of the oil with 5 c.c. of 10 per cent. solution of potassium iodide and 10 c.c. of carbon bisulphide and shaking for one minute. Oils of turpentine give a yellow aqueous layer, and a raspberry-red oily layer; with pine oils the oily layer is yellowish-red, and with pinolene, petroleum, or rosin oil more or less pale yellow. The constants and reactions of a number of oils of turpentine, &c., are given in a table.—J. T. D.

#### ENGLISH PATENT.

*Varnishes for producing "Mat" Surfaces; Manufacture of* — F. Waechendorf, Cöln-Ehrenfeld, Germany.  
Eng. Pat. 12,460, June 15, 1905. Under Int. Conv.  
April 3, 1905.

The admixture of a basic aluminium compound, such as aluminium hydroxide, basic aluminium silicate, or the like, with from 9 to 22 parts of a fatty drying oil varnish, yields a product containing aluminium compounds of the fatty acids present in the varnish or produced during the drying. This combination furnishes a "mat" varnish which does not become sticky, or show any tendency to soften. Owing to its complete homogeneity it remains elastic and free from cracks, and it is not attacked by water at ordinary temperatures. The claim is for varnishes of this character and the manufacture of the same.—M.J.S.

#### UNITED STATES PATENT.

*Turpentine; Apparatus for Distilling* — S. S. Fleming, Brunswick, Ga., U.S. Pat. 788,310, April 25, 1905.

The finely ground wood is introduced into a barrel-shaped tank, mounted horizontally on hollow shafts capable of revolving in suitable supports. Through one of these shafts passes a steam-supply pipe, whilst from the other issues an outlet pipe with a funnel-shaped inner end secured to a strainer. The manhole for introducing and discharging the material is in the middle of the side. The amount of wood introduced should be insufficient to fill the tank so that when the latter revolves, it can move freely, thus enabling the steam to penetrate every part and obviating the necessity of distillation under pressure.—C. A. M.

#### FRENCH PATENTS.

*Resin or Resinous Products; New Economical Furnace for Distilling* — A. A. Lagrave, Fr. Pat. 352,109, Feb. 22, 1905.

The system of flues is so disposed that the hot gases from

the fire can be conducted either under and round the proper or else to the preliminary heater, by opening and closing appropriate dampers. Passages in the brickwork enable any part of the flues to be cleaned as desired, and all the flues discharge into one stack.—C. S.

*Manila Copal, Sandarac and other similar Resins; Process for Rendering — Insoluble in Oil, in view of its Application in the Preparation of Furniture Polish* — W. Baringer, Fr. Pat. 352,323, March 13, 1905.

MANILA copal, sandarac or similar resins soluble in alcohol are mixed with from 1 to 5 per cent. of a fatty oil, heated gradually till of a suitable consistence, and maintained in this condition for from a half to one hour with constant agitation. It is claimed that the resins after this treatment are insoluble in oil and may thus be used in the preparation of furniture polish.—A. S.

#### (C.)—INDIA-RUBBER, &c.

*Litharge and Vulcanisation*. W. Esch, Gummi-Pat. 1905, 19, 977–978.

C. O. WEBER was of the opinion that the action of lead in accelerating vulcanisation was due to its power of acting as a sulphur-carrier. Schulze (this J., 1904, 719), on the other hand, considered that this action was due to good heat conductivity of litharge and to its capacity for forming soap-like compounds with the rubber. According to Weber no vulcanisation of rubber is effected in a mixture containing litharge until some lead sulphide is formed, and, in support of this contention, he stated that heating two mixtures: (1) Para rubber, 100; litharge, 100; and sulphur, 3 parts; and (2) Mangabeira or African rubber, 100; chalk, 100; litharge and sulphur, 3 parts, for eight hours in hot air at from –130° C., the Para rubber was well vulcanised and sulphide was formed, whilst, with the other mixture rubber was not vulcanised, and no lead sulphide produced. The author points out that the results of comparative tests are not at all conclusive, and state lead sulphide cannot be the active agent in effecting vulcanisation, since if in the Mangabeira rubber mixture litharge be replaced partly or wholly by lead sulphide no vulcanisation of the rubber takes place. The known facts appear to indicate that in consequence of reaction between the litharge and the caoutchouc carbon of Para rubber, the absorption of sulphur by the latter is accelerated; the formation of lead sulphide is regarded as being due to a secondary reaction. It is pointed out that the action of litharge is not analogous to that of lime or magnesia, as is frequently stated. Mixtures containing large proportions of lime or magnesia are passed between the mixing rolls, the "heating" produced by litharge is not observed, and the resulting vulcanised rubber soon becomes hard and brittle. Over lime unites directly with sulphur at moderate temperatures to form polysulphides, which are known to be direct vulcanising agents, whereas at similar temperatures no reaction takes place between litharge and sulphur, whilst even if lead sulphide were formed, it has no vulcanising action.—A. S.

#### ENGLISH PATENT.

*India-Rubber; Process for Devulcanising* — Strup and A/S. Gummi-Regenerations-Societet, Pat. 2655, Feb. 9, 1905.

SEE Fr. Pat. 351,816, Feb. 25, 1905; following these.

#### UNITED STATES PATENT.

*Caoutchouc; Process of Obtaining* — from a plant belonging to the *Nettle* Family. C. K. Roeder, Philadelphia, Pa., Administratrix of G. H. Roeder, Agent to E. F. Greeff and A. Tilt, New York, and C. C. R. Yonkers, N.Y. U.S. Pat. 795,860, Aug. 1, 1905.

From the green stalks of the plant, the bark is separated by decortication, and the remaining fibrous constituents are subjected to moderate pressure to remove the latex juices and saps, washed free from woody matter and impurities by means of water, and then treated with a suitable solvent for the extraction of the caoutchouc. A



# FRENCH PATENT.

*r*; *Process for Decalcinising* —. A/S. Gummi-  
generations-Soc. (System-Resen-Steensrup). Fr.  
251,816, Feb. 25, 1905.

invention relates to the regeneration of the rubber  
ste containing a backing or core of textile material,  
ut previous separation of the latter. The waste  
is ground, and then heated under a steam pressure  
—8 atmospheres, in a jacketed lead-lined boiler,  
hed with an agitator, with suitable proportions of  
cali or alkaline-earth and hydrofluoric acid. After  
reatment the recovered rubber is washed and dried.  
proportions of alkali or alkaline-earth and hydro-  
ic acid required vary according to the respective  
nts of sulphur and of textile material contained in  
ubber waste. If the waste contains only a small  
rtion of textile material, the hydrofluoric acid may  
erated in the boiler, during the heating operation,  
ding fluor spar to the mixture. For example, waste  
il containing 10 per cent. of sulphur and about  
er cent. of textile fabric would require 5 per cent. of  
and about 5 per cent. of hydrofluoric acid, whereas  
tain only 1 per cent. of textile fabric, 1—2 per cent.  
rofluoric acid or 1—3 per cent. of fluor spar would be  
ent.—A. S.

# V.—TANNING, LEATHER, GLUE, SIZE.

## ENGLISH PATENT.

*Treatment or Preserving of* —. A. A. Baily,  
tenbury, Somerset. Eng. Pat. 18,267, May 23, 1905.

with the natural wool or hair on them are treated  
edly with a "chrome liquor," which is applied to  
r or hairless side only of the skin, and is not allowed  
e in contact with the wool. The following formula  
nd to give good results: Potassium bichromate,  
hydrochloric acid,  $\frac{1}{2}$  gallon; glucose,  $1\frac{1}{2}$ —2 lb.;  
ater, to 2 galls. When the skin has been com-  
mpregnated with the liquor, it may be dried,  
sed, scoured, and dyed. Skins thus treated are  
to be more pliable than those tanned by older pro-  
—M. J. S.

## UNITED STATES PATENT.

*ng Apparatus*. W. R. Smith, Assignor to Buffalo  
ther Co., Buffalo, N.Y. U.S. Pat. 795,942, Aug. 1,  
1905.

pparatus claimed consists of a vat or series of vats  
adjacent to a liquid-storage tank. A circulating  
with suction and discharge pipes connects the  
-tank with the bottom of the vats; the suction pipe  
ng an air-inlet which allows of the liquid being  
d during the pumping operation; the discharge pipe,  
extremity, has perforated radiating arms arranged  
et the liquid in 2 horizontal direction and so impart  
tory movement to the solution.—M. C. L.

# XV.—MANURES, Etc.

*res*; *Retrogression of the Soluble Phosphates in*  
*ed* —. G. Gray. Chem. News, 1905, 92, 77—79.

GRESSION is slight in well-made superphosphates,  
ay be considerable when insufficient acid has been  
the unchanged tricalcium phosphato reacting with  
onocalcium phosphate to produce the dicalcium  
Similar changes take place when superphosphate is  
with certain other manures, sometimes added by  
s to improve the mechanical texture. The object  
present experiments was to ascertain the nature  
changes which occur in such mixtures as are known  
e been used, and also the rate of the change. The  
ments show that bone dust is the best form of  
ium phosphate for mixing with superphosphate, the  
ia in the amount of soluble phosphoric acid being

only 2.8 per cent. in 18 days. Coral Qu. a guano and  
kainite both reduced the soluble phosphoric acid by  
7 per cent. Chesterfield guano is far more injurious,  
the reduction in 18 days being 62 per cent. With slaked  
lime the reduction is very rapid, the whole amount being  
reduced in 24 hours, and 94 per cent. in three hours. Basic  
slag and ground limestone have less effect than slaked  
lime (88 and 86 per cent. respectively). With basic slag  
there is a great production of citrate-soluble phosphoric  
acid due to the iron present.—N. H. J. M.

# XVI.—SUGAR, STARCH, GUM, Etc.

*Levulose; Conversion of Dextrose into, and the*  
*Identification of* —. H. Ost. Z. angew. Chem., 1905,  
30, 1170—1174.

DIERSEN (this J., 1903, 312) has shown that levulose is  
produced during the saccharification of starch by oxalic  
acid, owing probably to the secondary action of the acid  
on the dextrose. The author has effected a similar  
transformation of dextrose into levulose by the action of  
moderately strong sulphuric acid. 1.1 kilo of dextrose  
was dissolved cold in a mixture of 2 litres of water and  
1 litre of concentrated sulphuric acid, and the solution  
was allowed to remain at the ordinary temperature  
for four months; it was then neutralised with chalk and  
concentrated at a low temperature. The syrup was  
fractionated by means of alcohol and ether, the final  
liquors being laevo-rotatory. The author estimates that  
100 parts of dextrose yielded approximately 20 parts of  
isomaltose, 5 to 10 parts of levulose, and 60 parts of  
recovered dextrose. The identification of levulose is very  
difficult; the most certain method is that of Dubrunfant,  
applied to the syrups enriched in levulose after the  
fractional crystallisation of the dextrose. The levulose  
was precipitated from a 10 per cent. syrup at 6° C. by the  
addition of dry slaked lime. The calcium levulosate was  
separated with certain precautions, and the sugar was  
regenerated by the action of oxalic acid. The levulose  
was obtained in the crystalline form by careful concen-  
tration of the syrups and the addition of methyl alcohol  
and ether; it was identified by its high laevo-rotatory  
power. The separation of the levulose from the dextrose  
by this method was by no means complete, a considerable  
proportion of it, together with traces of mannose, remain-  
ing in the dextrose liquors. Neuberg's reaction for levulose  
by the formation of the methylphenyllosazone has only a  
limited value. Dextrose forms the same methylphenyl-  
osazone as levulose, only more slowly. If a considerable  
crystallisation of osazone occurs within 20 hours at the  
ordinary temperature in a 10 per cent. solution of the  
sugar, the presence of levulose may be inferred with cer-  
tainty, but doubtful results are very easily obtained if  
the syrups be impure or comparatively poor in levulose.  
—J. F. B.

*Saccharose, Maltose, Lactose and Raffinose; Quantitative*  
*Hydrolysis of* —. B. Pfyl and B. Linne. Z. Unters.  
Nahr. u. Genuss., 1905, 10, 104—110.

THE authors have investigated the conditions necessary  
for the quantitative hydrolysis of certain sugars, using  
for the purpose a pressure cylinder, consisting of a bronze  
tube about 30 cm. in height and of 3.2 cm. internal and  
4 cm. external diameter. The tube is furnished at the  
upper end with a screw so that a head may be screwed  
on and rendered tight by lead packing. This head carries  
a side-tube provided with a manometer, and is furnished  
with a conical valve. The top of the head is  
closed by a screw cap tightened by means of lead. Inside  
the cylinder is fitted a thick-walled glass tube, constricted  
at the upper part and provided with a mark. By joining  
the apparatus with a cylinder of carbon dioxide, any  
pressure up to 50 atmospheres can be maintained in the  
tube. During the hydrolysis the cylinder is suspended  
in a glycerin bath so that the liquids are at the same level,  
inside and out, the temperature of the bath being kept  
constant by a regulator.

When saccharose is hydrolysed by mineral or organic

acids, it is impossible to complete the hydrolysis without destroying some of the monosaccharides formed, but the authors find that, without acid, saccharose is quantitatively hydrolysed in 2½ hours when subjected to a temperature of 125° C. and a pressure of 20 atmospheres produced by carbon dioxide; the invert sugar remains unaltered after a further period of half an hour. Under the above conditions neither dextrin, nor maltose, nor lactose undergoes change.

Raffinose is completely hydrolysed into melibiose and levulose when subjected for three hours to the action of carbon dioxide at a pressure of 20 atmospheres and a temperature of 125° C.

Investigation of the action of acids on maltose and invert sugar shows that those acids which have the least action on invert sugar, e.g., acetic, succinic, glycolic, &c., hydrolyse maltose to a very slight extent. The best acid to use for the hydrolysis of maltose is benzenesulphonic acid in 2 per cent. solution, the hydrolysis being quantitative after 2½ hours at 110° C. When saccharose or invert sugar is subjected to these conditions, 17 per cent. of it is destroyed, this proportion being independent of the concentration of the sugar solution or the magnitude of the pressure. The conditions for the quantitative hydrolysis of lactose are the same as those for maltose.

The methods above described can be employed for the determination of the purity of sugars, and for the determination of sugars in presence of one another, as, for example, in honey, condensed milk, &c.—T. H. P.

#### ENGLISH PATENT.

*Carbohydrates; Caramelisation of* —. C. H. K. Gonville and J. W. Jarvis, Stratford. Eng. Pat. 20,166, Sept. 19, 1904.

GLUCOSE or other carbohydrate is melted to a syrup and the syrup is run into another vessel, where it is mixed at the atmospheric pressure with ammonia, in solution or otherwise, without the application of heat. The mixture is transferred to a third vessel, in which it is heated with agitation to a temperature of about 220° F., at about which temperature, and at about atmospheric pressure, it is maintained until caramelisation is sufficient. —J. F. B.

#### FRENCH PATENT.

*Sugar; Malaxeur with Rotating Internal Temperature Interchanger for the Manufacture of* —. J. Labourbe. Fr. Pat. 352,135, March 6, 1905.

IN the malaxeur described and figured, the essential peculiarity is the arrangement, round a hollow axis rotating in a horizontal vat, of radiating arms which form a helix and which are hollow, so that hot or cold liquid, admitted at the extremity of the axis, can spread through all the arms and so maintain the saccharine mass at any desired temperature.—T. H. P.

### XVII.—BREWING, WINES, SPIRITS, Etc.

*Mucor Fermentation.* Wehmer. Ber. deut. botan. Ges.; through Brewers' J., 1905, 41, 518.

IN the case of the mucorinae, e.g., *Mucor javanicus*, *M. spinosus* and *M. racemosus*, the power of producing alcohol is inherent in the mycelium as well as in all other cells of the organism. The alcoholic fermentation induced by *M. racemosus* is entirely independent of the presence of gemmæ. The formation of gemmæ is an anaerobic phenomenon, but the alcoholic fermentation proceeds with or without the presence of air, and the production of gemmæ is rather the result than the cause of alcoholic fermentation, since it only takes place in the presence of a fermentable sugar. The growth of the fungus is restricted by the presence of 3 to 5 per cent. of alcohol, but in the

course of some weeks nearly one-half of this alcohol is consumed by the organism.—J. F. B.

*Sarcina; Question of the Transmutability of Genuine into Beer Pediococci.* N. H. Claussen. Amer. Brewer, 1905, 41, 529–530.

THE author defends his contentions (this J., 1904, 32, and 876) on this question, against criticisms by Schönfeld and reaffirms that the pediococci which produce the so-called sarcina sickness of beer are absolutely distinct from the genuine sarcina or the pediococci which thrive in alkaline liquids. The beer pediococci are essentially anaerobic organisms which cannot be grown in ammoniacal yeast water, whereas the real sarcinae are aerobic organisms which it is impossible to cultivate in an acid medium such as beer. In the author's experience the beer pediococci, *P. pernicius* and *P. damnosus*, show no tendency to racial variation, and are remarkably constant and well characterised species. These dangerous and specific organisms will escape detection in ammoniacal yeast water but be employed in the examination of the suspected beer; on the other hand, pure aerobic forms of genuine sarcina will be found, but well authenticated evidence has been produced to show these forms ever existed in the original beer, still less, they were the cause of disease. The various theories of virulence, acclimatisation and transmutability of sarcinae which have been adduced to account for the sickness of beer, are based, according to the author, on errors arising from aerial infections during the investigations, and from the use of an alkaline culture medium totally unfit to afford conclusions relative to any product such as beer.—J. F. B.

*Yeast Mashers [Distillery]; Lactic Acidification of* —. W. Henneberg. Z. Spiritusind., 1905, 28, 261–271–272, 281–282.

EXPERIMENTS on the laboratory scale with pure cultures of *B. Delbrücki* showed that the production of acid is rapid, and proceeds to a high degree at a temperature of 50° C., but that the bacilli are so debilitated under conditions that when transferred to a fresh quantity of mash at a more moderate temperature, they produce very little acid and are incapable of further growth in droplet cultures. This weakening is proved to be due rather to the high degree of acidity developed than to the action of the high temperature itself, since cultures at 50° C. in presence of chalk were less seriously affected. Cultures grown at moderate temperatures, e.g., 30° C., produce less acid than those made at 50° C., but remain in a vigorous condition and can continue to produce acid at temperatures of 20°–30° C., i.e., at the propagation of the yeast; they are also capable of development in droplet cultures at these temperatures.

The acidified mash on the large scale are pitched with yeast at a temperature of 25° C., and the temperature rises to 26°–29° C. in the course of 24 hours. It is found that a further production of acidity, ranging from 0.9 degree, was observed during this period. The further production of acid was always due to the action of *B. Delbrücki* alone, and not to infection. Continued acidification was inimical to the yeast, and proved by the more or less rapid dying off of the yeast cells; it was accompanied by decreased attenuation proportional to the increases in acidity. The production of acid was observed even when the acidified mash had been "pasteurised" by heating for one hour at 77° C., in spite of the fact that *B. Delbrücki* is immediately killed when exposed, in presence of the acid mash, to a temperature of 72° C. The persistence of *B. Delbrücki* in an active state in the "pasteurised" mash is attributed to particles of mash on the walls of the tun having escaped the necessary temperature.

The efficiency of the acidification in preventing infection and in suppressing infections produced artificially is extremely satisfactory. A serious infection of acidified mash showing more than one degree of acidity (0.1 per cent. of lactic acid) is practically impossible, and excessive acidity is liable to injure the yeast.—J. F. B.



ines; *An Objectionable Method of Fining* — R. Bodmer. Analyst, 1905, 30, 264-266.

Attention is called to a fining mixture sold under the name of "Heins Schnell-Klärung." It consists of two separate solutions, one containing 11.417 per cent. of crystallised zinc sulphate, and the other 10.52 per cent. potassium ferrocyanide. The solutions are supposed to be of exactly equivalent strength, and when added in equal volumes to a wine, form a bulky precipitate of ferrocyanide, which settles out and clarifies the wine. The author has found distinct quantities of zinc and ferrocyanide in various samples of Moselle, due to one or other of the above solutions being added in slight excess to the wine, and considers this process of fining to be a most dangerous one. — W. P. S.

*Hyd and Methyl Alcohols; Detection and Determination of — in Mixtures, by the Immersion Refractometer.* A. E. Leach and H. C. Lythgoe. XXIII., page 943.

## XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

### (I.)—FOODS.

*Wheat; The Proteids of —. I. The Proteid Soluble in Alcohol.* T. I. Osborne and J. F. Harris. Z. anal. Chem. 1905, 44, 516-525.

The authors can find no evidence that the proteid dissolved in alcohol from wheat-gluten, consists of more than one substance. The residues obtained on fractionally precipitating the proteid all yielded practically the same amount of glutamic acid, the quantity of the latter being the same in every case. They, therefore, come to the conclusion, that, taking into consideration the composition of the physical and chemical properties of the proteid, by one such substance is present in gluten, and this substance, gliadin, does not consist of two separate proteids, as stated by Kutscher. — W. P. S.

*Wheat; A Study of Durum —.* F. A. Norton. J. Amer. Chem. Soc. 1905, 27, 922-934.

Durum wheat (*Triticum durum*) is largely grown in the Mediterranean countries and Southern Russia, and is the principal raw material for the manufacture of macaroni. Varieties of this wheat have given very promising results in experimental cultivations in the middle-western States of North America, and are particularly well adapted for semi-arid regions. They give good yields and grade high. Most of the durum wheats are milled only with difficulty and give low yields of flour, but the best Russian varieties are readily milled and compare favourably with yield of flour with the best bread wheats. The high protein content which distinguishes the durum wheat has a tendency to increase still further in the American varieties. These wheats are especially rich in saccharose and dextrin; they have exceptionally large kernels, most translucent, and are characterised by the presence of a yellow colouring matter, which, however, does not detract from the value of the flour, and is considered to be a criterion of quality in macaroni. The gluten content is high but it is somewhat poor in quality, owing to a deficiency of gliadin; this deficiency is, however, compensated in the best wheats by the larger quantity of gluten. The best durum wheats make excellent bread, the colour is slightly yellower than that of ordinary bread, but the flavour is very pleasant. On account of its hardness durum wheat is far more suitable for making the coarse semolina from which macaroni pastes should be made than the more floury bread wheats; it should also be well adapted for "grit" foods. — J. F. B.

### ENGLISH PATENT.

*Milk free from Sugar; Production of —.* J. Bouma and S. B. Selhorst. The Hague, Holland. Eng. Pat. 17,818, Aug. 16, 1904.

The cream is separated from the milk by centrifugal

action and washed, the casing is precipitated by acetic acid, filtered off, washed and redissolved in a dilute alkaline solution; this casein solution is re-combined with the separated cream and the necessary salt is added. These salts consist of a soluble calcium salt, such as calcium chloride, sodium chloride, and a soluble phosphate, such as sodium phosphate; the desired sweetness is imparted by the addition of "crystalline," the sodium salt of methyl-saccharin. This sugar-free milk can be sterilised at 100° C. without coagulation. — J. F. B.

### (B.)—SANITATION; WATER PURIFICATION.

#### ENGLISH PATENT.

*Filtering Material [for Water]; New or Improved — and Method of Producing same.* O. Löffler and Dr. W. Weidle, Vienna. Eng. Pat. 6055, March 22, 1905.

One part of chalk, one part of asbestos, two parts of fossil meal and three to five parts of syenite are mixed together, made into a paste with water, compressed in a mould and burnt. The filtering material obtained is of great hardness and toughness, and is not easily broken or cracked either by heat or blows. The proportions can be varied to obtain filters of different degrees of hardness and porosity. — W. H. C.

## XIX.—PAPER, PASTEBOARD, Etc.

*Japanese Paper-making.* Foreign Office Diplomatic and Consular Reports, 1905. No. 635.

The principal paper-making fibres of Japan are obtained from the barks of the paper mulberry (*Broussonetia papy.*) and of the mitsumata (*Edgeworthia pap.*). These materials are consumed in approximately equal quantities, but the mitsumata is gradually replacing the paper mulberry fibre for all purposes where strength is not of the first importance. Other materials, used only in minor quantities, are the barks of "gampi" (*Wikströmia canescens*) and the silk mulberry (*Morus alba*), also straw, wood-pulp, and old papers. The bark is removed by steaming the stems in a primitive manner for 2-3 hours and stripping by hand; the outer bark is then scraped off from the white inner bark by means of a knife. This is not very readily effected in the case of *Broussonetia* and the imperfect portions are separated and used for a coarser grade of paper. The bark is boiled with lime, caustic soda or sodium carbonate, according to the district. The boiled bast is pulped generally by hand-beating with clubs; beating machines are rarely used and yield a paper of inferior strength. A cement or binding material prepared from various plants is added to the pulp; the preparations chiefly used for this purpose are infusions of the roots of *Hibiscus Manihot* or of the resinous bark of *Hydrangea paniculata*. The mould is made of a net of bamboo laths covered with silk gauze contained in a hinged wooden frame. Owing to the peculiar method of dipping the mould, the fibres of Japanese paper tend to lie all in one direction without felting or interlacing. The thinner qualities of such papers can only be torn parallel to the direction of the fibres; the thicker papers are composed of two layers of fibres arranged in directions at right angles to each other, these papers can hardly be torn at all. The strength of Japanese paper depends on the extreme length and toughness of the fibres; but the strength is not so great as formerly, owing to the increased use of mitsumata and the employment of caustic soda for freeing the bast. The report contains a list of the various classes of paper manufactured in Japan, together with an account of the materials employed, and the nature, uses and properties of the different papers. — J. F. B.

*Paper and Pulp Mills; Waste Waters from —.* M. L. Griffin. Paper and Pulp, 1905, 10, 492-496.

The author records the following analysis of the spent liquors resulting from the boiling of poplar [soda] wood

pulp: Silica 0.11, iron and aluminium oxides 0.02, calcium oxide 0.05, potassium oxide 0.09, sodium oxide 25.69, carbon dioxide 3.43, acetic acid 9.89 per cent. The organic matter extracted by petroleum spirit boiling below 60° C. was 1.56, by ether 7.14, by absolute alcohol 28.26 and by water 17.02 per cent. The total alkali by titration after incineration of the evaporated liquor was 44.25 per cent. These liquors, of course, are not polluting wastes, but solid and liquid wastes have to be disposed of after their treatment. The waste waters containing fibres and mineral loading from paper mills frequently present great difficulties in filtration. The author finds that if these waters be mixed with a small proportion of new coarse paper stock or sulphite screenings they drain readily, and the whole of the suspended solids can be recovered and used for inferior papers. The carbonaceous residue from the lixiviation of the black ash should be partially dried and burnt under the boilers with forced draught. The calcium carbonate from the causticising tanks should be re-burnt with liquid or gaseous fuel in a continuous rotary kiln; at one mill this waste is mixed with clay and burnt to Portland cement.—J. F. B.

#### ENGLISH PATENT.

*Silk; Manufacture of Artificial*.—H. E. A. Vittenet. Eng. Pat. 1686, Jan. 27, 1905. V., page 921.

### XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Opium; Meconic Acid in the Assay of*.—, and *Certain Meconates*. E. Mallinckrodt, jun., and E. A. Dunlap. J. Amer. Chem. Soc., 1905, 27, 946–964.

In the assay of opium by the U.S.P. 1890 method a yellowish scaly coating, which is evidently not morphine, settles on the bottom of the flask. This scale is now shown to be a double calcium ammonium meconate having the composition  $\text{CaNH}_4\text{C}_8\text{H}_7\text{O}_7$  with 2 or 3 mols. of  $\text{H}_2\text{O}$ , the calcium being derived from the opium and the ammonia being added during the assay. If this salt be present the results obtained in the titration of the morphine are too high, since it consumes nearly one-fourth as much acid as morphine itself. The hydroxyl group of meconic acid is replaceable by calcium or barium, and salts in which the meconic acid behaves as a tribasic acid are described. Di- and tri-barium meconates are nearly insoluble in baryta water; the di-calcium and di-barium salts, when prepared in absence of ammonia, are white, not yellow. When barium hydroxide and meconic acid are mixed in proportions corresponding to mono-barium meconate, the di-barium salt is produced and free meconic acid remains in the solution. Meconic acid can be titrated accurately as a di-basic acid by N/10 caustic soda, using blue litmus paper outside the solution as an indicator. The following *résumé* of the literature on meconic acid is appended to the paper:—Serturmer, *Gilbert's Ann.*, 55, 72 and 57, 183; Choufant, *ibid.*, 56, 349; Vogel, *Rep. Pharm.*, 4, 40; Robiquet, *Ann. Chem. Phys.*, 5, 275; Gregory, *Ann. Chem.*, 24, 43; Robiquet, *ibid.*, 5, 82; Liebig, *ibid.*, 7, 237 and 26, 114; Wackenroeder, *Arch. für Pharm.*, 2, 167; Stenhouse, *Ann. Chem.*, 51, 231; How, *ibid.*, 83, 352; Korff, *ibid.*, 138, 191; Ihlece, *ibid.*, 188, 31; Ost, *J. prakt. Chem.*, 19, 34; Rennie, *Chem. News*, 1880, 75; Dott, *ibid.*, 1880, 576; Meunel, *J. prakt. Chem.*, 2, 1882; Ost, *ibid.*, 23, 11, 439; Berthelot, *Comptes rend.*, 101, 685; Gal and Werner, *ibid.*, 103, 1141; Peratoner, *Chem. Zeit.*, 21, I., 40; Peratoner and Tamburello *Gazz. Chim. Ital.*, 33, II., 233. —J. F. B.

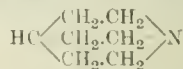
*Sparteine [Exhaustive Methylation]*. C. Moureu and A. Valeur. *Comptes rend.*, 1905, 141, 261–262.

ONLY one of the two nitrogen atoms of sparteine could be successively methylated by the Hofmann method. The methylsparteine products of the first methylation boil between 171° and 175° C., and have  $[\alpha]_D = -19.67$  and  $-40^\circ$  in absolute alcohol. A second methylation of this

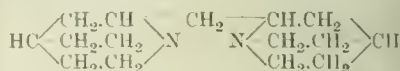
product gives a dimethylsparteine boiling at 182°–193° C. at 13.6 mm. If dimethylsparteine is methylated, treated with moist silver oxide, and then heated, there is copious evolution of trimethylamine, and a base, hemsparteilene, boiling at 135°–155° C. at 13 mm. is formed. Each of these three bases actively reduces permanganate in acid solution. They are evidently mixtures of isomers and not definite bodies.—F. S.

*Sparteine; Constitution of*.—C. Moureu and A. Valeur. *Comptes rend.*, 1905, 141, 328–330.

THE following facts have been established by the authors and others (see this J., 1903, 961, 1305, 1365, and 1905, 74813):—1. Its formula is  $\text{C}_{15}\text{H}_{25}\text{N}_2$ . 2. It is a bitertic diamine. 3. The two nitrogen atoms are equivalent and symmetrical with regard to one another. 4. While its decomposition by heat of methyl- and dimethylsparteinium hydroxides yields methyl and dimethylsparteinium tertiary unsaturated bases, that of trimethylsparteinium hydroxide liberates trimethylamine and gives hemsparteine  $\text{C}_{15}\text{H}_{25}\text{N}$ , a tertiary unsaturated monamine, the nitrogen in which therefore forms part of a bi-cyclic nucleus as



5. Sparteine is not, as Wackernagel and Woffenstein assert, a pyrrol derivative. Consequently, the above formula probably represents one of the two bi-cyclic nuclei of sparteine; the other is symmetrical, so that the formula may be written  $\text{C}_7\text{H}_{12}\text{N}.\text{CH}_2.\text{NC}_7\text{H}_{12}$ . 6. The stereoisomerism of the two isodimethylates has been established by the authors. A similar case is that of coniine, noticed by Scholtz. In no other alkaloid has this been noticed and coniine having the asymmetric carbon atom *ortho* to the nitrogen, this is probably the position also in sparteine, the formula of which would thus be



This formula is in agreement with other facts besides those given above.—J. T. D.

*Aethusa Cynapium; Chemical Examination of*.—F. B. Power and F. Tutin. Paper read before Internat. Congress of Chem. and Pharm., Liège, July 1905.

PREVIOUS investigations of “fools’ parsley” or “lesser hemlock,” *Aethusa Cynapium*, Linn., have led widely differing conclusions respecting its constitution and properties, whilst its reputed poisonous action alternately been affirmed and denied. The specimens of the plant used in the authors’ experiments were collected during the months of July and August, at a time when fruits were fully developed, but still green. Eleven kg. of the air-dried herb were exhausted with hot alcohol and the alcoholic extract was distilled with steam. A small quantity (0.015 per cent. of the weight of the fresh plant) of an essential oil of rather unpleasant odour was thus obtained, which was colourless at first, but rapidly acquired a deep brown colour. The aqueous distillate contained a small amount of formic acid. The residue of the distillation flask consisted of a dark coloured aqueous liquid and a quantity (0.8 per cent. of the weight of fresh plant) of a resinous substance. From this resinous petroleum (b. pt. 40°–50° C.) dissolved a portion, which, after boiling with an alcoholic solution of potassium hydroxide, yielded a crystalline hydrocarbon, *pentatriacontane*  $\text{C}_{35}\text{H}_{72}$ , (m. pt., 74° C.) and a crystalline alcohol (m. pt., 140°–141° C.,  $[\alpha]_D = -35.7^\circ$ ), which is either an isomeride of phytosterol,  $\text{C}_{26}\text{H}_{44}\text{O}$ , or a lower homologue. The alkaline liquid when acidified and distilled, yielded small amounts of formic and butyric acids. The portion of the resin insoluble in petroleum spirit yielded formic, butyric and protocatechuic acids when fused with potassium hydroxide. From



rk coloured aqueous liquid separated from the resin re isolated: *d-mannitol* (m. pt.,  $165^{\circ}$ — $166^{\circ}$  C.), a considerable amount of inactive *glucose* and *amorphous gummy matter*, and a very small amount of a *volatile caloid* having the peculiar characteristic odour coniine, and which, like the latter, yielded butyric acid oxidation. The amount of hydrochloride of the caloid obtained corresponded to 0.0003 per cent. of the weight of the fresh plant, which, if the base be regarded coniine, is equivalent to 0.00023 per cent. of the latter the plant. The alkaloid was found to resemble coniine its physiological action. The authors conclude that, view of the fact that the specimens of *Aethusa Cynapium* amined by them contained a small amount of a volatile caloid resembling coniine in physical and chemical characters and also in physiological action, it cannot be considered improbable that, under favourable conditions of growth, the proportion of alkaloid may be increased to an extent as to impart to the plant the poisonous properties ascribed to it.—A. S.

*anogenetic Glucoside of the Elder* [*Sambucus nigra*]. L. Guignard and J. Houdas. *Comptes rend.*, 1905, 141, 236—238.

GLUCOSIDE, together with a hydrolytic enzyme, is found in the leaves and green cortex of the twigs of the common elder. The enzyme only is found in the root. A quantity of the leaves was macerated with water, which was then distilled. Benzaldehyde was found in the distillate, showing the glucoside to be amygdalin.

—F. S.

*gentianin*. G. Tanret. *Comptes rend.*, 1905, 141, 263—264.

STILBIN is the sparingly soluble glucoside, associated to an extent of about 1 per cent. with gentiopierin. It crystallises from dilute alcohol in slightly yellow microscopic needles. It melts at  $274^{\circ}$  C. with decomposition; formula  $C_{25}H_{28}O_{14}$ . On hydrolysis with dilute sulphuric acid, it yields dextrose, xylose ( $C_5H_{10}O_5$ ), and gentianin ( $C_{10}H_{12}O_5$ ). Gentianin recrystallises from alcohol in purplish-yellow needles, insoluble in water. It is isomeric with gentisin. It differs from gentisin in melting at  $106^{\circ}$  C., and in giving a yellow coloration when dissolved in cold nitric acid.—F. S.

*ethyl and Methyl Alcohols; Detection and Determination of* — in *Mixtures*, by the *Immersion Refractometer*. A. E. Leach and H. C. Lythgoe. XXIII., page 943.

*strychnine and Brucine; Separation of* —. D. L. Howard. XXIII., page 944.

#### ENGLISH PATENTS.

*ethyl Dialkyl Barbituric Acids; Manufacture of* —. Chem. Fabr. von. Heyden Akt.-Ges., Radebeul, Germany. Eng. Pat. 10,201, May 15, 1905. Under Int. Conv., July 15, 1904.

PROCESS is claimed for making guanyl dialkyl barbituric acid by heating dicyandiamidine and dialkyl malonic acid dialkyl esters with sodium alcoholate or with condensing agents of analogous action. (See U.S. Pat. 787,360, this 1905, 559.)—F. S.

*mercury Cholate Salts of Mercury; Impts. relating to* —. J. Wetter, London. From J. D. Riedel, Akt.-Ges., Berlin. Eng. Pat. 11,180, May 29, 1905.

THE mercury salts of cholic acid are obtained by treating a dilute solution of a salt of cholic acid with a neutral mercury salt solution, preferably the mercury salt of tartaric or another organic acid. Mercurous cholate,  $H_{30}O_5Hg$  is a yellowish-white light powder almost insoluble in water, and is decomposed by the addition of alcohol. Mercuric cholate,  $(C_{24}H_{39}O_5)_2Hg$ , is a yellowish-white powder, very sparingly soluble in pure water, more

easily soluble in water containing salts (especially sodium or potassium chloride) in solution, and soluble in alcohol with decomposition.—F. S.

#### XXII.—EXPLOSIVES, MATCHES, Etc.

*Explosives Factories and Testing Stations; Report on Visits to Certain — in Belgium, Germany and Holland*. By Captain M. B. Lloyd and Captain A. P. H. Desborough, H.M. Inspectors of Explosives.

*Explosives Factories.* At the Baelen Factory, Belgium, the danger buildings are erected on a somewhat novel plan. They are circular in ground plan and lighted entirely from the roof by means of a patent glass having wire-netting in it, and which it is claimed will not let a splinter fall, even if it is very badly cracked. The mounds are then erected right up against the walls of the buildings, exceeding them in height by several metres. For this method of construction it is claimed that the force exerted by an explosion will expend itself in a vertical direction.

At the Haltern factory, Germany, every door on the nitroglycerin hill is provided with a leather pad, so hung by a short strap that it prevents the door from banging, thus avoiding the sudden impact otherwise suddenly given on a surface which might possibly have a film of nitroglycerin on it. In the nitrating and washing houses, cylinders of compressed carbon dioxide are connected with the air pipes so that in the event of a failure of the air supply the stirring can be continued with this gas if necessary.

At the Troisdorf factory, Germany, considerable quantities of trinitrotoluene are now being used in the manufacture of detonators. This substance is much safer to handle than fulminate of mercury, but as all such detonators require a priming of fulminate, as soon as this is introduced the risk becomes the same as with the older pattern. In the smokeless powder factory most of the operations are carried on with wet explosive, it being forbidden in Germany to use the dry process for the manufacture of smokeless powders.

At the Schlebusch factory, Germany, an arrangement has been installed, in the nitrating and separating houses, whereby in the event of an alarm, all the cocks to the drowning tanks can be turned on by means of a piston driven by compressed air, which can be operated by turning on a small air valve outside the mound.

*Testing Stations.*—At most of the testing stations visited, the gas gallery was constructed of wood, being elliptical in section with the major axis vertical, the diameters varying from 1.65 to 1.85 metres for the major axis and from 1.35 to 1.45 metres for the minor axis. The capacity of the explosion chamber was usually 10 cb. m. At the Haltern testing station, however, the gallery was constructed of boiler plate, and the explosion chamber had a capacity of only 4 cb. m. At this particular station it is said to have been proved that an iron gallery is more sensitive than one made of wood, and that the greater the length of the bore of the cannon the greater the liability to ignition. Pit gas is most generally employed as the inflammable constituent, but in some cases coal gas is employed, and, in one case, benzene vapour. The results, obtained with these latter, in comparison with other stations using natural gas, are held to be very reassuring as to the value of experiments made with coal gas or other substitutes. In nearly all cases coal dust, freshly ground, is also employed in the explosion chamber. It was generally held that its presence did not increase the sensitiveness to explosion, but merely added to the violence and visibility of the ignition. The bores of the firing cannons varied from 30 cm. to 70 cm. in length and from 4 cm. to 6 cm. in calibre. At the Haltern station, previously mentioned, an exceptional bore of 150 cm. is also employed. At the testing station of the Carbiton Akt.-Ges. at Schlebusch, in addition to the usual wooden gallery, a smaller gallery of the same dimensions as the one in use at Woolwich has been erected. It has been found that the relatively smaller diameter of

the explosion chamber in the Woolwich pattern gallery renders it far more sensitive and thus the use of stemming becomes a necessity. At Woolwich it has been found that extremely small charges of any explosive, when unstemmed, suffice to fire the gas, whereas on the Continent large charges fail to do so. The nature of the gas has apparently little influence and the reason of the difference is considered to lie in the dimensions of the explosion chamber. The important factor is undoubtedly the diameter, and sensitiveness would appear to vary, roughly, inversely as the sectional area of the gallery.

In Belgium the function of the Government testing station is similar to that at Woolwich. The most important difference lies in the fact that a definite maximum charge is prescribed for each explosive. This charge limit is determined by actual experiment at the testing station, and may be defined as the maximum charge which will not ignite the inflammable mixture when fired in the testing gallery.

In Germany only "safety explosives" may be used in dangerous mines, the onus of proof as to what constitutes a "safety explosive" resting with the mine owners.

The methods adopted for mixing the gas and air in most of the installations are considered to be crude. A No. 8 detonator is always used, and little attention is paid to the nature of the wrapper, whereas at Woolwich ample proof has been obtained that this is a matter of practical importance. Only limited attention is paid to the regularity of detonation of individual charges, and air spacing of the charge is considered as being quite unimportant. — G. W. McD.

*Explosives; Researches on* — Sir A. Noble. Roy. Soc. Proc., 1905, 76, A, 381–386. (See also this J. 1895, 185.)

THE object of the research was to ascertain the differences in the transformations which modern explosives suffer when fired under gradually increasing, but considerable, differences of pressure. Comparative results are given for the following three explosives (1) Cordite Mark I. (2) Modified cordite known as MD. (3) Tubular nitrocellulose known as R.R. Rottweil. Eight experiments were carried out in each case, the density of charge exploded varying from 0.05 to 0.50. In the following table the lowest, middle and highest densities are selected from those given in the original tables. —

	Cordite Mark I.				Cordite MD.			Nitrocellulose.		
Density of charge exploded .....	—	0.05	0.25	0.50	0.05	0.25	0.45	0.05	0.222	0.4
Volume of permanent gas per gram .....	—	678.0	691.9	623.6	781.8	745.5	676.3	814.7	759.2	680.9
Volume of total gas per gram. ....	—	877.8	871.3	798.8	955.4	888.6	810.6	993.1	922.3	816.3
Percentage volume of permanent gases	CO <sub>2</sub>	27.15	31.75	41.95	18.15	26.75	36.60	17.90	25.10	35.90
	CO	34.35	28.90	19.10	42.60	33.65	24.80	43.45	36.55	27.80
	H	17.50	14.95	12.05	23.15	19.80	11.90	24.40	20.25	12.60
	CH <sub>4</sub>	0.30	1.60	7.05	0.35	4.65	10.70	0.60	4.70	11.10
	N	20.70	18.80	19.85	15.75	15.15	16.00	13.65	13.40	13.40
Percentage volume of total gases .....	CO <sub>2</sub>	20.97	25.25	33.02	14.85	22.45	30.56	14.68	20.66	29.10
	CO	26.53	22.98	15.03	34.87	28.23	20.71	35.63	30.09	23.20
	H	13.52	15.07	9.48	18.95	16.61	9.94	20.01	16.07	10.50
	CH <sub>4</sub>	0.23	1.27	5.55	0.20	3.90	8.94	0.49	3.87	9.20
	N	15.99	14.95	15.62	12.89	12.71	13.36	11.19	11.03	11.10
	H <sub>2</sub> O	22.76	20.48	21.30	18.15	16.10	16.49	18.00	17.68	16.60
Pressure in tons per sq. in. ....	—	2.9	21.08	52.9	2.7	20.7	43.22	3.35	16.47	40.5
Units of heat (water fluid) .....	—	1272.3	1242.3	1360.0	1035.9	1041.4	1190.0	896.1	931.0	1636.9
Temperature of explosion °C. ....	—	5151.1	5086.4	5749.4	4056.2	4220.6	5026.8	3488.1	3667.7	4282.9
Comparative potential energy .....	—	0.9825	0.9689	1.0000	0.8401	0.8215	0.8842	0.7389	0.7438	0.7686

The transformation on firing appears, in all three explosives to follow the same general laws. With increase of pressure there is, at first a slight increase, afterwards a steady decrease in the volume of permanent gases produced, also a large increase in the volume of carbon dioxide and a

large decrease in the volume of carbon monoxide. The volume of hydrogen decreases with increasing pressure while that of methane rises rapidly. The temperatures of explosion, which can only be taken as provisional, have been obtained by dividing the units of heat (water gaseous) by the specific heats. From other considerations the author is inclined to believe that these temperatures are not very far removed from the truth. The wide differences in the transformation of the three explosives show that any attempt to describe by a chemical equation the nature of the metamorphosis which an explosive may be considered to undergo would only be calculated to convey an erroneous impression regarding the definite nature of the chemical results and their uniformity under different conditions. Experiments made on erosion, with the three explosives referred to, show that the amount of absolute erosion is governed practically entirely by the heat developed by the explosion. Under pressures varying from 5 tons to 32 tons per sq. in., erosion is practically entirely independent of the pressure both for cordite and nitrocellulose. — G. W. McD.

*Ammonium Oxalate: Formula and Stability of — [Use in Explosives].* P. V. Dupré. Analyst, 1905, 30, 266–273.

PURE ammonium oxalate prepared by recrystallisation at the boiling temperature, at ordinary temperatures, and at a temperature near the freezing point, furnished crystals of which had a composition agreeing with the formula (NH<sub>4</sub>)<sub>2</sub>C<sub>2</sub>O<sub>4</sub> · H<sub>2</sub>O. In no case under any of the conditions named, were crystals obtained with more or less than mol. of water.

In perfectly dry air ammonium oxalate loses water even at 12° C., although very slowly, whilst at 40° C., the evaporation is fairly rapid, being complete in two days. Under reduced pressure (1 mm.) the percentage loss was the same as before, but much more rapid, the salt losing its water in three days at a temperature of 67° C. The rate of decomposition is very nearly constant for any given temperature, and approximately doubles for every rise of 10° C.

The presence of ammonium oxalate in an explosive might be expected to affect the heat test, as minute traces of ammonia are set free when the salt is heated. Experiments show, that, although in the case of an explosive

giving a high heat test, the effect is very noticeable, it is of no practical importance with samples giving low tests. It is shown that the vapour pressure curve of ammonium oxalate does not reach that of water even at a temperature of 95° C., nor does it even reach the curve representing



e vapour pressure of moisture in air saturated to the tent of 70 per cent., so that the salt will be stable at all mperatures up to 95° C., provided that the air is not less an half saturated with moisture.—W. P. S.

tric Acid; *Manufacture of* —. F. Winteler. VII., page 924.

# UNITED STATES PATENTS.

asting Compound. F. G. Dokkenwadel, Coshockton, Ohio. Assignor to H. M. Grant, New York. U.S. Pat. 795,825, Aug. 1, 1905.

e explosive is composed of paper pulp, mixed with an ess by weight of sodium nitrate and potassium nitrate, lphur, to the amount of about one-third the weight of lp employed, is added and also glucose and glue, the ole being incorporated and formed into grains.  
—G. W. McD.

platives; *Process for Making* —. J. C. Smith, Lovington, Ill. U.S. Pat. 795,940, Aug. 1, 1905.

AM is made for the manufacture of a granular explosive mposition, by dissolving a mixture of sugar and salt- re in water, heating the solution to the boiling point; ling potassium chlorate and then powdered coal to n a paste, which is afterwards dried and pulverised.  
—G. W. McD.

## XXIII.—ANALYTICAL CHEMISTRY.

### APPARATUS, ETC.

ing-points of Fats; *Apparatus for Determining* —. a. Ubbelohde. Z. angew. Chem., 1905, 18, 1220—1225.

IL's method of immersing the bulb of a thermometer the melted fat, allowing the adherent fat to cool, ening the coated thermometer in an empty test-tube slowly heating in a water-bath, taking as melting- it the temperature at which the first drop falls, is ject to many inaccuracies, some of which are removed Finkener's method, who substitutes for the ther- meter-glass rods, specifies dimensions and time of immer- in the melted fat, and places the rods and a thermo- symmetrically in a test-tube of given dimensions for heating. Apart from the fact, however, that ny dipping method, the rod is likely, in a non-homo- ous fat, to become coated with an unduly large pro- tion of the higher-melting constituents, the author s that the temperature indicated by Finkener's od varies with the amount of substance adhering he rod. If this be very small, the outer layer becomes y mobile before a drop falls, and this drop is then ll and the temperature high; while if it be very large, a e drop soon collects from the large surface, and falls at ower temperature in consequence of its weight. In er case, however, the ratio of the weight of the drop to t of the total amount of substance is large, and in any es of experiments in which the weight of substance is ually increased from the one extreme or gradually inished from the other, it is found that there is one ntity for which the above-mentioned ratio is a mini- m. The actual value of this ratio at this point depends n the dimensions (diameter of rod and depth of immer- ) of the apparatus used; but the temperature indicated he melting-point when this minimum ratio is attained, not thus dependent, but is constant, whatever the ensions of the apparatus may be, and is regarded he author as the true melting-point of the fat.

he determination of the melting-point in this way, ever, is obviously a very long and laborious process; the author finds that it can be determined at one ration by the use of the apparatus figured:—

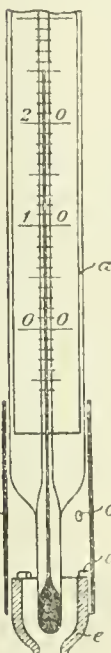


FIG. 1.



FIG. 2.

dimensions, should not differ by more than 0.2° C.  
—J. T. D.

### INORGANIC—QUALITATIVE.

Nickel; *Sensitive Reagent for* —. L. Tschugaeff. Ber., 1905, 38, 2520—2522.

a-DIMETHYLGLOXIME,  $\text{CH}_3\text{C}(\text{NOH})\text{C}(\text{NOH})\text{CH}_3$ , is a very sensitive reagent for nickel in solution, and gives a scarlet precipitate, or, with traces of nickel, a yellowish solution from which the red precipitate separates on cooling. The best method of applying this reagent is to remove excess of acid from the solution to be tested by adding excess of ammonia or sodium acetate, and then to add the powdered dimethylglyoxime, and to boil for a short time. Distinct indications are obtained with solutions containing only one part of nickel per 100,000 of water. The reaction is not disturbed by the presence of ten times as much cobalt as nickel, but when the proportion of cobalt is much greater than that of nickel, it is best to add a very large excess of ammonia to the liquid and to shake repeatedly, excess of the dioxime being then added and the solution boiled for a short time. In testing

by this method for nickel in such products as commercial cobalt salts, the reaction is manifested by the appearance of a scarlet scum rising up the walls of the test-tube, but it is generally necessary to filter or siphon off the cooling liquid and wash the residue with water; in presence of nickel this residue is red, but if nickel is absent, it is quite colourless. In this way one part of nickel can be detected when admixed with 5000 parts of cobalt.

—T. H. P.

### INORGANIC—QUANTITATIVE.

*Sodium: Detection and Determination of —, in presence of Lithium Compounds, by Hydrofluosilicic Acid.* C. Reichard. Chem.-Zeit., 1905, 29, 861—862.

HYDROFLUOSILICIC acid is proposed as a reagent for the detection and determination of sodium in the presence of lithium. The author finds that lithium compounds even in concentrated solution produce no turbidity with this acid and separate no precipitate even after 24 hours. Sodium salts on the other hand, are precipitated from solutions containing only 0.25 per cent. of sodium. Potassium salts, however, are also precipitated, and when this metal is present as well as lithium and sodium, indirect analysis, such as the conversion of the silicofluorides to sulphates, may be resorted to.—F. SBN.

*Antimony: Determination of — as Trisulphide, and the Separation of Antimony from Tin.* G. Vortmann and A. Metzl. Z. anal. Chem., 1905, 44, 525—535.

THE solution containing the antimony is acidified with at least 21 c.c. of concentrated hydrochloric acid for each 100 c.c. of the neutral solution, and heated to boiling. Hydrogen sulphide is then passed through the hot solution until the yellow antimony trisulphide which is precipitated changes to a red colour and finally black. Towards the end, the flask, in which the precipitation is carried out, is gently shaken. The black crystalline precipitate is collected on a filter, washed with water and alcohol, and dried. Before weighing the precipitate, the small quantity of free sulphur contained in it is removed by means of carbon bisulphide. Instead of weighing the precipitate directly as antimony trisulphide, it may be mixed in a crucible with iron sesquioxide and ferric nitrate— $\text{Fe}(\text{NO}_3)_3$ —and ignited, when antimony pentoxide is obtained. The heat should be applied cautiously at first, but at the end, a blast flame is used. The quantity of iron oxide and nitrate added is weighed out and the iron oxide it yields after ignition determined by a preliminary experiment.

For the separation of antimony from tin the mixed sulphides of these two metals are dissolved in a little hydrochloric acid (1:1) and the solution is neutralised with solid sodium carbonate or hydroxide, using a drop of phenolphthalein as indicator. After diluting to 60 c.c. with water, 60 c.c. of phosphoric acid (sp. gr. 1.3) and 24 c.c. of concentrated hydrochloric acid are added, the mixture is boiled and precipitated with hydrogen sulphide as described above. An equal volume of water is then added, the mixture again boiled and treated with a little more hydrogen sulphide. After filtering off the antimony trisulphide, the tin may be precipitated in the filtrate, by neutralising the greater part of the acid, diluting and passing hydrogen sulphide into the solution. The above method is stated to completely separate the two metals from each other.—W. P. S.

*Cement: Detection and Determination of Free Blast-Furnace Slag in —.* M. Garv. Mitt. Königl. Materialprüfungsamt zu Gross-Lichterfelde West., 1905, 23, 1—21.

THE process recommended, is first to determine the presence of sulphide sulphur in the cement to be examined; as sulphides are absent in well sintered cement clinker, their presence indicates admixture of slag. The object then is to obtain on the one hand pure slag, and, on the other, pure clinker meal, and from analytical determination of some constituent in the slag to calculate the amount of free slag in the cement as a whole. By removing the finest dust, it is comparatively easy to

separate by suitable liquids, such as a mixture of methyle iodide and oil of turpentine, the slag from the cement. About 500 grms. of the cement are treated on a sieve containing 10,000 meshes to 1 sq. cm., when generally about 150 grms. are left on the sieve; this portion freed from iron by a magnet, and washed with alcohol and ether, and dried. Of this "grit" 60 grms. are treated in a separating apparatus with a mixture of methyle iodide and oil of turpentine of a sp. gr. of 3.0, and the separation repeated if necessary on the light and heavy portions obtained after filtering. The portions are then examined for loss on ignition, silica, lime, insoluble matter, and sulphide sulphur. The sulphuric acid is determined as barium sulphate in the usual way in 4 grms. of the substance; another 4 grms. are oxidised with bromine water and the total sulphuric acid (including the oxidised sulphur) determined; the difference between the two amounts gives the sulphur present as sulphide. The calculation is as follows:—

Slag, free from carbon dioxide, water, and matter insoluble in hydrochloric acid—

Residue contains  $a$  per cent. sulphide sulphur.

Clinker contains  $b$  per cent. sulphide sulphur.

Mixed cement contains  $c$  per cent. sulphide sulphur.

Then the amount  $x$  of slag in the mixture is given by the equation:—

$$x = 100 \frac{c-b}{a-b}.$$

For if  $y$  denotes the amount of clinker particles in mixed cement, then:—

$$\begin{aligned} y &= 100 - x \\ \text{Hence, } x + y &= 100 \\ \frac{x.a}{100} + \frac{y.b}{100} &= c \\ \frac{x.a}{100} + \frac{(100-x).b}{100} &= c \\ \frac{x.a + 100.b - x.b}{100} &= c \\ \frac{x.a - x.b + 100.b}{100} &= c \\ x(a-b) + 100b &= 100c \\ x(a-b) &= 100c - 100b \\ x &= 100 \frac{c-b}{a-b}. \end{aligned}$$

(See also this J., 1900, 903; 1901, 1143; 1902, 72; 1903, 822, 1087.)—W. C. H.

*Cyanide Solutions; Assaying —.* A. M. Henderson. Inst. of Mining and Met., May 18, 1905. [Advanced Proof.]

THE solutions to be assayed are electrolysed for a period of four hours, the gold being precipitated on a cathode of lead-foil, the anode consisting of a wrought-iron plate. The formation of Prussian blue on the anode is prevented by the addition of an excess of ammonia; the necessary circulation of the solution is caused by the liberated bubbles and by the peculiar shape of the cathode.

The precipitation of gold is said to be very complete in solutions containing 10 to 15 dwt. of gold per ton and 0.03 to 0.25 per cent. of cyanide, the value can be reduced to below 3 grs. in four hours with a suitable current density. Ten assay tons (292 c.c.) of solution are placed in a tall beaker, and 12 to 15 c.c. of strong ammonia added.

The lead cathode consists of a cylinder of lead (2½ in. high and 1 in. in diameter), with three V-shaped notches cut in the lower rim, a lead strip being attached at the top with which to make connection. The lead-foil cylinder should be covered to a depth of about ½ in. A 6 in. nail is used as an anode. The disengaged gas bubbles cause an upward current in the solution inside the cylinder, down round the outside, and through the V-notches in the bottom.

It is usual to make from 14 to 20 assays at one time, joined in series between the terminals of 110-volt high-pressure mains. With 20 assays in series, no extra resistance is necessary; but with a lesser number than 14, incandescent lamps are inserted.

The current used is from 0.06 to 1.2 ampère; the further the solution, the higher the current density that can be safely used. The gold separates as a bright yellow



leposit, and, when precipitation is complete, the cathode is washed in water, dried, rolled up and scorified with the addition of some test-lead and cupelled.—A. S.

**Electrolysis [Electrolytic Analysis]; Methods of —.** N. Puschin and R. Trechevski. J. russ. phys.-chem. Ges., 1905, 37, 392—417. Chem. Centr., 1905, 2, 374—375.

In the carrying out of electrolytic methods of analysis, the authors point out the importance of arranging in advance, not only the desired E.M.F., but also the necessary resistance. In the more recent descriptions of electrolytic processes, the current strength or current-density is usually given in addition to the E.M.F., but according to Ohm's law for conductors of the second class:  $i = \frac{e - \eta}{\omega}$ ,

the true current strength,  $i$ , depends not only on the E.M.F.,  $e$ , and the resistance  $\omega$ , but also on the opposing E.M.F.,  $\eta$ , and this latter must, therefore, be determined. The authors recommend that in descriptions of electrolytic methods of analysis there should be given besides E.M.F. and current density, also the opposing E.M.F.; besides E.M.F., the "s-g electrolytic constant (K)." The significance of this constant may be indicated as follows:—If  $e$ ,  $i$ ,  $j$ ,  $\eta$ ,  $q$ , and  $\omega$  represent respectively the E.M.F., current strength, current density, opposing E.M.F., area of cathode surface, and resistance of the electrolyte, then since  $i = \frac{e - \eta}{\omega}$ , and  $i = j \cdot q = \frac{j}{\frac{e - \eta}{q \omega}} = \frac{j}{K}$ , if  $e$  and  $K$  be known, the resistance may be easily calculated by the formula  $\omega = \frac{1}{q \cdot K}$ .

As the result of numerous experiments, the authors state that, in general, the formation of precipitates during electrolysis has no injurious effect. Reference is also made to the use of rotating electrodes, and it is stated that equally satisfactory results are attained by vigorous agitation of the electrolyte by means of a mechanical stirrer.—A. S.

#### ORGANIC—QUANTITATIVE.

**Sodium Peroxide; Use of — in Organic Analysis.** H. H. Pringsheim and J. A. Gibson. Ber., 1905, 38, 2459—2461.

The authors have shortened the tedious portion of the nitrogen determination by means of sodium peroxide (this J., 1904, 76 and 504) devised by Pringsheim, namely, the titration, by substituting in the reducing process, sodium sulphite and sulphuric acid for aqueous sulphurous acid. The bulk of liquid to be dealt with is thus very much reduced, and the addition of 3 c.c. of strong nitric acid, before precipitating the halogens, prevents any co-precipitation of silver sulphate (*loc.cit.*). Even where the use of aqueous sulphurous acid is preferred, however, the titration can be very rapidly carried out with a Gooch crucible and the use of the pump. Experience has proved not only that this method is far more convenient than Arius' method, but that determinations can be made with ease on substances (Kaufler's  $\beta$ -iodoanthraquinone, for example) which are only with great difficulty decomposed by nitric acid in sealed tubes. Results are noted of analyses of  $\beta$ -iodoanthraquinone, of the trichloro- and tribromo-derivatives of phenol and of resorcinol and of addition-compounds of each of these with paranitroso-methylaniline, and of tetrachlorocatechol. These analyses were all made by Gibson with previous experience of the method, and the results are in every case closely concordant with theory.—J. T. D.

**Coal; Examination of —.** O. Pfeiffer. J. Gasbeleucht., 1905, 48, 713—715.

For the control of consignments of coal, determinations of the sulphur and ash and of the yield of coke by the crucible method usually suffice.

**Coke.**—The following method is stated to give more concordant results than the older process of Muck. A platinum crucible, having a height of 35 mm. and a diameter at the bottom of not less than 22 mm., is used,

and is supported on a triangle of thin platinum wire above a Bunsen burner giving a flame 18 cm. high, the distance between the crucible and the top of the burner being 6 cm. The crucible has an overlapping lid with a hole of 2 mm. diameter. One gram. of the finely-powdered coal is weighed out and is ignited in the crucible, till the ring of soot which is formed round the hole in the lid disappears.

**Ash.**—The crucible containing the coke, after weighing, is placed nearly horizontally on the triangle, and heated with the full flame of the burner, so disposed that the tip of the inner cone of the flame just touches the angle of the crucible. The incineration is stated to be complete in one hour.

**Sulphur.**—It is only necessary to determine the volatile sulphur in the coal, and Eschka's method is therefore inapplicable. Graefe's modification of Hempel's method (Z. angew. Chem., 1901, 516) gives good results, but the author has simplified it by determining the sulphuric acid formed by combustion of the sulphur, volumetrically instead of gravimetrically, and by substituting an asbestos holder for the coal for one of platinum. This asbestos cup is made by shaping a wetted disc of sheet asbestos, drying, and igniting; it is supported by a piece of thick copper wire, the other end of which is connected to the rubber stopper used for closing the flask in which the combustion is effected. One gram. of the coarsely-powdered coal is weighed into the asbestos cup and the latter introduced into the flask, which has a capacity of about 5½ litres. The flask is filled with oxygen, rinsed out with distilled water which has been made neutral to methyl orange by means of sulphuric acid, and then 20 c.c. of N/10 alkali hydroxide solution introduced. The water and alkali are introduced through a hole in the stopper, which is subsequently closed by a glass rod. The coal is then ignited by a piece of glowing tinder (free from sulphur and chlorine). After half an hour, the walls of the flask are rinsed with distilled water and the excess of alkali is titrated with N/10 acid. From the percentage of sulphur found, 0.018 must be deducted as a correction for the nitric and nitrous acids produced during the combustion, and allowance must also be made for the hydrochloric acid also formed, this being determined by titration with N/10 silver nitrate solution. By this method a sulphur determination can be completed in one hour, and the results are in agreement with those obtained gravimetrically by Graefe's method.—A. S.

**Glycerol; Comparison of Methods of Determining — in Distilled Glycerins, Crude Glycerin and Soap Leys.** F. Schulze. Z. landw. Versuchsw. in Oesterr., 1905, 8, 155. Chem.-Zeit., 1905, 29, Rep. 218.

FROM the results of comparative determinations the author concludes that no reliance can be placed upon the permanganate method, even for the determination of glycerol in oils and fats. The actin method is usually satisfactory, but does not give good results with soap leys containing 20 to 25 per cent. of glycerol. Zeisel and Fanto's iodide method (this J., 1902, 992) is satisfactory, but is too costly and tedious for commercial work. The bichromate method as modified by Richardson and Jaffé (this J., 1898, 330) is rapid and gives good results, but the volumetric method yields figures somewhat too low, and in the case of concentrated glycerin the error may, under certain conditions, be considerable. For scientific work the iodide method and Richardson and Jaffé's modification are regarded by the author as the most satisfactory.

—C. A. M.

**Ethyl and Methyl Alcohols; Detection and Determination of — in Mixtures, by the Immersion Refractometer.** A. E. Leach and H. C. Lythgoe. J. Amer. Chem. Soc., 1905, 27, 964—972.

THE refraction reading of methyl alcohol in the Zeiss immersion refractometer differs so widely from that of ethyl alcohol that it affords a very convenient means for the detection and determination of highly purified wood-spirit in pharmaceutical preparations. Whilst the specific gravities of these alcohols and their aqueous solutions at equal strengths are nearly identical, ethyl alcohol of 91 per cent. strength gives a refractometer reading of 98.3° at 20° C., whereas methyl alcohol of the same

strength reads only 14.9°. The difference between the refractometer readings of the two alcohols varies according to the alcoholic strength, as illustrated in curves, the widest differences being observed at strengths above 50 per cent.

In testing for methyl alcohol, the liquid is distilled, and if the refractometer reading indicates a percentage of alcohol agreeing with that obtained from the specific gravity, the absence of methyl alcohol can be inferred, but if the refraction is too low, and if other refracting substances are absent, the percentage of methyl alcohol can be deduced with a fair degree of accuracy by reference to tables which have been constructed by the authors. Care should be taken to eliminate any volatile oils from the liquid before distillation, but mere traces of oils do not cause any serious error. Acetone if present impairs the accuracy of the results, but the purified methyl alcohol which would be used as an adulterant is almost free from acetone.—J. F. B.

*Strychnine and Brucine: Separation of* —. D. L. Howard. *Analyst*, 1905, 30, 261—263.

In an investigation of Keller's method, the author found that, at a sufficiently low temperature, brucine can be completely destroyed in the presence of strychnine by the action of nitric acid, without any loss of strychnine taking place. The low results stated to be given by Keller's method are simply due to the use of chloroform and ether as solvents. By properly extracting the acid-treated alkaloids, the whole of the strychnine may be recovered.

—W. P. S.

*Meconic Acid in the Assay of Opium, and Certain Meconates*. E. Mallinckrodt, jun. and E. A. Dunlap. *XX.*, page 944.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Sodium Iodide: Crystallisation of* — from Alcohols. M. Loeb. *J. Amer. Chem. Soc.*, 1905, 27, 1019—1020.

According to the author the crystals obtained from alcoholic solutions of sodium iodide contain alcohol of crystallisation, whilst those from solutions of potassium iodide do not. The following compounds were prepared with sodium iodide:—From methyl alcohol solution,  $\text{NaI} \cdot 3\text{CH}_3\text{OH}$  in large plate-shaped crystals or white felted needles; from ethyl alcohol solution,  $\text{NaI} \cdot \text{C}_2\text{H}_5\text{OH}$ ; and from normal propyl alcohol,  $5\text{NaI} \cdot 3\text{C}_3\text{H}_7\text{OH}$ .—A. S.

*Sulphur; Amorphous* —. III. *The Nature of Amorphous Sulphur and Contributions to the Study of the Influence of Foreign Bodies on the Behaviour of Supercooled Melted Sulphur*. A. Smith and W. B. Holmes. *J. Amer. Chem. Soc.*, 1905, 27, 979—1013. (See this J., 1903, 322; 1905, 861.)

The present paper comprises a detailed account of numerous experiments on the different modifications of sulphur, and a discussion of the results obtained. In the hardening of plastic sulphur partial reversion of the amorphous (insoluble) sulphur to soluble sulphur takes place, and it is thus impossible, under these conditions, to obtain in quasi-solid form the whole of the amorphous sulphur present in the plastic material. Sulphur obtained by precipitation in the presence of concentrated acid, however, yields 100 per cent. of insoluble sulphur, and the smaller yields obtained from melted sulphur appear to be due to the impossibility of realising the requisite condition of very fine subdivision. The presence of various substances in melted sulphur causes an increase in the yield of amorphous sulphur obtainable therefrom. Iodine appears to be the most efficient in this respect. Sulphur to which iodine has been added in the proportion of two parts per 100 of sulphur, gives when heated and chilled, yields of insoluble sulphur ranging from 4 per cent. after chilling from 110° C. to 62.7 per cent. after chilling from 448° C. Determinations of the boiling point at ordinary and at reduced pressures, of specific gravity and of solubility,

showed that sulphur which will give the insoluble form when chilled is identical in constitution with that which will not, and prove that the insoluble form is present in all specimens of melted sulphur in proportions depending on the temperature alone, whether by treatment with ammonia or otherwise, the sulphur has lost the capacity to give insoluble sulphur by chilling or not. The authors conclude that amorphous sulphur is supercooled  $S_{\mu}$ —the form stable above 160° C. In the case of pure sulphur freed from sulphur dioxide by recrystallisation, or by treatment with carbon dioxide above 310° C., or by treatment of melted sulphur with ammonia or hydrogen sulphide, the  $S_{\mu}$  reverts so rapidly to the soluble form that it cannot be supercooled. When, however, traces of sulphur dioxide, iodine and other substances are present  $S_{\mu}$  is more or less completely supercooled and gives hardened amorphous sulphur, in which condition the reversion to soluble sulphur proceeds with extreme slowness, the proportion of insoluble sulphur showing little reduction, even after keeping for months.

In conclusion the authors point out the similarity between the phenomena observed and those encountered in the study of the chilling of iron and steel. For example pure iron ( $\alpha$ -ferrite) is transformed into  $\beta$ -ferrite at 755° C. and the latter into  $\gamma$ -ferrite above 890° C., this last modification being non-magnetic. These temperatures are transition points analogous to 95.46° (change of rhombic sulphur into the monoclinic form) and 160° C. (change of melted soluble sulphur  $S_{\mu}$  into melted amorphous sulphur  $S_{\mu}$ ) for sulphur. On chilling,  $\gamma$ -ferrite rapidly reverts to  $\alpha$ -ferrite and recovers magnetic qualities, but the presence of 12 per cent. of manganese so reduces the ease with which this reversion takes place, that when the alloy is chilled the product contains only supercooled  $\gamma$ -ferrite and wholly non-magnetic. Also, Charpy and Grenet (this J., 1902, 616) have shown that silicon favours the separation of graphite in cast iron, facilitating the initial appearance of the carbon phase and causing the separation to proceed more rapidly after it has been initiated, whilst at the same time not affecting the amount finally deposited when the system has reached a condition of equilibrium.—A. S.

*Ozone: Production of* — by Ultraviolet Light. Fischer and F. Braehmer. *Ber.*, 1905, 38, 2633—2636.

One of the authors has devised a form of mercury-arc-lamp containing a double-walled quartz vessel through the annulus of which a gas can be passed, and thus exposed to the radiation of the arc. The lamp can be immersed in water and its outer glass casing thus kept cool, and a stream of water (or other cooling liquid) can be passed through the interior of the quartz tube, cooling one coat of the annulus, and hence, as the annular space is on about a mm. across, cooling the contained gas very considerably. Through this apparatus pure oxygen, generated electrolytically from dilute sulphuric acid, was passed and exposed to the radiation from the arc. The total quantity of ozone formed during an experiment (15 minutes) was determined, and hence, from a knowledge of the quantity of gas that had passed, the percentage by weight in the ozonised gas. The results showed that without any cooling, when the temperature rose to 270° C., no ozone was formed; when cooling water was used, increase of its speed at 15° C., or lowering of its temperature, increased the yield of ozone. Under constant conditions of cooling-water, increase of the current through the lamp from 2 to 6½ ampères increased the yield, but further rise of current diminished it, doubt because of the rise of temperature which it caused. Increase of the oxygen-stream corresponding to a rise from 2 to 4 ampères in the generating vessel nearly doubled the yield of ozone, but slightly decreased the percentage in the issuing gas. The effect of moisture in the oxygen was examined, but no conclusions on that matter can yet be drawn. The experiments indicate that the conversion of oxygen into ozone by ultraviolet light is opposed by the decomposition of ozone into oxygen, the speed of which reaction increases rapidly with rise of temperature, and they lend support to the view that the production of ozone in the Siemens tube is due to the influence of ultraviolet radiation.—J. T. D.



*Electric Disintegration; Mechanism of —; Fusion of Carbon; Decomposition of Alloys.* F. Braun. *Ann. der Physik*, 1905, **17**, 359—363. *Chem. Centr.*, 1905, **2**, 175.

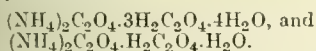
The discharge from a battery of Leyden jars be led through a thin metal wire laid on a glass plate or between glass plates, the metal disintegrates, because for an instant it is heated to the point of vaporisation; the condensed vapour frequently occurs in the form of a very fine metallic network. The higher the melting point of the metal, the higher must the intensity of the charge be in order to produce the effect described. The color photograph of the vaporisation of a tantalum (m.p. 2200° C.) and a zinc wire; the same form of color was obtained in both cases. The spectrum of the vapor evolved was also photographed; it was in the form of a continuous spectrum, showing the more important zinc lines. Under similar conditions carbon gave a continuous spectrum; by the aid of the microscope and globules of carbon could be distinctly recognised, such as brass (or of platinum and silver) can be separated by electric disintegration. The temperature is so high that the brass melts; the zinc is vaporised, and ejects particles of molten brass; during the flight of the particles, the zinc distils off, whilst the copper is deposited.—A. S.

*Supersaturated Solutions; Speed of Crystallisation of —.* C. Leenhardt. *Comptes rend.*, 1905, **141**, 188—189.

LEENHARDT has shown (*Z. physik. Ch.*, 1897, **23**, 526) that the speed with which solidification is propagated along a narrow tube of fused substance, while proportional to the number of degrees of over-cooling for small intervals, varies with further over-cooling constant, and decreases considerably again when the over-cooling is so great that the heat evolved by solidification cannot raise the material to its melting point. The author has found that the law is obeyed by the crystallisation of supersaturated solutions of salts (sodium sulphate, acetate, thiosulphate) on over-cooled. In the case of sodium acetate, for example, the speed of crystallisation of the solution cooled by the fusion of the crystallised salt is 0.7 cm. per second for all temperatures between 25° and -20° C. This physical constant of the solution, independent of the diameter of the containing tube, and varying only with concentration of the solution. In the case of sodium sulphate this variation is expressible as follows:—The duration of the speed of crystallisation is proportional to the square root of the amount of anhydrous salt dissolved in a given amount of crystallised salt.—J. T. D.

*Oxalates; Acid Ammonium —.* P. T. Walden. *Amer. Chem. J.*, 1905, **34**, 147—152.

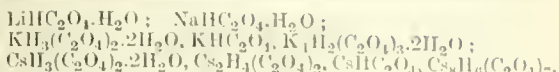
Solutions of oxalic acid and ammonium oxalate in varying proportions were made, containing more of the oxalates than would remain in solution at 25° C., and were then kept at that temperature, with frequent shaking, 48 hours. The solution and the residue were then analysed. The different solutions leave a constant residue and separate out varying residues, save where a double salt is formed, in which case the solution varies and the residue is constant. The only two salts thus obtained were:



In the case of each of these salts, its composition lay between the limiting compositions of the solutions from which it separated; hence it should be recrystallisable from aqueous solution. This was found to be so in each case.—J. T. D.

*Oxalates of Lithium, Sodium, Potassium, and Caesium; Acid —.* H. W. Foote and I. A. Andrew. *Amer. Chem. J.*, 1905, **34**, 153—164.

These salts were investigated by the same method which was used (see preceding abstract). The following were obtained:—



The solubilities of the normal oxalates in water and in oxalic acid of various strengths (or reciprocally that of oxalic acid in various normal oxalate solutions) were determined from the experiments, and plotted. From the curves so obtained it is possible to determine whether any given acid salt can or cannot be recrystallised from aqueous solution.—J. T. D.

*Oxalates; Alleged Double —.* H. W. Foote and I. A. Andrew. *Amer. Chem. J.*, 1905, **34**, 164—167.

From an examination of the behaviour of mixed solutions of the separate oxalates (see preceding abstracts) the authors conclude that none of the salts  $KNaC_2O_4$ ,  $NH_4KC_2O_4$ ,  $NH_4LiC_2O_4$ , each of which is mentioned in chemical literature, has any real existence. Nor are there at 25° C. (and probably at any other temperature) any double oxalates of ammonium with magnesium, zinc, or cadmium, though several of these are mentioned.

—J. T. D.

*Lipase.* F. L. Dunlap and W. Seymour. *J. Amer. Chem. Soc.*, 1905, **27**, 935—946.

The experiments were made with peanuts (*Arachis*), linseed, almonds and croton seeds. In the resting state these seeds possess no, or only a very slight, lipolytic power; nor is the enzyme in these seeds made active by the presence of mineral acid during the digestion. The peanuts and linseed were also tested after germination, the germinated seeds being macerated to a paste. In this state a very considerable action was observed, showing that the enzyme lipase is developed during the process of germination. Extracts were made from the germinated seeds by triturating with sand and subjecting the mass to a pressure of 250 atmospheres; these expressed extracts contained lipase. Both the peanut and linseed extracts gave voluminous precipitates when poured into alcohol. The precipitate from the peanut extract after washing and drying contained the active lipase in a highly concentrated form, but the precipitate from the linseed extract was perfectly inactive. The authors express the opinion that the zymogen and the lipase of these seeds differ in character from those of the castor oil bean.—J. F. B.

## New Books.

REPORT TO THE RIGHT HON. A. AKERS-DOUGLAS, M.P., HIS MAJESTY'S PRINCIPAL SECRETARY OF STATE FOR THE HOME DEPARTMENT, ON VISITS TO CERTAIN EXPLOSIVE FACTORIES AND TESTING STATIONS IN BELGIUM, GERMANY AND HOLLAND. By Captain M. B. LLOYD and Captain A. P. H. DESBOROUGH, H.M. Inspectors of Explosives. (See page 939). Darling and Son, Ltd., 34—40, Bacon Street, London, E. Price 3d. Wyman and Sons, Ltd., Fetter Lane, London, E.C., and 32, Abingdon Street, Westminster, S.W.; Oliver and Boyd, Edinburgh; E. Ponsonby, 116, Grafton Street, Dublin.

UEBER HEIZWERTHBESTIMMUNGEN MIT BESONDERER BERÜCKSICHTIGUNG GASFÖRMIGER UND FLÜSSIGER BRENNSTOFFE. von TH. IMMENKÖTTER. R. Oldenbourg's Verlag. Munich and Berlin. 1905. Price M. 3.

Two volume, containing Introduction and 97 pages of subject matter with 23 illustrations and a table of contents. The subject is subdivided as follows:—I. Introduction. II. Definitions. III. Methods up to present. IV. Calorimeter for continuous combustion, and continuing determinations of calorific value. V. Use of this Calorimeter for Gases of low heating value. VI. Its use for Liquid Fuels.

## Trade Report.

### II.—FUEL, GAS, AND LIGHT.

#### CALCIUM CARBIDE REGULATIONS IN CEYLON.

*Bd. of Trade J., Aug. 24, 1905.*

The *Ceylon Government Gazette* for 21st July last, contains amended rules, made by the Governor of the Colony, to regulate the importation, storage, and transport of calcium carbide.

The rules, dated 8th February, 1902, are cancelled, and the importation is prohibited of calcium carbide which contains impurities liable to generate phosphoretted hydrogen or siliciuretted hydrogen so as to render the gas evolved liable to ignite spontaneously.

Acetylene, when liquid or when subject to a pressure above that of the atmosphere, capable of supporting a column of water exceeding 100 inches in height, and whether or not in admixture with other substances, shall be deemed to be dangerous, and shall be prohibited from being manufactured, imported, kept, conveyed or sold subject to the following exception:—

Acetylene in admixture with oil gas in a proportion not exceeding 20 parts by volume of acetylene in every 100 parts of the mixture, when subjected to a pressure not exceeding 150 lbs. to the sq. in., shall not be deemed to be dangerous, provided that the acetylene and oil gas shall be mixed together in a chamber or vessel before the gases are subject to compression.

The rules under notice also direct that certain regulations are to be observed by the masters of vessels carrying calcium carbide, and provide regulations respecting the storage and transport of the article.

The full text of the rules may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

### VII.—ACIDS, ALKALIS, Etc.

#### CHEMICAL IMPORTS OF PORTUGUESE EAST AFRICA.

*Chem. and Drug., Aug. 26, 1905.*

During 1904 the imports of potassium cyanide into Lourenço Marques (in transit to the Transvaal) amounted to 2,513 tons (197,558*l.*) against 965 tons in 1903 and 673 tons in 1902. Germany sent more than twice as much as the United Kingdom last year, while in 1903 the United Kingdom sent through Lourenço Marques three times as much as Germany. Of mercury the imports were 56,974 lb. (7,705*l.*), and of this quantity the United Kingdom supplied 19,089 lb., Germany 7,285 lb., and Austria-Hungary 30,100 lb. The soap imports were: 1904, 2,606,427 lb.; 1903, 2,179,051 lb.; 1902, 888,099 lb. The 1904 imports included 20,592 lb. of toilet soap, the rest being common soap. Of the former the U.K. sent 12,810 lb., Austria-Hungary 4,300 lb., and Germany 1,400 lb.; of common soap, the U.K. sent 2,504,000 lb., U.S.A. 34,000 lb., and Germany 31,000 lb. Of essential oils, 12,739 lb. (858*l.*) were imported against 17,430 lb. during 1903; the U.K. supplied 9,342 lb. and Germany 2,322 lb. Chemicals and apothecaries' wares valued at 47,064*l.* were sent through to the Transvaal. These goods comprised 56 tons of alkali, 27 tons ammonia, 11 tons indigo, 9 tons benzine, 89 tons borax, 108 tons dextrin, 592 tons drugs, 689 tons sulphur (all from Italy), 35 tons magnesia, 28 tons medicines, 55 tons caustic soda, 53 tons bicarbonate of soda, 732 tons gypsum, and 57 tons chemical manure. The United Kingdom heads the list in everything but sulphur, benzine, gypsum, and manure. Of acids, 202,018 lb. were received. This amount included 110,000 lb. of carbonic acid and 92,016 lb. sulphuric acid. Of the former the United Kingdom supplied 3,000 lb., Germany 105,000 lb., and Belgium the remainder. The sulphuric acid was divided equally between the United Kingdom and Germany. In the supply of toilet soap to the Portuguese Colony of Lourenço Marques the United Kingdom has lost ground considerably, and Germany headed the list last year with 25,000 lb.

### CRYOLITE IMPORTS OF UNITED STATES.

*Mining World, Chicago, Aug. 12, 1905.*

There was a large falling off in the quantity of cryolite imported into the United States in 1904. This amount to 959 long tons, valued at 13,708 dols., as against 77 long tons, valued at 102,879 dols., in 1903. This is the smallest quantity of cryolite imported into the United States since 1871. Since 1885 the importation has, except in 1896, been over 5000 long tons a year, and 1887, 1894 and 1897 the importation was over 10,000 long tons a year.

### X.—METALLURGY.

#### PIG IRON PRODUCTION OF CANADA FOR FIRST HALF OF 1905.

*Bd. of Trade J., Aug. 24, 1905.*

The American Iron and Steel Association has received from the manufacturers the statistics of the production of pig-iron in Canada in the first six months of 1905. The figures show a large increase as compared with either the two halves of 1904, as will be seen by the following table, which gives the production according to the amount of fuel used in tons of 2,240 lbs., in half-yearly periods:—

Fuel used.	First half of 1904.	Second half of 1904.	First half of 1905.
	Tons.	Tons.	Tons.
Coke .....	111,840	139,831	188,54
Charcoal .....	8,803	10,468	21,66
Total .....	120,643	150,299	210,20

The Canadian production of pig-iron in the first half of 1905 was the greatest in any half year in the history of the Dominion, exceeding by 48,453 tons that of the last half of 1902, the next highest half year, when 161, tons were made. It was also greater than the production of any whole year prior to 1901. Down to that year production of pig-iron in Canada never amounted to 100,000 tons in any calendar year.

The production of Bessemer pig-iron in the first half of 1905 amounted to 63,785 tons. There was no production of Bessemer pig-iron in the first half of 1904 and only 26,016 tons were made in the second half of 1904. The production of basic pig-iron in the first half of 1905 amounted to 68,378 tons, against 28,981 tons in the first half of 1904 and 41,152 tons in the second half of 1904.

#### PIG-IRON PRODUCTION IN U.S.A.

*Bd. of Trade J., August 17, 1905.*

The *Bulletin* of the American Iron and Steel Association of Aug. 1, publishes the following statistics of production of pig-iron in the United States of America during the first half of the current year, as compared with the first half of 1904:—

	First half of 1904	First half of 1905
	Tons of 2,240 lbs	Tons of 2,240 lbs
Bessemer pig-iron .....	4,443,364	5,930,790
Low phosphorus pig-iron .....	87,582	77,637
Basic pig-iron .....	1,061,901	1,966,597
Charcoal pig-iron .....	213,356	179,511
Spiegeleisen, ferro-manganese, ferro-phosphorus, and ferro-Bessemer pig-iron .....	114,510	129,041
Other kinds of pig-iron .....	2,252,725	2,888,601
Total .....	8,173,438	11,163,176



SMELTING WORKS; LABOUR REGULATIONS IN GERMANY —.

Eng. and Mining J., Aug. 12, 1905.

The *Reichsanzeiger* has just published an order of Bundesrat, relating to lead smelters, lead colour works and zinc smelters. The employment of males and youthful labourers in dust chambers, dust canals and in the transportation of the dust is prohibited; and such persons are not permitted to enter premises mentioned. The workmen employed at smelting furnaces, with the exception of those on the floor, are restricted to eight hours' work per day. The rule applies to the labourers employed in the interior of old stacks and in the cleaning of dust chambers and canals containing wet dust. Labourers engaged in cleaning dust chambers and dust canals containing dry dust are not permitted to work longer than four hours a day in the interior of such chambers and canals, and more than eight hours per day in all. These rules go into effect Jan. 1, 1906, unless the public interest will be better subserved by waiting. In that case Bundesrat may extend the time to Jan. 1, 1913, and also modify the rules.

—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

CALCIUM, MAGNESIUM, AND ZINC PEROXIDES.

Mining World, Aug. 5, 1905.

Several new chemical products are being manufactured in an electric furnace at Niagara Falls. Calcium peroxide, made, contains from 60 to 65 per cent. of  $\text{CaO}_2$ . It is used to use calcium peroxide for the sterilisation and preservation of foods. Magnesium peroxide contains 25 to 32 per cent. of  $\text{MgO}_2$  and may be used in a similar manner to calcium peroxide. It may be utilised for sterilising water. Zinc peroxide contains from 50 to 60 per cent.  $\text{ZnO}_2$ . It is said to make a good anti-oxidising dressing.

XII.—FATTY OILS, FATS, Etc.

OLIVE OIL; ADULTERATION OF —.

Chem. and Drug., Aug. 19, 1905.

The result of a controversy between two local papers, *le Var* of Toulon, and *L'Eclair* of Nice, some interesting facts have come to light respecting the adulteration of olive oil in the very districts reputed to be home of this industry. The region of Nice is celebrated for the quality of its oil, and although there is stated annually from this centre something like 6 million litres, it is a fact that in the town of Nice itself it is comparatively difficult to get an oil which is unsophisticated; adulteration, which has been going on for years, was exposed last April, when the Syndicate of Grocers brought an action in the Tribunal Correctionnel de la Seine against certain firms for fraud. The principal centre of adulteration is a small town called Salon, situated about 50 kilometers from Marseilles and Avignon, at about 50 kilometers from the first-named town, and from here the various adulterated oils are forwarded to all parts of France, and also abroad. The Tribunal of the Seine pronounced judgment at the adulterators. The more important of the by-laws, &c., imposed upon members of the Olive Oil Syndicate of Nice, are the following:—The merchants forming part of the Syndicate are prohibited from dealing in any other oil than that of the olive, consequently from mixing the oils. Any member of the syndicate convicted of having mixed seed oil with olive oil having dealt in seed oils, will be expelled from the syndicate and fined 10,000 fr.; this sum to be added to the fines of the Syndicate. No member of the Syndicate is permitted to trade in olive oil under more than one name or style, nor conduct branches, either wholesale or retail, under any assumed name. In spite of all the protests there is carried on at Nice a great deal of blending of various qualities of olive oil. Oils arrive in the harbour from

various parts of the world. Large quantities come from Algiers and Tunis, from Spain and Italy. These are cheaper qualities, and have distinct characters and tastes, but are used to mix with various qualities of oil produced in the district in order to modify their flavour or appearance, and to diminish the cost. It frequently happens that an old oil perfectly sweet and good is improved by the addition of a young or green oil to pick up its flavour and give it more tone and body. This *coupage* corresponds to what is done in the wine trade, and is quite legal, although the product resulting from such an operation can scarcely be described as "pure olive oil from Nice," seeing that it is a mixture of Nice oil with cheaper kinds. The blending of seed oils with olive oil is done before the oils have been fined down. Both are mixed in a turbid state, and, after remaining in the earthenware vats to clear down, the oil so adulterated is pumped up into the "pile," as it is called, and the product is then filtered through cotton wool in the usual way, the result being an oil of a particularly bright and attractive colour and appearance, but by no means what is generally known as "huile vierge de Nice."

TRAIN OIL IN GERMANY.

For. Off. Misc. Series, No. 636.

The greater part of the total import of train oil into Germany is landed at Hamburg, and for many years past the bulk of it has come from Japan. The import from Japan sank, however, in 1903 from 53,357 to 35,013 casks, but it is to be observed that in this year there was a falling-off in the total import of this substance of nearly 30 per cent.

The total import of train oil into Germany during the years 1901, 1902 and 1903 was as follows:—

	Quantity.		
	1901.	1902.	1903.
	Cwts.	Cwts.	Cwts.
Hamburg .....	236,541	238,488	174,548
Stettin .....	39,954	39,103	28,093
Königsberg .....	11,412	12,669	12,021
Dantzic .....	7,739	15,449	9,246
Total .....	295,646	305,709	223,908

XIII.A.—PIGMENTS, PAINTS, Etc.

WHITE LEAD; CANADIAN DUTY ON —.

U.S. Cons. Rep., No. 2326, Aug. 4, 1905.

The Canadian Government has made known to the paint manufacturers of Canada that their requests with regard to the increased tariff on imports of dry white lead have been granted, and that all white lead coming into Canada up to September 15, 1905, will come in at the old tariff of 5 per cent., provided it was ordered previous to July 6, the date on which the new tariff of 30 per cent. was established.

The new tariff was made in response to an appeal from the recently organised Carter White Lead Company, which is preparing to manufacture in Montreal. Representatives of this company approached the Government and pointed out that there were no manufacturers of white lead in Canada, and that provided they could have a sufficiently protective tariff they would set up a manufactory in Montreal.

The imports of dry white and red lead, orange mineral, and zinc white for the year ending June 30, 1904, were upwards of 17,000,000 lb., valued at 666,365 dols. Of this amount there was imported from the United States 7,617,000 lb., Germany 5,173,000 lb., and the United Kingdom 3,491,000 lb.

The increase of duty on white lead will naturally affect the importations into Canada of paints, which amounted, during the year ended June 30, 1904, to 9,338,446 lb., valued at 451,481 dols., of which amount 6,278,492 lb., valued at 290,130 dols., came from the United States.

XIII.—INDIA-RUBBER. *Etc.*

## INDIA-RUBBER AT PARA.

Ed. of Trade J., Aug. 24, 1905.

H.M. Consul at Para has forwarded the following particulars of the supply and shipment of india-rubber in that district:—

The percentages of qualities calculated on the figures of the 17 preceding years are as follows:—

Fine ....	55 per cent.	Coarse ....	25 per cent.
Medium ..	10 ..	Caucho ....	10 ..

The qualities shipped during 1904-5 show a 5 per cent. decrease in the proportion of fine, and a 7 per cent. increase in caucho.

Para produced, as usual, about one-third of the total supply, but dealt with almost one-half of the entire shipments during the year ended 30th June, 1905.

The origin of the 1904-5 crop was as follows:—

	Tons.
States of Amazonas and Matto Grosso and Peru and Bolivia (including 4,613 tons caucho) ..	22,086
State of Para (including 515 tons caucho) ...	11,288
Total .....	33,374

It is to be noted that the port of Para handled the whole of the Para crop, as well as 5,267 tons of the up-river crop. Caucho is now regularly sent to the port of Para from the River Tocantins district.

XIV.—TANNING; LEATHER; GLUE, *Etc.*

## MANGROVE BARK AT ANGOLA.

For. Off. Ann. Series, No. 3478.

The British Acting-Consul at Loanda states that a sample of mangrove bark was sent to the United Kingdom to ascertain if it were of any use for tanning. The report on it showed:—

	Per cent.
Tanning matters absorbed by hide .....	15.7
Soluble non-tanning matters .....	5.3
Insoluble (at 60° F.) .....	63.0
Water .....	16.0
Total .....	100.0

It was stated, however, that as this sample was taken from old wood it may not have been of average quality, and that further experiments will be made. If this bark prove to have a commercial value good business should result, as there is a large quantity of it available.

XV.—MANURES, *Etc.*

## FERTILISERS IN MARSEILLES.

U.S. Cons. Rep., No. 2330, Aug. 9, 1905.

The most important article imported into France for fertilising purposes is rock phosphate, the greater part of which is received from Algeria. Thus in 1902, the latest year for which complete figures are immediately available, the total French importation amounted to 305,130 tons, of which amount Algeria supplied 173,461 tons. In 1904 Marseilles received 24,563 tons of phosphate and in the year ended June 30, 1904, Cete received 57,050 tons, of which the United States furnished 10,477 tons. At present phosphate rock sells in Marseilles at 10.05 cents. per unit of phosphate per ton.

The following table sets forth the importations at Marseilles during 1904 of the principal fertilisers:—

	Kilos.
Rock phosphate .....	24,563,435
Incinerated bone ashes .....	891,750
Degelatined bone dust .....	11,203,549
Sulphate of copper .....	1,844,376
Sulphate of potash .....	442,430
Chloride of potassium .....	593,040
Nitrate of potash .....	1,993,751
Kainite .....	190,809
Nitrate of soda .....	5,939,270
Bisulphate of potash .....	12,539

One of the most important items in the foregoing nitrate of soda. Three-quarters of the total amount reaching France is received at Dunkerque from Chili. Prices are so variable that professors of agriculture are advising farmers only to employ it when it furnishes nitrogen at a lower cost than sulphate of ammonia.

French potassium chloride averages from 56 to 57 per cent. of potash. At present, owing to German competition the refining operations are pressed less far, and the potassium chloride contains from 78 to 82 per cent. of pure KCl, or an average of 50 per cent. of potash. The German chloride comes from Stassfurt, and contains from 80 to 85 per cent. of KCl, or 50 to 53 per cent. of potash.

Desultory attempts have been made to import American copper sulphate into France, but owing to the excessive duty of 1 fr. per 100 kilos, which American copper sulphate pays, the American offerings must be by that amount lower than those from Spain and England. At the present time this article is quoted at 8.78 dols. per 100 kilos. c. Marseilles from England or Spain, or 9.65 dols. per kilos, duty paid.

Marseilles is a producing point for large quantities of oil cake and meal used for fertilising purposes.

## FERTILISERS IN CHINA.

U.S. Cons. Rep. No. 2335, Aug. 15, 1905.

The U.S. Consul at Amoy describes an extensive business enterprise started under American auspices for supplying fertilising material to China. He says there is an unlimited field for the sale of good and cheap fertilising material, and that the Chinese people are already regarding this enterprise with favour. The enterprise will probably take the form of a Hong Kong corporation, because Hong Kong would give a more favourable charter than can be had in the United States. At present the Chinese are using for fertilisers anything that can be had. The principal one is bean cake, of which the port of Ninchwang alone ships to Lower Chinese ports 5,000,000 dols. worth in gold a year.

In addition to the amount of bean cakes sold in China the country is accustomed to ship about 3,800,000 dols. worth a year abroad, mostly to Japan, but the importation interfered considerably with the sale of last year. On the other hand, it is already importing a considerable amount of commercial fertiliser. Manure cake, peanut cake and other varieties aggregated close to 25,000,000 dols. in addition to the 900,000 dols. of bean cake imported into Amoy alone last year.

XVI.—SUGAR, STARCH, *Etc.*

## BEETROOT SUGAR PRODUCTION IN EUROPE.

For. Off. Ann. Series, No. 3480.

The following table gives particulars of the production, export and consumption, &c., of beetroot sugar in 1904 in those European countries responsible for the enormous over-production:—

Country.	Quantity.		
	Production.	Consumption.	Export.
	Tons.	Tons.	Tons.
Germany .....	1,929,415	800,000	1,129,415
Austria-Hungary .....	1,158,800	400,000	758,800
Russia .....	1,154,299	886,000	268,299
France .....	794,431	420,000	374,431
Belgium .....	202,850	85,000	117,850
Netherlands ..	123,500	90,000	33,500
Total ....	5,363,295	2,681,000	2,682,295

The United Kingdom consumes over 1,700,000 tons of beetroot sugar per annum, accounting for very nearly one-third of the total production of Europe, notwithstanding the sugar tax of 2s. 10-2d. per cwt. upon



cent. polarisation sugar, the price of sugar is cheaper the United Kingdom than it is in any of the actual root sugar producing countries.

#### XVII.—BREWING, WINES, SPIRITS, Etc.

##### SPIRIT DENATURING IN RUSSIA.

*For. Off. Ann. Series, No. 3480.*

The Russian Government having sanctioned the use of denatured spirit for illuminating, heating and other purposes, an opening for lamps to burn spirit instead of petroleum is thereby presented. Such lamps have been imported from Germany, but are not yet perfect. There is also demand for small-sized stationary engines, traction motors, motor-cars using denatured spirit as fuel. Nearly every fairly-sized estate owns its own distillery, and as the production of rye spirit is not very costly, and no duty is levied by the Government upon it in its denatured state, landowners and farmers are anxious to make use of it as fuel. One small-sized stationary motor of 10 horse power which makes use of spirit as fuel has been imported into the Kiev district, and has proved eminently successful. Serviceable sized spirit-driven motor, powerful enough to work ordinary grinding mills, small threshing machines, cutters, ploughing and reaping machinery, would find a ready sale.

#### XVIII.—FOODS.

##### MEAT PRESERVATIVE; DANGEROUS —.

*U.S. Cons. Rep., No. 2338, Aug. 18, 1905.*

The President of the Berlin police has issued the following warning, which has been published in various German newspapers.

A preserving substance under the name of "sterilisol" has been put upon the market, with the statement that no action can be found to its application and that it is in no way injurious to health. Contrary to this it has been proven by investigations made by the chemical laboratory of the Imperial Health Office that samples of this preparation contain  $2\frac{1}{2}$  per cent. of formaldehyde. According to the opinion of the royal scientific deputation for medical reformalin, as well as all preparations which contain it, are to be considered as preservatives seriously injurious to health in all articles of nourishment and enjoyment. The preparation of meat for sale the application of formaldehyde has been expressly forbidden by statutory regulations.

#### XX.—FINE CHEMICALS, Etc.

##### MORPHIA AND FLOUR IN CHINA.

*U.S. Cons. Rep., No. 2338, Aug. 18, 1905.*

Attempts to smuggle morphia, concealed in a flour shipment, resulted in the death of a number of natives in Amoy and the up-country districts, and has made the Customs authorities more vigilant.

1,906 oz. of morphia were imported in 1902, owing to the impending introduction of the tariff, and 3,101 oz. in 1903, which still paid the old 5 per cent. *ad valorem* duty, while only 8 oz. were reported this year. The market for morphia at this present moment is still below 100 taels per ounce, the duty which it is supposed to pay. There is not the least doubt that this dangerous drug is still in great vogue among the Chinese, and that the duty has not in any way stopped its importation, simply induced the smuggling of this very easily concealed poison.

##### CHEMICAL ANALYSIS OF ARTICLES IMPORTED INTO TURKEY.

*Bd. of Trade J., Aug. 24, 1905.*

The Bulletin de la Chambre de Commerce française de Constantinople contains the text of the new Turkish Law relating to the chemical analysis of articles of consumption imported into Turkey.

The following are the principal provisions of this Law:—The goods subject to sanitary inspection and analysis by the Customs are (1) chemical and pharmaceutical preparations and specialties; (2) butter, oil, and flour; (3) coffee and tea; (4) liqueurs and alcoholic beverages.

With regard to chemical and pharmaceutical preparations and specialties, the Law prohibits the importation of medicines of which the composition is unknown or whose purity is below the standard established in the pharmaceutical code adopted by the Imperial Government. However, medicines of unknown composition will be admitted if accompanied by a certificate from an official academy or recognised institution or body having an official character, and by a list enumerating the substances composing the medicine, without specifying the quantity of each substance employed, provided that the chemical analysis made by the Customs shows the preparation to be free from all prohibited materials. The importation of specialties prepared with certain specified drugs (*e.g.*, cocaine and *Cannabis Indica*), as also of chemical substances, such as chlorate of potash or soda, picrates, and nitro-glycerin, which are used in the manufacture of explosives, is prohibited; but, so far as regards the latter class of materials, those substances of indispensable use in medicine, such as chlorate and nitrate of potash and of soda, or which are employed for agricultural and industrial purposes, will be furnished to chemists, &c., in fixed quantities by the authorised departments. Moreover, it is permitted to import chlorate of potash, &c., in a form unfitted for the manufacture of explosives, such as, for example, in the form of medicinal lozenges.

## Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

#### I.—PLANT, APPARATUS, AND MACHINERY.

- [A] 16,477. Sugg. Apparatus for compressing gases. Aug. 14.
- „ 16,700. Mackusick. Vessels or tanks for containing inflammable liquids. Aug. 17.
- „ 16,872. Lynde. Automatically actuating valve for mixing air or gases or liquids of varying temperatures and for regulating the amount of flow of same at an approximately desired temperature. Aug. 21.
- „ 16,919. Raps. Mixing apparatus for dry materials.\* Aug. 21.
- „ 16,991. Collet. Apparatus for filtering liquids. Aug. 22.
- „ 17,246. Burland. Mixtures or materials for making or retaining surfaces and other things moist. Aug. 25.
- „ 17,451. Schröder. Drying chambers. [Ger. Appl., Aug. 30, 1904.]\* Aug. 29.

- [A.] 17,457. Warren. Rotary kilns.\* Aug. 29.  
 „ 17,734. Rossée. Filter presses. Sept. 1.  
 [C.S.] 11,158 (1904). Barnabé (Mugna). Apparatus for washing or purifying smoke from furnaces or gases or air where it contains noxious matter and to enable recovery of the latter. Aug. 23.  
 „ 18,305 (1904). James. Apparatus for ascertaining the density or specific gravity of liquids and semi-liquids. Aug. 30.  
 „ 18,512 (1904). Lake (Dessoliers and Regnier). Apparatus for treating solids with liquid, fluid or gaseous agents. Aug. 30.  
 „ 23,261 (1904). Wilson. Filters. Sept. 6.  
 „ 24,446 (1904). Meura. Filter press frames. Sept. 6.  
 „ 29,479 (1904). Baudry. *See under III.*  
 „ 1033 (1905). Lees and Jackson. Filtering funnels. Aug. 23.  
 „ 2372 (1905). Ullrich. Apparatus for cooling fluids. Sept. 6.  
 „ 6075 (1905). Bouchaud-Praceig. Process and apparatus for taking up, collecting, aspirating, drying, cooling, fixing and recuperating the vapours of volatile solvents diluted in air. [Fr. Appl., March 26, 1904.]\* Aug. 30.  
 „ 6762 (1905). Forchpiepe and Schäfer. Drying apparatus. Sept. 6.  
 „ 8696 (1905). Caldwell. *See under XII.*  
 „ 11,957 (1905). Dreyfus, Meyenberg, and Clayton Aniline Company, Ltd. Apparatus for filtering or separating liquids from solids or matters from impurities, and for similar operations. Sept. 6.

## II.—FUEL, GAS, AND LIGHT.

- [A.] 16,600. Hutchins. Working and construction of gas producers. Aug. 16.  
 „ 16,700. Mackusiek. *See under I.*  
 „ 16,955. Shadbolt. Gas manufacture. Aug. 22.  
 „ 17,038. Furse. *See under XV.*  
 „ 17,114. Izzett. *See under X.*  
 „ 17,231. Ritchie. Manufacture of incandescent mantles for gas lighting. Aug. 25.  
 „ 17,708. Hartung. *See under XXIII.*  
 [C.S.] 18,456 (1904). Shields. Manufacture of combustible vapour or gas. Aug. 30.  
 „ 18,858 (1904). Grayson. Manufacture of artificial fuel. Sept. 6.  
 „ 19,222 (1904). Johnston. Apparatus used in the manufacture of coal gas. Aug. 30.  
 „ 19,774 (1904). Wilson. Manufacture of coal gas. Sept. 6.  
 „ 19,827 (1904). Cerasoli. Gas producers. Aug. 30.  
 „ 22,614 (1904). Ehmann. Atmospheric gas burner, particularly applicable for the gassing of textile yarns and threads. Aug. 30.  
 „ 1975 (1905). Bender. Process for bringing about smokeless combustion in connection with furnaces by the introduction of liquid fuel. Aug. 30.  
 „ 4352 (1905). Liebenenthal, Bieber and Inhalatorien G.m.b.H. System Dr. Herzog. Conversion into gas or vapours, and the distillation of difficultly volatile and other liquids. Aug. 30.  
 „ 5481 (1905). Ifö Kaolin-Och Chamottefabr., and Mohr. Retort furnaces. Sept. 6.

- [C.S.] 7310 (1905). Capitaine. Process for maintaining the temperature in a gas producer working with a varying consumption of gas. Sept. 6.  
 „ 11,680 (1905). Hennequin and Cayeux. Combustible liquids for explosion motors. Aug. 23.  
 „ 14,333 (1904). Elworthy and Williamson. Manufacture of gas for illuminating, heating, and power purposes. Sept. 6.  
 „ 14,687 (1905). Langhans. Manufacture of incandescing media for lighting purposes. Aug. 23.

## III.—DESTRUCTIVE DISTILLATION, TARS, PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [A.] 17,464. Johnson (Deuts. Continental Gas- & Petroleum Co.). Hydraulic mains of gas-making plants for selecting pitch. Aug. 29.  
 [C.S.] 29,479 (1904). Baudry. Method of distilling and separating unequally volatile elements contained in a complex mixture, particularly in a mixture of hydrocarbons, such as naphtha, crude petroleum, different kinds of tar, &c. Sept. 6.

## IV.—COLOURING MATTERS AND DYESTUFFS.

- [A.] 16,632. Johnson (Badische Anilin und Soda-Fabrik). Manufacture of derivatives of methylantraquinone. Aug. 16.  
 „ 16,782. Johnson (Badische Anilin und Soda-Fabrik). Manufacture of new condensation products and of sulphur colouring matters therefrom. Aug. 18.  
 „ 16,928. Johnson (Badische Anilin und Soda-Fabrik). Manufacture of sulphur colouring matters. Aug. 21.  
 „ 17,218. Singer, and The Bradford Dyers' Association. *See under V.*  
 „ 17,241. Johnson (Badische Anilin und Soda-Fabrik). *See under V.*  
 „ 17,242. Johnson (Badische Anilin und Soda-Fabrik). Manufacture of colouring matters of the anthracene series.\* Aug. 25.  
 „ 17,382. Imray (Meister, Lucius und Brüning). Manufacture of green acid mordant dyes. Aug. 28.  
 „ 17,540. Ris. Sulphurised colouring matters obtainable from indophenol. Aug. 30.  
 [C.S.] 24,045 (1904). Newton (Bayer und Co.). Manufacture of new azo dyestuffs. Aug. 30.  
 „ 24,869 (1904). Newton (Bayer und Co.). Manufacture of anthraquinone derivatives. Sept. 6.  
 „ 25,506 (1904). Lake (Oehler). Manufacture of sulphur dyes. Aug. 30.  
 „ 26,908 (1904). Johnson (Badische Anilin und Soda-Fabrik). Manufacture of azo colouring matters especially suitable for use in the form of its lakes. Sept. 6.  
 „ 26,909 (1904). Johnson (Badische Anilin und Soda-Fabrik). Manufacture of azo colouring matters especially suitable for use in the form of its lakes. Sept. 6.  
 „ 406 (1905). Imray (Meister, Lucius und Brüning). *See under V.*  
 „ 1367 (1905). Shillito (Geigy). *See under V.*  
 „ 1499 (1905). Newton (Bayer und Co.). Manufacture of quinizarin. Sept. 6.



- S.] 3160 (1905). Newton (Bayer und Co.). Manufacture of anthraquinone derivatives. Aug. 23.
- 3182 (1905). Imray (Meister, Lucius und Brüning). Manufacture of chlorinated indigo dyestuffs. Aug. 23.
- 4359 (1905). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Sept. 6.

# V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

- 16,453. Jeschke. Process for the production of a yarn warp of several colours in one piece of work.\* Aug. 14.
- 16,726. Maurel. Waterproofing of soft felt hats. [Fr. App., Mar. 8, 1905.] Aug. 17.
- 16,902. Brossard. Apparatus for dyeing, cleaning, and washing. Aug. 21.
- 17,185. Watson and Shaw. Process for bleaching cotton and other piece goods. Aug. 25.
- 17,218. Singer and The Bradford Dycers' Association. Production of Aniline Black on vegetable fibres, yarns and fabrics. Aug. 25.
- 17,241. Johnson (Badische Anilin und Soda Fabrik). Production of brown shades on the fibre with or without white or coloured discharge effects. Aug. 25.
- 17,315. Epstein. Method or process of dyeing and printing Aniline Black. Aug. 26.
- 17,381. Friedrich. Apparatus for the manufacture of artificial threads. [Ger. Appl., Sept. 7, 1904.]\* Aug. 28.
- 17,417. Barnacre Weaving Co., Ltd., and Woods. Producing wavy or watered effects on woven fabrics. Aug. 29.
- 17,568. Obermaier et Cie. Dyeing, scouring and other treatment of textile materials by liquids, and apparatus therefor. [Fr. Appl., Aug. 30, 1904.]\* Aug. 30.
- 17,775 (1904). Hunter, Moser and Burrows. Process and method of retting and preparing fibrous stems or straws—especially flax—preparatory to scutching. Aug. 23.
- 18,194. (1904) Brossard. Apparatus for dyeing, cleaning and washing. Aug. 30.
- 19,953 (1904). Mycock. Apparatus for guiding or distending textile piece goods in bleaching, printing and drying. Aug. 30.
- 21,988 (1904). Imray (Farbwerke vorm. Meister Lucius und Brüning). Manufacture of silk-like threads. Aug. 30.
- 22,614 (1904). (Ehmann). See under II.
- 25,284 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of pastes for the discharge of dyed textile fabrics. Sept. 6.
- 406 (1905). Imray (Meister, Lucius und Brüning). Manufacture of blue dyestuffs by oxidation on the fibre. Sept. 6.
- 1367 (1905). Shillito (Geigy). Production of light fast violet to blue shades on wool. Aug. 23.
- 7020 (1905). Kother. See under XI.
- 12,169 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of discharging pastes for use in the discharging of dyed textile fabrics. Aug. 23.

# VI.—COLOURING WOOD, PAPER, LEATHER, ETC.

- [A.] 17,163. Tittel. Apparatus for supplying colouring matter, mixture, solutions, or colour-producing chemicals in paper-making machines for the manufacture of one side coloured, clouded, coloured and marbled papers.\* Aug. 24.
- „ 17,338. Lamb and Rennie. Printing on leather.\* Aug. 28.

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- [A.] 16,929. Raschen, Wareing, Shores, and United Alkali Co. Treatment of arsenical sulphuric acid for the separation of arsenic and the obtainment of arsenious chloride. Aug. 21.
- „ 16,930. Raschen, Wareing, Shores, and United Alkali Co. Treatment of arsenious chloride for the obtainment of arsenious acid therefrom. Aug. 21.
- „ 16,931. Raschen, Wareing, Shores, and United Alkali Co. Treatment of arsenical sulphur ores for the obtainment of arsenious acid and of sulphuric acid deprived of arsenic. Aug. 21.
- „ 17,042. Harger. Removing impurities from inferior kinds of graphite and obtaining valuable products therefrom. Aug. 23.
- „ 17,198. Hurlbutt and Hurlbutt. Packing materials for hydrochloric acid towers and other acid towers. Aug. 25.
- „ 17,267. Langlands and O'Connor. Apparatus for making sulphate of ammonia. Aug. 26.
- [C.S.] 17,794 (1904). Lake (Soc. Anon. Ing. I. Vogel per la Fabbricazione di Concimi Chimici). Manufacture of sulphuric acid. Aug. 23.
- „ 20,835 (1904). Hargreaves. Generation and application of chlorine. Sept. 6.
- „ 4353 (1905). Niedenführ. Process of manufacturing nitric acid. Aug. 30.

# VIII.—GLASS, POTTERY, AND ENAMELS.

- [A.] 17,292. Wagner and Hermsdorf. Process for enamelling iron or steel goods. Aug. 26.
- [C.S.] 24,626 (1904). Sankey. Enamelling metallic surfaces. Aug. 30.

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- [A.] 248a. Matas y Rodés. Manufacture of compositions or agglomerates of cork.\* [Jan. 2, 1905, under Rule V.] Aug. 22.
- „ 16,530. Walker. Manufacture of cement. Aug. 15.
- „ 16,744. Kochmann and Kaufmann. Manufacture of substances capable of resisting water, chemical influences, and similar materials.\* Aug. 18.
- „ 16,841. Richards. Cement for attaching glass or pottery tiles to bricks, walls, and other surfaces. Aug. 19.
- „ 16,983. Shoop. Construction and arrangement of lime kilns. Aug. 21.
- „ 17,020. Woakes. Eliminating silicates and other cementing elements from earths or soils containing the same. Aug. 22.
- „ 17,109. Wynne. Manufacture of hydraulic cement. Aug. 24.

- [A.] 17,743. Clarke. Manufacture of bricks. Sept. 1.  
 [C.S.] 17,736 (1904). Powell. Wood and vulcanising or hardening, preserving and treating same. Aug. 23.  
 .. 22,056 (1904). Castle. Manufacture of cement. Aug. 23.  
 .. 26,516 (1904). Staudt. Manufacture of artificial stone compositions. Sept. 6.

## X.—METALLURGY.

- [A.] 16,643. Hernadthaler Ung. Eisenindustrie A.G., and Primosigh. Treatment of iron ores.\* Aug. 16.  
 .. 16,896. Newton (Somers). Furnaces. Aug. 21.  
 .. 16,897. Newton (Somers). Process and apparatus for making thin plate. Aug. 21.  
 .. 17,114. Izzett. Regenerative gas furnaces for melting steel and the like. Aug. 24.  
 .. 17,123. Hobson. New alloy. [U.S. App., Feb. 27, 1905.]\* Aug. 24.  
 .. 17,174. Hadfield. Manufacture of armour plates.\* Aug. 24.  
 .. 17,175. Cloud (McMurtry and Rogers). Treatment of ores, mattes, regulus, or the like metallurgical products and more especially those containing copper, for effecting the disulphurisation thereof and the obtainment of products suitable for smelting in blast furnaces. Aug. 24.  
 .. 17,178. Gredt. Treatment of ores.\* Aug. 24.  
 .. 17,250. Windhausen. Process and apparatus for treating ores and metals. Aug. 25.  
 .. 17,310. Hobson. Selective solvents for silver.\* Aug. 26.  
 .. 17,325. Swinburne. Treatment of poor ores. Aug. 28.  
 .. 17,370. Leggo. Furnace for treating ores, &c. Aug. 28.  
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 .. 17,651. Leitch. Furnaces for separating metals.\* Aug. 31.  
 .. 17,654. Boulton (Sutton, Steele and Steele). Dry concentration of ores.\* Aug. 31.  
 [C.S.] 18,660 (1904). De Bavay. Process for separating by flotation zinc blende from ores, tailings and concentrates, and for preparing such ores. Sept. 6.  
 .. 22,659 (1904). Morgan Crucible Co., Ltd., and Speirs. Compound for brushes of dynamo electric machines, bearings, &c. Sept. 6.  
 .. 22,688 (1904). Zohrab. Manufacture of steel and the smelting and reduction of iron or other ores or metals. Aug. 30.  
 .. 24,445 (1904). Witter. Process for obtaining and utilising tin from tin slags. Aug. 30.  
 [A.] 16,935. Cowper-Coles. Production of plates for printing purposes. Aug. 21.  
 .. 16,936. Cowper-Coles. Electrolytic manufacture of copper wire strip or the like. Aug. 21.  
 .. 17,152. Clarke. Apparatus for agitating electrolyte, alkaline or other solutions during electroplating, depositing, boiling, or mixing process. Aug. 24.  
 .. 17,238. Joel. Electrodes for secondary battery. Aug. 25.  
 .. 17,727. Lewis and Corey. Deposition of metal. Sept. 1.  
 [C.S.] 11,920 (1904). Bruno. Manufacture of electrodes for electric accumulators. Sept. 6.  
 .. 24,166 (1904). Monterde. Electric accumulator. Sept. 6.  
 .. 7020 (1905). Kother. Electrodes for electrolysis used in the manufacture of bleaching liquor. Sept. 6.  
 .. 14,333 (1905). Girod. Electric furnaces. Sept. 6.  
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 [A.] 17,777. Heys. Detergent and the manufacture thereof.\* Sept. 2.  
 [C.S.] 24,440 (1904). Holoubek. Manufacture of apparatus therefor. Aug. 23.  
 .. 1040 (1905). Silcock, Silcock and Stevenson. Extracting oil from seeds and the like. Sept. 6.  
 .. 8696 (1905). Caldwell. Processes for expressing oil or other liquids from material. Sept. 6.  
 .. 11,444 (1905). Da Cruz and Cardoso. Candles. Sept. 6.  
 .. 11,679 (1905). Hennequin and Cayeux. Lamps. Aug. 23.  
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 (A.)—PIGMENTS, PAINTS.  
 [A.] 16,490. Brunet. Manufacture of arsenic, antimony colours, white antimony, lithopone, antimony white, yellow and red sulphid antimony or minimum of antimony. [Fr. A. April 15, 1905.]\* Aug. 14.  
 .. 16,787. Ruch. Process of manufacture of pigments, varnishes, and the like.\* Aug. 18.  
 .. 16,840. Earle. Colour washes for brickwork. Aug. 19.  
 .. 16,951. Jones and Taylor. Non-corrosive pigments. Aug. 22.  
 .. 17,057. Shepherd. Water-proofing composition. Aug. 23.  
 .. 17,144. Fraser. Obtainment of zinc compounds for use as pigments. Aug. 24.  
 .. 17,639. Evangelidi. Paint for ships' bottoms. Aug. 31.  
 [C.S.] 24,238 (1904). Gebr. Heyl und Co., and Wiedemann. Manufacture of white lead. Sept. 6.  
 .. 26,908 (1904). Johnson (Badische Anilin und Fabrik). See under IV.  
 .. 26,909 (1904). Johnson (Badische Anilin und Fabrik). See under IV.

## XIV.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- [A.] 16,681. Craig. Apparatus for the production of ozone from oxygen or atmospheric air, and its application for various purposes. Aug. 17.



(B.)—RESINS, VARNISHES.

17,187. Morris. Substitute for felt, linoleum, oilcloth, leather, and the like.\* Aug. 25.

(C.)—INDIA-RUBBER, ETC.

17,452. Neilson. Process for regenerating rubber waste of all kinds. Aug. 29.

17,717. Price. Refining or purifying india-rubber, gutta-percha, balata, &c. Sept. 1.

330 (1905). Thomson (Michie and Colledge). Method of separating or coagulating india-rubber and appliances therefor. Aug. 23.

—TANNING, LEATHER, GLUE, SIZE, ETC.

16,887. Granville. Process for dressing skins. Aug. 21.

17,187. Morris. *See under XIIB.*

17,551. Baron and Aubert. Process of tanning leather and skins. [Fr. Appl., Oct. 14, 1904.]\* Aug. 30.

XV.—MANURES, ETC.

17,038. Forse. Obtaining manure and fuel out of house refuse, furnace refuse, or any other refuse. Aug. 23.

XVI.—SUGAR, STARCH, GUM, ETC.

16,589. Boidin. Process for rendering the hydrates of carbohydrates in general soluble.\* Aug. 15.

17,554. Bertels. Processes for the purification of sugar juices. Aug. 30.

17,718. Baker and Ling. *See under XVII.*

3827 (1905). Robin-Langlois. Machines for manufacture of sugar. Aug. 23.

XVII.—BREWING, WINES, SPIRITS, ETC.

16,507. Coffey. Means and apparatus for separating and removing fusel oil in the process of distilling. Aug. 14.

17,718. Baker and Ling. Method of utilising starch as a malt adjunct in brewing and distilling. Sept. 1.

18,013 (1904). Deichmann and Deichmann. Malting processes. Aug. 30.

23,597 (1904). Rüksam. Process of preparing beer wort. Sept. 6.

5930 (1905). Pampe. Process for separating by products of alcoholic fermentation from mash or wort. Aug. 30.

13,022 (1905). Petersen-Schepelern und Schwanenflügel. Preliminary treatment and ageing of spirits. Aug. 23.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(A.)—FOODS.

16,478. Scholvien. Non-alcoholic beverages resembling beer. [Ger. Appl., Aug. 14, 1904.]\* Aug. 14.

[A.] 16,609. Hawliczek. Preservation of meats. Aug. 16.

„ 16,681. Craig. *See under XI.*

„ 16,916. Kyle. Means for and method of preventing decomposition of fish.\* Aug. 21.

„ 17,330. Paudler. Substitute for coffee. Aug. 28.

„ 17,623. Kathreiner's Malzkaffee-Fabr., G.m.b.H. Manufacture from grain or malt, of a product resembling coffee. [Ger. Appl., Sept. 5, 1904.]\* Aug. 31.

„ 17,641. Gates (de Kunwald). Manufacture of extract of coffee. Aug. 31.

[C.S.] 23,576 (1904). Roberts. Process for restoring to flour certain properties lost in milling. Sept. 6.

„ 26,174 (1904). Overbeck. Separating arsenic from liquid food materials. Sept. 6.

„ 6939 (1905). Broeker. Means for bleaching cereals and grain. Sept. 6.

„ 7830 (1905) Langer. Process for producing blood albumen preparations. Aug. 30.

„ 7982 (1905). Glas. Manufacture of soluble milk powder. Aug. 30.

„ 15,311 (1905). Mann. Process for the manufacture of butter substitutes such as margarine and the like. Aug. 30.

(B.)—SANITATION; WATER PURIFICATION.

[A.] 17,383. Vogelsang. Purification or filtration of sewage. [Ger. Appl., Sept. 1, 1904.]\* Aug. 28.

XIX.—PAPER, PASTEBOARD, ETC.

[A.] 16,466. Rivers. Process of compacting liquid borne fibrous pulp and other material.\* Aug. 14.

„ 16,583. Peessarer. Process for the preparation of threads, films and laminae from viscose.\* Aug. 15.

„ 17,163. Tittel. *See under VI.*

„ 17,164. Friedrich. Manufacture of solutions of cellulose.\* [Ger. Appl., Aug. 25, 1904.] Aug. 24.

[C.S.] 22,381 (1904). Parkin and Williams. Process for rendering celluloid or nitric cellulose compounds non-inflammable. Aug. 30.

„ 10,319 (1905). Garbin, Gérard and Gérard. Process and apparatus for utilising the waste of celluloid and similar substances. Sept. 6.

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[A.] 16,723. Ellis (Chem. Fab. von Heyden A. G.). Manufacture of guaiacol sulphonic acids and salts thereof.\* Aug. 17.

„ 17,162. Imray (Meister, Lucius und Brüning). Manufacturer of aminobenzoic acid alkaline esters and derivatives thereof. Aug. 24.

„ 17,374. Newton (Bayer and Co.). Manufacture of a new iodine preparation. Aug. 28.

„ 17,511. Knoll und Co. Process of manufacturing neutral acid esters of sandal wood oil. [Ger. Appl., Feb. 10, 1905.]\* Aug. 30.

[C.S.] 19,411 (1904). Zimmermann (Chem. Fab. auf actien, vorm. E. Schering). Manufacture of dialkylated barbituric acids. Aug. 30.

„ 2031 (1905). Imray (Meister, Lucius und Brüning). Manufacture of dialkylbarbituric acids. Sept. 6.

[C.S.] 4055 (1905). Newton (Bayer und Co.). Manufacture of a new pharmaceutical compound. Aug. 30.

.. 9114 (1905). Valentiner. Manufacture of salicylic acid methylene acetate. Aug. 23.

.. 13,347 (1905). Maschmeyer. Manufacture of substances with the odour of violets. Sept. 6.

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.. 17,303 Hoffsummer. Manufacture of photographic papers.\* Aug. 26.

.. 17,638. Grünbaum. Photographic three and four colour printing processes.\* Aug. 31.

[C.S.] 24,987 (1904). Newton (Bayer und Co.). Flash light. Sept. 6.

[C.S.] 11,077 (1905). Pflanz. Preparation of photograph printing papers or surfaces. Aug. 30.

#### XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 16,514. Macnab, and Ammonal Explosives I Explosives. Aug. 14.

.. 17,741. Schneider. Explosive coherer-power [Ger. Appl., Oct. 27, 1904].\* Sept. 1.

[C.S.] 17,880 (1904). Boyd. Manufacture of explosive compositions. Aug. 23.

.. 18,269 (1904). Le Brocqy. Manufacture of cord Aug. 23.

.. 13,340 (1905). Claessen. Manufacture of prim compositions and charges for shells and torpedoes. Sept. 6.

#### XXIII.—GENERAL ANALYTICAL CHEMISTRY

[A.] 17,708. Hartung. Apparatus for use in analysis. [Ger. Appl., Sept. 2, 1904].\* Sept.



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## I.—PLANT, APPARATUS, AND MACHINERY.

## ENGLISH PATENTS.

*Firebars; Alloy employed in the Manufacture of —.*  
W. G. Cresthwaite. Eng. Pat. 20,842, 1904. X., page 973.

*Filters; Impts. in —.* A. Howatson. Paris. and W. Bobby. London. Eng. Pat. 21,644. Oct. 8, 1904.

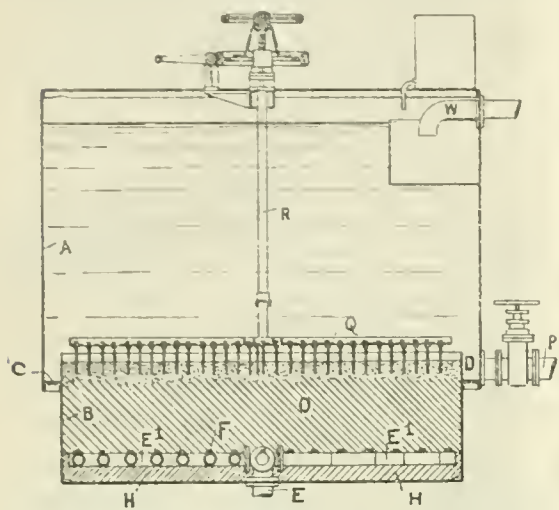


Fig 1

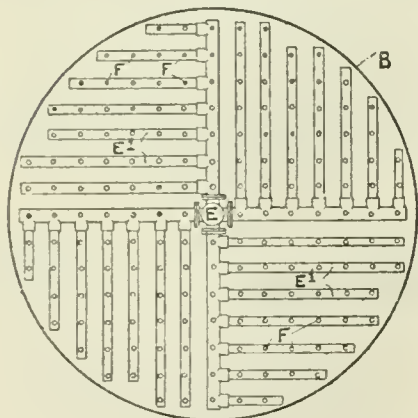


Fig. 2

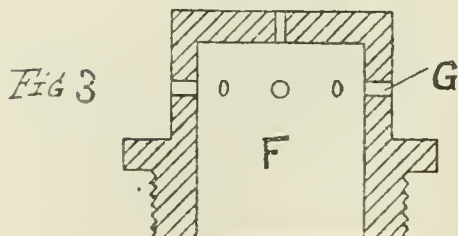


Fig 3

The filter is formed of the two vessels A and B, the latter being connected to the former by the ring C, as shown, so that the upper edge of B projects above the bottom of A and forms the annular gutter D. A grid of pipes, shown in fig 2, is placed on the bottom of the vessel

B; E is the outlet pipe, and passes through the bottom of B, and to it are connected the branch pipes E1, each at their outer ends and perforated to receive the nozzles F. The latter, shown in fig. 3, are formed with flat top and several flat side faces, both the top and the sides being perforated with fine holes G. The grid of pipes is cemented into the bottom of the tank B by bituminous cement. The grid may be replaced by a perforated plate bottom into which the nozzles are screwed. The water to be filtered enters by the pipe W and passes through the filtering medium O which may be of sand, broken flints, and away by the pipe E. The many fine perforations ensure a thorough use of the whole of the filter. When necessary to wash the filtering medium, the supply water is cut off and the tank drained out. Wash-water then admitted through E and, after percolating through the filtering medium, overflows into the gutter D, where it passes away by the pipe P. If desired, the surface of the filtering material may be agitated by the rake during the washing.—W. H. C.

*Furnaces for Calcining and Burning Briquettes of and for similar Purposes.* E. J. Bergendal. Hälsingland, Sweden. Eng. Pat. 6388, March 25, 1905.

The invention relates to furnaces operated by gas which the burnt material heats the air passing into combustion chamber. In order to effect intimate mixing of the gas and air currents, and thereby assist combustion, a supply of air under pressure is introduced into the combustion chamber through openings disposed at an angle to the inlets for the gas and air currents. The air entering is derived from the enclosed space created by placing of a cap or cover over hot material withdrawn from the furnace, such heated air being forced along connecting pipe by means of a fan.—E. S.

*Separating Apparatus; Impts. in Centrifugal -* Aktiebolaget Separator, Stockholm. Eng. Pat. 10, May 24, 1905. Under Int. Conv., May 27, 1904.

In centrifugal apparatus described in Eng. Pat. 3807 of (see Fr. Pat. 342,115 of 1904; this J., 1904, 895) which the removal of the heavier particles of liquid effected by means of scoop discs moving "planet-wise" along the inner periphery of the bowl, the following improvements are claimed. Inclined shields fast either to the bowl or guide-disc are used to direct heavy particles to the central outlet, and scrapers are provided to assist in removing the heavy particles from inclined shields. The scoop-discs may have an inclined form to facilitate the sliding of the heavy particles to the inclined shields.—W. H. C.

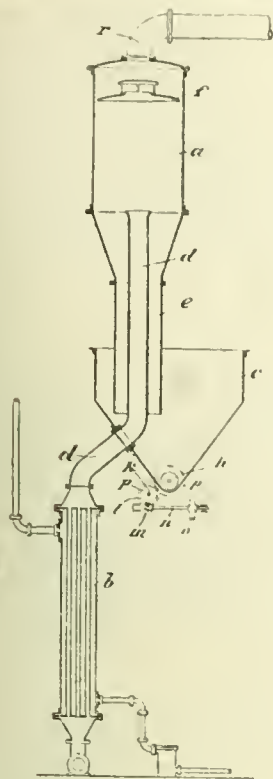
*Separating Apparatus; Impts. in Centrifugal -* Aktiebolaget Separator, Stockholm. Eng. Pat. 10, May 24, 1905. Under Int. Conv., May 27, 1904.

The patent refers to improvements in centrifugal apparatus described in Eng. Pat. 3807 of 1904 (see Fr. Pat. 342,115 of 1904; this J., 1904, 895). Ring-shaped rolling surfaces are fixed within the bowl, above and below the scoop discs, and the "naves" of the latter are prolonged so as to bear against the rolling surfaces. A cross-piece carried by the driving shaft embraces the upper ends of the "naves" of the scoop-discs, and keeps them in position.—W. H.

*Evaporators with Heating and Evaporation in Separating Chambers or Compartments; Impts. in Vacuum -* R. Samerbreij, Stassfurt. Eng. Pat. 10,947, May 1905.

To avoid the inconvenience caused by the deposition of solid matter on the sides of the vaporising chamber, the ascending pipe d, by which the liquid from the heating chamber b enters the vaporiser a, rises vertically through the descending pipe e, which leads to the separating chamber of tank c. The pipe d ends just above the surface of the liquid in a, and, as evaporation takes place at the surface, the solids are separated away from the sides of a, and





tend to form incrustations, but flow directly into *c*. plate *f* prevents any solid particles from being drawn the pipe *r* leading to the exhausting apparatus.  
—W. H. C.

UNITED STATES PATENT.

*Filtering Apparatus.* L. E. Beers, Aspen, Colo. U.S. Pat. 797,255, Aug. 15th, 1905.

BOILER, condenser and tank are connected together steam pipes, the boiler and tank also communicating water pipes. The tank has the same water level as boiler, so that when the level falls, a float in the tank is off the steam from the condenser and admits it to tank, where it blows a whistle alarm, whilst at the same time, the valve admitting water to the tank is opened.  
—W. H. C.

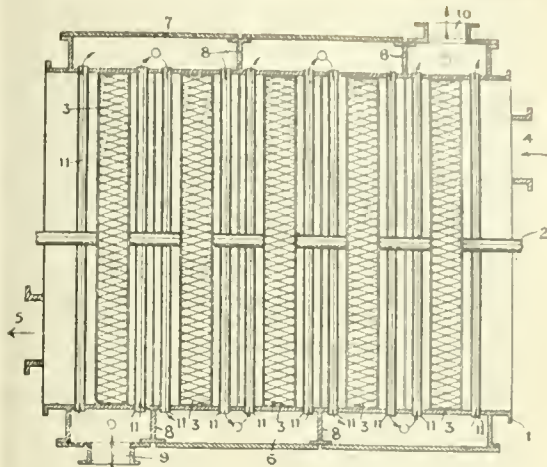
FRENCH PATENTS.

*Filtering and Washing Apparatus.* A. Hinze. Fr. Pat. 352,437, March 16, 1905. Under Int. Conv., March 17, 1904.

U.S. Pat. 793,133 of 1905; this J., 1905, 835.—T.F.B.

*Apparatus for Treating — with Gases or Liquors.* V. Defays. Fr. Pat. 352,719, March 25, 1905.

apparatus which is similar to the well-known "washer" used in gas-works for ammonia recovery is shown in plan in the figure. A number of coils 3, of wire wound spirally on the shaft 2, are rotated in the rig 1, provided with inlet and outlet pipes for the 4 and 5, the liquid being circulated in the contrary direction, as in the ordinary washer scrubber. Claim is made for constructing the coils 3, of metallic gauze wound helically, with the layers separated by a thin sheet of metal; several layers of gauze of different mesh, may be rolled together into a spiral. Further claim is made for a heating or cooling device, which consists in forming the rig chambers 6 and 7, on either side of the casing 1, the riggers being each divided by partitions 8 into several smaller ones which communicate with each other by



means of rows of tubes 11 passing between the separate coils of gauze 3. The cooling or heating agent enters at 9 and circulates in the direction indicated by the arrows, finally leaving by the outlet 10.—W. H. C.

*Steam Trap for High and Low Pressures.* G. Glöckler. Fr. Pat. 353,119, April 7, 1905.

THE valve of a steam trap is operated by the differential expansion of a nest of tubes of brass and iron or steel placed alternately in a casing. The iron tubes have flanges at one end on the inner, and at the other end on the outer side of the tube, and the ends of the brass tubes, which are threaded loosely on the iron ones, bear against these flanges. The steam trap is placed horizontally and so long as only water escapes from the valve, it runs away along a channel, placed underneath the tubes, without heating them. But when steam passes through the valve, it fills the casing and heats the tubes, causing them to expand and close the valve. When the apparatus is cold the valve is kept open by a spiral spring, and the steam-trap is provided with regulating and controlling screws, with a sieve to prevent foreign bodies such as grit getting into the valve and with a by-pass valve, by which steam may be blown through the apparatus to clean it.  
—W. H. C.

*Drying Oven; Rotary —.* F. Balitrand. Fr. Pat. 353,129, April 7, 1905.

A NUMBER of tubes which may have plain or gilled outer surfaces are arranged longitudinally around the axis within a rotary drying cylinder. The tubes extend from the end of the cylinder where the hot gases from the furnace are introduced, and terminate at successively increasing distances from that end. The tubes not only serve to convey the hot and dry gas to every part of the interior of the drier, but also help to heat the material to be dried by radiation and conduction from their outer surface. Local condensation of moisture is avoided and the cost of the apparatus is, it is claimed, reduced, as owing to the rapid drying a much shorter cylinder can be used.—W.H.C.

II.—FUEL, GAS, AND LIGHT.

ENGLISH PATENTS.

*Combustible Fluids for Power Purposes; Production of —.* J. Clay, Liverpool, and S. Goodall, Birkdale, Lancashire. Eng. Pat. 11,971A, May 26, 1904.

PETROLEUM or mineral oil is vaporised by atomising it in a chamber under a partial vacuum, the vaporised portions being carried off along with the air, whilst the heavier portions are left behind in the chamber, to be drained off or otherwise removed.—C. S.

*Hydrocarbon and other Liquid Fuels; Improved absorbent Non-Combustible Material for Burning* — W. Galloway, Glasgow. Eng. Pat. 20,138, Sept. 19, 1904.

A NON-COMBUSTIBLE absorbent material, for use in the burning of oils, spirits, &c., is prepared by treating slag wool (silicate cotton) so as to eliminate metallic and gritty substances. For example, the slag wool is roasted and agitated, to cause glassy particles to fuse together; a small quantity of paraffin oil is sprinkled over the material, which is then allowed to cool; and it is then passed over screens of various meshes to remove the heavy and gritty particles.—H. B.

*Gas from Pulverulent Fuel; Process of and Apparatus for Producing* — G. Marconnet, Paris. Eng. Pat. 1587, Jan. 26, 1905. Under Int. Conv., Feb. 1, 1904. SEE Fr. Pat. 340,075 of 1904; this J., 1904, 745.—T.F.B.

*Producer Gas Furnaces; Impts. in* — P. Schmidt and A. Desgraz, Hanover, Germany. Eng. Pat. 3245, Feb. 16, 1905

SEE Fr. Pat. 351,336 of 1905; this J., 1905, 838.—T.F.B.

#### UNITED STATES PATENTS.

*Peat; Process of Treating — for the Production of Fuel and the Recovery of the By-Products.* C. A. Sahlström. U.S. Pat. 796,019, Aug. 1, 1905. 111, page 962.

*Gas Producer.* W. B. Hughes, Wissahickon, Pa. U.S. Pat. 795,835, Aug. 1, 1905.

THE casing of the producer is divided horizontally, near the top, into two compartments. The upper portion, which is stationary, is provided with a fuel inlet for distributing the fuel in a circular path around the axis of rotation of the movable lower portion (body) of the casing and also carries, internally, an oscillating poker, which latter sweeps the fuel towards the axis of the body. The revolving body is attached, underneath, to an ash-hopper, partly conical and partly an open cylinder, so arranged as to support the fuel whilst leaving a free outlet for the ashes. The ashpit and sealing pit are also fixed to the revolving body, and are moved in unison with the same and with the ash-hopper.—C. S.

*Gas from Peat; Apparatus for the Manufacture of Combustible* — C. Whitfield, Northampton, England. U.S. Pat. 795,874, Aug. 1, 1905.

SEE Eng. Pat. 1738 of 1904; this J., 1905, 490.—C. S.

*Gas Producer.* E. Körting, Pegli, Italy.

U.S. Pat. 795,918, Aug. 1, 1905.

THE producer consists of a vertical down-draught shaft, with a central air-inlet and air-chamber in the upper part of same, and a bottom of considerable area, so that the fuel will move downward past the air chamber and leave a hollow space beneath the latter. The bottom of the air-chamber is perforated to supply air to the said hollow space, and the walls of the shaft, after sloping inwards at a sharp angle below the bottom of the air-chamber, are continued vertically downwards for some distance so as to form a secondary up-draught producing chamber of substantially uniform horizontal section. The gas outlets are in the part of the shaft below the main producing chamber, and a grate and closed ashpit are arranged at the bottom of the shaft. Means are provided for supplying air to the ashpit below the grate, and there is a channel leading from a point above the gas outlets down to the ashpit.—C. S.

*Gas-Generating Plant.* T. Fitzsimmons, Brooklyn, N.J. U.S. Pat. 796,632, Aug. 8, 1905.

TWO or more generators are connected at their tops by valve-controlled passage ways, with a receptacle common to all, whilst each generator is fitted at the bottom with a valve-controlled connection, leading to a source of vacuum, in order to reverse the draught of the generators

as desired. The generators are also fitted with valve-controlled air inlets at the top and bottom. The furnace which is arranged to burn alternately with an up-draught, is provided with an annular air-box underneath, which box has a number of upward passages located around the furnace. The latter has also a number of poker holes, situated just above the grate line, through which holes the said air passages pass and also a series of steam-injection pipes, whilst another series of steam pipes terminates at the grate line and beneath the bed of fuel, and a third series communicates with the top of the furnace. The passage ways from the air-box lead to the bottom of the fuel by means of a siphon, whereby air is heated before admission into the fuel.—C. S.

*Gas; Process of Making* — D. McDonald, Louisville, Ky. U.S. Pat. 796,670, Aug. 8, 1905.

A SUITABLE generator is charged with coke and with a superimposed layer of coal, the latter being of such height that the heat from the coke beneath can pass through the coal. The coke is raised to incandescence by a blast, which is passed through it but not through the coal, the latter being partly gasified by radiant heat from the coke. Steam is passed through the coke, and the resulting water-gas is enriched by passing it through the coal. The enriched gas is fixed by passing it through a superheater, and is mixed with the coal gas first given off. When the upper side of the coke is cooled, steam is passed downward through the mass, the resulting water-gas being produced through the superheater and mixed with the gas obtained previously.—C. S.

*Gas; Apparatus for Producing* — J. Luhne, Albstadt, Chapelle, Germany. U.S. Pat. 796,917, Aug. 8, 1905.

THE apparatus consists of an exterior generator; and an interior generator, for producing heat and initial gasification; an interior generator, with means for maintaining it at a high temperature by the heat developed in the outer generator; a receptacle, with perforated bottom, fitting the interior generator and containing a carburettor supplied with liquid fuel by suitable means; a dome surrounding the open end of the inner generator, a dome affixed to the cover of the outer generator, with sides extending downward far enough to be embedded in the charge contained in the latter; and a separately removable structure enabling the receptacle already referred to be withdrawn for re-charging.—C. S.

*Combustion; Device for Separating the Products of* — W. Cline, Lancaster, Pa. U.S. Pat. 797,558, Aug. 8, 1905.

A SEPARATOR chest interposed between the heater and the chimney is provided with a removable bottom, sloping from the sides towards a discharge pipe in the center. Sieve plates are secured to the removable part of the bottom at right angles to the flow of gas. Spraying nozzles are arranged in front of the sieves in a position to spray liquid against the sieves in a direction corresponding to the travel of the gas. One sprayer is placed below the last sieve and discharges obliquely into the space towards its inclined bottom and outlet.—R. L.

*Combustion; Apparatus for Purifying Gases of* — W. Cline, Lancaster, Pa. U.S. Pat. 797,661, Aug. 8, 1905.

A VERTICAL flue traversed by a rotating shaft, is interposed between the heater and the chimney. The gas is screened by sieve-plates spirally disposed on the shaft and revolving with it in frusto-conical enlargement towards the flue. The shaft is provided with water-wheels between the sieve-plates; jets of liquid discharging against the periphery of the water-wheels from pipes penetrating the wall of the flue, cause the shaft to revolve and spray liquid upon the sieve-plates. A water-wheel at or near the base of the flue can be revolved by the liquid collected there, and thus can drive a spiral suction fan located at the flue.—R. L.



## FRENCH PATENTS.

*for Generating Power: Method of Utilising Heavy Mineral* —. Comp. Ind. des Pétroles. Fr. Pat. 52,267, March 10, 1905.

heavy oils are gasified in a heated metal cylinder, the resulting gas is passed through a condenser which is maintained at such a temperature that any heavy oil which may have escaped "dissociation" is condensed, leaving the lighter hydrocarbons uncondensed. The latter are removed for conveyance to an explosion motor, whilst the condensed oils are either returned to the boiler or utilised for heating the same.—C. S.

*Gas Generator.* W. Towns. Fr. Pat. 352,540, Jan. 12, 1905.

Eng. Pat. 29,170 of 1904; this J., 1905, 611.—T. F. B.

*Gas; Electro-Catalytic Process for Obtaining Permanent* —, with a Carburetted Substance. A. A. Evencio. Addition dated Feb. 16, 1905, to Fr. Pat. 350,528, Jan. 4, 1905 (this J., 1905, 721).

heated carburetted liquid is passed through a tube traversed by electric sparks or electrical discharges; or the liquid may be heated in presence of a catalytic material like porous charcoal, with or without spongy platinum or the like; or the two operations may be combined, the result of the treatment being to gasify the liquid at a lower temperature than would ordinarily be necessary.—C. S.

*Producer Gas; Process and Apparatus for the Manufacture of* —. F. Jahns. First Addition, dated March 1905, to Fr. Pat. 327,214 of Dec. 10, 1902 Under Int. Conv., Oct. 31, 1904. (See this J., 1904, 181.)

The production of weak gas, free from tar, from bituminous fuel, by means of two or more connected generators, the pressure within the preliminary generator is to be increased as far as possible—for example, by providing a multi-jet aspirator in the vertical flue connecting the preliminary generator with the one adjoining.—H. B.

*Producer; Suction for Weak Gas* —, with Automatic Charging and Steam-Admission. V. É. Prétot. Fr. Pat. 353,000, March 20, 1905.

the top of the producer there rotates, on a vertical axis, a charging drum, having an opening on the top for the admission of fuel from a hopper, and an opening in the bottom for letting the fuel fall through a corresponding opening in the cover-plate of the producer. The charging drum, therefore, regulated by the rotation or non-rotation of the drum. A spindle, passing axially through the drum and extending down into the fuel chamber, rotates with the drum but has a free vertical movement, and carries at its lower end a plate of helical form. The latter, owing to its construction, always remains on the top of the fuel in the producer. As the producer is being charged, therefore, the plate and its spindle rise continuously until a predetermined point is reached, when the upper end of the spindle disengages the driving gear, and the rotation of the charging drum ceases. The charging of the producer then proceeds automatically according to the height of the fuel. The power for the driving gear may be obtained from a belt and driving shaft, or from a device connected to the explosion cylinder of the motor which works with the gas from the producer. The casing of the motor inlet valve of the producer is connected by a pipe to the cylinder of the motor in such a way that at each explosion the valve is raised from its seat and admits a certain amount of steam to the producer. The steam admission is thus varied automatically according to the consumption of gas.—H. B.

*Gas Generator.* J. Radcliffe. Fr. Pat. 352,812, March 28, 1905.

Eng. Pat. 7592 of 1904; this J., 1905, 490.—T. F. B.

*Gas from very Light Combustibles, such as Straw, Hay, Bagasse, &c.; Generator for the Production of Mixed* —. Cie. du Gaz H. Riché, and C. P. Bratasiano. Fr. Pat. 352,908, April 1, 1905.

The generator into which the straw or other material is charged is of large cross-sectional area, so that the fuel may sink readily in spite of its low density. The fire-grate, situated at one side at the foot of the generator, is provided with fire-bars having gutters on the upper surface. These gutters, in order to maintain a proper proportion of water to combustible, may be fed with water or hydrocarbon, according to the state of dryness or wetness of the fuel. Beneath the incandescent column of coke, through which the gas is led, a chamber of considerable size is provided, to favour the deposition of solid particles from the gas before it ascends through the coke. The hot gas, on leaving the coke, is led down a washing tower, in which it is caused to bubble through successive quantities of hot water.—H. B.

*Gas Generator having no Fire Grate.* Soc. Erhardt and Schmeier G.m.b.H. Fr. Pat. 352,938, April 3, 1905.

The body of the generator, which is open at the bottom, rests in an ash-pan, filled with water, which serves as a hydraulic seal. The blast-pipe rises from the centre of the pan and is covered by a conical bell, which prevents the fuel and cinders from entering the pipe. The cinders, resting on the ash-pan, support the fuel, without the intervention of a fire-grate.—H. B.

*Producers; Method and Apparatus for Keeping Constant the Temperature of Suction Gas* —, having Varying Consumption of Gas. E. Capitaine. Fr. Pat. 353,085, April 6, 1905. Under Int. Conv., April 8, 1904.

To prevent the fall in temperature which occurs in a suction gas-producer when the rate of gas consumption decreases, a portion of the gas generated is led off from the gas main as required and utilised in maintaining the temperature. For example, it may be conducted to a series of burners surrounding the generator and there burned, the flames being directed against the generator to minimise its loss of heat by radiation; or it may be burned so as to heat the pipes conveying air and steam to the generator; or it may be led along with air into the lower part of the generator, and there burned. The valve through which the gas is led off from the main is regulated automatically by a governor on the gas engine which takes the gas supply.—H. B.

*Gas; Process and Apparatus for Washing* —, particularly for Removing Sulphuretted Hydrogen from Coal Gas. E. Ott. Fr. Pat. 352,565, March 18, 1905.

The crude gas is scrubbed with concentrated aqueous ammonia (say, 30 per cent. strength), to remove the sulphuretted hydrogen, and is then washed with water in the usual way to free it from ammonia. The apparatus consists of a series of small superposed chambers, into each of which a downwardly-directed jet of strong ammonia solution is introduced under pressure and passes down a tube acting on the injector principle, whereby the crude gas is aspirated downwards along with the liquid, and is broken up into fine bubbles. The gas passes through each of the chambers in succession, separating from the liquid at the bottom of each and passing into the one below, whilst the used liquid is led off from each compartment to be used over again or submitted to a recovery process.—H. B.

*Lamps, Electric; Impts. in Osmium-Filament Incandescence* —. Soc. Française d'Incandescence par le Gaz (Système Auer). Fr. Pat. 352,751, March 27, 1905.

With the osmium of the filament there is mixed one or more of the reducible, highly infusible metals of groups VI. and VIII. of Mendeleeff's periodic system. For example, a plastic paste formed of osmium, fine carbon and an agglutinant is mixed with molybdenum oxide, and after being extruded into filaments, the latter are dried, baked *in vacuo*, and heated lightly by an electric current in a vacuum or an indifferent or reducing atmos-

phere. Whatever method is employed for producing the filament, the proportion of carbonaceous matter should be just sufficient, or rather less than sufficient, to reduce the oxide used. According to another method, a filament made entirely of the metal selected may be coated with osmium or a mixture of the latter with metals of the platinum group, and the filament thus coated is then raised to incandescence *in vacuo*, or in a suitable atmosphere, so that the metals become alloyed.—H. B.

*Mantles; Process of Manufacture of Incandescence* —. Comp. Française de l'Acétylène Dissons. Fr. Pat. 353,088, April 6, 1905.

THE fabric to be used in the manufacture of incandescence bodies is made of felted or carded cloth, instead of the usual tissues knitted from threads.—H. B.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

*Di-p-ditolylethane and the Dihydrides of 2.7.9.10-Tetramethylantracene and 2.7-Dimethylantracene; Constitution of Dissymmetric* —. J. Lavaux. Comptes rend., 1905, 141. 354—356.

By a critical examination of previous work by himself (this J., 1905, 884), Anschütz, (Ann., 235, 313) and Ador and Crafts (Ber., 10, 2173), the author proves that the ditolylethane, obtained by condensing *unsym. dichloroethane* with 2 mols. of toluene, has both its methyl groups in the *p*-position to the methylene group, and then shows that the dihydrotetramethylantracene, obtained by condensing this ditolylethane with a further molecule of dichloroethane, is the 2.7.9.10-compound; whence it follows that the dihydrotetramethylantracene of m.pt. 244°C. produced by condensing toluene with dichloromethane in presence of aluminium chloride, and also derived from the above tetramethyl compound by the loss of the methyl groups in the nine and 10 positions, is 2.7-dihydrotetramethylantracene.—T. F. B.

*Petroleum; Sulphur Compounds and Unsaturated Hydrocarbons in Canadian* —. C. F. Mabery and W. O. Quayle. Proc. Amer. Acad. Arts and Sc., 1905, 41, 89—113. (See also this J., 1894, 507.)

THE following sulphur compounds were isolated:—

	B. pt. °C.	Sp. gr. at 20° C.	Refractive Index.	Molecular Refraction.
Heptyl-thiophane ..	158—160	0.8878	1.468	40.82
Octyl-thiophane ..	167—169	0.8929	1.4860	44.92
Iso-octyl-thiophane	183—185	0.8937	—	—
Nonyl-thiophane ..	193—195	0.8997	1.4746	49.50
Decyl-thiophane ..	207—209	0.9074	1.4766	53.60
Undecyl-thiophane	128—130	0.9147	1.480	58.53
50 mm.				
Quaddecyl-thiophane	266—268	0.9208	1.4892	71.61
Sexdecyl-thiophane	283—285	0.9222	1.4903	80.44
Octodecyl-thiophane	290—295	0.9235	1.4977	—

Oxidation products, as detailed below, were obtained by adding slowly to the above sulphur compounds one and a half times the calculated quantity of potassium permanganate dissolved in thirty times its own weight of water, and keeping the solution cold. The manganese oxide was separated by filtration, and the unoxidised sulphur compounds by steam distillation, the oxidation products being extracted from the residue by ether. The products were: impure hexyl-thiophanesulphone; heptyl-thiophanesulphone (sp. gr. at 20° C. 1.1138); octyl-thiophanesulphone (sp. gr. 1.1142); nonyl-thiophanesulphone (sp. gr. 1.1161); undecyl-thiophanesulphone (sp. gr. 1.1126); and dodecyl-thiophanesulphone (sp. gr. 1.1372).

It is considered that the structure of the thiophanes,  $C_6H_5S$ , will have to be referred to the methylene ring, though the precise formation of the ring, with regard to the number of contained carbon atoms, is still uncertain.

Small quantities of hexylene, heptylene, octylene, nonylene were obtained from distillates of the sludge from the sulphuric acid treatment in refining, the unsaturated hydrocarbons having been dissolved out the acid without decomposition. The sludge oil is also found to contain sulphur-free oils, which are soluble in alcohol and resemble terpenes in smell; they have yet been identified.—C. S.

*Thiophen; Colorimetric Determination of* —. C. Schwalbe. XXIII., page 988.

#### ENGLISH PATENTS.

*Combustible Fluids [from Petroleum or Mineral Oil] for Power Purposes; Production of* —. J. Clay. F. Pat. 11,971A, 1904. II. page 959.

*Benzine or the like; Process for Rendering* —. A. Inflammable. J. E. Lyndall, Paris, and K. Cost White, London. Eng. Pat. 16,756, July 29, 1904.

THE "benzine" or like inflammable substance is made in the proportion of 80—60 per cent. with 20—40 per cent. of carbon tetrachloride, the requisite quantity of latter for ensuring non-inflammability being ascertained in each case by experiment.—C. S.

#### UNITED STATES PATENTS.

*Peat; Process of Treating — for the Production of Fuel and the Recovery of the By-Products.* C. A. S. ström, Ottawa. U.S. Pat. 796,019, Aug. 1, 1905.

PEAT is shredded and subjected to a continuously increasing pressure to extract a portion of the moisture it is then disintegrated without destroying the fibre heated to completely dry it, and the fibre separated from the peat powder by screening. The peat powder is now heated to a gradually increasing temperature till the acetic acid, ammonia, and other non-combustible gases are driven off, then further heated to remove tarry matter and certain other combustible products, afterwards partially cooled by blowing steam through whereby water-gas is produced. The solid residue is mixed with sufficient of the tarry products to serve as binding it, and the previously obtained combustible gases are absorbed by bringing them into contact with the cooling mass. The product is finally compressed into briquettes.—T. F. B.

*Flash Tester.* F. A. Courtois. U.S. Pat. 788,250, 1. XXIII. page 987.

*Viscosimeter.* F. A. Courtois, U.S. Pat. 788,251, 1. XXIII., page 987.

### IV.—COLOURING MATTERS AND DYESTUFFS.

*Dyestuffs; New Direct [Azo]* —. P. Barbier. Soc. Ind. Mulhouse, 1905, 153—154.

NEW azo dyestuff components, derived from diphenyl combined with the tetrazo-derivatives from benzene, the *p*-*p'*-diamino-phenyltolyls, tolidine, *p*-*p'*-diaminodixyls, dianisidine and all other diamines of the character. The new components are:—*o*- and *m*-anilinodiphenyl and their alkylated derivatives; *o*- and *m*-anilinodiphenylmono- and disulphonic acids and their alkyl derivatives; hydroxy- and dihydroxydiphenyls and their mono- and disulphonic acids; aminohydroxydiphenyls and their alkylated, arylated and sulphonated derivatives. The products vary in shade from red, orange, yellow and blue to violet. They dye cotton directly and the colours are fast to acids. Compounds of similar shade and properties are obtained by combining the tetrazo compounds mentioned above, partly with the above-mentioned new components and partly with the components ordinarily used.

In a report on the preceding article, E. Noelting points



it was known that di-*p*-dihydroxydiphenyl does not combine with diazo-compounds. The fact that hydroxy-1 dihydroxydiphenyls having the hydroxyl groups at other positions do combine is, though not unexpected, very interesting. Noelting does not believe that any of the dyestuffs mentioned are manufactured industrially. —E. F.

*Dyestuffs; New Hydrazinic* —. M. Prod'homme. Bull. Soc. Ind. Mulhouse, 1905, 155—156.

CESTA is diazotised, sodium bisulphite added, and the dye allowed to stand for 24 hours. The solution is then heated to 60° C., more hydrochloric acid added and the heating continued. A dyestuff of acid character is thus obtained dyeing wool in prune shades. If benzaldehyde be added immediately after the hydrochloric acid, another dyestuff of much bluer shade is obtained, also dyeing wool from an alkali bath. A similar product, though not quite so blue, is obtained if the benzaldehyde be replaced by acetone. The dyestuff compound from Safranin, treated with sodium sulphite and hydrochloric acid, yields a dyestuff giving red shades on wool. The leuco-compound obtained from diphenylcarbinol and sulphonic acid, oxidised and then treated similarly, gives a green very soluble in alkalis. *p*-Nitraniline gives a rather weak yellow, a very fine yellow being obtained in presence of benzaldehyde.

Noelting points out that the hydrazinosulphonates of acid character described in the preceding article, are very different in character to the basic dyestuffs obtained by the action of aldehydes and ketones on the basic dyes themselves, which have been described by Ziegler. —E. F.

*Dyestuffs [Oxazine Dyestuffs] Green* —, obtained by the condensation of Nitrosodimethylaniline with Polyhydroxylated Benzophenones. J. Eliasberg. Bull. Soc. Ind. Mulhouse, 1905, 157—158.

ROSODIMETHYLANILINE reacts with polyhydroxylated benzophenones, more especially with those derived from gallic acid, forming oxazine dyestuffs which dye in green shades on chrome-mordant. Amongst the benzophenone derivatives used were hexa- and penta-hydroxybenzophenone and tetrahydroxy-naphthylphenylketone. The method of preparation is the same as for Gallocyanine. The dyestuffs are only very slightly soluble in water, and for printing they must be used in the form of their sodium sulphite addition products.

In a report on the preceding article, C. de la Harpe states that he repeated Eliasberg's experiments and also prepared analogous dyestuffs, using trihydroxyphenylphenylketone (Alizarin Yellow C, B.A.S.F.) trihydroxybenzophenone (Alizarin Yellow A, B.A.S.F.) and trihydroxy- $\beta$ -methyl-coumarin. The nitrosodimethylaniline was also replaced by nitrosodiethylaniline and by diso-diethylanilinesulphonic acid. In all cases the results were low and the dyestuffs poor in quality. The results do not seem to combine with phenols to form gallocyanines. —E. F.

#### ENGLISH PATENTS.

*Colouring Matters [Dyestuffs] and Intermediate Products relating thereto; Manufacture of Azo* —. J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 1,638, Oct. 8, 1904.

Second Addition to Fr. Pat. 338,819, 1904; this J., Oct. 10, 1905. —H. L.

*Colouring Matter [Dyestuffs]; Manufacture of Azo* —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 22,735, Oct. 21, 1904.

Addition of Oct. 28, 1904, to Fr. Pat. 346,008 of Oct. 14, 1905, 329. —T. F. B.

*Rhodamine Colouring Matters [Pyrene Dyestuffs]; Manufacture of — and of Intermediate Products relating thereto*. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 23,198, Oct. 27, 1904.

See Fr. Pat. 347,546 of 1904; this J., 1905, 329. —T. F. B.

*Colouring Matters [Anthracene Dyestuffs] therefrom; Manufacture of New Compound and of —*. J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 853, Jan. 16, 1905.

See First Addition to Fr. Pat. 349,531, 1904; this J., 1905, 841. (See also this J., 1905, 192, 494, 669, 726 and 840.) —H. L.

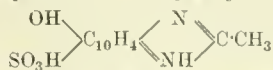
*[Anthracene Dyestuffs] Colouring Matters of the Anthracene Series; Manufacture of —*. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 1818, Jan. 30, 1905.

See U.S. Pat. 796,393 of 1905; this J., 1905, 919. —T. F. B.

*Azo Dyestuffs and New Intermediate Products for use therein; Manufacture of New* —. H. E. Newton, London. From Farbenfabriken vorm. Fr. Bayer und Co., Elberfeld, Germany. Eng. Pat. 1675, Jan. 27, 1905.

The new dyestuffs are obtained by combining diazo compounds with hydroxynaphthimidazoles or with hydroxynaphthoxazoles. The hydroxynaphthimidazoles can be prepared by the action of aldehydes, mixtures of aldehydes and ketones, acid anhydrides or acid chlorides on 1,2-naphthylenediamine-5-hydroxy-7-sulphonic acid. When employing acid anhydrides or acid chlorides the acyl derivatives first formed, must be heated with acids in order to close the ring, e.g.,

$\mu$ -methyl-1,2-naphthimidazole-5-hydroxy-7-sulphonic acid



is prepared by first treating 1,2-naphthylenediamine-5-hydroxy-7-sulphonic acid with acetic anhydride and sufficient sodium carbonate to keep the solution neutral, and subsequently acidifying with hydrochloric acid and boiling. 1,2-Naphthylenediamine-5-hydroxy-7-sulphonic acid is prepared by reduction of the azo dyestuff obtained when *p*-nitraniline is combined in acid solution with 2,5,7-aminonaphtholsulphonic acid. Using *o*- or *p*-nitrobenzylchloride in place of acetic anhydride in the above example, the corresponding  $\mu$ -nitrophenyl-1,2-naphthimidazole-5-hydroxy-7-sulphonic acids are obtained which on reduction yield respectively *o*- and *p*-aminophenyl derivatives. The latter combine with diazo compounds. The resulting dyestuffs can be further diazotised on the fibre and developed to red or bluish red shades, which are fast to washing.

The hydroxynaphthoxazoles are prepared by the action of acid anhydrides or chlorides on 1-amino-2,5-dihydroxynaphthalene-7-sulphonic acid. The latter substance is prepared by reducing the diazo compound of 2,5,7-dihydroxynaphthalenesulphonic acid. (See also U.S. Pat. 792,600, 1905; this J., 1905, 796.) —H. L.

*Anthraquinone Derivatives; Manufacture of* —. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 3160, Feb. 15, 1905.

*p*-NITRO- $\alpha$ -HYDROXYANTHRAQUINONES are obtained by nitrating erythrohydroxyanthraquinone, chrysazin or anthrarufin in sulphuric acid solution in presence of boric acid. For example, 5 parts of crystallised boric acid are added to a solution of 10 parts of chrysazin in 200 parts of sulphuric acid of 66° Bé. The mixture is heated to 50° C. for two hours, cooled to 10–15° C., and a solution of 2 mols. of nitric acid in sulphuric acid added. After stirring for three hours the melt is poured into water, by which means the product, *p*-dinitrochrysazin is precipitated. 1,4-Nitrohydroxyanthraquinone is claimed as a new article of manufacture. —E. F.

*Azo Colouring Matters; Manufacture of* —. T. R. Shillito, London. From Aniline Colour and Extract Works formerly J. R. Geigy, of Basle, Switzerland. Eng. Pat. 2228, Feb. 4, 1905.

DIAZO compounds of *o*-aminophenolsulphonic acid, its homologues and substituted derivatives are combined with ethyl-*a*-naphthylamine. The dyestuffs produce red to violet shades on wool from an acid bath, turning to violet and blue shades fast to milling after treatment with bichromate. By treatment with copper salts the shades become violet to blue, especially pure blue shades being obtained from an aminophenolsulphonic acid with the sulphonic group adjacent to the hydroxyl. The combinations of the following acids with ethyl-*a*-naphthylamine are described:—1,2-hydroxyaminobenzene-4-sulphonic acid, 4,5-hydroxyamino-toluene-3-sulphonic acid, 1,2-hydroxyamino-4-nitro-benzene-6-sulphonic acid, 1,2-hydroxyamino-6-nitro-benzene-4-sulphonic acid, 1,2-hydroxyamino-4-chloro-benzene-6-sulphonic acid, 1,2-hydroxyamino-4-acetamino-benzene-6-sulphonic acid, and 1,2-hydroxyamino-benzene-4,6-disulphonic acid.—H. L.

*Dyestuffs; Manufacture of Chlorinated Indigo* —. O. Imray, London. From Farb. vorm. Meister, Lucius und Brünig, Hoechst-on-Maine, Germany. Eng. Pat. 3182, Feb. 15, 1905.

CHLORINATED indigo dyestuffs are obtained by treating indigo or, by preference, indigo-white with sulphuryl chloride. An indifferent liquid solvent may be used, but is not essential. Carriers such as iodine are not absolutely necessary, but may be used. For example, 27 parts of indigo are suspended in 200 volumes of carbon tetrachloride and 68 parts by weight of sulphuryl chloride are added. The whole is allowed to stand at the ordinary temperature until the sulphuryl chloride has disappeared, and the chlorinated product is isolated by filtering and distilling off the solvent. The chlorinated indigos thus obtained, dye in shades which are redder and clearer than those obtained with indigo, and similar to those produced by the corresponding bromo-derivatives.—E. F.

#### UNITED STATES PATENTS.

*Dyestuff and Process of Making same; Red-Violet Sulphur [Sulphide]* —. T. Muchall, Assignor to Kalle und Co., Biebrich, Germany. U.S. Pat. 796,443, Aug. 8, 1905.

SEE Ger. Pats. 152,373 and 158,101 of 1903; this J., 1905, 614.—T. F. B.

*Dyestuff; Process of Making a Yellow Sulphur [Sulphide]* —. J. Hoerlin, Assignor to Chem. Fabr. vorm. Weiler-Ver.-Mer., Urdingen-on-Rhine, Germany. U.S. Pat. 796,514, Aug. 8, 1905.

SEE Ger. Pat. 157,862 of 1904; this J., 1905, 615.—T. F. B.

*Dyestuff; Azo — and Process of Making same*. T. Kroeber and C. Jagerspacher, Assignors to Society of Chemical Industry in Basle, Basle, Switzerland. U.S. Pat. 797,441, Aug. 15, 1905.

SEE Fr. Pat. 351,125 of 1905; this J., 1905, 640.—T. F. B.

*Dyestuff; Black Azo* —. M. Herzberg, Assignor to Farb. vorm. Meister, Lucius und Brünig, Elberfeld, Germany. U.S. Pats. 797,731 and 797,732, Aug. 22, 1905.

SEE Fr. Pat. 347,655 of 1904; this J., 1905, 329.—T. F. B.

*Indolic Bodies; Process of Making* —. P. Seidel, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 798,077, Aug. 29, 1905.

SEE Fr. Pat. 322,387 of 1902; this J., 1903, 360.—T. F. B.

*Dyestuff; Yellowish Azo* —. F. C. Günther, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 798,098, Aug. 29, 1905.

SEE Eng. Pat. 5861 of 1905; this J., 1905, 541.—T. F. B.

*Anthracene Compound and Process of Making same*. M. H. Isler, Mannheim. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 798,104, Aug. 29, 1905.

SEE Fr. Pat. 349,531 of 1904; this J., 1905, 726.—T. F. B.

#### FRENCH PATENTS.

1-Diazo-2-Hydroxy and 2-Diazo-1-Hydroxy-Naphthalene Mono-, Di-, and Trisulphonic Acids [Azo Dyestuff Process of Making] —. Fabr. de Couleurs d'Anilin et d'Extraits, ci-dev. J. R. Geigy. Fr. Pat. 349,531, June 14, 1904.

SEE Eng. Pat. 10,235 of 1904; this J., 1905, 433.—T. F. B.

[Azo Dyestuffs]. Nitro-1-diazo-2-hydroxynaphthalene Nitronaphthalenediazo Oxide; Process for the Manufacture of the 4-Sulphonic Acid of a —. Fabr. de Couleurs d'Anilin et d'Extraits, ci-dev. J. R. Geigy. Fr. Pat. 349,996, June 16, 1904.

SEE Eng. Pat. 15,418 of 1904; this J., 1905, 669.—T. F. B.

[Indigo Dyestuffs]. Hydroxyethylaniline and its Derivatives; Production of —. Badische Anilin und Soda Fabrik. Fr. Pat. 350,002, June 17, 1904.

SEE U.S. Pat. 778,772 of 1904; this J., 1905, 84.—T. F. B.

*Dyestuffs of the Anthracene Series; Production of a Series of Derivatives and —, and their Application in Dyeing and Printing*. Badische Anilin und Soda Fabrik. Second Addition, dated Feb. 22, 1905, U.S. Pat. 349,531, Dec. 21, 1904. Under Int. Conv., Jan. 1905.

A SERIES of dyestuffs isomeric with and very similar to Benzantrones of the principal patent (this J., 1905, 726) is obtained by the condensation, with glyceric sulphonic acid, of *a*-aminoanthraquinone and its derivatives, (except those diaminoanthraquinones obtained by nitration and reduction of anthraquinone, which produce anthraquinone-diquinolines). 20 kilos. of *a*-aminoanthraquinone are dissolved in 300 kilos. of sulphuric acid (62° B.), and heated with 18 kilos. of glyceric acid 150°–155° C. for half-an-hour. The cooled product is poured on to ice, and the precipitate filtered and washed. Its composition is represented by the formula C<sub>20</sub>H<sub>14</sub>O<sub>4</sub>N<sub>2</sub>. By melting with alkali hydroxides, it is converted into violet-blue dyestuff.—T. F. B.

*Phenylglycinates [Indigo Dyestuffs]; Production of —*. Badische Anilin und Soda Fabrik. Fr. Pat. 350,002, March 11, 1905. Under Int. Conv., Feb. 15, 1905.

SEE Eng. Pat. 5564 of 1905; this J., 1905, 541.—T. F. B.

*Dyestuffs which Dye Wool in Shades varying from Orange to Orange*; Production of [Azo] —. Badische Anilin und Soda Fabrik. Fr. Pat. 352,539, March 11, 1905. Under Int. Conv., Nov. 29, 1904.

SEE Eng. Pat. 5861 of 1904; this J., 1905, 541.—T. F. B.

*Dyestuff specially suitable for the Manufacture of Irides*. Production of a Red Monoazo —. Badische Anilin und Soda Fabrik. 2nd Addition, dated March 25, 1905. U.S. Pat. 346,008, Sept. 2, 1904. Under Int. Conv., Oct. 24, 1904.

RED insoluble dyestuffs of bluish shade, very suitable for the production of lakes, are obtained by combining with diazo-compounds formed from any di-substituted products of *p*-toluidine, *p*-anisidine, or *p*-chloro-aniline, in which the substituent groups are in the positions 3 and 4, amino-group. The substituting groups may be methoxyl-, chlorine-, or nitro-groups.—E. F.

[Azoine and Oxazine Dyestuffs]. Anthracene Series; Process of Preparing new Colouring Matters of the —. Badische Anilin und Soda Fabrik. U.S. Pat. 350,038, July 4, 1904.

SEE Eng. Pat. 14,970 of 1904; this J., 1905, 668.—T. F. B.



## —PREPARING, BLEACHING, DYEING, RINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

*Merising Industry; Studies on the* —. F. J. G. Beltzer. *Monit. Scient.*, 1905, 19, 641—651.

This article, which is supplementary to a previous one (this J., 1904, 981), dealing with the actual merising process, discusses the utilisation of the spent caustic soda liquors. Those of a strength lower than 4° B. are used for scouring the cotton previous to merising, whilst those stronger than 4° B. are more profitably concentrated. Evaporators working on the Kestner principle are recommended. A description is given of typical evaporators and their working, and some results of actual merising. An ideal merising establishment is also described. It is calculated that the average saving obtained by concentrating the spent liquors is 0.15 fr. per kilo. of cotton merised.—T. F. B.

*Chrome Mordant; Action of Sodium Silicate and of Sodium Hydroxide on* —. C. Fabre. *Bull. Soc. Ind. Mulhouse*, 1905, 150—152.

The affinity of chromium oxide, when fixed on the fibre, for dyestuffs, is diminished by the action of sodium silicate increased by that of sodium hydroxide. At the same time sodium silicate turns the shade of the fabric dyed with chrome towards blue, whilst sodium hydroxide turns it to a purplish green. It is therefore possible to obtain a uniform effect of semi-discharge by printing on to the chrome-mordanted fabric sodium silicate solution of 38° B. thickened with starch paste, steaming, souring, and then dyeing. The result is a bright design on a clearer ground, obtained by printing on to the chrome-mordanted fabric sodium hydroxide solution of 38° B. thickened with starch paste.

F. Aliston confirms the results of C. Fabre. The effect of the sodium hydroxide is not primarily due to any bleaching action. This is proved by the fact that by printing with sodium hydroxide solution of 38° B., then chroming and dyeing, the fabric is dyed most evenly throughout.—E. F.

*Dyestuffs; Action of Tannin on the Leuco-Derivatives of* —. E. Justin-Mueller. *Bull. Soc. Ind. Mulhouse*, 1905, 90.

CO-DERIVATIVES of sulphide dyestuffs combine with tannin to form compounds insoluble in water, which are chemically stable when exposed to the air, and are decomposed by sodium hydroxide solution forming the original, easily oxidisable leuco-compound. Attempts to utilise tannin addition products for printing on cotton were partially successful.—E. F.

### ENGLISH PATENTS.

*Preparing or Preparing Fibrous Stems or Straws, especially flax, preparatory to Scutching; Process of* —. G. J. Hunter and L. J. Moser, London, and T. Burrows, Limerick. *Eng. Pat.* 17,775, Aug. 16, 1904.

Flax or other straw, either green or dried, is boiled for two to three hours in a solution of alkali (e.g., a 2 per cent. sodium carbonate solution), with or without the addition of oil or soap; the bath is then allowed to cool and the flax steeped in it for a further four or five hours, when it is washed. If desired, it may now be treated with a dilute acid. The fibrous material is finally pressed and rushed, e.g., between rollers, and then dried, when it is ready for scutching.—T. F. B.

*Yarns; Process for Improving* —. M. Hölken, Jarmen-Rittershausen. *Eng. Pat.* 7140, April 4, 1905.

Yarn made from paper pulp is dipped for a short time into the finishing material (glue, dextrin, potato starch, &c., with oil, fat or soaps), and then immediately

treated under tension in a brushing machine. The brushes of the latter are supplied with paraffin, wax, fat, or the like, for the purpose of providing the paper threads with a coating to render them smooth. The yarn, it is stated, is thus strengthened and protected from moisture.—W. H. C.

*Dyeing of Textile Fibres or Fabrics [Aniline Black]*. C. E. Wild, Lansdowne, U.S.A. *Eng. Pat.* 16,503, July 26, 1904.

SEE *Fr. Pat.* 345,254 of 1904; this J., 1905, 24.—T. F. B.

*Dyeing and otherwise Treating with Liquids, Wool, Yarn and other Fibrous Material or the like; Apparatus for* —. J. Rhodes, Shipley. *Eng. Pat.* 18,056, Aug. 20, 1904.

This invention relates to improvements in apparatus described in *Eng. Pat.* 25,823 of 1898 (this J., 1900, 44). The claim is for providing an equal distribution of the liquid by means of a circulating force pump and a system of pipes. The latter are so arranged that they can be turned aside so as to allow the material treated to be easily introduced and removed.—W. H. C.

*Textile Fabrics and Materials; Perforated Beams or Cylinders on which — are treated with Liquids and Fluids*. J. W. Kenworthy, Bradford, and J. D. Ward, Halifax. *Eng. Pat.* 20,665, Sept. 26, 1904.

A LAYER of "expanded sheet-metal" or other suitably reticulated material, wire gauze or wire netting, is interposed between the textile materials which are to be dyed, &c., and the perforated cylinders around which, to this end, they are wound, or, more commonly, between the latter and the layer of "lapping" upon which the materials are wrapped, the object being to effect uniform distribution through the materials of the dye, &c., liquors or the gases applied.—E. B.

*Violat to Blue Shades on Wool; Production of Light, Fast* —. T. R. Shillito, London. From Aniline Colour and Extract Works, formerly J. R. Geigy, Basle, Switzerland. *Eng. Pat.* 1367, Jan. 24, 1905.

THE process is similar to that described in U.S. Pat. 794,315 of 1905 (see this J., 1905, 841); in addition, the halogen derivatives of o-aminophenolsulphonic acid may be replaced by the following derivatives:—3.4.5-aminocresolsulphonic acid; 4.2.6-nitroaminophenolsulphonic acid; 4-acetamino-2-aminophenol-6-sulphonic acid; 2.1.4.6-aminophenoldisulphonic acid. Derivatives of other o-aminophenolsulphonic acids may be employed, but the best results are obtained when the sulphonic acid group is *ortho* to the hydroxyl group.—T. F. B.

*Dyeing Machines; Impts. in* —. W. H. Fletcher, Passaic, U.S.A. *Eng. Pat.* 5244, March 13, 1905.

SEE U.S. Pat. 787,285 of 1905; this J., 1905, 544.—T. F. B.

*Brewers' Wash, Sewage or Spent Dyes and the like; Evaporator for Evaporating the Liquid in —, the Evaporator being also applicable as a Smoke Washer*. A. B. Lennox. *Eng. Pat.* 18,488, Aug. 26, 1904. XVIII.B., page 982.

*Printing Machines [for Intermittent Printing] for Fabrics; Roller* —. Mather and Platt, Ltd., and D. P. Smith, Salford. *Eng. Pat.* 21,509, Oct. 7, 1904.

THE printing, at predetermined distances apart, of cross borders or stripes upon textile tissues, is accomplished, according to this invention, with the aid of two pairs of endless chains, one pair bearing projections, the other, depressions, by the action of which upon the mandrels the two sets of printing rollers are brought into or thrown out of operation as required.

The bowl 1 (see figures) of the printing machine is provided at each end with an annular channel 2. Two endless chains 5 are led into the machine over wheels 6 above the first body- or ground-printing roller 7; these pass along the channels 2 and under guides attached to the side frames, and after leaving the last printing roller of the same set, are led out of the machine, returning to the

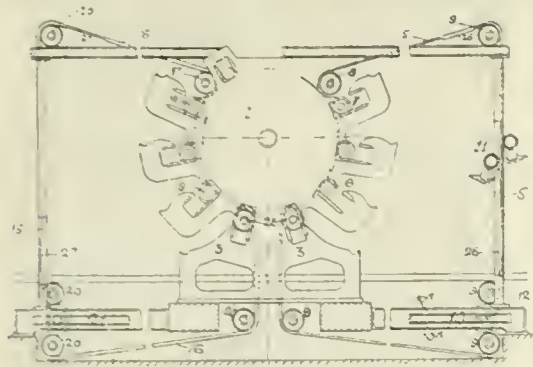


FIG. 1.

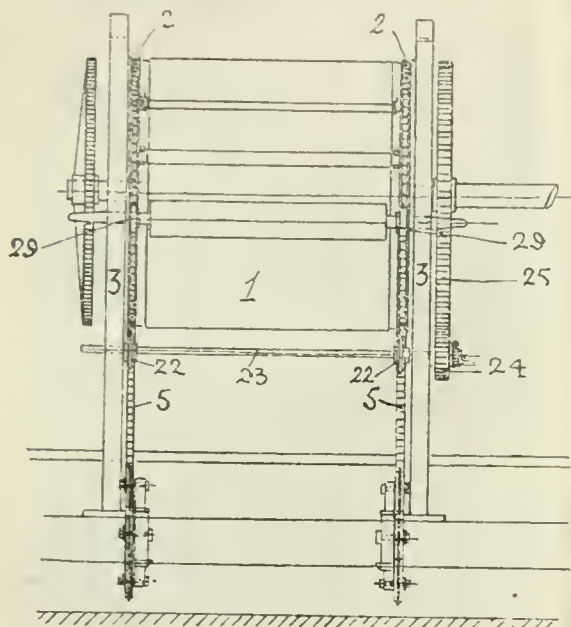


FIG. 2.

point of entrance over guide-pulleys 9 and through a tension apparatus 10, and cleaning arrangement 11. Two other, similar, endless chains 16 are led into the machine over wheels 17 above the last cross-border roller 18. These after leaving the first roller 19 of the same set, return over guide pulleys 20 and a tension arrangement 21. All four chains are driven by sprocket wheels 22, mounted on shafts 23, carrying toothed wheels 24, which gear with the main star-wheel of the printing machine, the gearing being so arranged that the four cam-chains move with the same speed as the periphery of the bowl.

The two chains 5 are provided with cams or projections 26, attached to their inner edges and fixed at predetermined distances apart from one another. At the same positions are also affixed protection plates, extending across the whole width of the bowl from one to the other of the chains. These plates, which are provided with screw adjustments 29, pass between the bowl and the printing rollers when the latter are lifted and effectually prevent any accidental smearing of the tissue with colour at the moment of the leaving or returning of the rollers. The chains 16 on the cross border side are provided with depressions 27 which correspond in length and in position on them with the projections 26 on the other chains 5. The chains 5 and 16 pass under the mandrels of the printing rollers and, therefore, when the projections on the cam chains 5 come under the mandrels the

printing rollers, which in this case print the ground pattern are pushed away from the tissue, and are held out of contact for the length of the projection, a corresponding blank space being left on the tissue. The chains 16 by means of their long projecting edges, normally hold the bowl the printing rollers upon which the cross-border pattern is engraved, and only allow them to drop in contact with the tissue and print when the depressions pass under the mandrels upon the side of the machine which they operate.

The pitch of the projections and depressions may be varied to suit the length of the pattern to be printed. But, set, however, to correspond exactly on the two pairs chains and these chains being driven at the same speed the cross borders will in all cases be printed in correct register in the blanks left in the ground pattern.—E. B.

*Discharging Pastes; Manufacture of —, for use in the Discharge of Dyed Textile Fabrics.* J. Y. Johns. London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 12,100, June 10, 1905.

THE discharging power of pastes containing a formaldehyde hydrosulphite compound or a formaldehyde-sulphoxyl compound is considerably augmented by the addition of metallic salts or oxides, or metals, which have a reducing action, or which can act as carriers of the reducing proper of the discharging compound; metallic iron, iron salts and iron oxides are best suited for this purpose, though oxides or salts of tin, nickel, cobalt and mercury may be employed. A discharge paste may be prepared by mixing together four parts of sodium formaldehyde sulphoxylate, one part of finely divided iron powder, five parts of an alkaline thickening; this paste is prior to the material, which is then dried, steamed for at least 3½ minutes, washed and acidified.—T. F. B.

*Finishing Machine for Textile and the like Fabrics Improved —.* L. Blanck, Reims. Eng. Pat. 8,400, April 17, 1905.

THE claim is for a continuous finishing machine for moving and crushing straw and similar substances in textile fabrics. The fabric is passed successively between friction rollers and pricking cylinders, then under beaters and over perforated plates in connection with exhaust fans to remove the comminuted bodies, and finally between fluted cylinders and friction rollers. The machine is enclosed in a steam-heated casing, to prevent a sudden change of temperature and to ensure a thorough removal of the dust.—W. H. C.

#### UNITED STATES PATENTS.

*Silk Threads; Device for the Manufacture of Artificial —.* R. Linkmeyer, Brussels. U.S. Pat. 796,500, Aug. 8, 1905.

SEE FR. Pat. 352,528 of 1905; following these.—T. I.

*Filaments from Viscose; Process of Manufacturing —.* C. A. Ernst, Lansdowne, Pa. U.S. Pat. 798,500, Aug. 22, 1905.

THE claims relate to a process of "setting" viscose filaments, by immersing them in a bath of alkali bicarbonate and a coagulating agent; a solution of sodium bicarbonate, ammonium bicarbonate, and ammonium sulphate are specified.—T. F. B.

*Wool; Process of Separating Extractive and Adhesive Matters from —.* A. P. Quackenboss, Providence, R.I., U.S.A. Assignor to Mary J. Bruns, Boston, Mass., U.S.A. U.S. Pat. 796,530, Aug. 8, 1905.

THE wool is first treated with a solvent, the excess of which is then removed. It is next treated with an emulsifying agent, such as a solution in warm water of neutral soap, the resulting magma is expressed and the grease is recovered from the same, by first heating it and then refrigerating, in order to stratify the constituents.—E. J.



*ching Apparatus; Continuous* —. M. Muntadas Rovira, Barcelona, Spain. U.S. Pat. 796,345, Aug. 1, 1905.

Fr. Pat. 327,931 and Additions thereto; this 903, 948; 1904, 251 and 933.—E. B.

*lant.* G. M. Lawton, Worcester, Mass. U.S. Pat. 797,588, Aug. 15, 1905.

m is made for a mordant for use in the finishing bath, consisting of a solution of sulphate, nitrate, and pyro- of iron.—T. F. B.

*ng Apparatus.* J. Marshall, Fall River, Mass. U.S.A. U.S. Pat. 796,668, Aug. 8, 1905.

apparatus consists of two tiers of dye-vats, one above the other below, and a series of movable frames, the frames are automatically passed through the upper a of vats and then through the lower series, being while revolved at suitable intervals.—E. F.

*ng Violet to Black; Process of* —. V. Fuss- nger, Assignor to Farbwerke vorm. Meister, Lucius d. Brüning, Höchst on the Main, Germany. U.S. t. 796,715, Aug. 8, 1905.

ES are dyed shades varying from violet to greenish- dark blue and black by impregnating them with inodiphenylamine (or one of its derivatives), a phenol amine, and the necessary oxidising agent, drying, teaming or heating. Such shades are said to be fast ht, boiling water, soap, "soda," dilute acids, ether and me, and slightly soluble in boiling alcohol and acetic —T. F. B.

*sing Apparatus; Rotary* —. [for Textiles]. N. Dubois, Philadelphia, Pa. U.S. Pat. 794,085, y 4, 1905.

OVEMENTS in apparatus which forms the subject .S. Pat. 676,647 of 1901, are proposed. They y consist in the provision of means for preventing e materials contained in rotary, oxidising cylinders becoming thrown to one end of the latter, thus enabling idation of the substances with which the textile ials are saturated to be effected more rapidly than to. To this end the concentrically disposed rails, which the cylinders revolve, are so arranged that after are supported in inwardly inclined positions angle of 5°—8°. With the greater rate of motion of nders which this arrangement permits, the oxid- takes place, it is stated, in 3—3½ instead of in the ½ hours' time previously necessary. The claims rise high and low speed gearing for rotating the r cylinders at a constant, positive, and uniform or low speed, as required.—E. B.

#### FRENCH PATENTS.

*Manufacture of Artificial* —. P. Cazeneuve. st Addition, dated Feb. 6, 1905, to Fr. Pat. 350,723, . 12, 1905.

e original patent (this J., 1905, 799) the filament, passing from the draw-plate, is unwound from the and exposed in hank form to an atmosphere of nia. According to the present modification, the nent with ammonia is replaced by treatment with rs of ammonium sulphide or hydrosulphide. This died out by exposing the thread over an open vessel ming these substances in aqueous solution. Fumes monium nitrate are formed, the thread becomes l with a thin layer of sulphur, and at the same time acts and becomes consolidated. This treatment es the final brilliancy and strength of the filament, is subsequently denitrated with ammonium hydro- de as in the original patent.—E. F.

[Cuprammonium Process]; *Apparatus for Manu- ure of Artificial* —. R. Linkmeyer. Fr. Pat. 3528, March 20, 1905.

filaments issuing from the coagulating bath are con- d through a fork which unites them so as to form a thread. This thread then passes over an upper

roller, which is driven at suitable speed; the thread is delivered vertically downwards from the roller into a cylindrical recipient to which is imparted simultaneously a rotary and a to and fro motion. The thread is thus deposited in the cylindrical vessel in uniform layers, which cross each other in the form of loops, and which can easily be wound off at a later stage.—J. F. B.

*Flax, Jute, and Similar Fibres; Process of Treating* — for the Purpose of Bleaching. G. de Keukelaere. Fr. Pat. 352,442, March 16, 1905. Under Int. Conv., May 28, 1904.

SEE Eng. Pat. 13,773 of 1904; this J., 1905, 616.—T. F. B.

*Zinc [Tin] Chloride for Mordanting and Weighting Silk and other Textile Fibres; Method of Facilitating the Decomposition of Solutions of* —. C. E. Carstanjen. First Addition, dated Jan. 31, 1905, to Fr. Pat. 344,782, July 12, 1904.

ACCORDING to the original patent (this J., 1904, 1212) sulphates, sulphites or thiosulphates of certain metals are added to baths of "zinc chloride" to increase the formation of zinc oxide on the fibres. The patentee states that in the whole original patent a clerical error occurred, and the word "zinc" should in every case be replaced by the word "tin."—E. F.

*Alizarin-Red; Dyeing Cotton in the Form of Cops, Spools, &c., in* —. Soc. dite Ateliers de Construction de Saint-Georges près Saint-Gall (Soc. en commandite Ludwig von Süsskind). Fr. Pat. 352,328, March 13, 1905.

SEE Eng. Pat. 13,484 of 1904; this J., 1905, 543. The formula of the strontium "bisaccharate" employed is given as " $C_{12}H_{22}O_{11}.SrO$ ."—E. B.

*Dyeing under Pressure; Apparatus for* —. L. Dôtré. First Addition, dated March 27, 1905, to Fr. Pat. 347,809, Nov. 11, 1904.

CERTAIN relatively unimportant additions are made to the main patent (this J., 1905, 331) including a helical arrangement for measuring the rate of flow of the dye-liquor.—E. F.

*Aldehydic Derivatives; Production of* — and their Applications as Discharges. Badische Anilin und Soda Fabrik. First Addition, dated Feb. 11, 1905, to Fr. Pat. 350,607, Jan. 7, 1905. Under Int. Conv., Oct. 28, 1904.

If aldehydes and hydrosulphites are brought together in equimolecular proportions in presence of hydroxides of the alkali or alkaline-earth metals, compounds of the general formula  $R.CH_2.SO_3M$  are formed with simultaneous production of an alkali sulphite. These compounds may be described as salts of aldehyde-sulphoxy acids (see this J., 1905, 329, 330). The products reduce neutral solutions of indigo-carmin on warming, and acid solutions of the same compound in the cold. The aliphatic derivatives are usually very soluble in water, the aromatic derivatives being only slightly soluble. They are said to be very suitable for use in both white and coloured discharges, and also for printing colours in the form of their leuco-compounds.

*Example.*—To a concentrated solution of neutral or alkaline sodium hydrosulphite, 1 mol. of sodium hydroxide solution of 40° B. is added (per mol. of  $Na_2S_2O_4$ ), and is followed by 1 mol. of 35 per cent. formaldehyde solution. The liquid becomes warm. The solution may be used in this condition, or it may be freed from sodium sulphite by concentrating and allowing the latter to crystallise out, or by precipitating the sulphite by adding alcohol. 1 grm. of the final product decolorises 1.4 to 1.5 grms. of indigo on warming.—E. F.

*Sizing Apparatus for Warps, of Large Output.* C. Vandamme. First Addition, dated Feb. 21, 1905, to Fr. Pat. 343,801 of June 8, 1904.

THE additions to the original patent (this J., 1904, 1027) consist mainly of removable brushes to remove size from

the guide-rollers with which the sizing-chamber is furnished, and also of a battery of heating-tubes and ventilators at the entrance of the same chamber in order to completely dry the size before the warp arrives at the first guide-rollers.—E. F.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

### FRENCH PATENTS.

*Skins; Dyeing — for Gloves and other Purposes.* P. Sorel. First Addition, dated Feb. 9, 1905, to Fr. Pat. 341,450, dated March 19, 1904.

THE skins, stained in a bath of a chromium compound, as described in the original patent (this J., 1904, 864), may be used for all purposes for which glacé, suède, etc., skins are ordinarily used, such as articles of clothing, fancy goods, surgical bandages, &c., as they are washable and the colour retains its brilliancy on soaping or on treatment with hot or cold water.—E. F.

*Dyeing Leather; Process of —.* R. Rieder. Second Addition, dated March 13, 1905, to Fr. Pat. 291,355, Aug. 1, 1899. Under Int. Conv., March 14, 1904.

THE object of the process is to stretch the skins in various directions during dyeing, in order to insure a more complete penetration of the fibre by the dye-liquor. For this purpose, the skins are hung on cross-bars, which are placed transversely between two parallel circular discs. These discs revolve in a box of corresponding shape, whilst dye-liquor is sprinkled on to the skins from jets in the centre of the box. An obstruction is placed in the bottom of the box, against which the hanging skins strike, and this causes the desired stretching. The box can also be lowered into a dye-vat, in which case the obstruction is unnecessary, its place being taken by the floor of the dye-vat.—E. F.

## VII.—ACIDS, ALKALIS, AND SALTS.

*Nitric Acid; Strength and Specific Gravity of —.* G. Lunge. Chem.-Zeit., 1905, 29, 933–934.

WINTER (this J., 1905, 800) is in error in asserting that the nitric acid used by Lunge and Rey for their specific gravity determinations (see this J., 1891, 543) contained nitrous acid. All the details of the preparation are given in the original paper, and the purity of the acids is beyond question. The author has plotted in comparative curves the results of Kolb, of Lunge and Rey, of Velej and Manley, (see this J., 1903, 1227) and of Winter; and the close agreement of the Lunge and Rey and the Velej and Manley curves affords very strong confirmation of the accuracy of both, and consequently very strong evidence of the incorrectness of Winter's results. The recently published tables of Ferguson (this J., 1905, 781) also agree very closely with those of Lunge and Rey and of Velej and Manley.—J. T. D.

*Sodium Hydrosulphite; Alteration and Preservation of Anhydrous — in Powder and in Aqueous Solution.* A. L. Lumière and A. Seyewetz. Rev. Gén. des Mat. Col., 1905, 9, 250–255.

ANHYDROUS sodium hydrosulphite remains unoxidised indefinitely in dry air. It can be safely kept in well-stoppered vessels. In moist air, however it is rapidly oxidised. A solution of hydrosulphite in boiled distilled water is oxidised in absence of air, a 3 per cent. solution being completely oxidised in 16 days, a 10 per cent. solution in 11 days, and a 25 per cent. solution in three days. The decomposition is much more rapid in presence of air, particularly in the more dilute solutions. A number of substances are found to retard this oxidation of hydrosulphite solutions; trisodium phosphate is the most efficacious of those which do not destroy the property of reducing indigo in the cold. Trioxymethylene in

presence of sodium sulphite, acetaldehyde, benzaldehyde and hexamethylenetetramine are among the substances which preserve hydrosulphite solutions, but the reduction of such solutions on indigo is only evident at temperatures about 100° C. The principal oxidation products of aqueous hydrosulphite solutions are sulphite and sulphate, with smaller quantities of thiosulphate and thionates.—T. F. B.

*Chloroborates of Calcium: The —.* L. ONYX. Comptes rend., 1905, 141, 351–354.

LE CHATELIER has found that molten calcium chloride dissolves boric anhydride and lime in certain proportions producing  $B_2O_3 \cdot 3CaO \cdot CaCl_2$  (Comptes rend., 99, 2). Another chloroborate of calcium,  $5B_2O_3 \cdot 3CaO \cdot CaCl_2$ , obtained by melting together for a considerable time equal weights of boric anhydride and calcium chloride, allowing the melt to cool, and separating the insoluble crystals by treatment with water. The needle-shaped crystals thus obtained, give place to prismatic crystals the same composition if the quantity of chloride be increased to not more than five times the weight of anhydride. The same compound is also produced by adding lime to the melt, in quantity less than 0.25 mol. of anhydride. By increasing the additions of to less than 0.5 mol. per molecule of anhydride, crystals of  $3B_2O_3 \cdot 3CaO \cdot CaCl_2$  are obtained; this compound is less stable towards water than the former; the compound is formed by heating one part of boric anhydride with eight parts of calcium chloride. By increasing the same proportions of anhydride to lime (2:1) diminishing the amount of calcium chloride, a calcium borate,  $B_2O_3 \cdot 2CaO$  is produced: it is obtained as a product when up to 50 per cent. of an alkali chloride is added to the above melt. By increasing the quantity of calcium chloride to above 5 mols., or by adding 0.5 to 3 mols. of lime for each mol. of boric anhydride, Le Chatelier's chloroborate results. If, on the other hand, the lime be increased to 3 mols. or more, and the calcium chloride be reduced to less than 5 mols., no chloroborate is formed, even in absence of alkali chloride, but prismatic crystals of tricalcium borate,  $B_2O_3 \cdot 3CaO$ .—T. F.

### ENGLISH PATENTS.

*Sulphuric Acid; Manufacture of —.* H. H. Johnson. London. From Soc. Anon. Ing. L. Vogel per la fabbricazione de Concimi Chimici, Milan, Italy. Eng. Pat. 17,794, Aug. 16, 1904.

SEE Fr. Pat. 348,769 of 1904; this J., 1905, 546.—T. F. B.

*Ammonia or Ammonium Salts; Process of Producing — from Nitrogenous Organic Substances containing a High Percentage of Water.* K. E. Fryklind, Stockholm. Eng. Pat. 20,241, Sept. 20, 1904.

NIGHT soil, moss litter, and other like nitrogenous organic substances, are mixed with a suitable proportion of quicklime, preferably in a closed vessel provided with a mechanical agitator. The ammonia evolved, is led into an acid solution or is otherwise collected. The rate of the chemical reaction is supplemented by heat applied externally.—E. S.

*Hydrosulphites; Manufacture of Stable Dry —.* J. Johnson. London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 22,323, Oct. 17, 1904.

SEE Addition of Oct. 25, 1904 to Fr. Pat. 341,718 of this J., 1905, 333.—T. F. B.

[Cyanides]. *Cyanogen Compounds; Production of Chemically Pure —.* J. Y. Johnson, London. Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 22,540, Oct. 19, 1904.

SEE Fr. Pat. 347,373 of 1904; this J., 1905, 333.—T. F. B.

*Alumina; Calcination of Hydrated —.* Cie. des Salins de l'Etat, d'Alais et de la Camargue, Salindres, France. Eng. Pat. 7032, April 3, 1905. Under Int. Conv., April 8, 1904.

SEE Fr. Pat. 349,709 of 1904; this J., 1905, 732.—T. F. B.



UNITED STATES PATENTS.

*tric Acid; Process of Making* —. H. H. Nidenführ, Halensee, Germany. U.S. Pat. 798,205, Aug. 29, 1905.

Fr. Pat. 155,095 of 1903; this J., 1905, 497.—T. F. B.

*Valine Metal Oxide; Process of Making* —. R. Hutzler, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 798,103, Aug. 29, 1905.

Fr. Pat. 323,793 of 1902; this J., 1903, 495.—T. F. B.

*nickeln*. S. W. Shoop, Front Royal, Va. U.S. Pat. 797,537, Aug. 15, 1905.

LED pipes or flues surround the lower end of the barrel of the structure, and lead from a chamber near the lower end, to discharge beneath the grate bars into furnaces under pressure, by means of forced draught apparatus. There is a second ashpit at a considerable distance below the combustion chamber and first ashpit, which are connected by a flue with the air inlets. (See U.S. Pat. 717,459 of Dec. 30, 1902; this J., 1903, 138.) —E. S.

*nickeln*. B. E. Eldred, Brookline, Mass., Assignor to Eldred Process Co., New York. U.S. Pat. 798,023, Aug. 22, 1905.

upright shaft limekiln has a laterally placed fire-place burning solid fuel. This fire-place, with the ashpit, is closed, so that a pressure of air above that of the atmosphere may be maintained in it. In the shaft of the kiln, vertical pipe is set axially, open at the bottom, and communicating at the top with a connected series of pipes inside the shaft. This piping enters the furnace below the ashpit, and is provided with a fan by means of which carbon dioxide and other gases are withdrawn from above the heating zone in the shaft, and delivered under pressure through the said ashpit, with the effect of diluting the otherwise admitted, and moderating the activity of the combustion. Immediately below a passage in the wall which separates the furnace from the shaft, a vertical pipe is set within the wall, discharging air under pressure into the passage, which air thus mingles with the flames as these pass into the kiln. This vertical pipe is continued as a horizontal pipe passing below the base of the furnace, terminating in a fan. The burnt lime is discharged through a valved opening at the bottom of the kiln shaft. —E. S.

*monia; Process of Making* —. K. Kaiser, Berlin. U.S. Pats. 797,961 and 797,962, Aug. 22, 1905.

Fr. Pat. 350,966 of 1905; this J., 1905, 801.—T. F. B.

*omates; Process of Making* —. P. Römer, Bernburg, Germany. U.S. Pat. 797,323, Aug. 15, 1905.

SOME iron ore is mixed with a quantity of an alkali carbonate insufficient to decompose it, and the mixture unacted. After cooling and lixiviation, the residue is fused with an alkali carbonate.—E. S.

*ing Material; Process of Producing a* —. C. Lindstrom, Detroit, Assignor to The Solvay Process Co., New York. U.S. Pat. 796,683, Aug. 8, 1905.

Fr. Pat. 341,355 of 1904; this J., 1904, 866.—T. F. B.

*enic; Process of Removing— from Gases [Sulphur dioxide]*. M. Scharff and F. Slama, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pats. 798,216 and 798,302, Aug. 29, 1905.

Eng. Pat. 11,549 of 1903; this J., 1904, 659.—T. F. B.

*um Ferrocyanide; Process of Making* —. C. Stri, Buchsweiler, Germany. U.S. Pat. 798,208, Aug. 29, 1905.

Fr. Pat. 339,996 of 1904; this J., 1904, 714.—T. F. B.

FRENCH PATENTS.

*Oxygen; Manufacture of* —. Cie. Française de l'Acétylène Dissous. First Addition, dated Feb. 11, 1905, to Fr. Pat. 332,098, May 15, 1903. (See this J., 1903, 1195.)

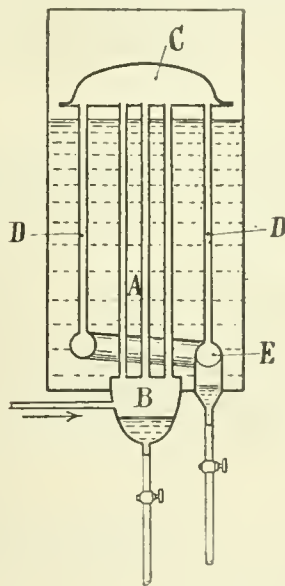
THE mixture of a chlorate with combustible matter described in the main patent, which, when placed in a capsule and heated, gives off a previously determined quantity of oxygen, is now modified by the use alternatively in such mixture, of a bromate or iodate; or of a more highly oxidised salt, such as a perchlorate, perchromate, or periodate, in place of the chlorate.—E. S.

*Oxygen; Apparatus [Gas Generator] for the Production of* —, by the action of a Liquid upon a suitable Compound. J. A. Ageron. Fr. Pat. 352,452, March 17, 1905.

THE apparatus in its simplest form includes an inverted bell-shaped vessel, having within it, supported on its bottom, boxes, perforated in the sides, and charged with peroxide of sodium, or similar substance, to which water can be admitted in regulated quantity through an opening in the bottom of the vessel. A tube leads from the apex of the bell, to a wash-bottle, whence the gas passes to a suitable holder.—E. S.

*Air; Apparatus to Liquefy* —, in several Portions of Different Composition. Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Procédés G. Claude). Fr. Pat. 352,856, March 30, 1905.

THE apparatus consists of two tubular systems, of which



the first, A, communicates with the lower collector B, and the upper collector C; whilst the second system DD communicates also with the upper collector C, and with the separate lower collector E. Both systems are plunged into liquid air or oxygen, and one of them is supplied with cold compressed air, through one (B for instance) of the lower collectors, which air is partially liquefied in the tube A, and the liquefied portion, rich in oxygen, falls into the collector B, whence it may be withdrawn as required. The residual air, now poorer in oxygen, passes into the collector C and thence into the tubular system D, in which it liquefies and falls into the collector E. Under certain conditions, the liquid collecting in E may be nearly pure nitrogen. (Compare Fr. Pat. 338,842 and 338,964, of 1903; this J., 1904, 1216 and 1028.) —E. S.

## VIII.—GLASS, POTTERY, AND ENAMELS.

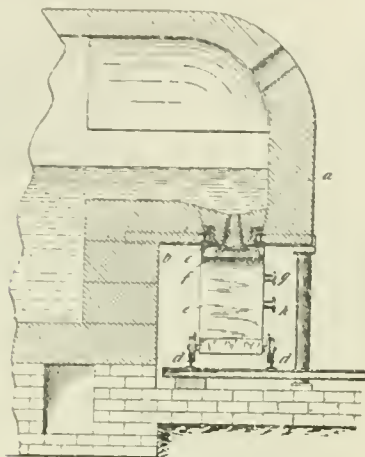
## UNITED STATES PATENTS.

*Glass-Tank.* W. E. Rock, Assignor to the Toledo Glass Co., both of Toledo, O. U.S. Pat. 796,410, Aug. 8, 1905.

A STATIONARY continuous glass-tank or furnace is provided with a top which may be moved horizontally so as to expose different portions of the glass for gathering through a port in the said top.—A. G. L.

*Glass-Melting Furnace.* H. Hilde, Rosswein, Germany. U.S. Pat. 796,513, Aug. 8, 1905.

THE glass-melting furnace is provided with a projecting



portion (a), having an outlet (c) in its bottom, below which is a block (e) running on rails, adapted normally to keep the outlet closed. Flanged pipes (g, h) are provided to allow a cooling agent to circulate through the block, which is also fitted with a horizontal knife (f) on its top for cutting off the glass at the outward run of the block.

—A. G. L.

*Glass; Manufacture of Sheets of* —. F. L. O. Wadsworth, Allegheny, Pa. U.S. Pat. 797,646, Aug. 22, 1905.

A GLASS sheet is made in one operation by forming a sheet between rolling surfaces on both sides of an intermediate mesh, supporting the rolled sheet in a vertical plane by its margin only, and then subjecting both surfaces of the sheet to the simultaneous action of figured pressing-surfaces.—A. G. L.

## FRENCH PATENTS.

[Glass] *Blast-Furnace Slag; Manufacture of Objects from* —. A. F. le Chatelier. First Addition of 25 Feb., 1905, to Fr. Pat. 350,659, of 10 Jan., 1905. (See this J., 1905, 802.)

TO the white-hot slag other substances, such as silica, lime, alumina, magnesia, or other earths, or alkalis, are added so as to obtain a mass suitable for making opal or other glass. Thus, if from a slag of the composition: silica, 40 parts; lime, 40; alumina, 10; metallic oxides, 1; bottle glass is to be made, 90 parts of silica and 10 parts of a mixture of equal quantities of potassium and sodium carbonates are added. In certain cases, if much silica be added, it may be necessary to re-heat the mixture before working it.

—A. G. L.

*Silica Glass; Manufacture of* —. J. F. Bottomley, R. S. Hutton, and A. Paget. Fr. Pat. 352,996, March 15, 1905. Under Int. Conv., May 9, 1904.

SEE Eng. Pat. 10,670 of 1904; this J., 1905, 673.—T.F.B.

*Rock Crystal (Quartz); Process of Making Hollow Vessels and Receptacles by Moulding Molten* —. W. Heraeus. Fr. Pat. 352,483, March 17, 1905.

SEE Eng. Pat. 4663 of 1905; this J., 1905, 498.—T.F.B.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

*Rock Powders; Effect of Water on* —. A. S. Cushman. U.S. Dept. Agric., Bureau of Chem., Bull. No. 92, pp. 2.

THE author has studied the effect of grinding a number of powdered crystalline rocks with water. In every case a considerable increase in the binding power of the powder is noticed after such treatment. This appears to be due to a certain amount of hydrolytic decomposition taking place immediately the water comes in contact with the rock powder, analogous to some extent to the action of water on glass and cement. In most cases an alkali silicate passes into solution, whilst the particles of powder become coated with a film of gelatinous ("gummy" insoluble silicate, such as aluminium silicate. It is owing to this film being constantly removed by abrasion during the grinding, that the action of water is so much more noticeable if the powders are ground, than when they are simply allowed to stand, with water. At the same time it appears that these gelatinous films, like other coagulated colloids, which the author proposes to call "pectoid" possess the power of selectively absorbing substances in solution present in the solution. Thus if the mixture of rock powder and water obtained after grinding, be treated with phenolphthalein, a pink colour will generally be obtained, due to the formation of potassium silicate; but if the rock-powder be first filtered off, and the phenolphthalein be added to the filtrate, no colour is produced; also, if the mixture of rock powder and water coloured with phenolphthalein be allowed to settle, the supernatant liquid will become colourless, whilst the solid particles will be superficially coloured pink. The suggested explanation of these phenomena is that the alkali bases first formed are absorbed by the pectoids coating the solid particles. The bases thus absorbed cannot be removed by mere washing with water, but can be, at least partially, dissolved out by treatment with a solution of ammonium chloride.

It is also suggested that the action of water on rock powders may be greatly increased by the presence of certain electrolytes, and that the potash contained in rocks may be rendered available in some such way.—A. G. L.

*Portland Cement; Injurious Action on* — of Oils and Fats. Tonindustrie-Zeit., through Chem. Rev. Feb. Harz-Ind., 1905, 12, 194–195.

IN preliminary experiments to determine the truth of conflicting statements as to the effects of mineral oils on Portland cement, the sample of the pure substance, and of mixtures of it with three parts of sand or limestone left to set for four days in moist air, and then treated daily with as much "signal" oil as they could absorb. The first signs of cracks appeared in the mortars containing sand and powdered limestone after 2½ months, whilst in the case of pure Portland cement they did not appear until after five months. The samples in this condition could be crumbled readily in the hand. Experiments were then made to determine the influence of different fats and oils upon pure Portland cements and mortars prepared from them. In each case the samples were allowed to set for seven days in a moist atmosphere, and then left in contact with the different oils, and tested after one, three, six, and nine months. The oils or fats were lard, whale oil, castor oil, linseed oil, petroleum, and "signal" oil, and their action on cements prepared from limestone and clay, chalk and clay, and furnace slag and limestone respectively was examined.

It is remarkable that the mortars containing sand, in many cases, offered greater resistance than the pure cements. Lard was undoubtedly the most injurious of the oils and fats employed, and the effects



d by the "signal" oil are attributed to the presence of animal oil. Whale oil and castor oil were relatively useless, and linseed oil and petroleum had no appreciable effect.—C. A. M.

#### ENGLISH PATENTS.

*d; Vulcanizing or Hardening, Preserving and treating* — W. Powell, Allerton, Lancs. Eng. Pat. 17,736, Aug. 16, 1904.

wood in the "green" state is immersed in a saccharine solution in which neutral or "alkaline salts" of lead, iron, tin, aluminium, mercury, arsenic, boric acid, etc., have been dissolved. The solution is gradually raised to the boiling point, by which treatment most of the material in the pores of the wood is expelled. The liquid is then allowed to cool to the ordinary temperature, and the wood is then doing impregnates the wood, which is finally dried at air, beginning at a temperature of about 80° F. and going to 200° F. or more. A suitable impregnating liquid consists of a 25 per cent. solution of sugar, to which 1 per cent. of lead acetate is added.—A. G. L.

*nt; Manufacture of* — J. E. Castle, Queenborough, Kent. Eng. Pat. 22,056, Oct. 13, 1904.

The usual cement mixture about 2 per cent. of fine shavings of "Thames ballast" is added, a saving in the cost of burning the cement being thereby effected.—A. G. L.

*s; Process for the Treatment of Blast-Furnace Slag Production of a Material similar to* — and the *co* H. Colloseus, Berlin, Germany. Eng. Pat. 886, July 5, 1905.

of lime is injected into melted blast-furnace slag, whereby a porous substance free from water, and possessing the properties of natural trass is obtained.—A. G. L.

#### UNITED STATES PATENTS.

*or Tile; Process of Manufacturing* — C. B. Xe, Carlton, Minn. U.S. Pat. 795,488, July 25, 1905.

sand or granulated or powdered slate or their equivalents mixed with a very small proportion of dry cement is then very slightly damped and subjected, in moulds, to a pressure of upwards of 5000 lb. per sq. in. The bricks formed are then stored in a moist atmosphere for a period of 36 hours.—A. G. L.

*icon; Process for Treating* — to produce therefrom *refractory Articles such as Brick, and the Resulting product*. B. Seaboldt, Salt Lake City, Utah, Assignor to C. Thorne, Tacoma, Wash. U.S. Pat. 796,459, Aug. 8, 1905.

siloxicon (Eng. Pat. 3629, 1903, this J., 1903, 743) mixed with compounds containing alkaline and acid ingredients, and the mass is raised to a temperature sufficient to crystallise the siloxicon, but sufficient to decompose the added compounds, after which the temperature is further raised to a point at which the liberated alkaline constituents behave as fluxes relatively to the siloxicon, whereby some of the latter is fluxed, and a veneer imparted to the mass without crystallising the siloxicon.—A. G. L.

*; Process for Making Artificial* — W. P. Butler, Minneapolis, Minn. U.S. Pat. 797,553, Aug. 22, 1905. A mud or plastic cement material composed of a mixture of sand with powdered talc, soap-stone, or any other material having the smooth, soapy, and slippery properties of soap-stone, is formed in or on a mould.—A. G. L.

*; Process of Manufacturing Artificial* — J. J. Jandt, Bonn, Germany. U.S. Pat. 797,624, Aug. 22, 1905.

Fr. Pat. 348,601 of 1904; this J., 1905, 499.—T. F. B.

*nt, Process of Burning* — B. E. Eldred, Oswego, N.Y., Assignor to Eldred Process Co., New York, N.Y. U.S. Pat. 797,506, Aug. 25, 1905.

The cement is burnt in a rotatory kiln in two distinct

stages, the mixed cement materials first passing through a relatively cool zone, in which they are calcined without being sintered by the action of a slow-burning flame composed of injected solid fuel and air diluted with products of combustion, which latter are blown in from the flue for this purpose by means of a fan; after which the calcined mixture is sintered in a zone in which local combustion is intensified by means of a transverse jet of air directed towards the material. Both stages of, and the plant necessary for, the process are also separately claimed.—A. G. L.

#### FRENCH PATENTS.

*Materials Refractory to Physical and Chemical Agencies, and Process of Manufacture of the Same*. A. de Karschell. Fr. Pat. 350,016, June 24, 1904.

REFRACTORY and resistant materials, e.g., firebricks and parts of furnaces, are made from natural or artificial spinels, especially chromite and magnesium aluminate, by mixing the powdered spinel with a specially prepared syrup, to which an aqueous solution of boric acid and tar residues may be added, then moulding under pressure and burning. Artificial spinels are made by heating in proper proportions aluminium oxide and magnesium oxide (or other oxides) with a relatively small quantity of boric anhydride which dissolves the two oxides, a spinel being formed. As this last is insoluble in boric anhydride, it separates out, further quantities of the oxides dissolving until the whole mixture has been converted into the spinel. In order to eliminate the boric anhydride, which would lower the fusing point of the final refractory product, calcium, or, better, aluminium fluoride is added to the mixture and the temperature is raised, when the boric anhydride is volatilised. The syrup mentioned consists of a mixture of starch and its decomposition products (glucose, &c.), with aluminium and magnesium oxides and an aqueous solution of boric acid. It is obtained by mixing waste vegetable matter (pine and fir shavings, &c.) with magnesium and aluminium oxides, and digesting the mass systematically with caustic soda in autoclaves. The product obtained is removed from the liquid, purified by renewed treatment with fresh caustic soda solution and carbon bisulphide, followed by washing, and is then converted into the syrup by heating with a solution of boric acid.—A. G. L.

*Wood; Preservation of* — W. Hoettger.

Fr. Pat. 352,615, March 22, 1905.

Wood, especially wood destined for use in mines, is impregnated with a hot solution of a silico-fluoride, e.g., with a  $\frac{1}{2}$  to 1 per cent. solution of sodium or zinc silico-fluoride. On cooling, the greater part of the salt crystallises out in the pores of the wood, preserving it and rendering it non-inflammable.—A. G. L.

*Wood; Process and Apparatus for the Manufacture of Refractory and Non-inflammable* — H. Salomon. Fr. Pat. 352,960, April 4, 1905.

THE wood to be impregnated is placed in a closed vessel on a bed of silicious material, e.g., infusorial earth or pumice, capable of absorbing water. The vessel is then heated and evacuated until the wood is dried, when a cold solution of caustic soda is gradually admitted into the vessel, and the heating continued. The caustic soda acts on the silicates, decomposing them and forming sodium silicate, with which the wood becomes impregnated. Finally the wood is again dried by heat. For decorative purposes the silicious materials may be mixed with colouring agents, or else coloured minerals containing silicates, e.g., ochres, certain iron phosphates, &c., may be used, whereby the wood becomes coloured as well as fire-proof. The apparatus necessary for carrying out the process is also claimed.—A. G. L.

*Wood; Liquid for the Impregnation of* — K. H. Wolman. Fr. Pat. 353,181, April 10, 1905.

THE liquid consists of a solution of a metallic salt of a mineral acid to which is added a salt of a weak organic acid, e.g., acetic or formic acid. The base of the latter neutralises the mineral acid otherwise set free in the

wood, and thus prevents the injurious action of the mineral acid on the wood.—A. G. L.

*Bricks or Agglomerates of Cork and Tanners' Bark.* C. C. Girod. Fr. Pat. 353,071, April 6, 1905.

THE claim is for the manufacture of a briquette or agglomerate composed of a mixture of cork and tanners' bark. It is stated that although the latter is much cheaper than the former, the briquette composed of the mixture is quite as useful as one made wholly of cork.—W. H. C.

*Kiln, Heated by Generator Gas, for Burning Lime, Dolomite, and Analogous Materials.* E. Schmatolla. Fr. Pat. 352,549, Feb. 17, 1905.

SEE Eng. Pat. 4245 of 1905; this J., 1905, 925.—T. F. B.

*Dolomite and Freshly Calcined Magnesia; Process of Treating —, for the Manufacture of Ornaments, Partitions, &c.* E. Lainé. Fr. Pat. 352,873, March 31, 1905.

SEE Eng. Pat. 8024 of 1905; this J., 1905, 848.—T. F. B.

*Plaster; Manufacture of Hardened —.* O. de Werra. Fr. Pat. 353,242, April 12, 1905.

THE natural stone is powdered and the fine powder removed by levigation to moulds, in which it is dried, after which it is burnt as usual.—A. G. L.

*Cement; Manufacture of —.* J. H. Blin de Saint-Armand and J. Palais. Fr. Pat. 349,995, June 16, 1904.

BOTH cement materials and fuel for burning (coal, coke, &c.) are finely powdered and mixed together, with or without the addition of pitch, tar, &c. The mixture is moulded into briquettes, which are burnt as usual.

—A. G. L.

## X.—METALLURGY.

*Wrought Iron; Note on the Crystallisation of —.* J. O. Arnold. Engineer, 1905, 100, 158.

SORBY in 1863 put forward the view that the polyhedral and rounded figures presented by wrought iron under the microscope were due to the interference of cubic and octahedral crystals. Direct evidence of cleavages parallel to the faces of the cube has, however, been wanting up to the present. The author has recently examined the end of a wrought-iron bolt which had broken after being in use for thirty years. The metal contained:—combined carbon, 0.047; silicon, 0.157; manganese, 0.096; sulphur, 0.020; and phosphorus, 0.350 per cent.; and was thus a very inferior wrought iron, the greater portion of the phosphorus not being contained in the involved slag, but in combination with the iron. On examining the fracture under the microscope, it was observed that one of the crystals of iron had broken at right angles to the axis of the bolt. When the fracture was cut off in the lathe and mounted for examination, the fractured face of this crystal was exactly at right angles to the axis of the microscope, and it was seen that the crystal exhibited perfect cleavages parallel with the faces of the cube. A micro-photograph of the crystal is given in the original.—A. S.

*Iron and Steel; Influence of Nitrogen on —.* H. Braune. Bull. Soc. d'Encour., 1905, 107, Rev. de Metall., 497—502.

DURING the past 20 years frequent cases of abnormal brittleness of iron and steel, especially in the case of metals manufactured by the basic process, have been met with, which have been proved, by chemical analysis, not to be due to the presence in the metal of excessive quantities of phosphorus, sulphur, or other elements of which the injurious action is known. The author's experiments lead him to the conclusion that this abnormal brittleness is due to the presence of nitrogen, fixed by the iron in different stages of its manufacture. The nitrogen is combined exclusively with the pure iron or ferrite; the nitride produced, in the case of annealed metal, forms

a solid solution with the ferrite, lowering the solidification point of the latter, and also its solvent power for iron carbide; in the case of chilled steel, the nitride forms a solid solution with the martensite. Samples of iron steel of good quality were heated in ammonia at 800° for a more or less prolonged period, and then annealed in sand; the annealed metal was analysed, and its tenacity and elongation determined. The first experiments were made with a soft iron containing carbon, 0.06; silicon, 0.01; manganese, 0.06; sulphur, 0.005; and phosphorus, 0.05 per cent. It was found that the tenacity gradually increased as nitrogen was introduced into the iron, while the elongation decreased gradually until the proper proportion reached 0.07—0.08 per cent., when the metal became brittle, and with a further increase of nitrogen the elongation fell rapidly almost to zero. Micrographic examination showed that a change of structure occurred when the proportion of nitrogen introduced into the metal reached 0.07—0.08 per cent. This critical proportion of nitrogen (0.07 per cent.) is rarely met with in industrial products, but in very soft irons, especially in Lancashire iron, lower proportions of nitrogen are capable of rendering the metal harder and more brittle. Experiments with steels gave somewhat similar results, the critical proportions of nitrogen being 0.030—0.035 per cent. for steel containing 1.15 per cent. of carbon, 0.040—0.045 per cent. for steel containing 0.5 per cent. of carbon, 0.05—0.06 per cent. for steel containing 0.2 per cent. of carbon.—A. S.

*Copper-Tin Alloys; Tensile Strength of —.* E. Shepherd and G. B. Upton. J. of Phys. Chem., 1905, 9, 441—476. Chem. Centr., 1905, 2, 538. (See this J., 1896, 810; 1901, 814; 1905, 241.)

THE authors find that the tensile strength of copper alloys containing the pure  $\alpha$ -crystals rich in tin is much affected by heat treatment. Bronzes containing 74.87 per cent. of copper become much stronger if they are heated above 510° C.; by long-continued heating the tensile strength is diminished, but the ductility increased. The alloy containing 78.81 per cent. of copper has the maximum tensile strength; it consists of a mixture of  $\alpha$ - and  $\beta$ -crystals. It is possible to prepare, on one hand, a cast bronze with a maximum tensile strength of 60,000 lb. per sq. in., and an extension of 1.5 per cent., and, on the other, a bronze with a tensile strength of 45,000 lb. per sq. in., and an extension of 39 per cent.—A.

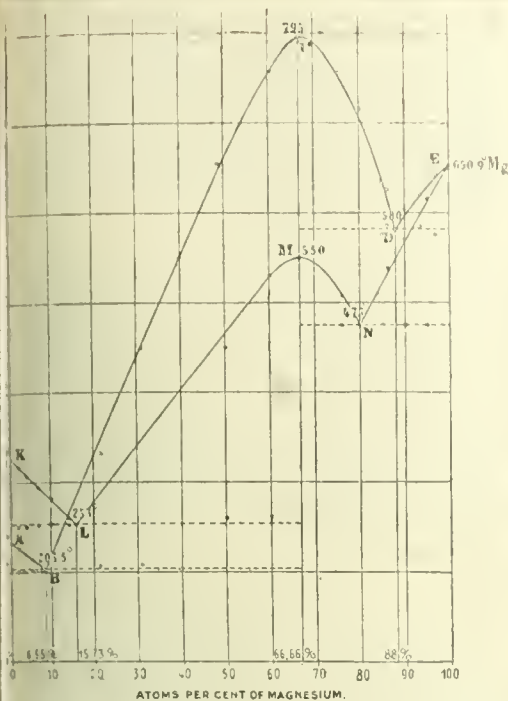
*Aluminium-Zinc Alloys.* E. S. Shepherd. J. of Phys. Chem., 1905, 9, 501—512. Chem. Centr., 1905, 2, 537—538.

MANY alloys of aluminium and zinc expand on solidification and should therefore give good castings, and since the two metals occupy positions near one another in the potential series, the alloys should not be very susceptible to atmospheric influences. The author determined the specific gravity of a number of different alloys. The curves representing the specific volumes of the alloys consist of two branches slightly inclined to one another, and intersecting near the point corresponding to the alloy containing equal proportions of the two metals. The two phases probably consist of solid solutions. The solidified alloys are stable, their specific gravity not being appreciably altered by heating for a week in boiling naphthalene. Alloys containing more than 50 per cent. of aluminium solidify completely above the eutectic point (381° C.). Microscopic examination showed that alloys containing more than 60 per cent. of aluminium are homogeneous, while the alloy containing 40 per cent. of aluminium, however, shows two phases can be distinctly recognised, one of which is the eutectic, containing 5 per cent. of aluminium. It is capable of taking up 4 per cent. of aluminium in a solid solution; aluminium, on the other hand, dissolves 50 per cent. of zinc.—A. S.

*Magnesium; Alloys of — with Tin and Lead.* N. Kurnakow and N. J. Stepanow. Z. anorg. Chem., 1905, 46, 177—192.

THE authors made melting-point determinations and micrographic examination of the alloys of magnesium





tin and with lead. The results of the melting-point determinations are shown in the accompanying diagram, each case one compound is formed, of the type  $Mg_2X$ , corresponding to the points C and M. The portions and D E of the curve A B C D E correspond to the solidification of tin and magnesium respectively; and in like manner the parts K L and N E of the curve M N E correspond to the crystallisation of lead and magnesium. The compound  $Mg_2Sn$ , dimagnesium stannide, is decomposed on exposure to moist air, yielding a black powder consisting of a mixture of metallic tin and hydrated magnesia. Magnesium-tin alloys are brittle; those containing a high proportion of dimagnesium stannide can be easily pulverised. Dimagnesium plumbide,  $Mg_2Pb$ , is more readily decomposed by moist air than the corresponding tin compound. (See also this J., 1905, 279.)—A. S.

*Analysis of Steel: Rapid Process for the Determination of —.* H. Rubricius. XXIII., page 988.

*Flow of —.* A. von Obermayer, G. Tammann, N. Werigin, and J. Lewkojew. XXIV., page 988.

#### ENGLISH PATENTS.

*Method employed in the Manufacture of Firebars.* W. G. Westhwaite, Leeds. Eng. Pat. 20,842, Sept. 28, 1904.

The alloy is obtained by adding aluminium to molten pig iron, and then steel borings; the proportions used being preferably 100 parts of pig iron to 1 part of aluminium and 5 parts of steel, all by weight. The alloy when solidified may be cast into firebars in the usual way.—E. S.

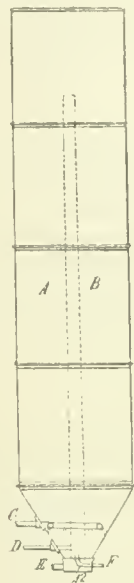
*Manufacture of Plates; Manufacture and Treatment of Compound —.* J. Bedford, Sheffield. Eng. Pat. 27,390, Feb. 23, 1905.

The compound plate is formed by pouring into a mould successive layers of molten steel, each new layer being poured in whilst the preceding one is still in a viscous condition. The layer forming the face of the plate is given its full content of carbon, i.e., 0.6 to 0.8 per cent., from the outside; the layers forming the back and middle of the plate would average not more than 0.35 per cent. of carbon. The plate is rolled and machined as usual, after which the face is raised to a temperature depending upon its condition, the back and middle being kept as cool as possible. The hot face is then freed from dirt as far as

possible, and cooled rapidly by means of a number of jets of compressed air, which issue from a perforated plate placed parallel to the armour plate, and forming the delivery end of an air box. The compressed air may be passed through a refrigerator before being applied to this box. It is claimed that a glass-hard skin free from hair-cracks can be obtained in this way.—A. G. L.

*Mixing or Circulating Materials in a Liquid or Semi-Liquid State [Treating Gold bearing sands or slimes with Cyanide Solution]; Impts. in Apparatus for —.* The Komata Reefs Gold Mining Co., Ltd., London. From F. C. Brown, Komata, New Zealand. Eng. Pat. 18,922, Sept. 1, 1904.

The upright cylindrical tank A has the pipe B fixed



concentrically within it, the pipe B terminates short of the top and conical bottom of the tank A. The material to be mixed is placed in the annular space between A and B, and the liquid or washing water is admitted to the annular space by the pipe C, and to the central pipe B by the pipe D.

Compressed air admitted to the bottom of the central pipe B by the pipe F, forces the material up the central pipe, to the top, where it overflows and descends through the annular space. In this way a continuous circulation takes place, which promotes a thorough admixture of the liquid and solid materials. When the mixture is complete, the liquid is drawn off after settling and the solids flushed out of E or A<sup>2</sup>.—W. H. C.

*Gold Extraction from Slimes, Tailings or the like. Improved apparatus for —.* O. W. Ellis and F. S. Highton, Lincoln. Eng. Pat. 19,653, Sept. 12, 1904.

The ore-pulp is made to pass through a cone-shaped revolving cylinder, lined with detachable, amalgamated copper plates. The ore in passing over the amalgamated copper plates, leaves the gold as an amalgam thereon, and the latter is treated in the usual manner for recovering the gold.—J. H. C.

*Ore-slimes, Treatment of —.* P. J. Ogle, H. L. Sulman, and H. F. K. Picard, London. Eng. Pat. 20,300, Sept. 20, 1904.

The water is removed in a continuous vacuum filtering apparatus, the residual water being displaced by solvent liquor, the slimes are then agitated with the solvent in a vessel having an internal rotating spiral flange and a series of agitating projections working between the turns of the flange; finally the slimes are again filtered and the residual solvent is displaced by water. "Spitzkasten" are used when necessary to remove coarse particles.

—J. H. C.

*Tantalum and Alloys thereof; Manufacture of Writing Pens of Metallic* — C. D. Abel, London. From Siemens und Halske Akt.-Ges., Berlin. Eng. Pat. 3691B., Feb. 22, 1905.

SEE Fr. Pat. 351,351 of 1905; this J., 1905, 849. —T. F. B.

*Copper; Process for Extracting — from Copper Ore, more particularly from poor Copper Ore.* P. Weiller, Vienna, and A. Weiller, Trieste, Austria. Eng. Pat. 7131, April 4, 1905.

SEE Fr. Pat. 347,840 of 1904; this J., 1905, 445. —T. F. B.

*Ores and Ore-waste; Briquetting Friable* — C. Reinke, Bredelar, Westphalia. Eng. Pat. 19,464, Sept. 9, 1904.

"MERZIT," consisting of limestone containing a high percentage of carbonate of lime finely ground with small additions of magnesia and good Portland cement, is intimately mixed with about six times its weight of the friable ore or ore-waste, and moulded into briquettes under high pressure. —J. H. C.

*Furnaces for Calcining and Burning Briquettes of Ore and for Similar Purposes.* F. J. Bergendal. Eng. Pat. 6388, 1905. L., page 958.

*Metals; Crucibles for Melting and Casting* — W. Sommer, Paris. Eng. Pat. 14,119, July 8, 1905.

The crucibles are formed with a partition provided with flanges or collars, the upper one being designed to prevent the overflow of the metal at the moment of casting, and the lower one to facilitate the discharge of the metal and retain the crust of dross or other floating impurity. —J. H. C.

#### UNITED STATES PATENTS.

*Ore Roasting, Process of* — J. A. Anker, J. H. Watson, and Pierce Evans, Los Angeles, Cal., U.S. Pat. 789,952, May 16, 1905.

The finely-divided ore is intermittently dropped in a thin stream or veil down a vertical tortuous chamber by stages, while pulsating flames, preferably produced by oil-burners, are forced against or through the streams of falling ore. Air blasts are employed for this purpose when necessary. —J. H. C.

*Furnace; Roasting* — F. Klepetko, New York. U.S. Pat. 793,939, July 4, 1905.

The invention, which may be applied to the McDougall or any similar furnace, consists of a rubble-arm rotating about a fixed axis, and provided with a series of rakes, the depths of which increase as they approach the central fixed axis referred to. —J. H. C.

*Furnace; Ore-Roasting* — H. C. Holthoff, Milwaukee, Wis., Assignor to Power and Mining Machinery Co., Cudahy, Wis. U.S. Pat. 797,003, Aug. 15, 1905.

An annular roasting chamber, having a rotary floor or hearth, surrounds a central combustion chamber, and is provided with means for discharging the roasted ore on to a stationary annular cooling hearth beneath it. Stationary stirrers having tubular arms pass through the roof of the roasting chamber, and are provided at the lower ends with inclined blades, capable of vertical and annular adjustment, which are placed across the hearth in series, with arrangements for a flow of water through the arms. Rotary stirrers move the ore across the cooling hearth, in an opposite direction to the movement of the ore in the hearth above. An annular wind trunk has intake openings around the inner sides of the cooling floor, a blower connected with which delivers the air thus heated by passage over the cooling ore, into a trunk connected by pipes located in the wall of the combustion chamber, into the roasting chamber around its inner side. —E. S.

*Furnace; Ore Roasting* — C. E. Keating, Assignor to B. S. Williams, both of East Chicago, Ind. U.S. Pat. 797,584, Aug. 22, 1905.

The furnace is of the horizontal type, and has a relatively long hearth, having a track along each side, wheels riding

on which, support a shaft extending across the hearth. Stirring devices with "radially disposed arms, curved in radial direction," are rigidly mounted on the shaft: the shaft is moved along the hearth, the stirring devices rotate, the arms passing endwise into the mass of material, and lifting it edgewise therefrom, thus prevent the formation of a crust on the surface. Alternately with the rotating stirring devices are relatively fixed devices on the shaft, which serves to turn the material into longitudinal furrows. —E. S.

*Furnace for Roasting Ores.* W. T. Rushton, London. U.S. Pat. 797,915, Aug. 22, 1905.

SEE Eng. Pat. 26,782 of 1902; this J., 1903, 1353. —T. F. B.

*Slime Separating Apparatus.* E. L. Godbe, Salt Lake City, Utah. U.S. Pat. 793,720, July 4, 1905.

The slimes are run into a tank, within which a drum shaped filter revolves. A partial vacuum is produced within the drum which causes the slime to adhere continuously to the filtering surface. This is sprayed first, with cyanide solution, then with water, and finally removed by brushing and scraping. But whilst considered preferable to employ this spraying, the invention is not limited to as it may be omitted, and the slimes, &c., may be removed without spraying. —J. H. C.

*Slimes in Ore Reduction; Apparatus for Treating* — G. A. Duncan, Deadwood, S.D. U.S. Pat. 796, Aug. 8, 1905.

Is a vertical tank, the width of which is small relative to its length and height, a filtering cell similarly proportioned is suspended, there being but little space on opposite sides. Suction pipes enter from the top of cell, of which the open ends terminate near the bottom, whereby the liquor supplied to the cell is sucked through the filtering walls, to be discharged from the bottom of tank. Pipes extend along the sides of the filtering cell the upper end, having numerous apertures through which flushing-jets are discharged inwards and downwards against the lateral walls of the cell. —E. S.

*Ore-Treating and Filtering Apparatus.* T. D. Jones, Denver, Colo. U.S. Pat. 795,774, July 25, 1905.

A BARREL is mounted on trunnions in a frame which is journaled at its extremities so as to allow of the barrel being rotated. At one end of the barrel there is a connection with a detachable section by means of flanges between which flanges there are placed lead-covered plates. Perforated coils filled with filtering material are inserted between these plates, below which is fitted a valve attached to a valved outlet for the filtered liquid. An arrangement is provided for the purpose of subjecting the contents of the barrel to pressure. —A. G. L.

*Ores; Apparatus for Treating Refractory* — J. L. C. Baltimore, Md. U.S. Pat. 796,585, Aug. 8, 1905.

An elevated furnace chamber, adapted for roasting by flames impinging from above, and having means for supplying to the ore an "alkaline cooling reagent," has a circular opening in its lower part, to which a boiler is mounted on a carriage movable on a trackway, and supplied with means for rotating and for raising and lowering, is adjusted. Within the chamber a series of burners are arranged in rows, having their orifices directed downwards to subject the ores to an oxidising flame. Placed between the rows of burners is an elongated liquid fuel distributor, having a series of discharge openings in its bottom, into which plugs, mounted on a movable block, fit in such a manner as to control the mechanism for effecting which control is described. —S.

*Ores [of Precious Metals]; Process and Machine [Mechanical] of Treating* — J. R. Parks, Spokane, Wash. U.S. Pats. 796,753 and 796,754, Aug. 8, 1905.

A SLIME is prepared of the powdered ore, from which the soluble portions, unsuitable for the cyanide treatment, are removed. The coarser particles in the slimes are separated by ground, and added to the slime, which is allowed to settle, and the pulp remaining after running off the water



ced with potassium cyanide solution, salt and lime. The pulp thus prepared is agitated by paddles between insulated amalgamated metal plate connected to the active pole of a source of electricity, above which plate an interval forming a chamber for the pulp is a series of stable annular metal discs, independently movable, and connected to the positive pole. Air is admitted under pressure to the compost. Insulation of the active metal faces from the containing metal shell of the apparatus obtained by layers of asphalt.—E. S.

*Antimony; Process for the Treatment of Ores Containing —*. J. S. MacArthur, Glasgow. U.S. Pat. 796,849, Aug. 8, 1905.

SEE Eng. Pat. 11,123 of 1904; this J., 1905, 801.—T. F. B.

*Waste, &c.; Process of Agglomerating — for the Manufacture of Ore Briquets.* T. Rouse and H. Cohn, London. U.S. Pat. 797,150, Aug. 15, 1905.

SEE Eng. Pat. 7478 of 1904; this J., 1905, 501.—T. F. B.

*Engraving and Etching —*. J. A. Dejeu, Charenton, France. U.S. Pat. 797,668, Aug. 22, 1905.

SEE Fr. Pat. 335,941 of 1903; this J., 1904, 327.—T. F. B.

*Assay —*. A. M. MacDuffee, Chloride, Ariz. U.S. Pat. 797,901, Aug. 22, 1905.

The assay furnace has a base and ends and an arch-shaped top portion lined with fireclay, a metallic jacket, and an asbestos lagging between the lining and the jacket. A file is supported above the floor of the base, having an easily separable false bottom, to permit the use of the file for either melting or for cupellation. A door for closing the open front end of the muffle has a portion of increased diameter to project into the open end and to form a tight closure, such projecting portion also serving for the admission of air beneath the lower edge of the door, when the latter is only partially removed.—E. S.

*Smelting —*. H. L. and N. Wrinkle, Keeler, Cal. U.S. Pat. 798,312, Aug. 29, 1905.

SEE Eng. Pat. 15,792 of 1904; this J., 1905, 731.—T. F. B.

#### FRENCH PATENTS.

*Process of Reduction applied to the Manufacture of —*. J. de Moya. First Addition, dated Jan. 21, 1905, to Fr. Pat. 349,233, March 14, 1904. (This J., 1905, 677.)

The preliminary process consists in adding to the molten metal in the converter, sodium chloride, or a mixture of sodium chloride with one of the substances named for fluxion in the main patent, followed by the addition of bituminous material done up in packets of definite weight and content, to the metal as it flows into the ladles, the addition being made to the pockets before the latter are filled.—E. S.

*Iron and Steel; Manufacture of —*. J. J. Hudson. Fr. Pat. 352,400, March 14, 1905.

SEE U.S. Pat. 785,002 of 1905; this J., 1905, 336.—T. F. B.

*Iron, Steel and Special Qualities thereof; Process and Apparatus for Manufacturing —*. T. Levor. Fr. Pat. 352,778, March 17, 1905.

The object of the invention is to make additions to cast iron, of soft or wrought iron, solid castings, oxidisers, or decarburisers, &c., during considerable increase of the heat of the bath, so that a temperature of 3000 C. or more is obtained, whilst the mixture is being melted, whereby great improvement in the quality of the product is stated to result. The apparatus consists essentially of a pair of chambers, each closed at the top by a removable cover, mounted as a single structure of refractory material, on hollow trunnions through which air blasts are forced into a specially heated pipe encircling the furnace and thence into and through a series of pockets containing liquid fuel so as to impinge on all sides upon the contained charge with the pul-

verised spray of the liquid combustible used. The two chambers communicate by means of a channel, through which the flames from one chamber pass into the next, issuing from the top of the latter, the cover of which is removed at this stage of the process. To start the process, molten cast iron is run into the first of the previously heated chambers, and when that charge is highly heated, and the second chamber is also highly heated in the manner described, iron turnings, scrap, or the like are charged into the latter, and when molten, the metal is caused to flow into the first chamber through the connecting passage by tilting the furnace.—E. S.

*Ores, Mixed, containing Gold and Antimony; Treating —*. H. L. Herrenschmidt. Fr. Pat. 349,980, June 11, 1904.

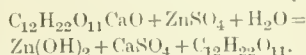
The ore, according to one process, is placed in an autoclave with substances capable of giving by reaction in presence of water on boiling under pressure, sodium sulphide or calcium sulphide. Or, the ore is boiled in the open with the same reagent, with or without previous roasting. If, however, the ore is roasted, it may be treated either with sodium sulphide or with sodium hydroxide. The antimonial solution obtained, may be precipitated by sulphurous acid to recover the antimony, and the gold in the ore thus purified is recovered by cyaniding or other suitable method.—E. S.

*Liquid from Solid Matters; Apparatus for Separating —*. The Cyanide Vacuum Filter Co., Limited. Fr. Pat. 352,447, March 16, 1905.

SEE Eng. Pat. 15,776 of 1904; this J., 1905, 893.—E. S.

*Zinc; Precipitating — from Liquids containing it.* C. H. T. Havemann. Fr. Pat. 349,957, June 1, 1904.

Zinc is precipitated from its solutions as hydroxide by a solution of calcium saccharate, as shown by the equation:



From the solution of sugar remaining after separation of the precipitate, calcium saccharate is reproduced by addition of lime.—E. S.

*Zinc; Precipitating — from Liquids containing it.* C. H. T. Havemann. First Addition, dated Aug. 17, 1904, to Fr. Pat. 349,957, June 1, 1904. (See previous abstract.)

It is now directed to wash the precipitate, consisting of zinc hydroxide and calcium sulphate, with a solution of sodium chloride, for which purpose sea water may be used, in order to dissolve out the calcium sulphate.—E. S.

*Alloy adapted for Ornamentation.* M. Wagner. Fr. Pat. 353,081, April 6, 1905.

FROM 65 to 76 parts of tin and from 20 to 25 parts of antimony, by weight, are fused together, and to the molten mass from 4 to 10 parts of arsenic are added. The mass is allowed to cool very slowly, or it is cast in previously heated moulds of iron or of sand. The alloy is rendered less friable by the addition to it of a small percentage of lead. The alloy shows crystalline ornamental figures on its polished sections, which figures may be made more conspicuous by treatment with acids, or by partial fusion. For some purposes, the alloy may be cast upon an iron or other resisting core. The alloy may also be cast into vases or the like as objects of ornament.—E. S.

*Furnaces; Roasting — [for Ores, &c.].* F. J. Falding. Fr. Pat. 353,123, April 7, 1905.

SEE U.S. Pat. 788,098 of 1905; this J., 1905, 549.—T. F. B.

*Air for Blast Furnaces; Process for Drying —*. Soc. E. Grimault, Le Soufaché, et Felix. First Addition, dated Jan. 18, 1905, to Fr. Pat. 349,219, Dec. 20, 1904. (This J., 1905, 677.)

INSTEAD of bubbling the air to be dried, through a solution of calcium chloride, as in the main patent, the air is passed through a perforated screen within a closed chamber so as to encounter a rain or spray of calcium chloride solution

falling from a cistern in the upper part of the chamber, the solution and chamber being cooled down to about  $-12^{\circ}$  C. by means of a system of coiled pipes through which cold ammonia gas circulates as a cooling medium.

—F. S.

*Blast-Furnace Slag [for Decorative and Building Purposes]: Manufacture of Objects from —.* Addition to Fr. Pat. 350,659, 1905. VIII., page 970.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A.)—ELECTRO-CHEMISTRY.

#### ENGLISH PATENTS.

*Cells; Improved Means and Appliances for Operating Electrolytic —.* J. Hargreaves, Farnworth-within-Widnes. Eng. Pat. 18,937, Sept. 2, 1904.

THIS invention relates to electrolytic cells designed for the decomposition of sodium chloride, the substance being charged into the cell in solid form in such a manner as to prevent it coming into contact with the electrodes or diaphragms until dissolved. The solid is charged into funnels which lead into tubular columns, the latter being built up of blocks, and the upper or lower corners, or both, of the blocks are cut away so as to form perforations or openings at the joints, these perforations being inclined upwards from the interior.—B. N.

*Batteries; Impts. relating to Electric —.* H. H. Lake, London. From La Soc. Anon. Le Carbone. Eng. Pat. 21,672, Oct. 8, 1904.

THE carbon electrode is surrounded by a suitable envelope containing the depolarising substance, such as a mixture of coke and peroxide of manganese. Around this is wound a sheet of blotting paper, or other porous material, thoroughly impregnated with a solution of a suitable electrolyte and then dried, so that the paper retains in its pores the active salts of the electrolyte in a solid state. The whole is then slipped into a zinc vessel acting as the other electrode, a washer of insulating material on the bottom of the vessel separating the two electrodes. An aperture in the cover of the vessel serves for the introduction of water.—B. N.

#### UNITED STATES PATENTS.

*Furnace; Electric —.* H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pat. 797,747, Aug. 22, 1905.

THIS invention relates to a method of supplying heat to the body of the furnace by utilising the latter as an electrical resistance, and adding to the heat thus produced the heat energy and electrolysis effects derived from a conducting gap, the heat of the furnace rendering the surrounding gas or vapour conductive. The terminal voltage is thus reduced so that the gap carries a current of lower voltage than that of the normal electric arc, and may also be regulated by varying the resistance of the circuit which includes the gap.—B. N.

*Electrode of Electrolytic Apparatus.* G. J. Atkins, Tottenham. U.S. Pat. 795,314, Aug. 29, 1905.

SEE Eng. Pat. 11,470 of 1904; this J., 1905, 446.—T. F. B.

#### FRENCH PATENT.

*Lead Oxides; New Process for the Preparation of Active and Porous —, Destined for Accumulators.* C. H. Jacob. Fr. Pat. 353,147, April 8, 1905.

THE hydroxides of lead are transformed into oxides by the action of steam and a final boiling; these oxides may be used immediately in the wet state for coating the plates of accumulators.—B. N.

*Gases; Electro-Catalytic Process for Obtaining Permanent — with a Carburetted Substance.* A. A. Eve. Fr. Pat. 350,528. II., page 967.

*Arcs or Electric Discharges; Process for the Deviation of —, and Apparatus for the Decomposition or Combination of Gases, for example, of Air, by means of these Deviated Arcs or Discharges.* J. J. Thoresen and F. Tharaldsen. Fr. Pat. 352,556, March 3, 1905. Under Int. Conv., March 4, 1904.

THIS invention relates to a process and apparatus producing the deviation of electric arcs or discharges, the two electrodes producing the arc being placed in a revolving magnetic field between two cores of iron. The two electrodes are disposed perpendicularly to the field with the object of giving to the arcs the form, speed, and duration, which permit of realising the maximum useful effect.—B. N.

*Gases; Apparatus for Absorbing — by Liquids by the Action of Electric Currents or Discharges.* A. Hemptinne. Fr. Pat. 352,911, April 1, 1905.

SEE Eng. Pat. 7101 of 1905; this J., 1905, 663.—T. F.

*Chlorine; Method of [Electrically] Treating —.* E. Paramore. Fr. Pat. 352,921, April 3, 1905.

SEE U.S. Pat. 786,595 of 1905; this J., 1905, 503.—T. F.

### (B.)—ELECTRO-METALLURGY.

*Furnaces, Electric; Impts. in —.* The British Thomson-Houston Co., Ltd., London. From The General Electric Co., Schenectady, U.S.A. Eng. Pat. 20,347, Sept. 27, 1904.

SEE U.S. Pat. 785,535 of 1905; this J., 1905, 446.—T. F.

*Furnaces; Impts. in Electric —.* F. A. Kjellin, Stockholm. Eng. Pat. 14,214, July 10, 1905. Under Int. Conv., July 11, 1904.

THE furnace is constructed with an outer annular chan and with an inner iron core surrounded by an induction coil, the latter being separated from the furnace chan by one or more concentric double-walled jackets, made of sheet metal. A cooling medium is passed through the jackets, which are provided on their whole length with at least one interruption of non-conducting material, thus preventing inductive currents from being set up in the jackets.—B. N.

*Metallic Strip, Wire or Rods; Impts. in the Production of — [Electrolytically] of —.* S. O. Cowper-Coles and The Metals Corporation, Ltd., both of London. Eng. Pat. 21,568, Oct. 7, 1904.

THE metal is deposited electrolytically on a mandrel, as is described in Eng. Pats. 21,974 of 1898 (this J., 1898, 1132) and 9731 of 1900 (this J., 1901, 1002), acting as the cathode, the latter being provided upon its periphery with a fine, V-shaped, sharp-angled, spiral line, scratch, indentation. The deposited metal may afterwards be divided along the line of the scratch, and stripped from the mandrel in the form of a continuous spiral. Instead of the cylindrical cathode, a disc-shaped one with a spiral line may be employed.—B. N.

*Silicium [Silicon] or Boron Carbide; [Electrical] Process for Producing Shaped Blocks of —.* F. Böll, Frankfurt on the Maine, Germany. Eng. Pat. 68,347, March 29, 1905.

THE body for the block is first constructed in the required shape from pure carbon, and is then embedded in fine powdered silicon carbide or boron carbide, the mixture being afterwards subjected to a firing process in an electric furnace.—B. N.



## UNITED STATES PATENT.

*gsten-Steels; Process of Producing* ——. E. D. endall, Brooklyn, N.Y., Assignor to E. N. Dickerson, roval, N.C., and E. R. Olecott, New York, N.Y. S. Pat. 795,517, July 25, 1905.

alloy of iron and tungsten is produced by heating mixture of tungsten ore, metallic zinc and iron in an electric furnace. —A. G. I.

## FRENCH PATENTS.

*rodes for Electric Furnaces.* E. F. Price, G. E. Cox and J. G. Marshall. Fr. Pat. 352,789, March 28, 1905. U.S. Pat. 785,832 of 1905; this J., 1905, 446.—B. N.

*per and Other Metals; Wet Process for the Electro-metallurgical Extraction of* ——. L. P. Basset. Fr. Pat. 352,826, March 29, 1905.

SOLUTION of sulphurous acid is introduced into the electrolyte, which consists of a solution of the sulphate of the metal to be extracted. The oxygen disengaged during the electrolysis combines with the sulphurous acid, and this reaction produces a current, the electromotive force of which is equal and contrary to that necessary for the decomposition of the metallic sulphate, thus reducing the electromotive force required in the electro-metallurgical action. —B. N.

*troplating Apparatus.* L. Potthoff. Fr. Pat. 352,852, March 30, 1905. Under Int. Conv., April 30, 1904. U.S. Pat. 786,776 of 1905; this J., 1905, 504.—T. F. B.

*ide of Silicon or Boron; Process for Making Moulded Shaped Blocks of* ——. F. Bölling. Fr. Pat. 353,017, March 29, 1905.

Eng. Pat. 6693 of 1905; preceding these.—T. F. B.

*minium, Silicon, Ferro-aluminium, Ferro-silicon, Aluminium Carbide, Aluminium Silicide, and Carbon Silicide; [Electric] Production of* —, and *Application of the Products in the Reduction of Metallic Oxides.* A. O. Viel and M. Jeantet. Fr. Pat. 353,070, April 1905.

MIXTURE of clay, kaolin, or aluminium sulphate with lime, or carbon, according to the product to be fired, is fused in an electric furnace. One or more bodies thus produced, may be applied in reducing cases, by inflaming a mixture of the oxides with such bodies. —E. S.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*macassar Oil) Schleichera Trijuga; The Seeds and Leaf* ——. D. Hooper. Agricult. Ledger, 1905, No. 1, 9.

1903 extensive demands were made in Europe for the seeds of the *Kusum* tree, *Schleichera trijuga*, and this led to inquiry by the Forest Department of India into the local uses and value of the tree. The fruit and seeds are used for food by local tribes in various parts of India and Burma, whilst the oil is employed for cooking illuminating purposes, and medicinally as a purgative (Central Provinces), a prophylactic against cholera (Bombay), for rheumatism (Bombay), and for skin diseases (Bombay, Malabar). The powdered seeds are used for roving maggots. No oil is exported from any of the districts. 100 parts of seeds yield 66 parts of kernels, and after, on extraction with ether, were found to contain 10 per cent. of oil, corresponding to 40.5 per cent. in the seed. Another determination by Walker gave 10 per cent. of oil from the kernels. The tree is infested by the lac insect in the Central Provinces, and lac cultivation could not be successfully carried on at the same time as the cultivation of the fruit.

The oil (the original macassar oil) has been found to consist of glycerides of oleic acid (70 per cent.), palmitic acid (5 per cent.), and arachidic acid

(25 per cent.), and its characteristics have been determined by Glenk, and more recently by Wijs (*Zeits. physik. Chem.*, 1900, 255). Old specimens examined by the author had acid values of 26, and 26, and iodine values of 129 and 90.6, whilst the fatty acids melted at 35° and 36° C. respectively. Hydrocyanic acid was detected in each case. The wood is hard and durable, the heart wood being reddish-brown and the sap-wood white. —C. A. M.

*Fats; Impts. in the Enzymic Decomposition of* ——. F. Hoyer. *Seifensiederzeit.*, 1905, 32, 509—510, 530—531, and 546—548. *Chem. Centr.*, 1905, 2, 582—583. (See this J., 1902, 1541; 1903, 639, 805, 873, 1094, 1137; 1904, 259, 550, 614, 1152.)

THE chief improvement which has been made in the process of decomposing fats by means of enzymes, consists in the use of the so-called "castor-seed extract" (this J., 1904, 619), in which the ferment is in a more concentrated condition than in the castor seeds themselves. By using the castor-seed extract only about 10 per cent. of the albuminoids contained in the seeds are brought into contact with the fat to be decomposed; the middle layer between the glycerin solution and the fatty acids is reduced in quantity, and the glycerin solution is purer. The middle layer is of a quite different character from those obtained by the earlier methods of working, and can be saponified directly for the production of curd soap. The best working temperature is about 23° C. for oils, and 1°—2° C. above the m. pt., for fats. The ferment loses its activity above 42° C. In the case of high-melting fats, the m. pt. must be lowered by addition of an oil or a low-melting fat. The author states that the quantity of the ferment required, appears to be directly proportional to the saponification value of the fat; for example, coco-nut oil requires at least 8 per cent., tallow 8—10 per cent., and linseed oil 5—6 per cent. The amount of water added should be about 35 per cent. of the weight of the fat; whilst to increase the activity of the ferment, an addition of 0.15 to 0.2 per cent. (on the weight of fat) of manganese sulphate dissolved in a small quantity of hot water is advantageous. The necessary quantity of water for the production of a satisfactory emulsion is added to the oil in the vessel in which the hydrolysis is to be effected, the mixture is at once heated to the working temperature, and then the ferment and manganese sulphate are introduced, the whole being agitated by a current of air. The vessel is then covered and allowed to stand. After 24 hours, about 80 per cent., and after 48 hours, 90 per cent. of the fat is hydrolysed. When castor seeds are employed, these are ground with the necessary quantity of water immediately before use, and the mixture allowed to settle, the supernatant milky liquid being used with the addition of 0.06 per cent. of acetic acid (on the weight of the fat), to effect the hydrolysis of the fat. After the hydrolysis is complete, the mixture, whilst being agitated by a current of air, is heated for 1—2 hours at 80°—85° C., a suitable quantity of dilute sulphuric acid being added shortly before this temperature is attained, in order to expedite the breaking up of the emulsion. The supplies of air and steam are then cut off, and the vessel is covered and allowed to stand. After 2—3 hours the main quantity of the clear glycerin solution can be run off: on standing overnight, complete clarification takes place, and 95 per cent. or more of the theoretical yield of glycerin solution can be separated, so the author states, whilst the fatty acids are obtained in an anhydrous condition. The middle layer when allowed to stand for several days yields a further quantity of glycerin solution, and is then washed and saponified. As the quantity of it is small compared with that of the fatty acids (3:100) it may, with advantage, be saponified with the latter. The clear glycerin solution is freed from sulphuric acid and then directly evaporated under reduced pressure, yielding a crude glycerin stated to be equal in value to saponification glycerin. —A. S.

## ENGLISH PATENT.

*Soap; Manufacture [Moulding] of* — and *Apparatus therefor.* F. Holoubek, Nüsse, Austria. Eng. Pat. 24,440, Nov. 11, 1904.

SEE Fr. Pat. 347,585 of 1904; this J., 1905, 338.—T. F. B.

## UNITED STATES PATENT.

*Oleic Acid; [Electrical] Process of Converting — into Stearic Acid.* A. de Hemptinne, Ghent, Belgium. U.S. Pat. 797,112, Aug. 15, 1905.

SEE Eng. Pat. 1572 of 1905; this J., 1905, 448.—T.F.B.

## FRENCH PATENT.

*[War] Composition for use in Moulding Phonograph Records, and its Method of Manufacture.* New Jersey Patent Co. Fr. Pat. 352,253, Feb. 14, 1905.

SEE Eng. Pat. 3070 of 1905; this J., 1905, 806.—T.F.B.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

## (A).—PIGMENTS, PAINTS.

## ENGLISH PATENTS.

*Pigments; Manufacture of* —. J. F. Bennett, Dronfield, and J. Mastin, Sheffield. Eng. Pat. 21,062, Oct. 1, 1904.

THE patentees claim the use of powdered glass, porcelain, or other materials of a vitreous nature for pigments of absolute permanence. The ordinary coloured glasses are not of sufficient richness of colour for the purpose. They therefore manufacture special glasses, intensely rich in colour, and either transparent or opaque. These are ground to impalpable powders, then mixed with the vehicles and the grinding continued, by which means the desired colour and tint are developed.—M. J. S.

*Pigments; Manufacture of* —. J. F. Bennett, Dronfield, Derby, and J. Mastin, Sheffield. Eng. Pat. 24,733, Nov. 15, 1904.

PORCELAIN or earthenware clay is mixed with suitable mineral substances, e.g., cobalt oxide, barium sulphate, and Paris white, and fired as usual. The coloured substance obtained is powdered and mixed as usual for crayons, distempers, printing inks, and the like.—A. G. L.

*Lithopones; Process for the Preparation of* —. R. Alberti, Goslar, Germany. Eng. Pat. 13,455, June 29, 1905.

To keep lithopones white, and prevent them from turning black or yellow in sunlight, an alkaline-earth or alkali peroxide, or hydrogen peroxide is added to the lithopone after it has passed through the incandescent process and has been washed. This may be done at the ordinary or at slightly elevated temperatures. If barium peroxide is used, about 2 per cent. is necessary. The peroxide may be also added to the dried lithopone before reduction.—A. G. L.

## UNITED STATES PATENT.

*Paint Composition.* W. A. Hall, Bellows Falls, Vt. U.S. Pat. 797,683, Aug. 22, 1905.

SEE Eng. Pat. 26,903 of 1903; this J., 1904, 328.—T. F. B.

## FRENCH PATENTS.

*Paint; Process for the Manufacture of* —. E. A. Ruch. Fr. Pat. 350,018, June 24, 1904.

CLAIM is made for the use of a compound of a drying oil with a metallic oxide, preferably alumina, as a base for the preparation of paints. The compound is prepared either by saponifying the drying oil directly with alumina, or by decomposing the alkali soap prepared from the oil with a soluble salt of aluminium. The insoluble aluminium soap is washed with water to remove soluble salts and glycerin, then carefully dried, ground with the colouring matter, and mixed with oil of turpentine to a suitable consistence.—A. S.

*Minerals; Process and Apparatus for the Treatment of Sulphide and other* —. [Manufacture of Pigments] G. E. Kingsley. Fr. Pat. 352,608, March 22, 1905.

SEE Eng. Pat. 23,909 of 1904; this J., 1905, 681.—T. F. B.

*Dyestuff specially suitable for the Manufacture of Lac* —. Production of a Red Monoxo —. Badische Anilin- und Soda Fabrik. Second Addition, dated March 1, 1905, to Fr. Pat. 346,008, Sept. 2, 1904. IV., page 1.

## (B).—RESINS; VARNISHES.

*Resin; Garcinia* — from Perak, Federated Malay States. Bull. Imp. Inst., 1905, 3, 149—150.

THE resin examined was obtained from the sap of a sp. of *Garcinia* which has not been identified: it appears to be quite different in constitution from gamboge, and is obtained from *Garcinia Hanburii* and *G. morella*. The resin is prepared by boiling the sap until it is as thick cream, and then adding a little oil of turpentine to form a pale yellow emulsion. If the sap be boiled until all the water is evaporated, it solidifies, and is then insoluble in oil of turpentine, but it may be made into an emulsion by immediate addition of water. The emulsion is stable and gives a nearly white, very hard and brilliant coating, equal to that obtained with Japanese lacquer. A specimen of the resin examined, was soft and opaque, had an odour resembling that of tung oil. It was covered by a very thin layer of brittle material, insoluble in turpentine oil and the usual solvents, and practically identical with the insoluble resin mentioned above. The soft resin was soluble in oil of turpentine, chloroform, benzene and ether, and almost completely so in alcohol. It melted at 65° C., and yielded 0.21 per cent. of ash. It contained a large proportion of free resin acids, a comparatively small amount of resin esters, 1 "grm. requiring 89.2 mgrms. of potassium hydroxide for saponification and 93.5 mgrms. for complete saponification. The solution of the resin in oil of turpentine yielded a hard, nearly white coating, similar to that produced by dammar varnishes.—A. S.

## ENGLISH PATENTS.

*Varnishes and Oil Colours; Process for Separating and Recovering the Residues of* —. A. Gottschalk. Pat. 352,880, March 31, 1905.

SEE Ger. Pat. 158,310 of 1904; this J., 1905, 681.—T. F. B.

*Lacquers or Varnish; Process for the Manufacture of* —. L. Lederer. Fr. Pat. 352,897, April 1, 1905.

CLAIM is made for the use of acetylene tetrachloride alone or mixed with other solvents in the manufacture of varnishes and lacquers. Special reference is made to the use of acetylene tetrachloride as a solvent for esterified cellulose for the purpose of preparing lacquers or varnishes, but the solvent named may also be employed in the preparation of resin varnishes.—A. S.

## (C).—INDIA-RUBBER, &amp;c.

*Rubber from the Sotik Forest, East Africa Protectorate.* Bull. Imp. Inst., 1905, 3, 146—147.

THE rubber was obtained from a species of *Landolphia*, probably *L. ugandensis*. The specimen examined was somewhat soft, but exhibited good elasticity and tenacity, and was free from stickiness. It was soluble in carbon tetrachloride, benzene and carbon bisulphide, and partially soluble in ether. It contained: Caoutchouc, 78.3; resin, 1.1; moisture, 6.2; dirt and insoluble matter, 6.4; and (included in "dirt"), 2.4 per cent. The rubber was sold at from 3s. to 3s. 6d. per lb.—A. S.

*Rubber of Ficus Elastica from the Madras Presidency.* Bull. Imp. Inst., 1905, 3, 147—148.

THE specimen of rubber examined was fairly tenacious and



ic, somewhat moist, but not sticky. It contained: starch, 85.2; resin, 7.8; albuminoid matter, 1.4; fibre, 3.7; dirt and insoluble matter, 1.9; and ash added in "dirt", 0.5 per cent. It was valued at from 1d. to 3s. 9d. per lb.—A. S.

#### ENGLISH PATENT.

*Rubber; Method of Separating or Coagulating — and Appliances therefor.* R. C. Thomson, Glasgow. From D. K. Michie, Colombo, and G. H. Gollidge, Ceylon. Eng. Pat. 330, Jan. 7, 1905.

The coagulation of the rubber is effected by subjecting latex, mixed, if necessary, with a small quantity of acetic acid, to centripetal combined with centrifugal motion. The apparatus for carrying out the process consists of a cylindrical vessel mounted on a rotating central spindle supported by a frame. On the inner surface of the rotating vessel are a number of vertical projections or ribs which serve to guide the latex towards the centre. To the top of the outer frame is bolted a ring, from which curved vanes project downwards into the cylindrical vessel. These vanes do not extend to the centre of the vessel, a free space being left in which the coagulated rubber forms a sponge-like ball which is removed when of the proper consistence. It is stated that the time occupied in the separation of the rubber is 15 to 15 minutes.—A. S.

#### FRENCH PATENTS.

*Rubber; New Process for Joining or Cementing —.* G. A. Le Roy. Fr. Pat. 349,981, June 13, 1904.

Two surfaces of the rubber to be cemented together are superficially melted by the application of a hot sheet of metal; the excess of melted rubber is removed by scraping or by employing a solvent, and the surfaces are coated with a vulcanising compound such as, for example, a chloride, iodide or fluoride of sulphur (a mixture of these), applied as a solution in benzene, carbon bisulphide or tetrachloride. The coated surfaces are then applied to each other. The preliminary fusion of the rubber is intended to retard the vulcanising action of the sulphur compound or compounds, which would otherwise be too rapid.—M. C. L.

*Rubber Solutions; Process for the Preparation of — and Utilisation of such Process for the Regeneration of Rubber.* Robinson Bros., Ltd., and G. A. L. Clift. Fr. Pat. 352,371, March 14, 1905. Under Int. Conv., March 17, 1904.

Eng. Pat. 6471 of 1904; this J., 1905, 449.—T. F. B.

### IV.—TANNING, LEATHER, GLUE, SIZE.

#### UNITED STATES PATENT.

*Leather; Treating Raw or Partially Dressed —.* H. W. Southworth, London. U.S. Pat. 797,982, Aug. 22, 1905.

Fr. Pat. 344,441 of 1904; this J., 1904, 1104.—T. F. B.

#### FRENCH PATENTS.

*Tanning; Rapid —.* R. Berthon. Fr. Pat. 352,700, March 27, 1905. (See also this J., 1905, 339 and 449.)

Leather skins after depilation are immersed in a solution of humic chloride (6 to 8 per cent.) and hydrochloric or sulphuric acid (three to four per thousand) for 24 to 48 hours. They are half dried and are then ready to be tanned. Instead of this pickling process the pelts may be subjected to the action of an alternating electric current, the goods being suspended between plates of lead which act as electrodes, in a solution of salt and acid as stated above. The goods are afterwards treated in the same way with a solution (4 to 5 per cent.) of free tannin (i.e., free from glucosides). The tanning solution is prepared from glucosides by treating the solution with

sprouted barley or potatoes for 48 hours at 50° C. Glucosides combined with tannin retard the tanning process, and render the leather brittle, though free glucosides have no detrimental effect. The tanning may be completed by the process of "laying away" in pits.—M. C. L.

*Bricks or Agglomerates of Cork and Tanners' Bark.* C. C. Girod. Fr. Pat. 353,071, April 6, 1905. IX., page 972.

### XV.—MANURES, Etc.

#### ENGLISH PATENT.

*Manure from Offal and the like; Improved Process of and Apparatus for Manufacturing Artificial —.* C. Bollé, Manchester. From C. Schmidt and Co., Leipzig. Eng. Pat. 23,045, Oct. 26, 1904.

In order to effect economies in the quantity of acid required for the decomposition of waste animal substances and to obtain a product requiring a minimum amount of drying to convert it into a solid powder, the steaming of the offal and the treatment with acid are carried on in separate vessels, the excess of condensed water and the fat being removed before the acid is added. The steamer or digester is a vertically-placed cylindrical vessel, divided into two compartments, an upper and a lower, by a horizontal flap which can be lowered from the outside. The materials are charged into the upper compartment, where they become warmed by the waste steam from the lower compartment. By opening the flap they are allowed to fall into the lower compartment, where they are submitted to an adequate steaming. The excess of water and the oil are then drawn off below by a cock, after which a slide at the bottom is drawn out and the steamed material falls gradually into the disintegrator, being sprayed during its descent with acid blown in by an injector. In consequence of the previous removal of the excess of water, the material soon absorbs the acid, and much less is thus required for the necessary degree of concentration, than is the case where steaming and treatment with acid are simultaneous.—M. J. S.

#### UNITED STATES PATENT.

*Manures; Manufacture of Humous —.* J. J. Boutan. First Addition, dated April 22, 1904, to Fr. Pat. 338,981, Aug. 13, 1903. (This J., 1904, 1037.)

In the preparation of the "humo-phosphatic" manures described in the main patent, it is now preferred to treat the peaty matter with the pasty product obtained by acting on insoluble phosphates with such a proportion of sulphuric acid as may set free the phosphoric acid.

—E. S.

### XVI.—SUGAR, STARCH, GUM, Etc.

*Starch; Products of Hydrolysis of — by Hydrochloric Acid [New Modification of Dextrose], and their Influence in the Sweetmeat Industry.* A. Roessing. Chem.-Zeit., 1905, 29, 867—873.

In previous communications (see this J., 1903, 886; and 1904, 386, 953) the author described a method for the determination of dextrose in starch syrups by the action of baryta water, and showed that certain syrups prepared by hydrochloric acid yielded abnormally high results. When, as in the manufacture of sweetmeats, these abnormal syrups are melted with cane sugar, they yield deliquescent products, the practical consequence being that starch syrups converted by hydrochloric acid are considered to be unsuitable in that industry. The peculiarity of these syrups is now shown to be due to the presence of a new modification of dextrose, termed provisionally "ε-dextrose." It is formed when excessive conversion temperatures of 130° C. and upwards in conjunction with hydrochloric acid are adopted; when sulphuric acid is employed the products are entirely normal at tempera-

tures up to 160° C., so that abnormal syrups prepared with sulphuric acid are comparatively rare. Abnormal dextrose hydrate, as prepared by the author by heating starch or pure dextrose with hydrochloric acid under pressure, remains fluid, when heated at 100–105° C. after all the water has been driven off; the anhydride thus obtained is extremely hygroscopic. This form of dextrose readily yields the alternative (Skraup's) form of the phenylhydrazone, which is only rarely obtained from normal dextrose. By the action of baryta water under standard conditions, abnormal dextrose suffers a decrease in cupric-reducing power about three times as great as normal dextrose. The action of baryta water on the two forms of dextrose results in the production of organic acids, chiefly lactic acid, which takes place without absorption of oxygen. The dextrins of abnormal starch syrups are also abnormal, the unfermentable residue being distinguished by its great hygroscopicity and abnormally high cupric-reducing power. The hygroscopic nature of abnormal dextrose anhydride and the abnormal dextrins causes the deliquescence or softening of the cane sugar melts to which they are added: this action is still further aggravated by the inversion of the cane sugar produced by the ash constituents of starch syrups converted by hydrochloric acid. All these syrups contain acid phosphates and chlorides, including calcium chloride. At the temperature of the sugar melt these constituents react with the production of free hydrochloric acid, which inverts the cane sugar. Syrups converted with sulphuric acid are generally free from soluble phosphates and contain very little ash. The proportion of dextrose to dextrin in a starch syrup has no influence on the hygroscopicity of the sweetmeat products, the only question being the normal or abnormal nature of the components of the syrup.—J. F. B.

#### UNITED STATES PATENTS.

*Cane Juices; Preparation for Clarifying* — G. B. Williamson. U.S. Pat. 797,391, Aug. 15, 1905.

The preparation used for clarifying cane juices and syrups consists of bone-black dust (1 lb.), sulphuric acid (0.75 lb.), and water (1 lb.).—T. H. P.

*Sugar; Process of Making* — J. V. P. Lagrange, Paris. U.S. Pat. 797,965, Aug. 22, 1905.

SEE Eng. Pat. 21,454 of 1902; this J., 1903, 504.—T. F. B.

*Bone Black [Revivifying] Kiln*. B. Eba, Warren, Pa. U.S. Pat. 796,304, Aug. 1, 1905.

A RETORT for revivifying bone-black and similar materials is composed of upper and lower sections, the upper section having openings in its walls shielded by guards placed over them inside the section; the lower section has an enlarged upper end, into which the upper section fits; this enlarged end is provided with passages for the exit of vapour; inside the lower section, terminating at a short distance from the walls, are a number of deflectors to conduct the vapours towards the spaces mentioned above. The retort is set in a kiln, in a chamber communicating with the fire-grate.—T. F. B.

#### FRENCH PATENTS.

*Masseccutes [Sugar]; Process and Apparatus for Boiling* — with Circulation. H. Roy. First Addition, dated Feb. 6, 1905, to Fr. Pat. 337,227, Dec. 1, 1903. (See this J., 1904, 616.)

MEANS are described whereby the exact position of the sliding tube, through which the masseccute is withdrawn for circulation, can be ascertained. The internal sliding tube is attached at its upper end to a carrier-bar parallel with the tube. This bar passes through a separate orifice in the bottom of the pan, and terminates in a screw thread by which the movement of the sliding tube is effected, and its position is indicated by a pointer. A special form of re-heater is described, also an arrangement by which the principle of circulation can be applied to existing pans; this consists of a vertical slit cut in the side of the pan and a sliding gate which moves in a casing fixed externally over the slit.—J. F. B.

*Crystals [Sugar]; Process for Obtaining Good, Ch. mi Pure* — V. Schütze. First Addition, dated Feb. 14, 1905, to Fr. Pat. 339,896, Jan. 26, 1904. (This J., 1904, 708.)

THE apparatus which is specially adapted for the crystallisation of sugar from syrups, consists essentially of an internal and external horizontal cylinder, so mounted to be capable of very slow rotation or of to-and-fro movement, the space between the two cylinders being adapted for the circulation of a fluid which may serve to heat or cool the interior, the course of such fluid being helical. A vacuum is formed and maintained within the internal cylinder, into which the hot syrup (at a stated temperature and density) is admitted, as it becomes concentrated and cooled at the farther end of the cylinder, crystals are formed, which are discharged into a receptacle, also vacuous. The heating fluid circulates in the jacket on the counter-current system.

*Bart Sugar; Process of Making* — M. Roe and A. Schaer and H. W. Binze. Addition, dated Aug. 15, 1905, to Fr. Pat. 345,299, Aug. 1, 1904.

SEE U.S. Pat. 770,700 of 1904; this J., 1904, 994.—T.

*Gas from very Light Combustibles, such as Straw, Bagasse, &c.; Generator for the Production of Mixed Gases*. H. Riché and C. P. Bratasiano. Fr. Pat. 352,908, April 1, 1905. II., page 961.

## XVII.—BREWING, WINES, SPIRITS, &c.

*Malt Grist from Different Mills*. O. Reinke. Z. f. Brau., 1905, 22, 452–453.

IN grinding malt to determine the proportion of grist flour, the percentage of moisture is a very important factor which has to be taken into account; the influence of high kilning is of less importance. In grinding malt on the practical scale, it is desirable that the proportion of hulls and flour should be as small as possible; in case of flour for filter-press work, the hulls should be sifted off and mashed separately.

In the principal malt-mills of German make, the following adjustments all give equivalent results as regards yield of extract:—

	Arme, Giesecke and Konegen	Luther.	
	4 rollers.	2 rollers	2
For fine grist—			
Top pair .....	0.2 mm.	1.5	
Bottom pair .....	0.05 mm.		
For coarse grist—			
Top pair .....	0.6 mm.	6.0	
Bottom pair .....	0.6 mm.		

The finer the grist the longer is the time required for saccharification. The results of grinding should always be controlled by sifting and weighing the hulls, grist flour. In grinding to flour, the malt should first be broken up in the cone-mill before the grinding, otherwise many fine shreds of hulls will be present.—J. F. B.

*Malt and Beer; Influence of the Duration of Germination on the Nitrogenous Constituents of* — A. I. Z. ges. Brauw., 1905, 28, 576–578 and 590–592.

IN the valuation of brewing barleys, the nature and amount of nitrogenous substances is a factor of far greater importance than their absolute total quantity. A good brewing barley should not contain much more than 1 per cent. soluble albuminoids; this low proportion of albuminoids is frequently, but not always, accompanied by a maximum of 10 per cent. of total albumin. It is a particularly good characteristic if a large proportion of the soluble albumin is coagulable, and treatment on the malting floor should be regulated according to the quantities of soluble and coagulable albuminoids in the barley. The higher the quantity



albuminoids, the more protracted should be the treatment, especially when the coagulable albuminoids. Too short a growth is shown by low proportions of soluble albuminoids and coagulable albumin in malt; forced growth is shown by a high proportion of soluble and a low proportion of coagulable albuminoids. Suitable proportions of soluble and coagulable albuminoids in the barley can generally be corrected by suitable treatment. In the malting of barleys rich in albuminoids, the time on the floor should be sufficiently long to ensure a rapid saccharification (to avoid starch losses); the quantity of soluble albuminoids in the malt should be about 3.5 per cent., i.e., about 35 or at the 38 per cent. of the total albuminoids (to avoid gluten losses). With a proportion of soluble albuminoids of 3 per cent., there is a tendency to excessive attenuations and pasty hazes. In such a case, the proportion of nitrogenous extract can be regulated by extending the time of treatment, but the improvement is often obtained at a cost of an appreciable loss of extract. In the case of malt, if the albuminoids are properly modified, the proportion of coagulable albumin should be low. If, however, proportion falls below 0.1 per cent. without the saccharifying power and quantity of soluble albuminoids satisfactory, an improvement in these relations can be obtained by extended floor treatment, but only at the expense of the extract. Bohemian and Moravian barleys are not suitable for giving malts with good saccharifying power and normal proportions of soluble albuminoids require floor treatment without excessive losses of extract.—J. F. B.

*Cause of the Presence of Abnormal Quantities of Tannin in Bruised —.* G. Warcollier. *Comptes Rendus*, 1905, 141, 405—408.

Apples are frequently gathered in the unripe state and allowed to ripen on a dry floor. A considerable portion of the fruit is bruised by careless handling during packing and transport, and the bruises so produced not only afford entrance to micro-organisms, but turn into a zone in which the apple starch remains entirely unsaccharified even when the rest of the fruit is ripened or decayed. The browning of the bruised portion is due to the action of an oxydase upon the tannin which exudes from the ruptured cells. The author now shows that it is the paralyzing action of this tannin upon the yeast, which prevents the saccharification of the starch, upon which normal ripening depends. Experiments showed that the presence of 0.2 per cent. of gall-nut or 0.075 per cent. of apple tannin completely arrested the saccharification of a 1 per cent. starch solution by one-tenth of its volume of a 10 per cent. malt extract at 62° C.

From these facts, it is concluded that the rupture of the apple causes the tannin to escape and to coagulate the yeast in the fruit, and that the consequent paralysis entails a serious loss of sugar to the cider manufacturer. —J. F. B.

*Rapid Vinegar Generators; Processes occurring in the "Rapid" —.* F. Rothenbach. *Deutsche Essigind.*, 1905, 9, 220. *Chem. Centr.*, 1905, 2, 581—582.

In the "rapid" vinegar generators, only a very small quantity of aldehyde is produced under normal conditions, the fragrant ester with an odour different from that of acetic acid is formed in somewhat larger amounts. Acetic fermentation must be caused by an enzyme (zymes) secreted by the acetic bacteria, since it can be produced by dead bacteria; the presence of these enzymes can, however, be detected by the guaiacum reaction. The processes also appear to play a part in the operation of the generators. A generator which had been previously filled with the ordinary mash employed in the rapid process, was charged with a wine mash, when it was found that the amount of "extract" contained in the vinegar was the same after 24 hours as at first, viz., 0.720 gm. per 100 gm. of mash; after 4 days, the quantity had increased to 0.8058 gm.; after 8 days to 0.8875 gm.; after 10 days to 1.0472 gm.; after 13 days to 1.1531 grms.; after 14 days to 1.2100 gm., and after 18 days to the maximum of 1.2873 grms.

per 100 c.c. According to the author, this slow increase of the proportion of "extract" in the vinegar is due to the fact that the wine mash is absorbed by the chips of wood used as filling material for the generator, and is then slowly given up again according to the laws governing osmotic processes.—A. S.

*Acetic Bacteria; Enzymic Fermentation of —.* F. Rothenbach and L. Eberlein. *Deutsche Essigind.*, 1905, 9, 233—234. *Chem. Centr.*, 1905, 2, 642—643.

The authors determined the amount of acetic acid produced by the action on alcohol of dead acetic bacteria obtained from a pure culture of *Bact. pasteurianum* by destroying the cells mechanically and then treating them with acetone and ether. In a parallel experiment without addition of alcohol, the amount of acid formed was 0.7 gm. less than with alcohol, and the difference must be attributed to enzymic action. Rothenbach had observed previously that when the preparation known as permanent acetic bacteria ("Daueressigbakterien") from *Bact. acetigenum* and *B. ascendens* is triturated with kieselguhr and sea-sand, an acid odour is produced. Three grms. of the permanent bacteria from *Bact. pasteurianum* were triturated with water and 1.5 grms. each of sea-sand and kieselguhr for 12 minutes, when it was found that 0.4 gm. of acetic acid had been produced. (See also Buchner and Meisenheimer; this J., 1903, 374.)—A. S.

#### ENGLISH PATENT.

*Brewer's Wash, Sewage or Spent Dyes and the like; Evaporator for Evaporating the Liquid in —, the Evaporator being also applicable as a Smoke Washer.* A. B. Lennox. *Eng. Pat.* 18,488, Aug. 26, 1904. *XVIII B.*, page 982.

#### FRENCH PATENT.

*Wine Must; Process of Fermenting Red —.* A. Fuchs. *Fr. Pat.* 352,480, March 17, 1905.

The must is fermented in a closed tun provided with a suitable fermentation floor of laths covered with muslin; the tun is only partially filled with must, and is rotated from time to time during the fermentation, the carbon dioxide being allowed to escape by vents provided for the purpose.—J. F. B.

### XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

#### (A.)—FOODS.

#### ENGLISH PATENTS.

*Milk-food for Infants and others, and Method of Manufacture.* J. R. Hatmaker, Paris. *Eng. Pat.* 20,339, Sept. 21, 1904.

CLAIMS are made for a soluble, powdery milk-food containing approximately: casein, 24; butter-fat, 12; milk sugar, 54; milk salts, 5; and moisture, 5 per cent., and for the process of preparing it, which consists in exposing a liquid of suitable composition in a thin layer or film upon a surface heated to above 212° F., until only sufficient water for its good preservation remains. The liquid is obtained by adding milk sugar to cows' milk from which a portion of the cream has been removed.—T. H. P.

*Milk-food for Infants and others, and Method of Manufacture.* J. R. Hatmaker, Paris. *Eng. Pat.* 20,340, Sept. 21, 1904.

SIMILAR claims to those in the preceding specification are made, the approximate composition of the food being in this case: casein, 20; butter-fat, 20; milk sugar, 50; milk salts, 5; and moisture, 5 per cent.—T. H. P.

## UNITED STATES PATENTS.

*Wheat, Flour and other Cereals; Process of and Apparatus for Improving, Bleaching or Conditioning* —. W. T. Mercier, Belfast, Assignor to The Ozonised Oxygen Co., Ltd., Manchester. U.S. Pats. 796,339 and 796,340, Aug. 1, 1905.

SEE Fr. Pat. 343,805 of 1904; this J., 1904, 1040.—T. F. B.

*Milk; Process of Making Peptonised* —. J. H. Campbell, Brooklyn, N.Y., Assignor to National Nutrient Co., Jersey City, N.J. U.S. Pat. 796,496, Aug. 8, 1905.

MILK is partially peptonised and then dried to a powder at a temperature of about 130° F., so that the action of the added ferment is stopped but not destroyed. On the addition of water to the powder, the solids of the milk are further peptonised.—W. P. S.

*Separator [Milk]; Centrifugal Liquid* —. M. H. Matty, Clayton, N.Y., Assignor to M. Decker, Chicago, Ill. U.S. Pat. 797,969, Aug. 22, 1905.

THE bowl of the separator consists of a cylindrical vessel surmounted by a conical cap, in which is an opening for the cream. A tube for the whole milk, passes down through the cap, concentrically with the bowl and terminates in a cone resting on the bottom of the bowl. The interior of the bowl is divided by a number of cylindrical partitions, having notches into which fit ribs placed on the central tube. The partitions have vertical openings near the centre and horizontal openings in their peripheries. A number of tubes arranged round the bottom of the bowl, lead from the outer partition to the conical termination of the central tube.—W. H. C.

*[Cream] Separator; Centrifugal* —. P. H. Watts, Dursley, U.S. Pat. 798,243, Aug. 29, 1905.

SEE Eng. Pat. 11,732 of 1904; this J., 1905, 509.—T. F. B.

*Butter; Process of Renovating* —. S. S. White and J. H. Strong, Wadena, Minn. U.S. Pat. 797,481, Aug. 15, 1905.

THE butter is washed several times with water or brine at a temperature of 85° F. It is then worked with milk, cream or ripened milk; colouring matter and salt are added, and, finally, about 5 per cent. of water is incorporated with the mass.—W. P. S.

*Meat Meal; Process of Preparing* —. E. Maragliano, Genoa, Italy. U.S. Pat. 798,138, Aug. 29, 1905.

SEE Eng. Pat. 15,440 of 1901; this J., 1905, 685.—T. F. B.

## (B.)—SANITATION; WATER PURIFICATION.

## ENGLISH PATENTS.

*Water and Sewage, &c.; Regenerative Heating Apparatus for the Purification of* —. C. Tuckfield and W. G. de F. Garland, East Molesey. Eng. Pat. 16,689, July 29, 1904.

THE sewage is pumped into the lower part of a vertical cylinder in which is suspended a smaller cylinder provided with a tube plate at each end and a number of tubes connecting these plates. The liquid rises through the tubes and round the outside of the smaller cylinder until it reaches a steam coil placed in the larger cylinder, and immediately above the smaller one. The temperature of the sewage is thus sufficiently raised to sterilise it and to cause most of the impurities to fall to the bottom of the cylinder. The heated liquid then passes from the top of the cylinder through a pipe, which conducts it into the interior of the small cylinder, where it comes in contact with the outside of the tubes up which the impure sewage is flowing, and finally leaves the apparatus nearly cold. The sterilised sewage may be allowed to flow through a closed settling tank before it enters the smaller cylinder. As the treated liquid leaves the apparatus under pressure, it may be employed to actuate a hydraulic engine, water-wheel, or the like, and the power obtained utilised to aid in driving the feed-pump.—W. P. S.

*Brewers' Wash, Sewage or Spent Dyes and the Evaporator for Evaporating the Liquid in* —. A. B. Lennox, Newcastle-on-Tyne. Eng. Pat. 1 Aug. 26, 1904.

HINGED portions are attached to the lower ends of division plates placed in the apparatus described in Pat. 13,227, 1904 (this J., 1905, 811). When the portions hang vertically, the hot air takes a course through the compartments, but on raising each portion cuts off one of the compartments, and hot air, or smoke, passes straight to the chimney, or all of the compartments may be cut off at one time.—W. J.

*Filter-Beds for Sewage or other Purposes; Impts. in* M. J. Adams, Stockfield on Tyne. Eng. Pat. 1 Sept. 9, 1904.

THE sewage is caused to flow in a shallow layer series of slightly inclined troughs. The troughs are formed of a material having a granular surface on which bacteria may grow, or they are covered with a thin layer of granular material.—W. H. C.

*Sterilising and Purifying Water and other Liquid* Freyssinge and R. Roche, Paris. Eng. Pat. 2 Oct. 7, 1904.

SEE Fr. Pat. 345,148 of 1904; this J., 1904, 1232.—

*Filters; Impts. in* —. A. Howatson and W. Eng. Pat. 21,644, 1904. L. page 958.

*Water; Decanting Apparatus for Purifying* —. G. Pulinx and C. A. G. Pulinx, Lille, France. Eng. Pat. 8366, April 19, 1905. Under Int. Conv., May 16,

THE apparatus consists of a vertical cylindrical vessel in which the water and the added reagent enter the central pipe reaching nearly to the bottom of the vessel. The water then slowly rises in the interior of the vessel which is provided with truncated conical diaphragms on which the precipitate settles. The central tube plugs on its exterior which close the lower ends of the diaphragms. This tube may be raised to permit simultaneous opening of all the plugs so that the water may fall round the outside of the tube to the bottom of the apparatus, where it is discharged through an opening provided for the purpose. The clear water passes to a filter at the top of the vessel and is then run off.—

## UNITED STATES PATENTS.

*Water; Process and Apparatus [Lime-water Softening] Purifying* —. H. Reiser, Cologne. Assignor to H. Heisert Co., Germany. U.S. Pats. 796,088 and 796,089, Aug. 1, 1905.

SEE Eng. Pat. 967 of 1903; this J., 1904, 74.—W. J.

*Water-Purifier*. C. L. Kennicott, Chicago. Assignor to Kennicott Water Softener Co., Ill. U.S. Pat. 797,115, Aug. 15, 1905.

THE apparatus consists of a rocking vessel divided into two compartments, and a spout for delivering the water into this vessel. The latter is connected by means of a sprocket wheel, ratchet and chain to a shaft provided with a number of arms and cups placed in a tank surrounding the rocking vessel. As the shaft rotates, the cups intermittently discharge a chemical solution from the tank into the compartments of the rocking vessel.—W. J.

*Water; Apparatus for Softening and Purifying* —. H. H. Sutro, New York, and L. M. Booth, Plainfield, N.J. U.S. Pat. 797,759, Aug. 22, 1905.

A VERTICAL cylindrical vessel is divided into several compartments, one of which serves as a reaction tank and the other as a lime-water tank. A second compartment serves as a settling tank. The water is delivered into the apparatus in two regulated streams, one being led to the lower part of the lime-water tank and the other to a mixing pipe communicating with the reaction tank where it is mixed with the water from the lime-water



of lime and other reagents are conducted from settling tanks to the mixing pipe, the supplies being regulated by valves actuated by the flow of crude water. The treated water is led to the settling tank and withdrawn from the upper part of the latter. A sludge pipe, having numerous branches, is provided at the bottom of the settling tank.—W. P. S.

*Apparatus for Softening and Purifying* — H. Sutro, New York, and L. M. Booth, Plainfield, N. J. U.S. Pat. 797,760, Aug. 22, 1905.

The apparatus consists of a lime-water tank, a reaction tank, and a number of superposed settling tanks. The water to be treated is supplied to the lime-water and reaction tanks, and from thence by separate pipes to the settling tanks. The upper settling tank is provided with a filter through which the purified water is drawn off.—W. P. S.

*Process for the Purification of* — E. Declercq, Belgium. Addition, dated March 7, 1905, to Fr. Pat. 348,375, v. 30, 1904 (this J., 1905, 510).

The quantity of precipitate obtained in a previous treatment of the water is added to the latter before introducing chemical reagents, in order to increase the rapidity of precipitation. The water is conducted into a tank having a conical bottom. A portion of precipitate is drawn from the bottom of the tank to the channel conveying the water to the tank, the reagents being supplied through another pipe. The mixture enters through the stem of an inverted funnel suspended in the tank, from which the heavier part of the precipitate falls into a funnel placed above the bottom of the tank and is drawn off when necessary, whilst the finer part, settling on the conical bottom, is pumped into a further supply of water. The treated water is drawn off from the top of the tank.—W. P. S.

*Filtering Material*. O. Löffler and W. Weidle. Fr. Pat. 352,462, March 17, 1905.  
Eng. Pat. 6055 of 1905; this J., 1905, 937.—T. F. B.

*Waters of Paper Mills; Recovery of Residual Matter from, and Clarification of* — M. Erfurt. Fr. Pat. 352,524. XIX., page 984.

### (C).—DISINFECTANTS.

#### UNITED STATES PATENT.

*Septic Compound [from Succinic Peroxide Acid]*. M. Clover, Ann Arbor, Mich. U.S. Pat. 798,013, g. 22, 1905.

The antiseptic compound is prepared by adding a basic substance to succinic peroxide acid (see Eng. Pat. 8415 of 1904; this J., 1904, 834). Its aqueous solution has a powerful germicidal action; when acidified with a mineral succinic peroxide acid is formed; on standing, it decomposes to the salts of succinic acid and succinic monoxide, and on prolonged standing, hydrogen peroxide is evolved.—T. F. B.

#### FRENCH PATENT.

*Reagents; Fluorescent* — E. Turpin. Addition, dated Jan. 31, 1905, to Fr. Pat. 346,363, Sept. 20, 1904 (this J., 1905, 148, 854).

Fluorescein, other phthalicins may be employed as antiseptics, either alone or mixed with fluorescein. Phthalicins of quinine, quinone, hydroquinone, phenol, thol, pyrogallol, &c., and their derivatives in general are used.—W. P. S.

### XIX.—PAPER, PASTEBOARD, Etc.

*Test; Durability of* — and *Testing same*. J. P. Nischilgen. Papier-Zeit., 1905, 50. 2570—2572 and 22—27, 23.

Paper for permanent records and hard wear should only be made from strong, sound rags; old and tender rags

give a paper which deteriorates rapidly by use. The nature of the sizing is probably of little importance, provided it has been properly incorporated. The tensile strength is of importance from the point of view of durability, owing to the fact that the strongest papers are generally those made from long and sound fibres, and include those papers of which the fibres are beaten wholly or partly to fine fibrille which interlace well and the presence of which is the best guarantee of long-wearing qualities. The tensile strength is greater in the machine way than in the cross way, whereas the breaking stretch is greater in the cross way owing mainly to the longitudinal tension under which the paper is dried. Consequently a book of which the paper is folded in the cross way will be less durable than one in which the binding folds are parallel to the machine way. The author argues strongly against the custom of judging a paper by the mean tensile properties of the two directions; for durability, it is only the weakest direction which counts, and the specifications should state minimum values for breaking length and stretch. Rag papers are easily made with a ratio of 66 per cent. between the weakest and the strongest directions; the best rag papers properly beaten will even show ratios of 85—90 per cent. Short-fibred papers from straw, esparto and deciduous wood cellulose are easily made with a ratio of 60—65 per cent., but papers composed of coniferous wood cellulose generally show a ratio of only 40—50 per cent. between the two directions. In such cases the mean strength gives a very false idea of the real strength. The most important mechanical test for durability is the loss of tensile strength and elasticity produced by folding the paper backwards and forwards a given number of times (say, five double creases) under standard conditions in the Schopper creasing machine. A paper containing a high proportion of gelatinised cellulose [wet beaten] generally possesses extremely high tensile qualities, but it may be very brittle and of low durability, in which case it will be immediately condemned under the folding test. By means of the folding test also the presence of weak or old rag fibres, deficient beating, bad felting, over-drying and hydrocellulose are detected. Wood celluloses and other rag substitutes show up badly under this test. The author suggests that, if lignified fibres be excluded, the specifications of the German "normal" papers can be made efficient measures of durability without making any reference to the fibrous composition. A kind of natural selection in these respects will be made by specifying a minimum breaking length and stretch together with a maximum loss of these values after the folding test. For instance, "normal" papers of the first class should have a minimum breaking length of 5000 m., minimum breaking stretch of 3.5 per cent., and a maximum decrease in these values after five double creases of 20 per cent.—J. F. B.

#### ENGLISH PATENTS.

*Papers; Manufacture of Blotting and other Water Leaf* — C. Beadle and H. P. Stevens, London. Eng. Pat. 19,178, Sept. 6, 1904.

A sufficient quantity of dilute hydrochloric acid is added to the washed rags or other fibrous material used in the manufacture of paper, to neutralise the basic mineral matters contained in the rags, &c., and also in any water with which these materials are mixed. The quantity of acid employed is ascertained by experiment. Paper thus prepared can be used repeatedly for blotting ink without becoming non-absorbent.—W. P. S.

*Paper Yarns; Process for Improving* — M. Hölken. Eng. Pat. 7140, 1905. V., page 965

#### UNITED STATES PATENT.

*Solvent for Nitro Derivatives of Carbohydrates*. R. N. Riddle, Uwehland, Pa., Assignor to the Warner Chemical Co., Carteret, N.J. U.S. Pat. 797,373, Aug. 15, 1905.

PHENYL acetate is used for dissolving nitro derivatives of carbohydrates (e.g., nitrocellulose).—T. F. B.

## FRENCH PATENTS.

[Paper] Composition; Incombustible, Non-Putrefying —, Unattacked by Acids. A. Andrien. Fr. Pat. 349,982, June 13, 1904.

SIXTY kilos. of "crocidolite" fibres [wool-like fibre, of bluish tint, and mainly a ferrous silicate] are mixed for a few minutes with 200 litres of water, and then for 15 minutes with 15 kilos. of powdered mica and 10 kilos. of kaolin. Five kilos. of waste of aloes, defibred and bleached, 5 kilos. of powdered starch, and 5 kilos. of pure gelatin are then added and the whole mixed for another 30 minutes, after which the homogeneous mass obtained is manufactured as usual into paper (for bank-notes, securities, &c.), insulating material, &c.—A. G. L.

Paper or Cardboard; Casein Sizing of —. F. Dobler. Fr. Pat. 350,035, July 4, 1904.

THE sheets or webs of paper, after their formation, are passed through a bath containing a solution of casein and then through a second bath containing a solution of aluminium sulphate or other precipitating agent. If desired, substances like starch, gelatin or rosin may be mixed with the casein solution.—J. F. B.

Papers; Impt. of the Baths used for Manufacture of Coated —. L. F. J. L. Aubertin. Fr. Pat. 353,033, April 5, 1905.

A CHLORIDE, such as barium chloride or the chloride of an alkali metal, preferably common salt, is added to the coating composition in order to minimise the frothing and to increase the flexibility and brilliancy of the coating. With gelatin compositions 7–8 per cent. of the dry weight of the gelatin is employed; with casein compositions 5–6 per cent.—J. F. B.

Casein; New Method of Preparing —. J. T. Gateau. Fr. Pat. 352,531, March 20, 1905.

BLUE milk is subjected to electrolysis in such a manner that the positive electrode is in the milk and the negative electrode is in a porous pot containing an alkaline conducting liquid. Under the action of the current, phosphoric acid is liberated in the milk from the phosphates contained therein, the casein is precipitated and the alkaline solution in the porous pot becomes enriched in alkali.—J. F. B.

Waste Waters of Paper Mills; Recovery of Residual Matters from, and Clarification of —. M. Erfurt. Fr. Pat. 352,524, March 20, 1905.

THE overflow from the paper machine is passed through a series of funnel-shaped vessels each one slightly larger than the preceding one, and arranged in steps. The sedimentary portion of the contents of the funnels is withdrawn for the purpose of filling and emptying the beaters and diluting the pulp; the overflow from the last funnel is finally clarified in a large tank and the clear liquid is discharged into a stream.—J. F. B.

Celluloid; Manufacture of — by means of Borwols. A. Béhal, P. Magnier and C. Tissier. Fr. Pat. 349,970, June 7, 1904.

SEE Eng. Pat. 41,512 of 1905; this J., 1905, 855.—J. F. B.

Celluloid; Process of Making Non-Inflammable Materials similar to —. P. A. D. Prost and E. Michéy. First Addition, dated March 18, 1905, to Fr. Pat. 351,555, Jan. 17, 1905. (See this J., 1905, 855.)

THE following substances are added to the mixture described in the principal patent:—Fused zinc chloride (in alcohol solution), 10 to 25 per cent.; ammonium chloride (in alcohol solution), 1 to 5 per cent.; carbon tetrachloride, 1 to 15 per mille; glycerin, 5 to 10 per cent.—T. F. B.

Celluloid; Manufacture of —. C. Gillet.

Fr. Pat. 352,853, March 30, 1905.

IN the manufacture of celluloid, the whole or a portion of the camphor is replaced by an equal quantity of rosin

or other resinous material equally soluble in alcohol. The process of manufacture is the same as is usually employed.—J. F. B.

Lacquers or Varnish; Process for the Manufacture of —. L. Lederer. Fr. Pat. 352,897, April 1, 1905. X B, page 978.

Gases Heavier than Air; Process for the Recovery of obtained from very Volatile Liquids. C. and M. Libl. Fr. Pat. 352,298, March 11, 1905. Under Int. Jan. 27, 1905.

THE process is intended for the recovery of vapours heavier than air, such as carbon bisulphide or vapour, for example, in the manufacture of celluloid, smokeless powder, &c. The chambers in the vapours are present are provided with trough perforated false bottoms, the spaces between the troughs being connected with a pump; these troughs are situated at the bottom of the chambers, so that the vapour collected in them and drawn off, whence they are introduced into a condensing liquid through perforated pipes, the liquid being cooled if necessary.—T. F. B.

## XX.—FINE CHEMICALS, ALKALOID ESSENCES, AND EXTRACTS.

Cyanogenetic Glucosides of the Cherry-Laurel and Cherry. K. Jouck. Archiv Pharm., 1905, 243, 426.

THE bark of the wild cherry (*Prunus padus* L.) was found to contain about 0.5 per cent. of glucoside, which was to consist of an amorphous yellow substance, very scopic, easily soluble in water and alcohol, but insoluble in ether, light petroleum and ethyl acetate. It melted at 60°–70° and smells of benzaldehyde at 130° C. Analysis shows the formula to be  $C_{45}H_{68}N_2O_{23}$ , or  $C_{45}H_{68}N_2O_{22}$ ; it yielded 6.05 per cent. of hydrocyanic acid and 10 per cent. of dextrose. A barium salt  $C_{28}H_{46}O_{14}Ba$  was prepared. The leaves of the laurel (*Prunus laurocerasus* L.) yielded 0.8 per cent. of a yellowish, amorphous glucoside, which deliquesces and turned brown in the air. It is easily soluble in water and alcohol, insoluble in ether, light petroleum or ethyl acetate. It yielded 2.75 per cent. of hydrocyanic acid, and 2 per cent. of dextrose. By alkaline hydrolysis a crystalline barium salt was produced.—F. S.

Citral in Lemon Oil; [Determination of —] G. Romed. XXIII, page 988.

## ENGLISH PATENTS.

Pyrimidine; Manufacture of New Oxycyanamide Derivatives of —. F. Boehm, London. From E. Darmstadt, Germany. Eng. Pat. 16,996, Aug. 3

SEE Fr. Pat. 349,353 of 1904; this J., 1905, 689.—T

Cream of Tartar; Process for Producing —. Lake, London. From The California Product New York. Eng. Pat. 1503, Jan. 25, 1905.

SEE U.S. Pat. 783,524 of 1905; this J., 1905, 290.—T

Salicylic Acid Methylene Acetate; Manufacture of —. F. W. S. Valentiner, Leipzig-Plagwitz, Germany. Eng. Pat. 9114, May 1, 1905. Under Int. Conv. 16, 1901.

SEE Fr. Pat. 350,623 of 1905; this J., 1905, 750.—T

## UNITED STATES PATENTS.

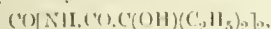
Urea; Process of Making —. H. Foersterling a Philipp, Perth Amboy, Assignors to The Bressler-Hasslacher Chemical Co., New York. U.S. Pat. 791, Aug. 8, 1905.

CYANAMIDE salts (such as disodium cyanamide) are added to excess of mineral acid (e.g., sulphuric acid) to form cyanamide, which is then converted into urea by heating its sulphuric acid solution.—T. F. B.



doxyacetylurea and Process of Making Same. E. C. empensen and A. H. C. Heitmann, Assignors to Parke, Davis and Co., Detroit. U.S. Pat. 797,792, Aug. 22, 1905.

yl derivatives of hydroxyacetic acid are condensed with urea to form alkylhydroxyacetylureas. Thus yldihydroxydiacetylurea,



produced by condensing a diethylhydroxyacetic with urea by means of an alkali alcoholate. It is uid of sp. gr. 1.1107, having a slightly ethereal ce; its b. pt. at 36 mm. is 186° C.; it is soluble in 20 of water, forms crystalline salts with alkalis, and sily soluble in organic solvents.—T. F. B.

ol Esters [Ethers]; Process of Making ——. F. arre, Assignor to E. I. Du Pont De Nemours Powder ., Wilmington. U.S. Pat. 797,024, Aug. 15, 1905.

cor. ethers are prepared by passing a halogen deriva- of the necessary hydrocarbon into an alcoholic solution i alkali phenolate. For instance, anisol is produced passing methyl chloride into sodium phenolate in iolic solution.—T. F. B.

#### FRENCH PATENTS.

phor; Synthetic Process of Preparing ——. A. hal, P. Magnier and C. Tissier. First Addition, ted May 16, 1904, to Fr. Pat. 349,886, May 5, 1904.

conducting the reaction described in the original it (this J., 1905, 857) in an autoclave, heated to about C., it is possible to reduce by half the quantity of acetate used. Much of the acetic acid may be removed the distilled solution (*loc. cit.*) by cooling to 0° C., it crystallises out. The camphene in acetic acid ion is found to be converted into bornyl and isobornyl tes by adding a small quantity of sulphuric acid, mixture of borneols obtained by saponifying the mixed tes is conveniently purified by passing steam through hich removes the oily impurities, but very little of orneols. The camphene may be easily and advantage- oxidised to camphor by means of potassium perman- te in acetone solution, or in presence of ethyl acetate. borneol mixture may be oxidised by the same process, etone being distilled off after the reaction, and steam d through the residue.—T. F. B.

phor from Isoborneol; Process of Preparing ——. F. Boehringer and Soehne. Fr. Pat. 352,888, March 31, 05. Under Int. Conv., May 20, 1904.

Eng. Pat. 28,035 of 1904; this J., 1905, 249.—T. F. B.

phor from Borneol and Isoborneol; Process of Pre- ring ——. Chem. Fabr. auf Actien, vorm. E. hering. Fr. Pat. 353,065, April 5, 1905. Under Int. uv., April 27, 1904.

Eng. Pat. 8297 of 1905; this J., 1905, 857.—T. F. B.

tolylsemicarbazide; Process for the Preparation of —. Soc. Anon. Prod. F. Bayer et Cie. Fr. Pat. 9,968, June 6, 1904.

U.S. Pat. 765,164 of 1904; this J., 1904, 950.—T. F. B.

thin; Process of Producing a Halogen Derivative ——. Act.-Ges. f. Anilinfabr., Fr. Pat. 349,985, ue 13, 1904.

Ger. Pat. 156,110 of 1903; this J., 1905, 512.—T. F. B.

ols; Process for Preparing Addition Products of —, d the Separation of Phenols from Phenol Mixtures heir Aid. Farbenfabr. vorm. F. Bayer und Co. Pat. 350,023, June 28, 1904.

Eng. Pat. 9953 of 1904; this J., 1905, 345.—T. F. B.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Emulsions; Silver Phosphate. —. Valenta. Phot. Kerr. Through Phot. Mitt., 1905, 42, 250—251.

SATISFACTORY silver phosphate emulsions are obtainable by adding ammoniacal silver nitrate solution to 1500 c.c. of 3 per cent. collodion, to which is added a solution of 20 c.c. of 20 per cent. phosphoric acid and 60 grms. of citric acid in 100 c.c. of alcohol. The ammoniacal silver nitrate solution is obtained by adding sufficient "880" ammonia to 60 grms. of silver nitrate to obtain a clear solution, and then adding 250 c.c. of absolute alcohol. 250 c.c. of ether are added to the emulsion, which is then filtered.

—T. F. B.

Bichromate [Sensitising] Mixtures; Increase in Sensitive- ness of — by the Addition of Different Dyestuffs. H. Calmels and L. P. Clerc. Monit. de la Phot. Through Phot. J., 1905, 45, 309—311.

THE increase in sensitiveness of bichromated gelatin and albumin mixtures (such as are used for ornamenting metal plates) is not proportional to the quantity of dye- stuff added (in the case of Erythrosin and Eosin), but attains a maximum; e.g., in the case of Erythrosin and a "gelatin enamel" mixture, the maximum is reached with 2 grms. of Erythrosin per litre of enamel solution (one part to 30 parts of ammonium bichromate). Beyond this maxi- mum, the sensitiveness rapidly decreases. Gradation is found to be better rendered as the sensitiveness is increased. No other dyestuffs were found to be of such value as the two above mentioned; Acridine Orange, and the Ethy. and Methyl Violets were found to have no useful action!

—T. F. B.

Development; Physical ——. of "Printing Out" Papers. Schmidt. Phot. Kunst. Through Brit. J. Phot., 1905, 52, 646—648.

NUMEROUS details are given of the results obtained by the "physical" development of "printing-out" papers with pyrogallol, quinol and Metol; a variety of tones is stated to be produced by the addition to the developer of various organic acids, phosphoric acid, potassium bichromate, acetone, copper salts, &c.—T. F. B.

Intensification with Chromium and Iodine. C. W. Piper and D. J. Carnegie. Phot. J., 1905, 45, 306—307.

THE intensification produced in a negative by bleaching with bichromate and hydrochloric acid and redevelopment is found to be due to a compound probably identical with chromium tetroxide, produced by the reduction of the chlorochromate by the metallic silver. The bleaching solution recommended consists of potassium bichromate, 10 grs.; hydrochloric acid (sp. gr. 1.16), 5 minims; water, 1 oz.; this is less strongly acid than that recommended by Eder, and gives greater intensification. If a large excess of acid is used, chlorine is generated, and re-exposure is necessary before development; otherwise the silver chloride produced develops readily without exposure. Amidol with sodium sulphite is recommended for redevelopment, as the process may then be safely and advantageously repeated.

Intensification with iodine is useful in cases where the negative is not excessively "thin"; the negative is bleached in a solution of potassium iodide,  $7\frac{1}{2}$  grs.; iodine, 15 grs.; water, 2 oz.; rinsed and immersed for a short time in a quinol-soda developer; the plate is then exposed, on both sides, to the light of burning magnesium, and again immersed in the developer, when intensification results; it is found to be due to enlargement of the grains; the image contains considerable quantities of unreduced silver iodide, 25 to 40 per cent. of the total silver being present as iodide.—T. F. B.

Sodium Hydrosulphite; Alteration and Preservation of Anhydrous — in Powder, and in Aqueous Solution. Lumiere and Seyewetz. VII., page 965.

## ENGLISH PATENT.

*Transfer Paper; Photographic Carbon* —. C. L. A. Brasseur, New York. Eng. Pat. 21,208, Oct. 3, 1904.

SEE U.S. Pat. 778,917 of 1905; this J., 1905, 152.—T.F.B.

## UNITED STATES PATENTS.

*Photographic [Cascin] Emulsions; Process of Producing* —. F. Römpler, Vienna, Assignor to Protalbinwerke Act.-Ges., Dresden, Germany. U.S. Pat. 797,458, Aug. 15, 1905.

SEE Fr. Pat. 343,263 of 1904; this J., 1904, 1044.—T.F.B.

*Designs, Pictures, Letterpress and the like; Process for Reproducing* —. W. Ostwald, Leipzig, Germany. U.S. Pat. 798,528, Aug. 29, 1905.

SEE Eng. Pat. 22,841 of 1901; this J., 1903, 380.—T. F. B.

## FRENCH PATENT.

*Photographs; Process for Producing Pigment, Monochrome, or Polychrome, or Natural Colour* —, and *Plastic Printing Plates, by means of a Silver Salt or similar Emulsion*. J. Mészáros. Fr. Pat. 352,815, March 30, 1905.

A PHOTOGRAPHIC negative, obtained in the ordinary manner, is immersed for from three to five minutes in a solution of an alkali bichromate, and is then transferred to a bath which will dissolve out the silver, and, at the same time, permit the precipitation of silver chromate on the gelatin; a 2 or 3 per cent. solution of nitric acid is stated to serve this purpose. The negative is now immersed in hot water, and the chromate removed from it by any suitable method, e.g., by means of nitric acid, whereby a gelatin relief negative results; this may be coloured with a pigment, and the resulting plate used for printing purposes, or it may be employed in the usual manner for the preparation of positive photographs. Plates, films, and papers containing the necessary pigment (which is insoluble in the various reagents used) are also claimed.

—T. F. B.

## XXII.—EXPLOSIVES, MATCHES, Etc.

*Explosion of Fireworks; Circumstances attending an* —, which occurred at the *Factory of Messrs. John Jennison and Co., at Belle Vue, near Manchester, in the County of Lancaster, on July 9, 1905*. By Major A. Cooper-Key, H.M. Inspector of Explosives.

WHILE workmen were engaged with copper funnel and drift in stemming fireworks composition into earlboard cylinders to form "lances," one of these burst into flames, and 30 lb. of explosive in the building were also involved. The composition in question consisted of potassium chlorate, copper oxychloride, rosin, potassium nitrate, and arsenic sulphide. This composition is extremely sensitive to percussion and friction, and it is considered that a blow between the two copper implements used might well suffice to raise a thin film of powder to the ignition point, although having regard to the rareness of such accidents, it is, perhaps, more probable that a particle of grit was present. Experiments showed that the composition in question will fire when rubbed between two wooden surfaces even when the ingredients are of the best quality, and it is considered desirable that the smallest possible quantity of explosive should be present in any building in which the somewhat rough and ready operation of filling "lances" is in progress. Attention is drawn to the value of unflammable clothing, and also the provision of adequate means of escape from danger buildings, and a suggestion is made that the sleeves of the working dress should not be turned up in a danger building.—G. W. McD.

*Explosives in Coal Mines Order; Aug. 4, 1905* —. A. Akers-Douglas, one of H.M. Principal Secretaries of State.

THE following have been added to the list of "Permitted Explosives":—

*Kynite Condensed*:—Consisting of nitroglycerin (24—26

parts), wood meal dried at 100° C. (2.5—3.5 parts), starch dried at 100° C. (32.5—35.0 parts), barium nitrate (31.34.5 parts), calcium carbonate (0.0—0.5 part) and moisture (3.0—6.0 parts). The explosive shall be only when contained in a non-waterproof wrapper parchment paper, and with an electric detonator of less strength than No. 6.

*Recipe*:—Consisting of nitroglycerin (6.5—8.5 parts), ammonium nitrate (64—68 parts), sodium nitrate (16 parts), trinitrotoluene (6.5—8.5 parts), wood dried at 100° C. (3—5 parts) and moisture (0.5—1.5 parts).

The explosive shall only be used when contained in stout paper case thoroughly waterproofed with cement and resin, and with an electric detonator of not less strength than No. 6.

*Withnell Powder*:—Consisting of ammonium nitrate (88—92 parts), trinitrotoluene (4—6 parts), flour (4 at 100° C. (4—6 parts) and moisture (0.0—1.5 parts). The explosive is to be used only when contained in a stout paper case thoroughly waterproofed with a mixture of carnauba and paraffin waxes, and with an electric detonator of not less strength than No. 7.—G. W. McD.

## ENGLISH PATENTS.

*Explosive Compositions; Manufacture of* —. H. E. London. Eng. Pat. 17,880, Aug. 17, 1904.

SEE Fr. Pat. 346,135 of 1904; this J., 1905, 105.—T.F.B.

*Cordite; Manufacture of* —. L. Le Brocqy, Du. Eng. Pat. 18,269, Aug. 23, 1904.

CLAIM is made for the employment, in the manufacture of cordite, of a pure or refined hydrocarbon oil or such as "white mineral jelly" or *paraffinum liquidum* with or without the addition of paraffin wax or cement or both, in place of the "semi-crude mineral jelly" usually employed. The deterioration which cordite suffers exposure to heat and light or by mere storage for a long time is stated to be due to the fact that the "semi-crude mineral jelly" employed in its manufacture becomes partially nitrated owing to its content of olefines and naphthenes.—A. S.

*Nitroglycerin; Manufacture of* —. A. Mikolajewski, Castrop, Germany. Eng. Pat. 27,706, Dec. 19, 1904.

SEE Fr. Pat. 349,078 of 1904; this J., 1905, 636.—T.F.B.

*Explosives [Chlorate]; Manufacture of* —. L. The Paris. Eng. Pat. 8746, April 25, 1905. Under Conv., Dec. 12, 1904.

A GRANULAR explosive is produced by incorporating potassium chlorate (75 parts), with molten dinitrotoluene (25 parts), allowing the mass to cool and sifting to required size of grain. To produce a plastic explosive nitrocellulose (2 parts), is gelatinised with melted dinitrotoluene (25 parts), and potassium chlorate (75 parts) is then added. The use of perchlorates is also claimed.—G. W. McD.

## UNITED STATES PATENTS.

*Explosive Composition*. N. Ceipek, Vienna. U.S. Pat. 797,493, Aug. 15, 1905.

SEE Eng. Pat. 14,480 of 1904; this J., 1905, 456.—T.F.B.

*Blasting Compound*. G. Dittmar, Washington. U.S. Pat. 798,398, Aug. 29, 1905.

SEE Eng. Pat. 29,056 of 1904; this J., 1905, 250.—T.F.B.

*Dinitroglycerin and Process of Making the same*. Mikolajewski, Castrop, Germany. U.S. Pat. 798,493, Aug. 29, 1905.

SEE Fr. Pat. 349,078 of 1904; this J., 1905, 636.—T.F.B.

## FRENCH PATENTS.

*Dinitroglycerin; Method of Manufacture of* —. Dynamit-Act.-Ges. vormalig Alfred Nobel and Co. Fr. Pat. 352,486, March 17, 1905.

SEE Eng. Pat. 28,808 of 1904; this J., 1905, 690.—G. W. McD.



*Explosive Materials and Propellant Compositions; Process of Manufacture of —.* Westfälisch Anhaltische Sprengstoff Agt.-Ges. Fr. Pat. 352,750, March 27, 1905.

hydrochloric acid gas be passed into glycerin, heated between 70 and 100° C., rapid absorption takes place with the formation of monochlorhydrin. If the oil be then distilled, *in vacuo*, the monochlorhydrin escapes over between 135°—160° C. By the action of the acid it is converted into dinitromonochlorhydrin, proposed to use this body in explosives, in place of glycerin, either wholly or in part. The compound can be manufactured without danger, and is more stable, less sensitive to shock than nitroglycerin. It does not freeze at low temperatures and has a strong gelatinising effect on nitrocellulose, &c. Increased safety in the manufacture of nitroglycerin is said to be obtained by adding to the glycerin before nitration a certain proportion of monochlorhydrin.—G. W. McD.

*Oil Heavier than Air; Process for the Recovery of —.* Obtained from very Volatile Liquids. C. and M. Librecht. Fr. Pat. 352,298, March 11, 1905. XIX, page 984.

# XXIII.—ANALYTICAL CHEMISTRY.

## APPARATUS, Etc

### UNITED STATES PATENTS.

*Oil Tester.* F. A. Courtois, Newark, N.J. Assignor to Fiske Bros. Refining Co., New York. U.S. Pat. 825,040, April 25, 1905.

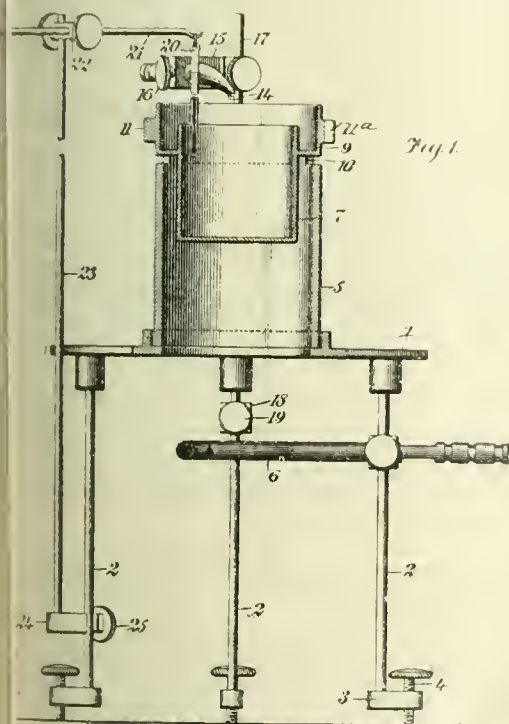
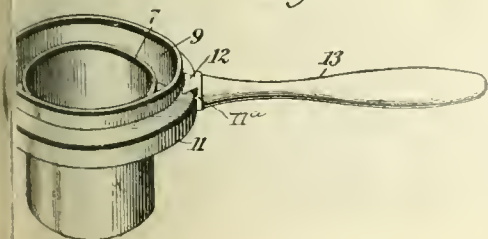
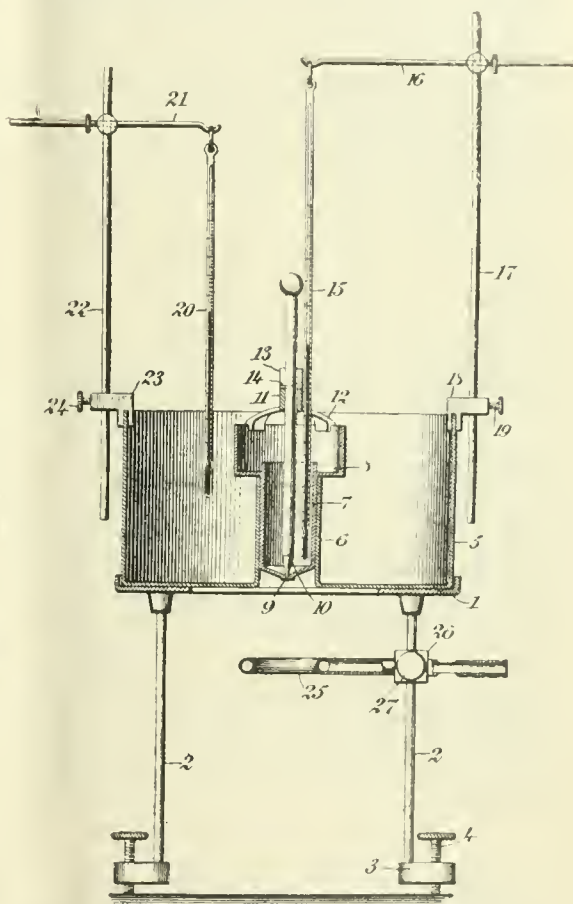


Fig. 1



THE annular stand 1 is mounted on legs provided with levelling screws. It supports a movable flue 5, which receives heat from a Bunsen burner, or the like, attached to a leg of the stand. The test cup 7 (see Fig. 1, and see also Fig. 2) rests on lugs 10 on the flue, and is fitted with an overflow trough 9 to receive any oil that overflows by expansion, whilst the open spaces between the lugs form draught ports for the heating flame. An outer ring 11 on the cup has a dove-tailed recess 11" to fit a lifting handle (see Fig. 2). The test flame device consists of a gas-burner tip 14 mounted so as to project just above the top of the cup, by means of a block 15, which slides up and down a vertical rod 17 attached to one of the legs of the stand, the whole being arranged so that the test flame passes in a nearly horizontal direction over the surface of the oil in the cup. The temperature of the oil is measured by a thermometer 20, suspended from an adjustable rod mounted on a leg of the stand; and the rate of heating is controlled by adjusting the height of the main burner on its support.—C. S.

*Viscosimeter.* F. A. Courtois, Newark, N.J. Assignor to Fiske Bros. Refining Co., New York. U.S. Pat. 788,251, April 25, 1905.



THE main features of the invention are:—An oil bath 5, with a vertical central tube 6 open at the bottom; a testing cup 7 inserted into the tube 6, and provided at the upper end with an overflow trough 8, whilst the lower end contains an outflow orifice 9, which is normally closed by a needle-valve 10; a spider 12 loosely seated on the upper edge of the trough 8 and carrying a sleeve 11 which guides the stem of the needle-valve and is slotted to receive a pin 14 on the said stem when the latter is in position for closing the outlet orifice, the pin being rested on the upper edge of the sleeve when the orifice is to be kept open; thermometers 15 and 20 dipping into

the test cup and oil bath respectively and suspended from adjustable supports mounted on the edge of the bath; also an annular stand, mounted on legs, fitted with levelling screws and supporting a heating burner.—C. S.

### INORGANIC—QUANTITATIVE.

**Ferrous Iron; Titration of —, with Permanganate, in Presence of Hydrochloric Acid.** G. P. Baxter and H. L. Frevert. *Amer. Chem. J.*, 1905, **34**, 109–117.

Ferrous chloride solution was prepared containing enough hydrochloric acid for the conversion of the ferrous to ferric salt, and quantities of this containing 0.25 grm. of  $\text{FeCl}_2$ , diluted to 150 c.c., were titrated with potassium permanganate. Excess of permanganate over the theoretical amount was always necessary, but the excess lessened with rise of temperature from 1.0 per cent. at 30° to 0.3 per cent. at 80°–85° C. At the latter temperature, dilution (between the limits of 50 and 300 c.c.) had no influence. Addition of hydrochloric acid, up to 40 c.c. of acid of sp. gr. 1.05, was almost without influence, but tended to lessen the excess of permanganate needed. Addition of 0.5 grm. of manganous chloride was insufficient to eliminate the error save at 95°–97° C., but 1 grm. of the salt, or 0.5 grm. of manganous sulphate, made the titration accurate at all temperatures. The error appears to be due to the formation, not of chlorine, but of hypochlorous acid; and the effect of the manganous salt is due to its reaction with the permanganate, and the formation of tervalent or tetravalent manganese compounds, which react on the ferrous salt, these successive reactions occurring more rapidly than that of the permanganate upon hydrochloric acid. (See also this *J.*, 1905, 639.)

—J. T. D.

**Silicon in Steel; Rapid Process for the Determination of —.** H. Rubricius. *Stahl u. Eisen*, 1905, **25**, 1012–1013.

Five grms. of steel cuttings are dissolved in 40 c.c. of dilute (1:2) sulphuric acid warmed to 50°–60° C. in a beaker of 300–400 c.c. capacity. After the first violent evolution of gas has ceased, the walls of the beaker are rinsed with a very small quantity of water, and the beaker is heated over wire gauze until practically the whole of the water is expelled. Under these conditions, ferrous sulphate separates in the form of a voluminous mass, and the mixture can be boiled without any danger of spitting or bumping. If the cuttings have not completely dissolved, further successive additions of small quantities (not sufficient to dissolve the separated ferrous sulphate) of water (or of nitric acid) are made, and the mixture boiled after each addition. The residue of ferrous sulphate, &c., and sulphuric acid is cooled, diluted with 100 c.c. of water, a few c.c. of hydrochloric acid added, and the whole heated to boiling. The solution is then diluted to about 200 c.c., filtered, and the residue of carbon and silica washed with hot water, hot dilute hydrochloric acid, and again with hot water. The filter is then incinerated, the ash and residue ignited, and the pure silica weighed. It is stated that if the prescribed conditions be adhered to, the results obtained agree well with those obtained by other methods of determining silicon employed in metallurgical laboratories.—A. S.

### ORGANIC—QUANTITATIVE.

**Thiophen; Colorimetric Determination of —.** C. Schwalbe. *Chem.-Zeit.*, 1905, **29**, 895–896.

THE methods hitherto introduced for the quantitative estimation of thiophen in benzene being more or less unsatisfactory, the author has devised a colorimetric method based upon the isatin reaction. It is simple and rapid in execution, capable of detecting differences of 0.02 per cent. and perfectly trustworthy within the limits of 0.5 per cent. and 0.05 per cent., which are said to be the maximum and minimum proportions of thiophen found in commercial benzols. The requisite solutions are:—A number of test solutions of benzene containing the following percentages of thiophen:—0.5, 0.25, 0.1, 0.075, 0.05, 0.025, and 0.01. A solution of 0.5 grm. of isatin in 1000 grms. of pure concentrated sulphuric acid. Two

100 c.c. measures are each charged with 25 c.c. of is solution and 25 c.c. of pure concentrated sulphuric acid. To one of the measures 1 c.c. of one of the thiophen test solutions is added, and to the other 1 c.c. of the benzol to be examined. Both solutions are then shaken for minutes and the colours viewed on a white base.—D. J.

**Citral in Lemon Oil; [Determination of —].** G. Rochem. and Druggist, 1905, **77**, 408.

THE method proposed by the author for the determination of citral in lemon oil, or other mixtures containing it, is based upon the fact that if citral be absorbed by a solution of potassium sulphite or sodium bisulphite containing sufficient excess of the acid sulphite for the liquid to remain acid after the absorption, the acidity is diminished in the proportion of three mols. for each molecule of citral. The sulphite solution is prepared by dissolving 400 g. of crystallised sodium sulphite in one litre of water, adding a sufficient quantity of a saturated solution of sodium bisulphite to make 25 c.c. of the mixed solution capable of neutralising about 20 c.c. of N/2 caustic potash solution. The solution is then heated in a closed vessel on the water-bath for three hours, and its acidity determined. In making a determination, 5 grms. of lemon oil are neutralised, if necessary, by a drop or two of weak alkali, using rosolic acid as indicator, and are then heated with the sulphite solution in a closed vessel on the water-bath for 45 minutes, and the acidity of the solution determined. The percentage of citral is calculated by the

formula:  $P = \frac{D \times 5.066}{x}$ , where D is the decrease of acidity in c.c. of N/1 acid, and x the weight of lemon oil. Samples of lemon oil were found to contain 3.64, 4.48, and 3.80 per cent. respectively of citral.—A. S.

ERRATUM.—This *J.*, 1905, page 692, col. 2, line 24 bottom. For *green* read *yellow*.

### XXIV.—SCIENTIFIC & TECHNICAL NOTES.

**Liquids of High Specific Gravity; Use of Alkali Mercuric Iodides for —.** Duboin. *Comptes Rendus*, 1905, **141**, 385–388.

THE author prepared solutions of high specific gravity by dissolving the alkali iodide and the mercuric iodide separately in a small quantity of water, till no more substances were taken up. The liquid was washed slightly and filtered after standing for 24 hours. The densities at 26° C. and refractive indices for the sodium flame of the following solutions were determined: 1. Sodium mercuric iodide (Thoulet's liquid), sp. gr., 3.46;  $n_D = 1.730$ . Sodium mercuric iodide: sp. gr., 3.46;  $n_D = 1.797$ . Lithium mercuric iodide: sp. gr., 3.28;  $n_D = 1.797$ . Ammonium mercuric iodide: sp. gr., 2.98;  $n_D = 1.797$ . The sodium solution cannot be diluted with water without dissolving without decomposition in alcohol and other organic liquids. It causes filter paper to thicken and become gelatinous.—F. S.

**Solids; Flow of —.** A. von Obermayer, G. Tammen, N. Werigin and J. Lewkojew. *Beiblätter, Annalen der Physik*, Leipzig, 1905, **29**, 6. *Proc. Inst. Civil Engineers*, 1905, **160**, 65.

ICE, camphor, clay, paraffin wax, beeswax, and other materials all showed disc or scale structures after being subjected to a flow through a hole in a steel cylinder. The discharge formed conglomerating grains of about  $\frac{1}{16}$  in. diameter. For ice and paraffin wax, the efflux velocity was found to be nearly proportional to the cube of the pressure. The speeds of flow of potassium, sodium, lead, thallium, bismuth, cadmium, zinc and antimony at various pressures and at temperatures of from 212° to 350° C. (100°–180° C.) were in the order given. Zinc did not flow until a pressure of 30,000 lb. per sq. in. was applied, whilst antimony showed no movement under a pressure of 45,000 lb. per sq. in. and a temperature of 440° (249° C.). In general, the rate of flow of the metals doubled for an increase of temperature of 18° F. (1° C.). At 392° F. (200° C.) the rate of flow of lead was markedly reduced, whereas thallium showed a distinct softening at 356° F. (180° C.).—A. S.



## New Books.

**OTHER FOR LIBRARIES.** By E. W. HULME, J. GORDON PARKER, A. SEYMOUR-JONES, CYRIL DAVENPORT and J. WILLIAMSON. The Library Supply Co. Published for the Sound Leather Committee of the Library Association, Bridge House, 181, Queen Victoria Street, London, E.C. 1905. Price 1s. 6d. nett.

**1st Svo.** volume containing 54 pages of subject matter and an alphabetical index. The subject matter is divided into five chapters, and is the work of five authors. I. History of Smack Tanning in England, Degradation of Manufacture of Leather, and History of the Reform Movement (E. W. Hulme). II. Causes of Decay in Book-binding Leathers (J. Gordon Parker). III. Provenance, Characteristics and Values of Modern Bookbinding Leathers (A. Seymour-Jones). IV. Repairing and Binding Books for Public Libraries (Cyril Davenport). V. Classification for the Fittings of a Small Bindery (F. J. Hamson). The work is illustrated with six specimens of leathers.

**AR AND THE SUGAR CANE: AN ELEMENTARY TREATISE ON THE AGRICULTURE OF THE SUGAR CANE AND ON THE MANUFACTURE OF CANE SUGAR.** By NOEL DEERR. Norman Rodger, Altrincham, Manchester. 1905. Price 7s. 6d. nett.

Volume containing preface, bibliography, and 392 pages of subject matter, with an appendix of three pages and an addendum (one page), and the alphabetical index subjects. There are 130 illustrations and nine coloured plates. The subject matter is subdivided as follows:— I. The Cane. II. Range of Soils and Climate suited for Cane. III. Varieties of Sugar Cane. IV-VII. Its Cultivation, Irrigation, Manuring and Diseases and Insects. VIII. Transport. Harvesting and Unloading the Cane. IX. Extraction of Juice by Mills. X. Juicing Process. XI. Clarification or Defecation of Juice. XII. Carbonation Process. XIII-XV. Refinement of Juice; Its Evaporation to Syrup, and Concentration to Massecuite. XVI. Separation of Crystals from Massecuite. XVII. Crystallisation in Motion Process. XVIII. Molasses, and Geerlig's Theory, &c. XIX. Cane as Fuel. XX. Control of the Factory. XXI. Polariscopes. XXII. Determination of Glucose. XXIII. Analysis of Sugar-House Products. XXIV. Appendices in reference to the Sugar-House.

## Trade Report.

### I.—GENERAL.

**PATENTS ACT, 1902, AND THE PATENTS RULES, 1905: THE —.**

The memorial which Sir Lloyd Wise presented to the President of the Board of Trade in March last praying for certain amendments to be made in the new Patents Rules, together with the counter-memorial, signed by 76 interested patent agents, urging that the amendment would be harmful, has now received the consideration of the Board of Trade. The following is a copy of the letter communicating the decision:—

Board of Trade (Finance and General Department), 7, Whitehall-gardens, London, S.W., Aug. 14, 1905. Sir, I am directed by the Board of Trade to refer to your letter of April 1 last addressed to the President submitting a counter-memorial to the memorial presented by Sir W. Lloyd Wise urging a modification of the Patents Rules, 1905, and, in reply, to state for the information of your counter-memorialists that the Board of Trade have

consulted the law officers of the Crown in the matter, and have been advised by them that in their opinion there is no reason for making any alterations in the rules as they stand at present.

I am, Sir, your obedient servant,

WALTER J. HOWELL.

The following is the substance of the memorial referred to:—

As Rules 9 and 10 now stand, when the Comptroller determines that reference ought to be made in the applicant's specification to a prior specification or specifications by way of notice to the public, the form of reference must be as follows, and be inserted after the claims:—

"Reference has been directed, in pursuance of Section I, Sub-section 6, of the Patents Act, 1902, to the following specification of Letters Patent No. .... granted to ....."

Where the reference is inserted as the result of a provisional report under Rule 7, a statement to that effect must be added to the reference.

Such a reference will virtually make public the pith of the Examiners' Report, notwithstanding the enactment that Reports of Examiners shall not in any case be published or be open to public inspection (Sub-sec. 4 of Sec. 1 of 1902 Act, and Sub-sec. 5 of Sec. 9 of 1883 Act, as amended by 1888 Act). Moreover, although based upon mere opinion, which may be erroneous, it will usually render a patent commercially worthless. This is a very serious matter, seeing that, in the past, large manufacturing concerns, which have rendered public service by introducing articles of great utility not previously on the market, besides giving employment to many thousands of workmen and others, have accomplished these beneficial results under patents for inventions as to the novelty of which (in the patentable sense) expert and even judicial opinions have differed.

We, therefore, hope that it will be found possible to forthwith so modify the Rules as to obviate the unnecessary risk they at present involve of seriously retarding the introduction of improvements which, though individually of a minor character, do, in the aggregate (to quote the Select Committee of 1872), contribute greatly to the progress of industry. To this end, we venture to suggest revision in the sense that in no case shall either an official notification be endorsed upon, or a stereotyped form of reference be inserted in an applicant's specification, unless and until he shall have been notified of the Comptroller's determination, and shall have been afforded, and shall have failed to exercise, the option of himself inserting in his own specification a reference, by number, year and name (and not in a stereotyped form) to the prior specification (or specifications) reference to which the Comptroller shall have determined ought to be made in the applicant's specification by way of notice to the public.

We submit that the Act does not provide for Official insertion in, or endorsement upon an Applicant's specification of any notification; and, moreover, that, as the specification is addressed to the public, a reference in it to a prior specification or specifications, inserted by the applicant himself, would obviously constitute a notice thereof to, and would adequately protect the public, without necessarily injuring the applicant, as any official notification inevitably will.

Should it, however, be insisted that the modified procedure we recommend cannot be adopted as the law now stands, then regard being had to the importance of the interests involved, we trust His Majesty's Government will see fit to introduce a short Bill, in the coming session of Parliament, with a view of clearly legalising the proposed change in the Rules.

CAPE COLONY: TRADE OF —.

*Bd of Trade J.*, Sept. 7, 1905.

The value of certain goods imported into and exported from Cape Colony during the six months ended the 30th June, 1905, as compared with the corresponding period of the preceding year, are as follows:—

*Imports into Cape Colony.\**

Articles.	Six months ended 30th June.	
	1904	1905.
	£	£
Metals and metal manufactures (includes iron, lead, machinery, hardware, wire fencing, &c.)	1,391,000	1,009,000
Leather and leather manufactures (includes boots and shoes, and saddlery and harness)	403,000	482,000
Alcoholic beverages (includes wine, beer, and spirits)	194,000	182,000
Drugs and chemicals	134,000	130,000
Soap and candles	123,000	127,000
Oil, mineral	86,000	96,000
Coal, coke, and patent fuel	110,000	79,000
Arms and ammunition (includes dynamite and blasting compound and powder)	91,000	69,000
Earthen manufactures	56,000	52,000
Paints, varnish and turpentine	51,000	52,000
Cement	42,000	48,000
Oilman's stores (not edible)	33,000	38,000

\* Exclusive of imports of diamonds and gold from South African States outside the Colony:—7,618,000*l.* during the first six months of 1904, and 10,485,000*l.* during the same period of 1905.

*Exports from Cape Colony.*

Articles.	Six months ended 30th June.	
	1904.	1905.
	£	£
Gold (raw)	7,539,000	10,053,000
Diamonds	2,479,000	2,641,000
Copper ore	254,000	290,000
Hides and skins	210,000	256,000

## NATAL: TRADE OF —.

*Bd. of Trade J., Sept. 7, 1905.*

The following tables show the value of the import and export trade of Natal (by sea) in certain branches during

the six months ended 30th June, 1905, as compared with the corresponding period of 1904;—

*Imports.*

Articles.	Six months ended 30th June.	
	1904.	1905.
	£	£
Metals and manufactures of (includes agricultural implements, hardware, ironmongery, machinery, sewing machines, &c.)	709,000	724,000
Leather and manufactures (includes saddlery)	163,000	210,000
Beverages (includes ale, spirits, wine and aerated waters)	171,000	166,000
Oilman's stores (includes oils and paints)	117,000	101,000
Drugs and chemicals	85,000	75,000
Soap and candles	77,000	70,000
Glass and glassware	37,000	34,000
Cocoa, chocolate and confectionery	22,000	28,000
Arms and ammunition (includes blasting compounds)	22,000	26,000
Earthen, china and stoneware and marble	20,000	23,000
Floorcloth	21,000	23,000

*Exports (Colonial Produce).*

Articles.	Six months ended 30th June.	
	1904.	1905
	£	£
Coal (bunker and cargo)	189,000	234,000
Bark	58,000	56,000
Sugar	29,000	40,000
Hides and skins	10,000	16,000
Matches	3,000	7,000

## MEXICO; CUSTOMS TARIFF OF —.

*Bd. of Trade J., Sept. 7 and 14, 1905.*

The following is a further portion of the revised Customs Tariff for Mexico, which came into force on the 1st of (See this J., 1905, 908—9.):—

No.	Articles.	Unit.	Duty.
515	Aniline oils, natural or artificial alizarines, and anthracene	Kilo. gross	Pesos. 0 00
516	Acetates of alumina, ammoniac, lime, copper, chrome, iron, lead, and soda	Kilo. legal	0 00
517	Arsenious acid	Kilo. legal	0 05
518	Sulphuric acid	—	Free
519	Hydrochloric and sulphurous acids	100 kilos. gross	1 50
520	Acetic, boric, citric, chromic, nitric, oxalic, pyroligneous and tartaric acids	Kilo. legal	0 00
521	Liquid acids not specified	Kilo. legal	0 10
522	Acids in crystals and powder, not specified	Kilo. legal	0 20
523	Size for cloths, liquid soaps, alkaline sulpho-olcates and sulpho-ricinates	Kilo. gross	0 04
525	Alcohol or spirits of wine	Kilo. net	0 80
526	Amylic, methylic and methylated alcohol	Kilo. legal	0 10
528	Ammonia	Kilo. gross	0 01
530	White and coloured varnishes, blacking and japan, in paste or liquid	Kilo. legal	0 22
531	Bicarbonate of potash or of soda	Kilo. legal	0 09
534	Carbonate of potash and of soda	Kilo. gross	0 02
535	Carbide of calcium	Kilo. gross	0 04
536	Alkali cyanides	—	Free
537	Chloral	Kilo. legal	1 00
538	Chlorate of potash and of soda	Kilo. legal	0 07
539	Chloroform	Kilo. legal	1 00
540	Chloride or hypochlorite of lime, soda or potash, chloride of zinc, and protochloride of tin	Kilo. gross	0 01
543	Colours, in crystals or powder	Kilo. gross	0 08
544	Prepared colours	Kilo. gross	0 15
545	Cream of tartar	Kilo. legal	0 11
546	"Creoline" and all kinds of disinfectants not specified	Kilo. legal	0 03
547	Medicinal drugs and chemical or pharmaceutical products, not specified	Kilo. legal	1 00
550	Extracts of dye-woods	Kilo. gross	0 08
551	White and red phosphorus	Kilo. legal	0 35
552	Matches of all kinds	Kilo. legal	1 70
553	Hyposulphite of soda	—	Free
556	Photographic dry plates	Kilo. legal	0 40
557	Common or table salt	Kilo. gross	0 02
558	Salts and oxides of all substances, not specified	Kilo. legal	0 18
559	Saltpetre, or nitrate of potash, or of soda	—	Free
561	Caustic potash or soda	Kilo. gross	0 01
562	Sulphate of copper	—	Free
563	Sulphate of iron and ammonia	Kilo. gross	0 01
564	Sulphate of alumina, of magnesia, of potash and of soda	100 kilos. gross	4 50
565	Sulphite, bi-sulphite and tri-sulphite of lime, potash and soda	100 kilos. gross	1 50



No.	Articles.	Unit.	Duty.
67	Writing ink .....	Kilo. gross	0 12
69	Spirits in receptacles of earthenware or glass .....	Litre	0 75
70	Spirits in receptacles of wood .....	Litre	0 65
71	Mineral waters, natural or artificial .....	Kilo. legal	0 02
72	Beer, cider, or refreshing beverages in bottles .....	Kilo. net	0 25
73	Beer or cider in barrel .....	Kilo. gross	0 10
76	Vinegar in wooden receptacles .....	100 kilos. gross	5 50
77	Vinegar in glass receptacles .....	Kilo. net	0 11
82	Paper of all classes weighing up to 50 grammes per square metre .....	Kilo. legal	0 16
93	White paper containing more than 40 per cent. of mechanical wood pulp, and weighing more than 50 grammes, but not more than 150 grammes per square metre .....	100 kilos. legal	7 50
94	White paper, containing up to 40 per cent. of mechanical wood pulp, and weighing more than 50 grammes, but not more than 150 grammes per square metre .....	Kilo. legal	0 20
95	Paper of dyed pulp, and all kinds of paper not elsewhere mentioned, weighing more than 50 grammes, but not more than 150 grammes per square metre .....	Kilo. legal	0 29
96	Paper of the natural colour of the pulp, weighing more than 50 grammes, but not more than 150 grammes per square metre .....	Kilo. legal	0 09
97	Paper and cardboard of the natural colour of the pulp, weighing more than 150 grammes per square metre .....	Kilo. legal	0 06
98	White paper and cardboard, weighing more than 150 grammes per square metre ...	Kilo. legal	0 15
99	Paper and cardboard of dyed pulp, weighing more than 150 grammes per square metre ..	Kilo. legal	0 12
102	Dynamite, blasting powder, pyroxylin or gun-cotton and other explosives, not specified	100 kilos. gross	3 30
107	Lubricating oils .....	Kilo. gross	0 08
108	Soap, scented .....	Kilo. legal	1 00
109	Soap, unscented .....	Kilo. legal	0 25
110	Oilcloth of all kinds .....	Kilo. gross	0 33
111	Printing ink, black .....	—	Free

in accordance with Article 3 of the Decree promulgating the new tariff, no additional duties are to be levied on imports over and above the duties specified in the tariff, except the 1½ or 2 per cent. tax levied by the Customs on behalf of the municipalities under the general Customs regulations, and (where necessary) the loading and unloading dues provided by the Decree of the 1st July, 1898. Regulations and provisions of law in conflict with the present Decree are abrogated, including especially:—

The Decree of the 25th November, 1902, with reference to the method of calculating import duties;

Article 106 of the Law of the 25th April, 1893, and Article 4 of the Law of the 4th May, 1895, imposing duties on foreign alcoholic and fermented beverages.

Article 3 of the Decree of the 23rd February, 1897, imposing 50 per cent., the import duties on iron pipes for the installation of urban water supply.

The special exemptions accorded in favour of the sugar industry and to imports into the Quintana Roo Territory are, however, maintained.

#### VII.—ACIDS, ALKALIS, Etc.

##### PHOSPHATE DISCOVERY IN JAPAN.

*Bd. of Trade J., Sept. 7, 1905.*

The July report of the Yokohama Chamber of Commerce states that a rich phosphate deposit has been discovered at Hannoura, Nanao Bay, Noto Province, and a merchant of Osaka has obtained a concession covering 3,000,000 *tsubo*.\* The deposit extends under the sea, in a layer of 30 ft. The concessionaire intends to establish a factory at Nanao for manufacturing manure from the phosphorus.

#### XII.—FATS, FATTY OILS, Etc.

##### OIL SEEDS AND OIL CAKE: EXPORTS OF — FROM RUSSIA.

*Chem. Trade J., Sept. 9, 1905.*

The exports of oil cake from Odessa during the last three years were as follows:—

	1902.	1903.	1904.
	Tons.	Tons.	Tons.
United Kingdom .....	5,370	4,900	11,313
Belgium .....	7,510	3,930	7,005
Denmark .....	3,000	2,323	4,281
Germany .....	1,580	4,095	4,583
Netherlands .....	7,560	8,009	21,714
France .....	3,900	8,089	22,560
Other countries .....	1,530	702	209
Total .....	30,450	32,048	71,665

#### IA; ENFORCEMENT OF NEW "GENERAL" TARIFF DUTIES ON CERTAIN ARTICLES IN —.

*Bd. of Trade J., Aug. 31, 1905.*

Servian Royal *ukaz* has been issued putting into force the new Servian "General" Tariff duties on the articles enumerated in the following statement:—

Servian "General" Tariff No.	Articles.	Rate of Duty under the new "General" Tariff.
ex 69	Fish fat and fish oil, unrefined .....	Dinars.†
(a) & (b)	Skins of domestic animals, raw, dried, wet, salted, limed or not, with or without the hair	Free.
97	Wood and bark for tanning—	
	Quebracho and other wood and bark for tanning, in blocks or cut in pieces; algarovilla, bablach, gall nuts, dividivi, valonia, myrobalans, catechu, sumach, kino, and other materials for tanning not specially mentioned in the tariff .....	"
0 ex (2)	Gum arabic (excluding liquid gum arabic) and adraganth .....	"
100 (1)	Borax, crude, and boracic acid, crude .....	100 kilos. 10 00
ex 206	Bichromate of calcium .....	"
ex 207	Chrome-alum—	
ex 1	Crystallised .....	" 2 50
ex 2	Calcined and powdered .....	" 15 00
2 ex (4)	Sulphate of soda .....	" 0 50
4 ex (3)	Hydrochloric acid .....	" 1 00
4 ex (4)	Chronic acid .....	" 20 00
ex 225	Albumin —	
ex (2)	For technical purposes .....	" 35 00
ex 230	Barberry juice for tanning .....	Free
7 ex (2)	" " dyeing .....	100 kilos. 10 00

\* *Tsubo* = 3.9 square yards.

† Dinar = 9.6d.

The following comparative table shows the quantities of oil seeds exported in the last three years:—

	1902.	1903.	1904.
	Tons.	Tons.	Tons.
Linseed .....	4,022	2,902	217
Hemp seed .....	3,170	1,501	250
Ravison .....	—	14,150	7,504
Mustard seed .....	100	31	133
Colza .....	187	—	538
Other oil seeds .....	3,773	536	87
Total .....	11,252	19,120	8,729

#### XVI.—SUGAR, STARCH, GUM, Etc.

##### SUGAR PRODUCTION OF AUSTRIA-HUNGARY.

For. Off. Ann. Series, No. 3486.

There were 7,780,000 tons of beetroot worked in the sugar mills of Austria-Hungary during the campaign of 1903-04 as against 7,130,000 tons in 1902-03. The number of mills working in 1903-04 was 215, producing 1,159,221 tons of raw sugar, as against 216 mills producing 1,051,264 tons in 1902-03.

The number of mills working in Bohemia in 1903-04 was 127, which produced 562,528 tons of raw sugar from 3,620,000 tons of beetroot, as against the same number of mills producing 440,225 tons from 2,860,000 tons of beetroot for the preceding campaign of 1902-03.

The total export from Austria-Hungary was:—

	Quantity.	
	1902-03.	1903-04.
	Tons.	Tons.
Raw sugar .....	108,505	55,444
Refined sugar .....	639,509	474,132
Lquiv. in raw sugar .....	819,070	582,258

For the 1905-06 campaign there has been an increased area under sugar beet cultivation in Austria-Hungary on that of 1904-05 of about 12 per cent., and the outlook is favourable, pointing to a larger production of sugar than in previous years, and consequently the market price is falling in anticipation.

The percentage of sugar contained in the beet was:—

In—	1902-03.	1903-04.
	Per cent.	Per cent.
Bohemia .....	15.3	15.5
Austria .....	14.8	14.9

There were 236,652 tons of molasses produced in Austria-Hungary in 1903-04, of which 109,274 tons were produced in Bohemia. 172,553 tons were used in the distilleries, and the export was nil.

### Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

#### I.—PLANT, APPARATUS, AND MACHINERY.

- [A.] 17,815. Doulton and Hopkins. Furnaces. Sept. 4.  
 „ 17,844. Weiss. Method of producing solid hard pieces from pulverulent material of any origin.\* Sept. 4.

- [A.] 17,879. Brown and Brown. Separating organic materials melting at different temperatures apparatus therefor. Sept. 4.  
 „ 17,933. Soddy. Method of producing vacuum. Sept. 5.  
 „ 17,946. Clamond. Method and apparatus for separating mixed gases. [Fr. Appl., Sept. 2, 1904.]\* Sept. 5.  
 „ 18,130. Jürgens. Vacuum evaporating apparatus. Sept. 7.  
 „ 18,172. Unglaub. Method and apparatus for distilling and evaporating liquids in vacuum. Sept. 8.  
 „ 18,444. Johansson. Centrifugal liquid separator. Sept. 12.  
 „ 18,596. Reyscher. Drying apparatus. Sept. 16.  
 „ 18,719. Oxford. Apparatus for drying semi-liquids. Sept. 16.  
 [C.S.] 20,276 (1904). Aktiebolaget Separator. Centrifugal separators. Sept. 20.  
 „ 24,670 (1904). Imray (Meister, Lucius and Co.). Extraction of water or other liquid from mineral, vegetable and animal substances. Sept. 20.  
 „ 1769 (1905). Wilkinson. Means for and method of carrying out secret manufacturing processes by chemical treatment. Sept. 20.  
 „ 3015 (1905). Suzuki. Furnaces. Sept. 13.  
 „ 6876 (1905). Löffler and Weidle. Filters. Sept. 13.  
 „ 7599 (1905). Bach. Manufacture of refractory furnaces. Sept. 20.  
 „ 8984 (1905). Boulton (Goldman and Co.). Filtration. Sept. 13.  
 „ 10,277 (1905). Bonnicart (Chapelle). Apparatus for filtering liquids. Sept. 20.  
 „ 12,533 (1905). Barthelmeß. See under II.

#### II.—FUEL, GAS, AND LIGHT.

- [A.] 17,871. Lake (Gasglühlicht-Ges. Hameln). Incandescence bodies for incandescent gas lamps.\* Sept. 4.  
 „ 17,967. Gardam. Gas producers. Sept. 5.  
 „ 18,004. Kennedy. Making producer gas and apparatus therefor. Sept. 6.  
 „ 18,174. Ziegler. Kiln for the gasification of peat.\* Sept. 8.  
 „ 18,403. Siemens and Halske Akt.-Ges. Incandescence bodies of tantalum wire for electric lamps. [Ger. Appl., Oct. 13, 1904.]\* Sept. 13.  
 [C.S.] 24,400 (1904). Sutton and Rudd. Incandescence gas mantle. Sept. 20.  
 „ 24,467 (1904). Kirkham, Hulett and Chubb Ltd., and Hersey. Apparatus for washing and scrubbing gas. Sept. 20.  
 „ 24,489 (1904). Albano and Boswell. Means for vaporising heavy hydrocarbons. Sept. 13.  
 „ 24,787 (1904). Spencer. Regenerative furnace for gas retorts and the like. Sept. 20.  
 „ 563 (1905). Smyth. Plant for manufacturing acetylene. Sept. 20.  
 „ 1307 (1905). Daniels, and Daniels, Ltd. Gas producers. Sept. 20.  
 „ 1507 (1905). Lake (Cie. Gén. d'Electricité). Incandescence bodies for arc lamps. Sept. 20.  
 „ 1671 (1905). Kelly and Billington. Incandescence fuel. Sept. 13.  
 „ 3174 (1905). Vedy and Bilbie. Gas producer apparatus and method of working same. Sept. 20.  
 „ 7499 (1905). Thomas. Means for treating smoke for effecting its combustion. Sept. 20.  
 „ 9001 (1905). Van Vriesland. Incandescence mantle. Sept. 13.  
 „ 12,059 (1905). Moore and Livens. Gas producer. Sept. 13.  
 „ 12,533 (1905). Barthelmeß. Method of and apparatus for purifying blast furnace gases, dust, air, &c., and for dissolving gases and matters in liquids. Sept. 13.



- [1.] 13,533 (1905). Carpenter. *See under* XXIII.  
16,050 (1905). Davis. Apparatus for generating gas from gasolene. Sept. 20.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [.] 17,945. Boulton (Standard Oil Co.). *See under* XII.  
18,174. Ziegler. *See under* II.  
[.] 23,984 (1904). Brunck. Extraction of ammonia from distillation gases. Sept. 13.

### I.—COLOURING MATTERS AND DYESTUFFS.

- [.] 18,196. Newton (Bayer und Co.). Manufacture of anthracene dyestuffs. Sept. 8.  
[.] 24,669 (1904). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of 1,6- or 1,7-arylnaphthylamine sulphonic acid. Sept. 20.  
25,889 (1904). Johnson (Badische Anilin und Soda Fabrik). Reduction of indigo and similar colouring matters. Sept. 13.  
26,457. (1904). Newton (Bayer und Co.). *See under* XIII.  
1368 (1905). Shillito (Geigy). Production of blue-black colouring matters. Sept. 20.

### V.—PREPARING, BLEACHING, DYEING, DYEING AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [.] 17,915. Clegg. Method for printing certain effects on cotton. Sept. 5.  
17,960. Kelling. Machine for washing or dyeing carpets.\* Sept. 5.  
18,168. Hulme. Apparatus for printing calicoes and other woven fabrics. Sept. 8.  
18,436. Pryor (Soc. Anon. Soieries Nouvelles de Bruxelles). Apparatus for washing threads or yarns of artificial silk or other material in the wound state. Sept. 12.  
[.] 22,098 (1904). Davies. Production of ornamental patterns or effects on velvets, velveteens, &c. Sept. 20.  
25,296 (1904). Todtenhaupt. Preparation of artificial silk or hair. Sept. 20.  
6357 (1905). Linkmeyer. Devices for twisting and winding artificial threads. Sept. 20.  
7807 (1905). Delhotel. Apparatus for regaining the benzene employed for cleaning fabrics. Sept. 20.

### —COLOURING WOOD, PAPER, LEATHER, Etc.

- [.] 23,292 (1904). Lake (Chem.-Techn. Fabrik Dr. A. R. W. Brand und Co.). Colouring of stone. Sept. 20.  
16,316 (1905). Kornmann. Method of colouring wood. Sept. 13.

### VII.—ACIDS, ALKALIS, AND SALTS.

- [.] 17,886. Raschen, Wareing, and The United Alkali Co., Ltd. Treatment of gases obtained from arsenical sulphuric acid and other gas containing arsenious chloride and the obtainment of arsenious acid. Sept. 4.  
17,887. Raschen, Conroy, Wareing, and The United Alkali Co., Ltd. Treatment of arsenious chloride for the obtainment of arsenious acid. Sept. 4.  
18,141. Duke and Hubbard. Catalytic substance. Sept. 7.  
[.] 23,036 (1904). Spence, and Spence and Sons, Ltd. Manufacture of aluminous compounds. Sept. 20.  
23,984 (1904). Brunck. *See under* III.

- [C.S.] 3820 (1905). Johnson (Foersterling und Philipp). Treatment of alkali peroxides for use in the obtainment of oxygen gas. Sept. 13.  
" 6139 (1905). Wultze. Process for manufacturing lead carbonates. Sept. 20.  
" 7616 (1905). Cornillaux. Extraction and purification of sulphur. Sept. 13.

### VIII.—GLASS, POTTERY, AND ENAMELS.

- [A.] 17,890. Seaboldt. Process of treating siloxicon. [U.S. Appl., Jan. 6, 1905.]\* Sept. 4.

### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.]\* 17,847. Peters. Manufacture of Portland cement. Sept. 4.  
" 18,722. Alexander and Wallis. Manufacture of bricks, tiles, and such like, from sand, slag, destructor clinker, &c., mixed with lime. Sept. 16.  
" 18,725. Payne. Manufacture of silica fire bricks, crucibles, retorts, and the like. Sept. 16.  
[C.S.] 22,169 (1904). Perkin, and Whipp Bros. and Tod, Ltd. Treatment of wood for rendering it fire-proof. Sept. 20.  
" 23,292 (1904). Lake (Chem.-Techn. Fabrik Dr. A. R. W. Brand und Co.). *See under* VI.  
" 2343 (1905). Heintzel and Cramer. Method of improving gypsum mortar and utilising dead burnt gypsum. Sept. 20.  
" 4693 (1905). Rogers. Method of applying pure mica as a covering for heat and cold. Sept. 20.

### X.—METALLURGY.

- [A.] 17,839. Blackmore and Howard. Treatment of pyritic ores containing gold, silver, or other valuable metals. Sept. 4.  
" 18,056. Steinbart and Vogel. Treatment of tin ores. Sept. 6.  
" 18,659. Abelspies. Ore dressing or concentrating tables. Sept. 15.  
[C.S.] 8808 (1905). Klepetko. Roasting furnaces. Sept. 20.  
" 13,350 (1905). Langer. Apparatus for obtaining nickel from nickel carbonyl. Sept. 13.  
" 13,613 (1905). Hobson. Silver alloys. Sept. 13.

### XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- [C.S.] 21,211 (1904). Kieseritzky. Method of regenerating negative accumulator plates of diminished capacity, or for avoiding the diminution in capacity of new plates. Sept. 13.  
" 25,265 (1904). Boulton (Accumulatoren und Electricitäts Werke A.-G., vorm. W. A. Boese und Co.). Manufacture of accumulator electrodes. Sept. 20.  
" 11,353 (1905). Luckow. Process of regenerating electric accumulators. Sept. 13.

### XII.—FATTY OILS, FATS, WAXES, AND SOAP.

- [A.] 17,945. Boulton (Standard Oil Co.). Manufacture of composite paraffin wax candles.\* Sept. 5.  
" 17,999. Heys. Detergents and the manufacture thereof.\* Sept. 6.  
" 18,667. Bernard. Apparatus for extracting by means of carbon tetrachloride fatty substances from products containing the latter. [Fr. Appl., Dec. 24, 1904.]\* Sept. 15.  
[C.S.] 24,023 (1904). Boardman. Manufacture of soap. Sept. 13.  
" 1635 (1905). Bloom. Oil or fat compounds for edible and other purposes. Sept. 20.  
" 10,326 (1905). Buchanan. Apparatus for heating and cooling linseed oil. Sept. 20.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

#### (A.)—PIGMENTS, PAINTS.

- [A.] 18,683. Milburn. Anti-corrosive paints or compounds. Sept. 15.  
 [C.S.] 26,457 (1904). Newton (Bayer und Co.). Manufacture of new colour lakes. Sept. 13.  
 .. 7750 (1905). Bell. Antifouling substances for ships. Sept. 13.

#### (B.)—RESINS, VARNISHES.

- [C.S.] 11,063 (1905). Menge. Driers for oils, paints, lacquers and the like. Sept. 13.

#### (C.)—INDIA-RUBBER.

- [C.S.] 21,899 (1904). Frost. Vulcanising apparatus. Sept. 20.  
 .. 24,691 (1904). Kite. Rubber vulcanising apparatus. Sept. 20.  
 .. 5965 (1905). Sine and Rosenthal. Material for the manufacture of rubber articles. Sept. 13.

### XIV.—TANNING. LEATHER, GLUE, SIZE, Etc.

- [A.] 14,328. Thomas. Manufacture of casein compounds for films, sheets, and coatings. Sept. 11.  
 .. 14,338. Bögel. Process of and apparatus for the uninterrupted extraction of tanning substances.\* Sept. 11.  
 .. 18,500. Smith. Apparatus for treating hides and leather. [U.S. Appl. Sept. 13, 1904.]\* Sept. 13.  
 [C.S.] 23,619 (1904). Nottelle and Leroux. Method of treating corneous substances. Sept. 13.  
 .. 2441 (1905). Hunter. Process of treating bone. Sept. 13.  
 .. 12,266 (1905). Trenckmann. Manufacture of parchment-like skin. Sept. 20.

### XVI.—SUGAR, STARCH, GUM, Etc.

- [A.] 18,138. Monti. *See under XVII.*  
 [C.S.] 21,865 (1904). Hatmaker. *See under XVIII.A.*

### XVII.—BREWING, WINES, SPIRITS, Etc.

- [A.] 18,138. Monti. Treatment of wine must, beer, beetroot juice and the like.\* Sept. 7.  
 .. 18,351. House. The process of brewing. Sept. 11.  
 .. 18,393. Nycander. *See under XVIII.A.*  
 .. 18,658. Edwards (Piandler Co.). Process for fermenting beer, ale, and other fermentable liquids, and apparatus used in carrying out said process.\* Sept. 15.  
 .. 18,748. Roche. Process of sterilising and preserving beers.\* Sept. 16.  
 [C.S.] 10,198 (1905). Worssam. Apparatus for heating or boiling brewers' wort or the like. Sept. 13.

### XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS

#### (A.)—FOODS.

- [A.] 18,393. Nycander. Production of distillers' yeast from the raw materials for, and products, by-products, and residues from the manufacture of tapioca, sago, arrow-root, flour and like materials. Sept. 12.  
 [C.S.] 21,865 (1904). Hatmaker. Process of obtaining milk sugar and casein from milk. Sept. 13.  
 .. 23,616 (1904). Fulda. Preserving animal food substances. Sept. 13.  
 .. 24,430 (1904). Mitchell. Obtaining proteids. Sept. 13.  
 .. 1655 (1905). Bloom. *See under XII.*  
 .. 13,861 (1905). Kronheim. Substitute for coffee. Sept. 13.

#### (B.)—SANITATION; WATER PURIFICATION.

- [C.S.] 23,640 (1904). Spence, Spence, and Spence Sons, Ltd., and Ockel. Treatment of sewage and other similar sludges. Sept. 20.  
 .. 23,747 (1904). Bolton and Mills. Apparatus the automatic treatment of sewage or of impure fluid. Sept. 13.

#### (C.)—DISINFECTANTS.

- [C.S.] 4455 (1905). Fournier. Effecting the deodorisation of places or materials which have been disinfected with formaldehyde, or the like. Sept. 13.

### XIX.—PAPER, PASTEBOARD, Etc.

- [C.S.] 24,083 (1904). Johnson (Badische Anilin & Soda Fabrik). Manufacture of acetyl cellulose. Sept. 13.

### XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 17,850. Livingstone (Stein). Compound for use as medicine. Sept. 4.  
 .. 18,582. Newton (Bayer und Co.). Manufacture of pyrimidine derivatives. Sept. 14.  
 .. 18,674. Mettler. Manufacture of aromatic alcohols. [Ger. Appl., Nov. 17, 1904.]\* Sept. 15.  
 [C.S.] 23,974 (1904). Abel (Act.-Ges. f. Anilinfabrik). Manufacture of *o*-oxybenzenecarboxylic ethers of the phenyl or naphthyl series. Sept. 13.  
 .. 3279 (1905). Thompson (Wenghöffer). Local anesthetic. Sept. 13.  
 .. 10,758 (1905). Béhal. Manufacture of camphor. Sept. 13.  
 .. 10,758A. (1905). Béhal. Manufacture of boron acetates. Sept. 13.  
 .. 10,758B. (1905). Béhal. Manufacture of camphor from bornyl acetates. Sept. 20.

### XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 18,513. Lederer. Process for making emulsions of mercury and other similar metals and apparatus therefor.\* Sept. 13.  
 [C.S.] 23,900 (1904). Bogaerts. Process for the reproduction of pictures. Sept. 20.  
 .. 26,456 (1904). Newton (Bayer und Co.). Pigment process and copying materials for use thereon. Sept. 13.  
 .. 10,372 (1905). Smith. Manufacture of films for photographic and other purposes. Sept. 13.

### XXII.—EXPLOSIVES, MATCHES, Etc.

- [A.] 18,275. Volpert. Processes of manufacture of mine-gas-proof safety explosives. [Ger. Appl. Sept. 10, 1904.]\* Sept. 9.  
 .. 18,692. Silberrad. Explosives. Sept. 15.  
 [C.S.] 23,366 (1904). King's Norton Metal Co., Ltd. Bayliss and Brownson. Materials employed in the manufacture of percussion caps, detonators, &c. Sept. 20.  
 .. 26,146 (1904). Curtis & Harvey, Ltd., and Higgins. Explosive compounds. Sept. 13.  
 .. 27,005 (1904). Wetter (Westfälisch-Anhänger Sprengstoff Act.-Ges.). Priming or detonator compositions suitable for percussion caps. Sept. 20.  
 .. 1416 (1905). Hesketh and Willcox. Manufacture of nitroglycerine, nitrocellulose and like explosives. Sept. 13.  
 .. 14,545 (1905). Imperiali. High explosives. Sept. 20.

### XXIII.—GENERAL ANALYTICAL CHEMISTRY.

- [C.S.] 13,553 (1905). Carpenter. Testing of gas. Sept. 13.



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### SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY. ROME. 1906.

The Sixth International Congress of Applied Chemistry will be held in Rome in April, 1906, during Easter week. All communications should be addressed to the President, Prof. E. Paternò, Via Panisperna, 89 Rome.

## Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

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## Sydney Section.

Meeting held at Sydney on Wednesday, May 10th,

PROF. A. LIVERSIDGE, F.R.S., IN THE CHAIR.

### THE MINERAL OIL FROM THE TORBANITE OF NEW SOUTH WALES.

JAMES M. PETRIE, D.Sc., F.I.C.

#### TORBANITE.

This organic mineral exists, as far as is known, only in three countries of the world, viz., at Torbanite Hill in Scotland, Autun in the centre of France, and in New South Wales. All occur in the carboniferous or permo-carboniferous epoch. The Scotch mines were completely worked out between 1850 and 1872. The Autun shale has been worked since 1839, and the New South Wales shale since 1865. Its discovery was first recorded in 1807 in Paris by the members of a scientific expedition who visited Australia in 1802.

In the formation of torbanite, four factors are noted—(1) Humic compounds constituting the dark fundamental matter, precipitated from solution by the inorganic substances in the water; (2) the gelatinous bodies of microscopic algæ, and their secretions; (3) spores and pollen grains, vegetable debris, and fossil ferns (the latter seldom occurring in the torbanite); no shells, bones, fish-scales or diatoms have been found; (4) dark brown bituminous matter derived through the mass, as a secondary and quite accidental infiltration.

*Relation of Torbanite to other Bituminous Minerals.* The special characteristic of torbanite is the presence of gelatinous algal bodies, which constitute 90 per cent of the total organic matter present; hence the ratio of volatile to fixed carbon in the mineral is high. In coal also contains algal cells in the humic precipitates, they are no longer the predominating matter in the



avid has identified the alga in West Maitland (New South Wales) cannel coal as *Reinschia australis*. Bituminous shale, the present oil-shale of Scotland, consists of the undamental humic matter only, with various amounts of the secondary bituminous infiltrations. It contains numerous spores and pollen grains, and has a large proportion of mineral matter present. This shale includes the humic coals of Bertrand. Coals are specially characterised by the great accumulations of plants, stems and leaves, &c., preserved in the humic precipitate; they contain also immense numbers of spores.

**Microscopic Structure of Torbanite.**—As far back as 1853 there are records, in the *Journal of the Microscopical Society*, of attempts to solve the problem of the origin of torbanite. In the thin sections prepared from it transparent yellow bodies were recognised, which were long considered to be vegetable cells—spores, pollen grains, &c. In 1889, David recognised in these yellow bodies an intimate resemblance to certain lowly forms of algae like *Volvocineae*—minute cœnobias inclosing many spores. Bertrand began in 1892 to make a complete microscopic study of the French torbanite, and in 1894 the New South Wales mineral also. His conclusions agree with those of David. Bertrand has named the alga the New South Wales torbanite *Reinschia australis*, and at of the Scotch and French torbanite *Pila*. I have succeeded in obtaining after great difficulty a number of thin microscopic sections of the torbanite, and have examined the presence of the algal cells. Drawings were made (800 diameters) showing complete cœnobias with numerous zoospores embedded in the gelatinous mass.

**Composition of New South Wales Torbanite.**—The following analysis of the richest Joadja Creek shale is given by W. A. Dixon:—C, 75.32; H, 12.05; O, 5.49; N, 0.28; S, 0.31; ash, 6.55 per cent. Pyrites is found in the shale and is probably the source of the sulphur. The ash has the following composition:— $\text{SiO}_2$ , 77.12;  $\text{Al}_2\text{O}_3$ , 20.14;  $\text{Fe}_2\text{O}_3$ , 0.76;  $\text{CaO}$ , 0.30;  $\text{MgO}$ , 0.45;  $\text{P}_2\text{O}_5$ , 0.65 per cent. Anhydrous oxide has been found in the ash of New South Wales shale by Mingaye (Record Geol. Survey, New South Wales, 1903) to the extent of 0.01 per cent., and also in the ash of Scotch shale as much as 0.12 per cent. has been shown to occur.

The ratio of volatile to fixed carbon in the richest torbanite of New South Wales is 16 to 1, and the ash 6 per cent., while in the torbanite of Scotland the ratio is 8 to 1, and the ash 20 per cent. The sp. gr. of the average New South Wales shale is 1.2, and of the richest shale 0.98.

Pure torbanite is distilled for oil in New South Wales. In France it is used together with bituminous shales. The New South Wales mineral is also exported to Europe for distillation with cannel oil to enrich the ordinary coal gas. The gas is largely used on the Australian railways for illuminating purposes, as it can be compressed into cylinders without the condensation of any of its constituents taking place.

**Natural Oil in Torbanite.**—In order to discover whether any natural oil was present, some of the richest shale was crushed and pulverised till it passed through a 60-mesh sieve. It was agitated with benzene for three months by means of a hot-air motor. The solution, when separated, presented a deep yellow colour by transmitted light, bright emerald-green by reflected light, and was highly fluorescent. The benzene was distilled off in a retort with a long rod-and-disc fractionating column, and, when reduced to a small volume, it was transferred to a test-tube and distilled to dryness. The following fractions were collected:—

B. pt., °C.	Vol.
79—85 .....	600 c.c.=80 per cent.
85—90 .....	35
90—100 .....	25
100—110 .....	60
110—115 .....	20
115—130 .....	10
130—150 .....	4
150—170 .....	0.5

Above 90° C. the fractions possessed a sharp acid sour, the last fraction was yellow, with an oily smell, and the residue above 170° was black and decomposed. It is evident that a molecular association takes place between

the oil and the benzene; the latter distils off between 80° and 150°, when the oil begins to decompose. Benzene, therefore, is an unsuitable solvent. The rest of the trials were done in the same way with pure dry ether as a solvent. The ethereal extract was separated, the residue washed till a colourless filtrate passed through, and the solution distilled. No odour of oil was perceived, and the whole of the ether distilled off within 1° of its b. pt.; 3.73 grms. of oil were obtained from 1100 grms. of shale, the maximum extraction being 0.3 per cent. This does not, however, represent the whole of the oil in the shale, since, on further treating with boiling ether the supernatant liquid was still deep yellow, and by grinding the shale still finer more oil was again obtained.

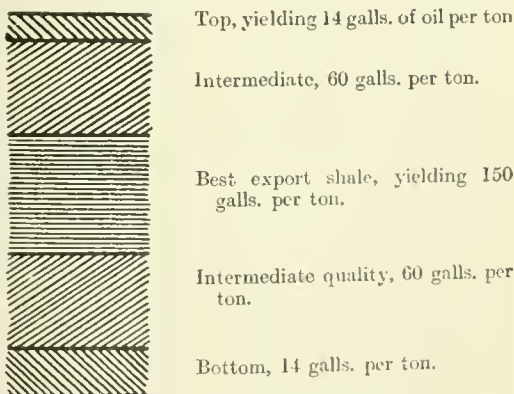
The natural oil has the consistency of vaseline; its colour is reddish-brown with a dark green fluorescence by reflected light; it has a very slight odour. When heated gradually it begins to volatilise at 160° C., and immediately blackens and decomposes. On cooling it sets to a tough, rubber-like, odourless solid with a dark brown colour. A comparative experiment with vaseline under the same conditions showed incipient volatilisation and decomposition to take place almost simultaneously at a temperature of 260°, and on cooling the residue very much resembled in appearance the residue from the oil.

The oil solidifies at 30° C.; its b. pt. is about 160°;  $d_{20}^{20}=0.9516$ ; ref. index at 20°, 1.5338. Concentrated sulphuric acid produces no blackening, and no smell, but after some time a faint dark brown colour is produced. The oil slowly chars when heated to the b. pt. of the acid. No additive compounds are formed on treatment with bromine; substitution derivatives are, however, formed, 100 grms. of the oil taking up 7 grms. of bromine. On analysis, the oil gave the following result: C, 85.27 per cent.; H, 11.62; undetermined, 3.11 per cent., probably S, N, and O.

The natural oil in torbanite, therefore, consists of saturated hydrocarbons of high b. pt., along with a small quantity of other compounds of high sp. gr. and ref. index, and easily forming bromine substitution derivatives.

#### COMMERCIAL TREATMENT.

The best quality of torbanite is exported for gas-making, only the inferior qualities being treated for the manufacture of oils, paraffin wax, and ammonia. The following is a diagram of a typical section of the Hartley seams:—



At the present time destructive distillation is carried on near Torbane only, beyond the Blue Mountains, about 130 miles from Sydney. The crude oil is conveyed by rail in tank waggons to the Hartley Vale refinery for further treatment. The crude oil is of a greenish-black colour, and solid (except in hot weather). It is treated first with sulphuric acid and then with caustic soda, giving a dark-green oil and much tar. On distilling the green oil four fractions are separated:—

Naphtha .....	3 per cent.	up to 0.790 sp. gr.
Solar oil .....	60 "	0.790—0.875 "
Heavy oil .....	17 "	0.875—0.920 "
Residue .....	20 "	above 0.920 "





termining the variation of the ratio of saturated to unsaturated hydrocarbons with the rise of boiling point. The properties of these distillates, after seven fractionations, are described and tabulated below:—

*Properties of the Naphtha Distillates—Fractions of 5°.*

Fraction.	Vol. after 7th distn. c.c.	Sp. gr. $\frac{12.5}{4}$	Refractive index.	Spec. refract. constant.	Bromine.		Ratio per cent.	
					Substitution Per cent.	Addition Per cent.	Olefines.	Paraffins, by diff.
30°—40°	5.5	0.6616	1.3879	0.35059	—	—	—	—
40°—50°	1.5	—	1.3894	—	—	—	—	—
50°—60°	4.0	0.6998*	1.3986	0.34535*	—	—	—	—
60°—65°	9.0	0.7039	1.4017	0.34570	3.3	93.0	09.3	30.7
65°—70°	18.5	0.7177	1.4093	0.34471	4.5	74.0	54.1	45.9
70°—75°	0.5	0.7584	1.4301	0.34158	9.5	59.5	41.2	58.8*
75°—80°	12.0	0.7737*	1.4345	0.33603*	9.2	66.4	45.1	54.9
80°—85°	8.5	0.7612	1.4272	0.33744	7.9	76.6	52.8	47.2
85°—90°	12.0	0.7382	1.4168	0.34053	8.2	60.2	64.1	35.9
90°—95°	31.0	0.7167	1.4078	0.34408	7.4	60.0	70.9	29.1
95°—100°	91.0	0.7296	1.4123	0.34126	7.0	60.7	51.0	49.0
100°—105°	62.0	0.7851*	1.4078	0.34410*	10.0	60.8	47.4	52.6*
105°—110°	26.0	0.7745	1.4345	0.33658	14.3	59.8	47.2	52.8
110°—115°	46.0	0.7732	1.4330	0.33612	14.7	67.4	53.4	46.6
115°—120°	185.0	0.7562	1.4272	0.33966	14.6	66.0	61.0	39.0
120°—125°	187.0	0.7471	1.4242	0.34168	15.0	61.2	57.3	42.7
125°—130°	170.0	0.7546	1.4272	0.34038	16.3	53.5	49.6	50.4
130°—135°	100.0	0.7683	1.4345	0.33929	18.2	32.2	47.6	52.4*
135°—140°	86.0	0.7743*	1.4374	0.33860*	18.0	55.2	49.9	50.1
140°—145°	164.0	0.7695	1.4345	0.33877	17.5	54.9	56.1	43.9
145°—150°	303.0	0.7655	1.4330	0.33950	15.2	62.2	53.7	46.3
150°—155°	191.0	0.7672	1.4345	0.33978	15.8	49.2	50.5	49.5
155°—160°	167.0	0.7785	1.4388	0.33773	17.6	46.6	47.1	52.9*
160°—165°	155.0	0.7866*	1.4432	0.33716*	19.9	46.5	51.7	48.3
165°—170°	275.0	0.7844	1.4417	0.33711	15.5	48.4	54.0	46.0
170°—175°	271.0	0.7876	1.4432	0.33711	16.9	43.5	48.3	51.7
175°—180°	181.0	0.7953	1.4460	0.33531	18.5	40.2	44.2	55.8*
180°—185°	104.0	0.7992*	1.4475	0.33465*	20.0	37.9	41.5	58.5*
185°—190°	189.0	0.7986	1.4459	0.33580	18.6	36.6	44.1	55.9
190°—195°	73.0	0.8036	1.4517	0.33552	19.6	32.2	38.6	61.4
195°—200°	34.0	0.8093*	1.4546	0.33499*	20.2	28.6	34.0	66.0

NOTE.—\* Maximum or minimum values.

*Properties of the Fractions.*—The distillates up to 140° colourless; from 140° upwards the colour gradually passes to straw-yellow at 200°. On boiling for a short time, a colourless oil quickly turns yellow, and after a number of hours, dark brown. The first three fractions, lying between 30° and 60°, have a very distinct garlic odour, which is absent in all the others. All are optically active, and give no absorption spectra.

In the tabulated results, regular periods are clearly visible. The paraffins (in last column) increase to No. 6, and decrease to a minimum in No. 10, and gradually rise to No. 12. In each period there is a recurrence of similar values, and these correspond to the theoretical boiling points of the paraffins. On referring to the tables of specific gravities and refractive constants the same facts of recurrence are noticed. These values are marked with asterisks in the table, and clearly indicate a coincidence of the fractions in the neighbourhood of the normal paraffins.

The observations of the angles of refraction were made with a "Fuess" refractometer with sodium light, and at the same temperatures at which the specific gravities were determined. The specific refractive constants were calculated by the Lorenz-Lorentz formula. For comparison the critical values of the corresponding paraffins and olefines are calculated and shown in the following table:—

Formula.	Paraffins.	Olefines.	Boiling Points.
			Degs.
$C_7H_{16}$	0.34884	—	38, (30)
$C_8H_{18}$	—	0.35317	39 (36, 31)
$C_9H_{20}$	0.34558	—	71 (64, 62, 58)
$C_{10}H_{22}$	—	0.34911	73 (69—71)
$C_{11}H_{24}$	0.34323	—	98.5 (91)
$C_{12}H_{26}$	—	0.34620	95 to 100
$C_{13}H_{28}$	0.34146	—	125.5 (118)
$C_{14}H_{30}$	—	0.34402	123
$C_{15}H_{32}$	0.34007	—	149.5
$C_{16}H_{34}$	—	0.34233	145 (153)
$C_{17}H_{36}$	0.33896	—	173 (162)
$C_{18}H_{38}$	—	0.34008	170 to 174
$C_{19}H_{40}$	0.33805	—	194.5
$C_{20}H_{42}$	—	0.33987	195

The figures in brackets are the boiling point of the isomeric forms.

The specific gravities of the fractions are all very much higher than those of the pure normal paraffins, as is seen

from the following table. This may partly be due to naphthenes in the oil:—

Boiling Points.	Specific Gravity.	
	Theory.	Found.
$C_7H_{16}$ 100°—105°	0.703	0.785
$C_8H_{18}$ 125°—130°	0.720	0.754
$C_9H_{20}$ 150°—155°	0.740	0.767
$C_{10}H_{22}$ 170°—175°	0.752	0.787
$C_{11}H_{24}$ 195°—200°	0.765	0.809

The bromine absorptions show an average of 56 per cent. of paraffins between 70° and 185° b. pt.; at 200° the amount is 66 per cent., and from this temperature upwards, the proportion of paraffins gradually increases through the solar oil, till in the heavy oil the olefines vanish entirely.

*Separation of Paraffins from Olefines in a Naphtha Fraction.*—100 c.c. of the fraction with b. pt. 145°—150° were treated with pure bromine in dim gaslight. The bromine was added in small quantities until a slight excess was present, the flask being well shaken and kept cool. The product was then distilled under a pressure of 100 mm., with the following result:—From 85° to 90°, 1 c.c.; from 90° to 110°, 57 c.c.; from 110° to 120°, 2 c.c., giving a total of 60 c.c. of paraffins. The residue in the still (olefine bromides) was black and nearly solid, the compounds being almost entirely decomposed. The colour of the distillate was at first pale yellow, it became dark blue on standing, but on shaking with potassium hydroxide the yellow colour returned. After washing with water the oil had a sweet ethereal odour.

When treated with concentrated sulphuric acid, a black tar separated; the process was repeated till the acid ceased to be discoloured. The colourless oil measured 55 c.c. Concentrated nitric acid removed a small quantity of tar, and when no further action took place fuming nitric acid was added, and more tar removed. A mixture of nitric and sulphuric acids produced a considerable amount of black tar with evolution of heat; the treatment

was repeated till no further blackening occurred, and the decomposition products removed by agitating with sulphuric acid. When all discoloration ceased the oil was washed with potassium hydroxide and water, and finally dried with calcium chloride and sodium. The naphthenes and all other compounds except paraffins are completely decomposed by the above treatment.

Thus from 100 c.c. there were removed by bromine 40 c.c., by sulphuric acid 5 c.c., by a mixture of nitric sulphuric acids 8 c.c., leaving as saturated hydrocarbons 47 c.c.

The same fraction, 145°—150°, gave the bromine addition figure 52.2 per cent. When this is calculated to nonene (b. pt. 145° C.), it represents 53.7 c.c. of olefines, and by difference 46.3 c.c. of paraffins, whereas 47 c.c. were actually found.

Since the acid treatment gives pure paraffins only, and

volume measured 231 c.c. Thus from 1000 c.c. of refined naphtha, 250 c.c. were separated with b. pt. above 200° C. 8 c.c. were removed with sodium hydroxide, 432 c.c. were removed with sulphuric acid, 79 c.c. were removed by nitric and sulphuric acid mixture, and 231 c.c. of pure paraffins were left.

The saturated hydrocarbons were distilled from an ordinary flask, the residue then remaining in the flask was black and solid on cooling. The sp. gr. of the distillate (20°/1°) was 0.7434. This distillate was then fractionated by four successive distillations. The results are given in the following table, and also the properties of each fraction. The asterisks mark the points of maximum volume, a minimum increments of specific gravity, and refractive index. All these points coincide with the theoretical boiling points and show the concentration of the distillates in the neighbourhood of the normal paraffins.

*Characteristics of the Paraffin Fractions.*

No.	Boiling point.	Volume after 4 distillations.			Sp.gr.	$\Delta d$	Refraction.				Vap. dens. and mol.	
		o.c.	Per cent.	$\frac{\Delta r\%}{\Delta t^\circ}$			Refractive index.	$\Delta n$	Spec. ref. constant.	Theoret.	Theoretical.	Fe
1	below 110°	2.25	0.82	0.013	—	—	1.4047	—	—	—	C <sub>8</sub> H <sub>18</sub>	V.D.
2	110—120°	4.0	1.46	0.146	—	—	1.4047	—	—	—	C <sub>8</sub> H <sub>18</sub>	57
3	120—129°	8.5	3.11	0.336*	0.7212	14*	1.4062	15*	0.34075	0.34146	C <sub>8</sub> H <sub>18</sub>	57
4	130—140°	8.0	2.92	0.292	0.7266	54	1.4093	31	0.34049	—	C <sub>9</sub> H <sub>20</sub>	64
5	140—147°	7.5	2.73	0.390	0.7321	55	1.4123	30	0.34009	—	C <sub>9</sub> H <sub>20</sub>	64
6	147—155°	35.0	12.82	1.602*	0.7346	25*	1.4138	15*	0.34002	0.34007	C <sub>9</sub> H <sub>20</sub>	64
7	155—165°	17.5	6.41	0.641	0.7308	62	1.4168	30	0.34011	—	C <sub>10</sub> H <sub>22</sub>	71
8	165—170°	14.0	5.12	1.024	0.7439	31	1.4183	30	0.33898	—	C <sub>10</sub> H <sub>22</sub>	—
9	170—175°	30.0	10.98	2.196*	0.7444	5*	1.4183	0*	0.33876	0.33896	C <sub>10</sub> H <sub>22</sub>	—
10	180—185°	12.0	4.39	0.878	—	(46)	—	(25)	—	—	C <sub>11</sub> H <sub>24</sub>	M.W.
11	185—190°	10.0	3.66	0.732	0.7537	(47)	1.4233	(25)	0.33807	—	C <sub>11</sub> H <sub>24</sub>	156
12	192°—198°	26.0	9.52	1.587*	0.7553	16*	1.4242	9*	0.33797	0.33805	C <sub>11</sub> H <sub>24</sub>	156
		174.75	63.94									

the bromine absorption result agrees so closely with it, the above method of calculation was used to obtain the ratios of paraffin to olefine in the whole series of distillates.

The above 47 c.c. of paraffin yielded, after two distillations, with a rod-and-disk column, the following result:—Below 149°, 3 c.c.; 149°—151°, 18 c.c.; 151°—157°, 6 c.c. The paraffin, boiling at 149°—151°, gave a dark brown colour with sulphuric acid, showing that a certain amount of decomposition had taken place during the distillation; it was agitated repeatedly with sulphuric acid till no further blackening was observed, then washed and dried as before. It then stood for two days exposed to a strong light, and, on testing with sulphuric acid, gave a dark coloration, proving that further decomposition had ensued. This was repeated a number of times, and after each time the acid was blackened.

After complete removal of the products of decomposition, and washing and drying over sodium, the oil was kept for two months in the dark, and on again testing with sulphuric acid, no change was observed. The physical properties of the product showed it to be nonane.

*Paraffins. Separation of the saturated hydrocarbons in the distillate up to b. pt. 200° C.*—1000 c.c. of refinery naphtha were distilled for the lighter portion boiling below 200° C.; the distillate measured 750 c.c. It was then agitated for six hours with a 25 per cent. solution of sodium hydroxide, and after settling, the alkaline tar was removed by means of a separating funnel. The oil left measured 742 c.c.; one litre of concentrated sulphuric acid was added to the residue in six separate quantities, agitated for three hours after each addition, and the acid tars run off after settling; the last acid was only slightly blackened. The volume of oil left was 310 c.c. 200 c.c. of a mixture of equal volumes of nitric and sulphuric acids were agitated with the oil, and kept cold; much tar was removed with the acids, and 260 c.c. of oil remained. The nitro-compounds and decomposition products were dissolved out by sulphuric acid till the latter remained clear; the residual oil was then neutralised with solid sodium hydroxide, washed with water till neutral, allowed to settle for two days and dried over calcium chloride and sodium. The final

*The Vapour Densities* were determined by Victor Meyer method. Only the first fraction gave a successful result the ordinary apparatus with glass boiling tube. Ethyl iodate boiling at 211° C. was used. With the higher boiling fractions, condensation took place at the end of the tube, causing the water in the trough to rush back. To overcome this difficulty a long copper cylinder with brazed bottom was made, and filled with paraffin wax. In this the Meyer tube was completely immersed up to delivery tube, and the whole apparatus surrounded by galvanised iron cylinder to shield it from draughts. The temperature of the paraffin bath was kept about 30° higher than the boiling point of the fraction. The fraction boiling above 170° could not be determined by this method and though every possible precaution was taken, water was drawn back every time, and cracked the tube.

The freezing point method with benzene, as the solvent was employed for the higher fractions. During freezing crystals separate in a very finely divided state only in small quantity, so that the alteration in contraction is very slight. This method gave the most satisfactory results.

*Nitro-paraffins.*—On treatment with a mixture of nitric and sulphuric acids, 100 c.c. of naphtha yielded 7 c.c. of paraffin, evolving much heat and nitric peroxide fumes. This low yield shows that by rapid oxidation the paraffins are attacked, forming nitro-paraffins which remain dissolved in the acid mixture. The 7 c.c. of oil was deep red in colour and possessed a sweet, pleasant odour, and in addition a peculiar buttery smell. The buttery odour is recognised in all the nitrated oils, and is removed by continuous washing with water or sodium hydroxide solution, although the washings possess it well.

The above product was shaken with a little sulphuric acid to remove most of the red colour; it then gave a deep red nitrolic acid reaction, characteristic of primary nitro-paraffins, and also an intense red colour with sodium hydroxide solution—a property which Worstall has shown to belong to the primary dinitro derivatives of hexane, heptane, and octane. Worstall has succeeded in converting a number of the normal paraffins completely



o nitro and oxidation products. In his experiments likewise noticed the "persistent butyric-like odour," mentioned above, and concludes that it is due to the nitro paraffins themselves, since he has obtained only oxidation products with nitric acid (succinic, oxalic, tartaric, and carbonic acids). The pure mononitro paraffins possess the sweet ester-like odour.

All the nitro paraffins are insoluble in water, and only slowly dissolved by a saturated solution of sodium hydroxide. They dissolve in concentrated sulphuric acid, being converted into the corresponding fatty acids and other products of decomposition. In order to dissolve the nitro compounds completely, it is therefore very necessary to treat with successive portions of concentrated sulphuric acid till the latter ceases to be discoloured, and then to wash with a saturated solution of sodium hydroxide many days.

### SOLAR OIL.

The solar oil obtained from the Hartley refinery, has an aqueous port-wine colour, and leaves a deep crimson stain on paper.  $d_{4}^{20} = 0.843$ ; refractive index, 1.4678.

**Distillation.**—1 litre of the oil was distilled at 100 mm. pressure through a four-bulb "pear" fractionating column, and a Liebig condenser, into a vacuum receiver of about 1 c.c. capacity. Each fraction could be drawn off from the receiver without destroying the vacuum or interrupting the distillation.

The freshly distilled fractions possessed a pale greenish-yellow colour. Nos. 1, 2, and 3 had a most pungent odour and quickly became opaque, while Nos. 4, 5, and 6 were colourless and remained clear.

After standing for a few days (in the dark) all the fractions had become dark red in colour, and a bright crimson deposit was observed in each. The first three fractions possessed no fluorescence, while the last three showed a dark blue fluorescence.

No. 1	deep red, opaque	no fluorescence.
2	deep red, nearly opaque	faint blue fluorescence.
3	deep red, clearer	dark blue fluorescence.
4	deep red, quite clear	light blue fluorescence.
5	light red, very clear	pale greenish-blue fluorescence.
6	dark brown, clear	light green fluorescence.
7	dark brown, clear	light green fluorescence.

All the distillates possessed a faint not unpleasant odour at first. On standing, Nos. 1 to 4 changed in appearance. A thick sediment, having an intense crimson colour, was noticed in the oil and round the stoppers, and a rank, unpleasant odour was developed.

Nos. 5, 6, and 7 remain unaltered, and possess very little odour.

The portion of the heavy oil boiling above 280° C. (760 mm.), and contained in fractions 5, 6, and 7, is quite different in properties from the rest. It has a light green fluorescence, remains transparent, and is almost odourless. The last column in the table shows it to consist almost entirely of paraffins, solidifying at the ordinary temperature.

An attempt was made to extract the solid paraffins by freezing the heavy oil at 15° C., and then subjecting it to pressure in linen cloth. The press was completely immersed in ice and salt for some hours and the pressure gradually increased.

The solid paraffin obtained from 600 c.c. of heavy oil was 38 grms. = 6.3 per cent. of the heavy oil. This is much below the true amount present, and is due to insufficient pressure.

One hundred c.c. of the heavy oil were treated with successive small portions of sulphuric acid until black tar ceased to separate. Sixty-five c.c. of saturated hydrocarbons were left. On shaking the residual oil with hot water, a thick creamy emulsion formed, which would not separate. Further addition of concentrated sulphuric

### Characteristics of the Solar Oil Fractions.

Boiling points.		Volume Per cent.	Setting point. °C.	Sp. gr. 12.5 °C.	Refractive index. 12.5 °C.	Br absorption.	
At 100 mm.	At 760 mm.					Substitution.	Addition.
1 to 100°	to 165°	4.2	—	0.7834	1.4403	Per cent.	Per cent.
2 100°—125°	165°—190°	14.3	—	0.8100	1.4532	11.6	44.2
3 125°—150°	190°—220°	10.0	—	0.8307	1.4644	14.5	34.6
4 150°—175°	220°—240°	21.3	—15	0.8446	1.4727	15.4	23.5
5 175°—200°	240°—255°	15.7	—5	0.8555	1.4795	15.3	21.1
6 200°—225°	255°—280°	10.2	+ 4	0.8636	1.4836	15.7	15.2
Residues		24.3					

### HEAVY OIL.

The heavy oil from the Hartley refinery has a dark reddish-brown colour, and leaves a deep crimson stain on paper.  $d_{4}^{20} = 0.8945$ ; refractive index, 1.4974; setting point, 0° C.

One litre was distilled under 100 mm. pressure, and fractionated twice with a "pear" still-head. The following results were obtained:—

Boiling points.		Volume Per cent.	Setting point.	Sp. gr.	Refractive index.	Br absorption.	
At 100 mm.	At 760 mm.					Substitution.	Addition.
1 110°—150°	below 190°	0.9	—	0.8597	1.4795	21.4	20.0
2 150°—175°	190°—215°	3.7	—20° C.	0.8708	1.4863	20.9	18.1
3 175°—200°	215°—235°	10.6	—16	0.8785	1.4930	21.4	11.6
4 200°—225°	235°—260°	25.0	0	0.8856	1.4956	19.5	6.4
5 225°—250°	260°—300°	12.7	+ 12	0.8810	1.4908	18.1	3.1
6 250°—275°	285°—310°	20.5	+ 12	0.8986	1.5026	18.3	0.8
7 275°—300°	310°—320°	9.0	+ 22	0.9248	1.5179	19.75	0.3

The colour of the distillates was pale brown when collected; but after standing some weeks in tightly-corked bottles in the dark, the following changes were observed:—

acid failed to give a clear oil, and even after 20 successive trials, the acid was discoloured and decomposed.

### AROMATIC COMPOUNDS.

**Benzenes.**—A quantity of the refinery naphtha was distilled, and the following fractions separated:—65° to 100° for benzene, and 100° to 150° for toluene and xylene. These fractions were treated with successive small

portions of concentrated sulphuric acid, and the unsaturated hydrocarbons removed as tar. The remaining oil was then nitrated in the ordinary way with acid mixture, and on pouring into water a yellow oil settled on the





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—PLANT, APPARATUS & MACHINERY.

Copper Pipes; Action of Brine on —. H. Keil. Woch. f. Brau. 1905, 22, 495.

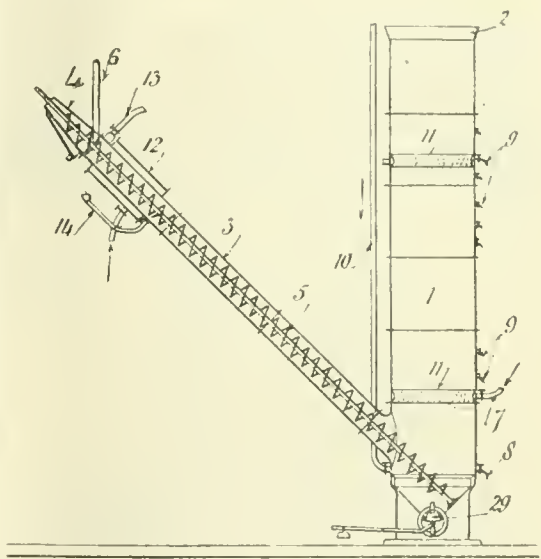
ASE is cited in which the copper refrigerating pipes employed in connection with a brine-circulating system corroded away in a few months. Examination of brine taken from the system showed the presence of 1 per cent. of ammonia, which had presumably red the brine through a leakage in the coils of the ammonia ice-making machine employed. It was found the presence of such small quantities of ammonia in the brine, or even the presence of ammonia vapours in air to which pure brine was exposed, was sufficient to exert considerable action on pieces of copper immersed in the liquid. It is known that, even when free from ammonia, brine containing small quantities of iron salts slowly corrode copper piping. Such corrosion, it is said, can be prevented by making the brine alkaline with sodium carbonate.—J. F. B.

Oil in Water from Condensing Engines; Determination —. J. McFarlane and J. Mears. XXIII., page 38.

ENGLISH PATENTS.

Slu with Liquid, Fluid or Gaseous Agents; Apparatus Treating —. H. H. Lake, London. From H. Messoliers, Ténès, and P. Regnier, Mustapha, Algeria. Eng. Pat. 18,512, Aug. 26, 1904.

T apparatus consists of a vertical cylindrical vessel 1, provided with perforated "sleeves" 11 for the introduction and withdrawal of liquids, and with a feeding hopper 2. An inclined pipe 3 having a perforated compression-cone 4, Archimedian screw 5, to which a right-handed or left-handed motion can be imparted alternately, and a heating or cooling jacket 12, projects at an angle from the bottom of the cylinder 1. The material to be treated passes down the cylinder 1 and up the inclined pipe 3, is discharged from the open end of the compression-cone 4. Liquid treating agents are admitted through the pipes 6 and 7, steam and gaseous or liquid agents through the pipes 11, any liquid from the compression-cone 4 being recirculated through 14. Volatile products are taken away by the pipes 13, light liquids by the taps 9 and heavy ones by 8. A sludge-valve 29 is used for cleaning out. It is stated that several different treating agents may be used at



the same time in different parts of the apparatus, which occupies little space and gives very complete extraction owing to the constant movement of the particles treated, and to the use of the counter current principle.—W. H. C.

Filter-Press Frames; Impts. in —. P. Meura, Tournai, Belgium. Eng. Pat. 24,446. Nov. 11, 1904.

SEE Fr. Pat. 340,503 of 1904; this J., 1904, 815.—T.F.B.

Filtering, or Separating Liquids from Solids, or Matters from Impurities and for Analogous Operations; Apparatus for —. C. Dreyfus, A. Meyenberg and The Clayton Aniline Co., Ltd., Manchester. Eng. Pat. 11,957, June 7, 1905.

A STRONG closed vessel, made in two parts with only one joint, is divided internally into an upper and lower compartment by a perforated partition, which carries the filtering medium, preferably "porous filter stone." It is stated that by the use of porous stone or tile instead

of filter-cloths, higher temperatures and much greater pressures can be employed. The material to be filtered is placed in the upper compartment of the vessel which is then closed and steam or compressed air is admitted above the material, which may be heated, if desired, by a steam jacket. The liquid portion is forced through the filtering medium into the lower part of the vessel from which it flows away by a pipe near the bottom. Several different methods of supporting the filter grid to facilitate emptying are described.—W. H. C.

*Volatile Solvents Diluted in Air; Process and Apparatus for Taking up, Collecting, Aspirating, Drying, Cooling, Fixing and Recuperating; Vapours of —.* E. Bouehand-Pracieg, Angoulême, France. Eng. Pat. 6075, March 22, 1905. Under Int. Conv., March 26, 1904.

SEE Fr. Pat. 341,690 of 1904; this J., 1904, 859.—T.F.B.

*Drying Apparatus; Impts. in —.* A. Forschepiepe and C. Schäfer, Dortmund, Germany. Eng. Pat. 6762, March 30, 1905.

A HORIZONTAL, cylindrical drying chamber is provided with a steam-jacket surrounding the lower half and with an air-jacket surrounding the upper half. The material to be dried is fed in at one end and air enters the upper jacket at the same end, and, after becoming heated during its passage through the jacket, enters the drying cylinder proper at the other end. It then passes back over the material to be dried, and leaves the cylinder saturated with moisture, through the opening by which the substance is introduced. A fan is used for aspirating the air.

—W. H. C.

*Separators; Impts. in Centrifugal —.* N. S. Bök, Stockholm. Eng. Pat. 9115, May 1, 1905. Under Int. Conv. May 9, 1904.

THE claim is for the axially located supporting body shown at 4, 5, 6 in the figures. Fig. 1 is a section of one form of the invention applied to an ordinary Alpha-Lavalseparator; figure 2 is a cross section of fig. 1. along

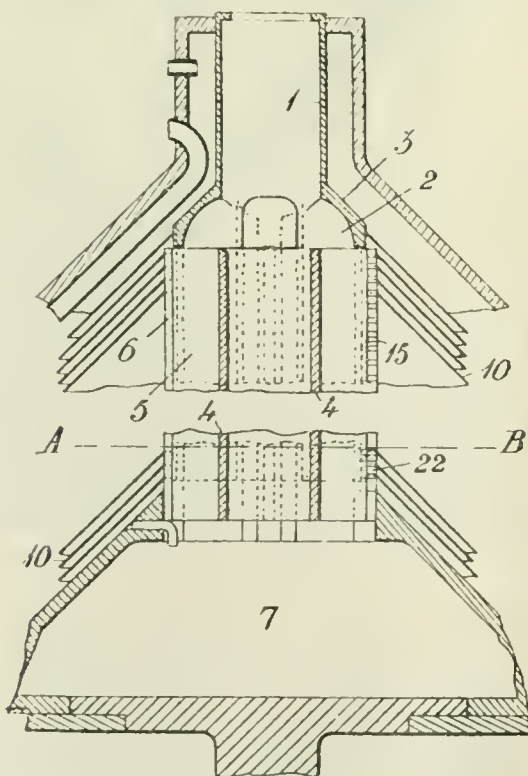


FIG. 1.

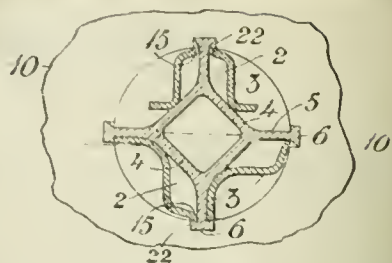


FIG. 2.

the line AB. The supporting body consists of a central part 4, of square section, provided with the extension-piece 5, terminating in a T-shaped end piece 6, and forming abutments against which the walls 3, forming the passages 2, bear. The liquid to be separated passes down feed-pipes 1 and 4 into the "slime-cup" 7, from which it travels up the passages 2 and passes out between partitions 10 by the openings 15 and 22 formed between side walls 3 and the bearing pieces 6.—W. H. C.

#### UNITED STATES PATENTS.

*Filters; Process of Removing Solid or Semi-solid Material from Containers of Pressure —.* C. W. Merrill, I. S. D. U. S. Pat. 798,200, Aug. 29, 1905.

THE sludge is removed from the containers of pressure filters, without separating the units of which they are made up, by introducing a stream of liquid, vapour or gas under pressure, immediately below or behind the sludge and at a point near to the outlet.—W. H. C.

*Filter-Press —.* H. T. Shriver, New York. U.S. Pat. 798,304, Aug. 29, 1905.

THE filtering-chamber of the filter-plate is connected by a channel to a groove or duct, provided with a separate inlet and formed in the joint surface of the plate which surrounds the filtering-chamber.—W. H. C.

*Evaporating Apparatus —.* W. E. Jaques, Grand Rapids, Mich. U.S. Pat. 798,681, Sept. 5, 1905.

THE liquid or semi-liquid to be dried is fed into a tank where it is converted into froth by agitators. An endless band travelling on rollers and provided with a wiping belt takes the froth from the tank, and delivers it on to a second endless band conveyor working in a horizontal chamber, which is fed with hot air. At the end of this chamber a belt delivers the partly dried material into another vertical drying chamber also supplied with hot air.—W. H. C.

#### FRENCH PATENTS.

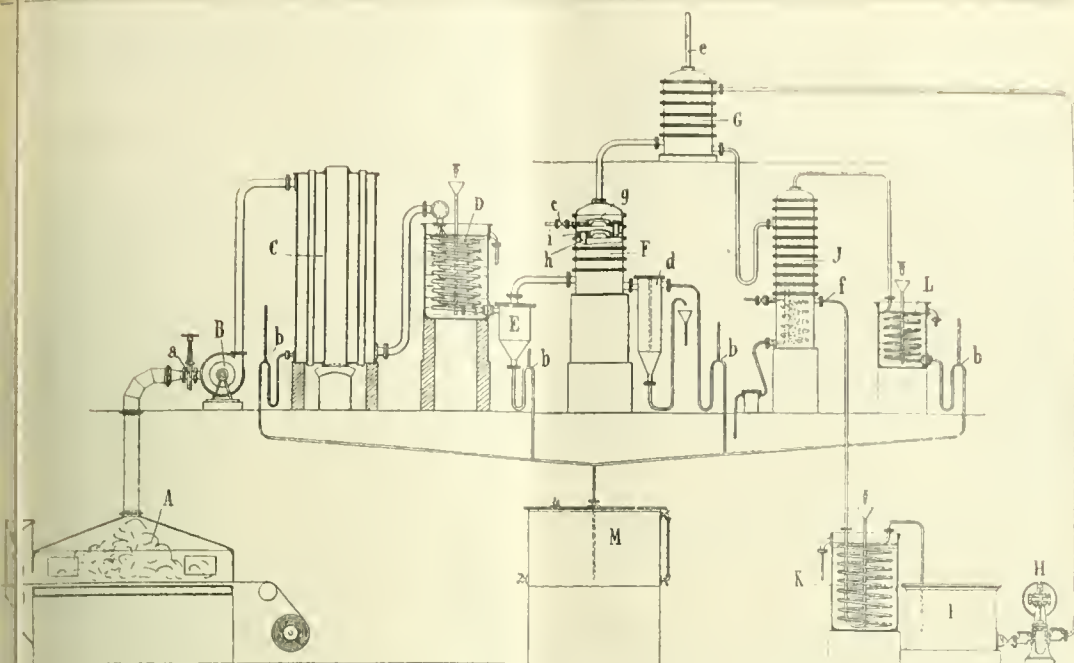
*Cooling and Evaporating Liquids; Apparatus for —.* H. R. Worthington. Fr. Pat. 353,346, April 13, 1905.

SEE Eng. Pat. 7468 of 1905; this J., 1905, 792.—T.F.B.

*Volatile Products [Solvents]; Process for the Recovery of —.* A. A. P. Mallet. Fr. Pat. 349,747, June 16, 1905.

THE recovery of volatile solvents used in various industries is effected by aspirating the air, which may be mixed in any proportion with the vapour to be recovered, through a train of apparatus. The air first passes through the atmospheric cooler C from which any condensed liquid runs off to the store tank M through the trap siphon b. It next passes through the water-cooled worm D to the separator E, the condensed liquid flowing through b to M whilst the air passes on to the cooler F. This vessel is similar to the well-known distilling column, and is fed through the pipe C with cooled liquid in which the vapour is not soluble. The air is forced to bubble through successive layers of liquid on bonnet plates g, and the cooling liquid and condensed





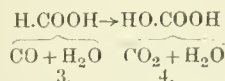
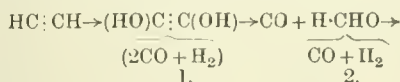
it flow down from plate to plate through the pipes *h*. The condensed liquid is specifically heavier than the gas agent, the pipes *h* are provided with caps *i* in that the condensed liquid may flow down before cooling liquid. The mixture passes through the absorber *d*, and the air goes on to the absorber *G*, which is of similar construction to *F*, but is fed by the pump in the reservoir *I*, with a liquid which will absorb and dissolve the vapours. From *G* the air, now completely freed from vapour, escapes by the pipe *c*, the saturated absorbent flows into the distilling in *J*, heated either by fire or by a steam coil. The air distilled off passes through the condenser *L* and up by pipe *b* to *M*, and the absorbent flows by the pipe *f* through the condenser *K*, to the reservoir *I* to be used again. Owing to the methodical and thorough treatment, very complete recovery of the vaporised acetylene is effected, even when mixed with a very large proportion of air, and consequently the working place *A* is kept well ventilated.—W. H. C.

## II.—FUEL, GAS, AND LIGHT.

*Acetylene; Combustion of* — W. A. Bone and G. W. Drew. Chem. Soc. Trans., 1905, 87, 1232—1248.

The authors find that the combustion of acetylene is a case of essentially the same type as that obtaining in the cases of methane, ethane and ethylene (see this J., 1901; also Chem. Soc. Trans., 1902, 81, 536; 1903, 80, 74; 1904, 85, 693, 1637); the oxygen is initially incorporated with the hydrocarbon, giving rise to an unstable molecule which rapidly undergoes thermal decomposition into simpler products. When sealed glass vessels are filled with mixtures of acetylene and oxygen at atmospheric pressure and temperature, are heated, action begins at 250° C., or even a somewhat lower temperature, and proceeds rapidly at 300° C. Explosive combustion takes place at 350° C. in the case of mixtures containing 1 or 2 mols. of acetylene to 1 mol. of oxygen, and at about 375° C. with mixtures containing 2 mols. of acetylene to 3 mols. of oxygen. A decrease of initial pressure or an addition of oxygen over and above an equimolecular proportion, causes a rise of the ignition point. The presence of more than an equimolecular proportion of oxygen retards the rate of com-

busion below the ignition point, and also, as H. B. Dixon has shown (Phil. Trans., 1893, 184, 183), above it. The formation of carbon monoxide and hydrogen, which occurs in accordance with the empirical equation:— $C_2H_2 + O_2 = 2CO + H_2$ , when an equimolecular mixture of acetylene and oxygen is exploded, must be ascribed to the secondary decomposition of the unstable hydroxyacetylene first formed. Carbon monoxide and formaldehyde are produced at an early stage in the slow combustion of acetylene, probably as the result of the decomposition of the unstable hydroxy derivative  $(HO)C:C(OH)$ . The production of formaldehyde certainly precedes that of steam. The slow combustion may be represented by the following scheme:—



Below the ignition point, the formic and carbonic acids, produced at stages 3 and 4 respectively, are decomposed into steam and oxides of carbon, whilst above the ignition point, the formaldehyde produced at stage 2 (or possibly also the dihydroxyacetylene at stage 1) is resolved into carbon monoxide and hydrogen.

In the explosive combustion of acetylene, separation of carbon occurs only when the reacting mixture contains more than an equimolecular proportion of the hydrocarbon, being due to the secondary decomposition of the excess of acetylene. In contact with a hot catalysing surface, such as porous porcelain, acetylene even in presence of oxygen unites with steam, forming acetaldehyde:— $HC:CH + H.OH = CH_2:CH(OH) = CH_3.CHO$ . No evidence of the formation of benzene was observed in any of the experiments.—A. S.

*Gas; Use of* — for Power and Heating. E. A. Dowson. Paper read before the Birmingham Assoc. Mech. Eng., April 27, 1905.

*Calorimeter; Junkers'* — T. Immenkötter. XXIII., page 1032.

## ENGLISH PATENTS.

*Fuel; Manufacture of Artificial* —. P. Grayson, London. Eng. Pat. 18,858, Sept. 1, 1904.

SEE Fr. Pat. 345,474 of 1904; this J., 1904, 1205.—T. F. B.

*Smokeless Combustion; Process for Bringing about* — in connection with Furnaces, by the Introduction of Liquid Fuel. O. Bender, Treptow, Germany. Eng. Pat. 1975, Feb. 1, 1905.

SEE Fr. Pat. 351,210 of 1905; this J., 1905, 838.—T. F. B.

*Combustible Liquids for Explosion Motors; Impts. in* —. L. A. A. Hennequin and G. J. B. Cayeux, Compiègne, France. Eng. Pat. 11,680, June 3, 1905.

CAMPHOR is dissolved in a hydrocarbon liquid, 20 grms. of the former to 1 litre of petroleum spirit being recommended. The odour of the camphor can be masked with benzoïn, asafoetida, &c. It is claimed that the liquid combustible also acts as a lubricator and protects the parts of the motor with which it is brought into contact.—C. S.

*Burner particularly applicable for the Gassing of Textile Yarns and Threads; Improved Atmospheric Gas* —. C. P. Ehmann. Eng. Pat. 22,614, Oct. 20, 1904. V., page 1010.

*Furnaces; Impts. in Retort* —. Ifö Kaolin-Och Chamottefabriks, A.B., and O. Mohr, Bromölla, Sweden. Eng. Pat. 5481, March 15, 1905.

SEE Fr. Pat. 352,141 of 1905; this J., 1905, 883.—T. F. B.

*Gas for Illuminating, Heating and Power Purposes; Manufacture of* —, and Apparatus therefor. H. S. Elworthy and S. Williamson, London. Eng. Pat. 14,333, June 25, 1904.

COAL gas, after purification in the usual way and after removal of hydrocarbons, other than methane, by scrubbing with paraffin oil or the like, is passed over metallic nickel at a temperature of 250° C., for the purpose of converting the carbon monoxide and hydrogen present into methane and water, according to the equation,  $\text{CO} + 3\text{H}_2 = \text{CH}_4 + \text{H}_2\text{O}$ . If necessary, hydrogen may be added to the gas before treatment. If carbon dioxide is present as well as carbon monoxide, the gas is treated first at 250° C., as above, and then at 350° C., to convert the dioxide also into methane according to the equation,  $\text{CO}_2 + 4\text{H}_2 = \text{CH}_4 + 2\text{H}_2\text{O}$ . To the gas after treatment there may be restored the hydrocarbons which were removed by scrubbing. Instead of coal gas alone, a mixture of coal gas with water-gas, Dowson gas, or the like, with or without the addition of hydrogen, may be subjected to the process; and such a mixture may be prepared by passing water-gas or the like through a superheater and then through a column of fresh coal, whereby the hot gas effects the destructive distillation of the coal, the coke left by the latter being used in turn for the production of the water-gas, &c.

—H. B.

*Combustible Vapour or Gas [Carburetted Air]; Manufacture of* —. A. Shiels, London. Eng. Pat. 18,456, Aug. 25, 1904.

A RECIPROCATING pump, driven by a hot-air engine, draws air through a carburetter, and delivers the carburetted air to a gas-holder. The air is heated by the burner of the hot-air engine, and, as it enters the carburetter, is maintained at a constant temperature, by means of a thermostatic device. The rate of flow of air through the carburetter is kept constant, however the gas production may vary; to effect this, the downward stroke of the pump piston is caused by a cam driven by the engine, whilst the upward stroke (which sucks the air through the carburetter) is given by a spring, which has been compressed during the downward stroke. The time occupied by the suction stroke, therefore, depends only on the strength of the spring, and not on the speed of the pump. The burner of the

engine is fed with gas from the holder, and is controlled by the movements of the latter, so that the speed of the engine is regulated automatically according to the consumption.—H. B.

*Gas; Apparatus used in the Manufacture of Coal* —. A. A. Johnston, Ilford, Essex. Eng. Pat. 19, Sept. 6, 1904.

To enable the depth of seal of the dip-pipes in the hydrant main to be varied to any desired extent, whilst gas being made or the retorts are open, the hydraulic main is divided into two longitudinal compartments by means of a plate depending into the liquor. The upper part of the two compartments may be brought into communication by means of a by-pass pipe; or this pipe may be closed, and gaseous pressure applied (say, from a holder) to one of the compartments, so as to cause the liquor to rise to the desired extent in the other compartment, into which the dip-pipes depend. The depth of seal can thus be varied. The compartment enclosing the ends of the dip-pipes communicates with the hydrant main; the other has an outlet to a tar chest, the flow being regulated by means of a slide-valve.—H. B.

*Gas; Manufacture of Coal* — [Vertical Retort]. Wilson, Kirkintilloch. Eng. Pat. 19,774, Sept. 1904.

A VERTICAL gas retort is constructed in two portions, the upper portion being enclosed in a furnace, whilst the lower portion, or "cooling chamber," is open at the bottom and dips into a water seal, which allows coke to be withdrawn without the admission of air or interruption of the distillation in the upper portion. The steam generated by the hot coke, on meeting the water of the seal, is converted into water-gas and passes off along with the coal-gas from the top of the retort. The cooling chamber may be either exposed to the atmosphere, or wholly or partially provided with a water-jacket.—H. B.

*Gas Producers; Impts. in* —. A. Cerasoli, London. Eng. Pat. 19,827, Sept. 14, 1904.

THE producer, which is intended for use with bituminous fuel, is constructed with blast inlets at the top and bottom of one side, and gas outlets at the top and bottom of the other side, these inlets and outlets being controlled by linked valves in such a manner that the air is directed alternately upwards and downwards from the inlets in an oblique direction through the main mass of fuel, the gas produced during each phase being led off by the diametrically opposite outlets. A hanging wall separates the freshly-charged fuel from the upper gas-outlet.—H. B.

*Carburetted Air; Process of* —, and Apparatus therefor. J. Gore, Sutton, Surrey. Eng. Pat. 19,444, Sept. 16, 1904.

AIR is forced through a revolving drum partly filled with a liquid hydrocarbon, to which a certain quantity of naphthalene may be admixed, into a compressed-air chamber. The air thus partially carburetted is then admitted to the carburetted chamber, where it meets a spray of oil which is pumped through suitable nozzles at the top of the chamber. The carburetted chamber is always kept free from liquid oil, any excess being collected on the bottom and run into the supply tank.—R. L.

*Gas Producer Working with a Varying Consumption of Gas; Process for Maintaining the Temperature of* —. E. Capitaine, Frankfort-on-the-Maine, Germany. Eng. Pat. 7310, April 6, 1905. Under Int. Conv. April 9, 1904.

SEE Fr. Pat. 353,085 of 1905; this J., 1905, 961.—T. F. B.

*Smoke or Products of Combustion; or Gases or Vapours containing Noxious Vapours, Apparatus for Washing or Purifying* —. L. P. Barnabé, London. Eng. Pat. G. Mugna, Forlì, Italy. Eng. Pat. 11,158, May 4, 1904.

A VERTICAL spindle is mounted to revolve on a step-bearing at the bottom of a cylindrical vessel. The lower part of the spindle and the step-bearing are enclosed in a



er casing, to prevent access of water and dirt, is supplied continuously to the vessel from a supply and is kept at a constant level within the vessel, the water surface, the spindle carries arms projecting downwards into the water, and agitating the same the spindle is being rotated. The inlet for the product of combustion consists of a horizontal tube passing through the side wall of the apparatus and communicating with a central vertical cylindrical chamber, the end of which is open and is situated just above the rotating arms. The lower part of this inner cylindrical chamber is provided with an exterior annular flange, which a similar flange is fixed to the inside of the vessel. While the water is being agitated, these flanges act as baffle-plates, preventing the water from rising too high, and at the same time causing the smoke which are drawn through the apparatus by a centrifugal fan, to come in close contact with the water. The water and the impurities washed out from the smoke can be moved through a cock and a man-hole at the bottom of the apparatus.—R. L.

*Impts. in Treating* —, and *Apparatus therefor*. E. Ransford, Upper Norwood, Surrey. From L. F. Yacono, Buenos Ayres. Eng. Pat. 22,050, Oct. 13, 1904.

Smoke is led into a chamber where the soot deposits, then drawn, by means of a centrifugal pump, through a gauze screen into a coke tower, where it deposits of the solid hydrocarbons. The tower is fitted with a heating coil, through which boiler feed water is passed. The gases then pass into another column packed with coke or other material, over which light petroleum or kerosene flows. The smoke thus treated is returned to the furnace or stored in a gas-holder.—R. L.

*Descending Media for Lighting Purposes; Manufacture* —. R. Langhans, Berlin. Eng. Pat. 14,687, May 17, 1905.

Manufacturing mantles according to Eng. Pat. 12,950 (this J., 1900, 649), an improvement is effected in the following proportions of oxides:—Thoria, 256 mols.; ceria, 2.25—4 mols.; zirconia, 1 mol.; 1 mol.; beryllium, oxide 1—1.44 mols.; and cerous oxide, 0.125—0.25 mol.; and by adding mols. of sulphuric acid to the solution of the salts.—H. B.

#### UNITED STATES PATENTS.

*Clinker; Manufacture of* —. C. Ellis, Assignor to Eldred Process Co. U.S. Pat. 798,175, Aug. 29, 1905, 19 IX., page 1018.

*Process of Generating* —. C. Ellis, Assignor to Eldred Process Co. U.S. Pat. 798,176, Aug. 29, 1905, 19 IX., page 1018.

*Producer*. C. Ellis, Assignor to Eldred Process Co., New York. U.S. Pat. 798,500, Aug. 29, 1905.

A blast-pipe of a producer passes through the water-projects upwards in the centre of the lower part of the generator chamber and terminates in a "blast baffle" with radial arms. The latter have sloping sides and are in tuyères, arranged to deliver the blast downwards upon the sloping sides. The blast pipe has a connection for introducing a cooling medium along with the blast.—W. H. C.

*Apparatus for Making* —. J. Leede, Baltimore, Assignor to Leede Process Co. U.S. Pat. 799,009, Sept. 5, 1905.

U.S. Pat. 353,502 of 1905; following these.—T. F. B.

#### FRENCH PATENTS.

*Briquettes; Process for the Manufacture of* —. E. A. Ash and W. Grant. Fr. Pat. 353,507, April 18, 1905. The claim is for the addition of water to the coal dust or, of which the briquettes are formed. Not more

than 10 parts by weight of tar are mixed with 20 parts of water, and 100 parts of coal dust, the mixture being then pressed and the water expelled. The object of adding the water is to ensure a thorough incorporation of the tar with the coal dust, so that only a small quantity of the former is used. It is stated that such briquettes do not require heating during the manufacture, and that they do not soften whilst burning, provided that not more than 10 parts of tar are used to every 100 parts of coal. For paving, the tar may also be mixed with water and then mixed with the gravel, sand, &c. The mixture is spread on the road, and the water pressed out by a heavy roller.—W. H. C.

*Retorts; Furnace with Vertical* —. P. de Lachomette, Villiere and Co. Fr. Pat. 353,197, April 10, 1905.

The retort setting consists of four pillars resting on the generator and regenerator. The conduits for gas, air and products of combustion are transversely arranged between these pillars. The retorts are constructed in three parts, luted into each other, to avoid ruptures. The spaces around these parts are divided by partition walls. Inlets for air are provided at various points, and gases, escaping combustion in the generator, are burned in the top compartment of the furnace.—R. L.

*Gas Generator capable of Utilising any kind of Fuel*. A. de Karischeff. Fr. Pat. 350,015, June 23, 1904.

The generator consists of a chamber in which solid fuel is distilled with production of coke; of a lower compartment in which part of the products of combustion are burned, producing the heat required to dissociate the gases and vapours and raise the temperature of the necessary air; and a third chamber on top of the second one, in which, at a temperature of about 3000° C., combustion of another portion of the distillation products takes place, and where, by means of an injected combustible liquid, the carbon dioxide is reduced to carbon monoxide.—R. L.

*Gas Generators; Suction* —. H. F. Smith. Fr. Pat. 353,293, March 7, 1905.

See U.S. Pat. 786,063 of 1905; this J., 1905, 540.—T. F. B.

*Gas Producers; Process for Regulating the Air Supplied to Suction* —. H. F. Smith. Fr. Pat. 353,445, March 7, 1905.

See U.S. Pat. 786,063 of 1905; this J., 1905, 540.—T. F. B.

*Gas; Process and Apparatus for the Manufacture of Illuminating* — with Continuous Admission of Coal. P. Busse. Addition, dated March 14, 1905, to Fr. Pat. 348,411, Dec. 1, 1904 (this J., 1905, 540).

The rotating cylinders in the feeding hoppers are provided with helical grooves, by means of which the coal is continuously fed into the retorts. The setting for these cylinders has a cooling arrangement to keep down the temperature and thus reduce wear and tear of the movable parts. The gas chambers are combined in a battery by suitable conduits for the hot illuminating gas, which serves to heat two regenerators beneath each gas chamber by means of suitably-constructed flues. The coal is so distributed in the gas chamber that the coarse lumps are accumulated close to the walls, whilst the smaller are heaped together in the centre.—R. L.

*Gas-Producer*. Leede Process Co. Fr. Pat. 353,502, April 18, 1905.

The producer consists of an iron casing, lined with refractory material, into which coal or coke is charged. At one end of the producer is an oil burner, worked by compressed air, for heating the fuel, and a regulated supply of air is introduced through an annular channel surrounding the burner. A further quantity of air is admitted near the outlet of the chamber and mixed with the gas produced, the mixture being aspirated from the generator by a fan driven by a belt. The speed of the fan is regulated by means of two oppositely-placed cones, one of which is fixed on the pulley driving the belt. By altering the position of the band which connects the cones, the alteration of speed is effected.—W. H. C.

*Gas Purifiers Lighting* — T. Redman. Fr. Pat. 353,628, April 21, 1905.

SEE Eng. Pat. 9514 of 1904; this J., 1905, 611.—T. F. B.

*Wicks of Candles, Lamps, Tapers, &c.; Process for Increasing the Inflammability of* — A. Haase. Fr. Pat. 353,339, April 13, 1905. Under Int. Conv., June 14, 1904.

SEE Eng. Pat. 3438 of 1905; this J., 1905, 666.—T. F. B.

#### GERMAN PATENT.

*Gas; Process of Purifying, Illuminating and Coke-oven* — by means of Ferric Hydroxide Mud. E. Riepe. Ger. Pat. 159,613, Jan. 1, 1902.

THE gas passes through a suitable scrubber in the same direction as a quantity of ferric hydroxide mud, the desulphurised gas is drawn off to the holder, whilst the mud passes back to the end of the scrubber in which the gas entry pipe is situated. On its passage back it meets with a current of air or oxygen, which reoxidises it, when it may be used for a further operation.—T. F. B.

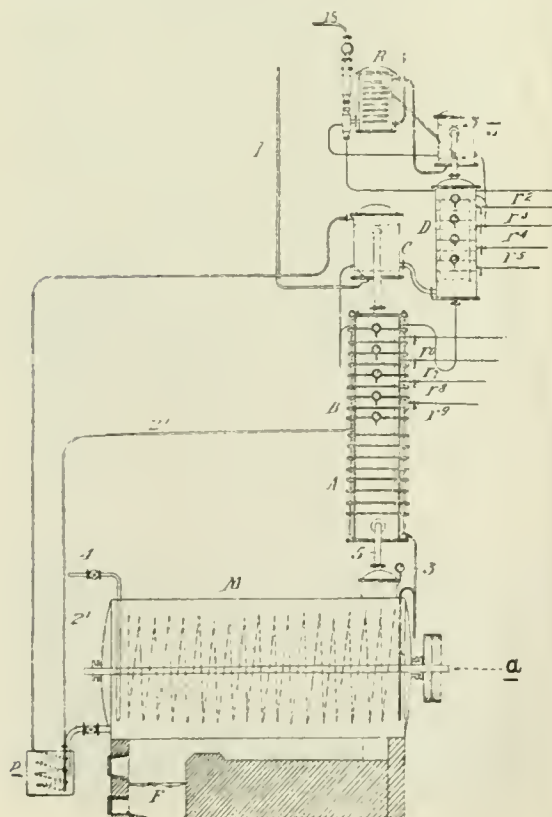
### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

*Coal-tar and its Properties.* J. Gasbeleucht., 1905, 48, 826—827.

A table is given, showing the proximate constituents and the quality of over 100 different samples of coal-tar.  
—W. H. C.

#### ENGLISH PATENTS.

*Distilling and Separating Unequally Volatile Elements contained in a Complex Mixture, particularly in a Mixture of Hydrocarbons, such as Naphtha, Crude Petroleum, different Kinds of Tar or the like.* A. Baudry, Kieff, Russia. Eng. Pat. 29,479, Dec. 31, 1904.



THE liquid to be fractionated is introduced through pipe 1 to condenser C, where it cools, and is heated by vapours from column B; it then passes through (which is heated by liquid from boiler M) and pipe 2 column A, where it falls on the plates and is boiled the vapours coming from M through pipe S. The liquid then passes through pipe 3 into the boiler M, where it is heated directly by the furnace F, and also superheated steam coming through pipe 4, agitated by discs, shown in dotted outline, mounted on a shaft a, rotated by a pulley. The vapour passes through pipe 5 into A, and thence into the fractionating columns B and D; they are then completely condensed in C and C', the condensed liquids descend again into the columns. It is stated that in this process each of the sections of the columns B and D contains distillate of constant composition, and of which the boiling point corresponds to the temperature of the section. It is further stated that petroleum, tar, tar distillate, alcohols, and other similar mixtures can be completely separated into their constituents by this method. The pressure in the apparatus may be lowered by connecting the "refrigerator" R, by pipe 18, to a barometric denser. The cocks  $\pi_2$ ,  $\pi_3$ , &c., lead to diminutive densers attached to apparatus wherein the boiling of a small portion of the distillate in each of the sections of the columns may be tested from time to time.—T. F. B.

*Lubricants; Impts. in* — L. A. A. Hennequin G. J. B. Cayeux, Compiègne, France. Eng. Pat. 11,679, June 3, 1905.

CAMPOR, dissolved in petroleum, is added to an animal, vegetable or mineral lubricating oils, so as to furnish a product containing 10 to 250 grms. of camphor per litre; or a solution of 70—125 grms. of camphor in one litre of petroleum may be used.—C. S.

#### FRENCH PATENTS.

*Coal; Process and Apparatus for the Manufacture of Coke, Ammonia, Illuminating Gas, Tar, Benzene by the Distillation of* — J. G. Aarts. Fr. Pat. 353,128, April 7, 1905.

THE material to be distilled and carbonised is introduced continually into the retort, passing first into the heating zone in the centre, and then into zones getting gradually cooler. To obtain a high proportion of gas, a maximum temperature of 1100° C. is required, while for a production of coke and products of distillation, the temperature is kept at 600°—800° C. By the progressive cooling of the coke with the aid of a hydraulic seal at the lower end of the retort, steam and water-gas are formed. Part of the steam heated to 500° C. may be admitted into the upper zone at the same temperature, whilst a portion of the water-gas may serve for the heating of the Carburetted oil can be introduced at suitable points into the retort, which may be of vertical or other shape.—J. G. Aarts.

*Coke; Recovery of Coal Gas in the Manufacture of* — P. L. Huln. Fr. Pat. 350,020, Jan. 1904.

PRODUCER gas from an ordinary producer is used for the heating of coke ovens after being mixed with 15 to 30 per cent. of coal gas, distilled off in the preparation of coke in an oven. The mixture is heated with hot air, the furnace being provided with a regenerator.—P. L. Huln.

#### GERMAN PATENT.

*Sulphur Derivatives of Mineral Oils; Process for the Manufacture of Sulphonated* — G. Hell and Co. Ger. Pat. 161,663, Dec. 23, 1900.

THE impure, red-brown coloured sulphonated derivatives of sulphur compounds of mineral oils (i.e. sulphonic acids) are purified by first removing the organic salts by dialysis, passing steam through the solution, extracting it with ether-alcohol, and again passing steam through the residue. The products thus obtained are pure sulphonic acids.—G. Hell and Co.



stated to be free from the disagreeable odour possessed by similar products which have not been subjected to analysis.—T. F. B.

#### IV.—COLOURING MATTERS AND DYE STUFFS.

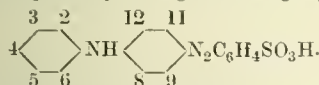
*Aldehyde-Azo-Benzoic Acids.* F. J. Alway and V. D. Bonner. J. Amer. Chem. Soc., 1905, 27, 1107—120.

One of the authors stated in 1902 (see this J., 1902, 1022) that *p*-azoxybenzaldehyde when heated with concentrated sulphuric acid to 110°—120° C. is converted into a brown substance having the characteristic properties of the hydroxyazo compounds. Since then Human and Weil (this J., 1903, 1239) have contended that *m*- and *o*-azoxybenzaldehydes when heated with concentrated sulphuric acid are converted into the isomeric benzaldehydrazobenzoic acids. The authors have repeated the experiments of Human and Weil, with the result that their first view is confirmed, *m*-azoxybenzaldehyde being converted into the isomeric hydroxyazo compound, while *p*-azoxybenzaldehyde yields a mixture of hydroxyazo compounds. The *m*- and *p*-benzaldehydrazobenzoic acids were prepared synthetically and it was found that they did not agree in properties with the products obtained by Human and Weil, which were in probability hydroxyazo compounds, as they were capable of staining the skin and dyeing wool and silk, properties not possessed by the benzaldehydrazobenzoic acids.—A. S.

*Orange IV.; The Nitro Derivatives of —.* P. Juillard. Bull. Soc. Chim., 1905, 33, 974—994.

The nitro derivatives of Orange IV. (phenylaminoazobenzene-*p*-sulphonic acid) are met with in commerce as Indian Yellow, Citronine, Azoflavine, &c. The dyestuffs consist of a mixture of soluble and insoluble nitro compounds. The soluble compounds isolated by the author are three mononitro, two dinitro and one trinitro derivative of Orange IV.; these are present partly as normal salts partly as acid salts, and it is entirely to these that the Indian Yellows, &c., owe their dyeing properties. In all the nitro group (or groups) is in an *o*- or *p*-position to the NH group. The insoluble portion of the dyestuffs consists of nitrodiphenylamines, of which there exist mononitro, two dinitro, two trinitro, and occasionally tetranitro derivative; the nitro groups here also are in ortho or para to the NH group. The author's observations indicate that the positions of the nitro groups do not affect the shade of the dyestuff; the difference in shade between mono- and dinitro derivatives is considerably greater than that between di- and trinitro derivatives.

*Mononitro derivatives of Orange IV.*—The three derivatives isolated had the nitro groups in the positions 2, and 8 respectively, Orange IV. being represented as



They are present, together with *o*-*p*- and *p*-*p*-dinitrophenylamine, in the less highly nitrated derivatives of Orange IV., which dye wool and silk golden yellow (Indian Yellow XV., Curcumeine, &c.). The 4-nitro derivative is the most abundant. They can be distinguished by the reactions of their aqueous solutions with hydrochloric sulphuric acid. The 4-derivative gives a blue-black coloration followed by a precipitate of the same colour; the 2-derivative gives a precipitate soluble in excess, producing a violet-red solution; the 8-derivative undergoes no change in dilute solutions, but in concentrated solution gives a precipitate insoluble in excess of acid. The 4-nitro derivative is prepared by nitrating Orange IV. in acetic acid solution with  $\frac{1}{2}$  mols. of nitric acid, the temperature being kept below 25° C.; a mixture of 2,4-mononitro, and of the dinitro acids, together with nitrodiphenylamines and diazobenzenesulphonic acid

results. The product is filtered, dried, and extracted with toluene, and the mononitro derivative purified by recrystallisation of its potassium salt. The other two mononitro acids are produced on nitrating Orange IV. in acetic acid solution with 1 mol. of 20 per cent. nitric acid; the dinitrodiphenylamines are removed from the product by extraction with toluene and the two acids separated by fractional crystallisation of their potassium salts, that of the 2-nitro derivative being less soluble. The two potassium salts are isomorphous.

*Dinitro derivatives of Orange IV.* are three in number: One, the 2,4-derivative, is not present in the commercial dyestuffs, but was obtained synthetically by heating bromo- or iodo-dinitrobenzene with aminoazobenzene-*p*-sulphonate of soda in presence of sodium acetate. The 4,8-derivative may be obtained by nitrating either Orange IV. or the 4- or 8-mononitro derivative. It may also be obtained, together with the 2,8-derivative, by nitrating the nitrosamine of Orange IV.; this gives a mixture of the nitrosamines of the two dinitro derivatives, and of 4,10- and 2,10-dinitrodiphenylamines. This product is washed, the diphenylamine derivatives removed by treatment with toluene, the nitroso groups split off the dinitro derivatives by heating with alcohol in presence of sulphuric acid, and the acids separated by recrystallising the mixed potassium salts, of which that of the 4,8-dinitro derivative (which is more abundant) is less soluble.

*Trinitro derivatives of Orange IV.*—Two trinitro derivatives have been isolated; the 2,4,8-derivative is obtained by direct nitration of Orange IV., or by nitrating either of the dinitro derivatives. The second trinitro derivative, the 2,4,6-compound, was obtained by heating picryl chloride with aminoazobenzene-*p*-sulphonate of soda in presence of sodium acetate. When treated with cold nitric acid this latter trinitro derivative gives a mixture of 2,4,6,10-tetranitrodiphenylamine and a brown substance which has not been examined, but which is thought probably to be a tetranitrated Orange IV.—T. F. B.

#### ENGLISH PATENTS.

*Dyestuffs; Manufacture of New Azo —.* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,045, Nov. 7, 1904.

SEE Fr. Pat. 347,655 of 1904; this J., 1905, 329.—T. F. B.

*Anthraquinone Derivatives; Manufacture of —* [Anthracene Dyestuffs]. H. E. Newton, London. From the Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,869, Nov. 16, 1904.

SULPHONIC acids of *p*-amino- or *p*-alkylamino-hydroxyanthraquinones containing the sulphonic group in the unsubstituted nucleus, are obtained by sulphonation of these substances in the presence of boric acid or by the sulphonation of their boric esters. By the usual methods of sulphonation the sulphonic group is introduced into the nucleus already containing the hydroxyl and amino group. The new substances are stated to be of value both as dyestuffs and as intermediate products.—H. L.

*Quinizarin [Anthracene Dyestuffs]; Manufacture of —.* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 1499, Jan. 25, 1905.

SEE Fr. Pat. 350,957 of 1905; this J., 1905, 796.—T. F. B.

*Dyestuffs; Manufacture of Azo —.* H. E. Newton, London. From the Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4359, March 2, 1905.

MONOAZO black dyestuffs for wool, stated to be identical with those obtained by the combination of diazotised nitroacyldiphenylenediamine with aminonaphtholdisulphonic acids or their acyl, alkyl, aryl or glycin derivatives, and subsequent saponification of the intermediate products (Fr. Pat. 347,655; this J., 1905, 329), are produced by replacing the aminonaphthol acids by the corresponding naphthylenediaminedisulphonic acids or their mono-acyl, alkyl, aryl or glycin derivatives. It was

found that, during the process of saponification, one amino group in the naphthylenediamine nucleus is replaced by a hydroxyl group.—H. L.

*Dyestuffs; Manufacture of Sulphur [Sulphide] —.* H. H. Lake, London. From K. Oehler, Offenbach-a/Main, Germany. Eng. Pat. 25,506, Nov. 23, 1904.

SEE U.S. Pat. 785,675 of 1905; this J., 1905, 433.—T. F. B.

*Colouring Matter [Dyestuff] suited for Use in the Form of its Lakes; Manufacture of an Azo —.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 26,908, Dec. 9, 1904.

SEE Fr. Pat. 348,588 of 1904; this J., 1905, 494.—T. F. B.

*Colouring Matters [Dyestuffs] especially suitable for Use in the Form of their Lakes; Manufacture of Azo —.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 26,909, Dec. 9, 1904.

SEE Addition of March 25, 1905, to Fr. Pat. 346,008 of 1904; this J., 1905, 964.—T. F. B.

#### UNITED STATES PATENTS.

*Indophenol Sulphonic Acids and Process of Making same.* A. L. Laska, Assignor to K. Oehler, Anilin- und Anilinfarbenfabr., Offenbach on the Main, Germany. U.S. Pat. 798,807, Sept 5, 1905.

SEE Fr. Pat. 352,200 of 1905; this J., 1905, 920.—T. F. B.

*Dyestuff; Blue Azo Wool — and Process of Making same.* A. L. Laska, Assignor to K. Oehler, Anilin- und Anilinfarbenfabr., Offenbach on the Main, Germany. U.S. Pat. 798,808, Sept. 5, 1905.

SEE Eng. Pat. 7839 of 1905; this J., 1905, 796.—T. F. B.

#### FRENCH PATENTS.

*Dyestuffs; Process for Producing Bordeaux-Red Mordant [Azo] —.* K. Oehler. Fr. Pat. 353,270, Jan. 21, 1905.

SEE Eng. Pat. 28,596 of 1904; this J., 1905, 328.—T. F. B.

*Dyestuffs and Intermediate Products for their Manufacture; Process of Preparing New Azo —.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 353,273, Jan. 25, 1905. Under Int. Conv., Feb. 25, 1904.

SEE Eng. Pat. 1675 of 1905; this J., 1905, 963.—T. F. B.

*Paranitrohydroxyanthraquinones [Anthracene Dyestuffs]; Process of Producing —.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 353,281, Feb. 14, 1905. Under Int. Conv., March 22, 1904.

SEE Eng. Pat. 3160 of 1905; this J., 1905, 963.—T. F. B.

*Dyestuffs of the Anthracene Series; Production of Green —.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 353,549, April 19, 1905. Under Int. Conv., Sept. 23, 1904.

SULPHONIC acids containing a sulphonic group in the anthraquinone ring are prepared by treating 1,4-diaryl-diamino-8-hydroxyanthraquinones with a sulphonating agent in the presence of boric acid. A mono- and a disulphonic acid derivative of 1,4-di-*p*-tolyl-diamino-8-hydroxyanthraquinone prepared in this way are described. The former dyes unmordanted or mordanted wool yellowish-green shades and its chrome lake on cotton is very fast to soaping. The disulphonic acid gives bright, yellowish-green shades in dyeing or printing. Both produce brighter, yellower shades and are more suitable for calico printing than the isomeric mono- and disulphonic acids (substituted in the side chain), which are produced by the ordinary method of sulphonation.—H. L.

*3,4-Dichloraniline; Process of Making a New Sulphonic Acid of —.* Act.-Ges. f. Anilinfabr. Fr. Pat. 352,471, March 16, 1905.

ONE hundred and sixty-two parts of 3,4-dichloraniline are heated with 105 parts of sulphuric acid (66° B.), about 215° C., until a sample of the mixture is completely soluble in sodium carbonate solution. The product dissolved in sodium carbonate solution, and the sulphonic acid precipitated by addition of hydrochloric acid. The acid, which is in all probability 3,4-dichloraniline sulphonie acid, is characterised by its sparing solubility in water (1 in 200 at 100° C., 1 in 1000 at 20° C.). It produces, on treatment with sodium nitrite in the usual manner, a diazo derivative which is with difficulty soluble in water, and the salts of this new acid are very easily crystallised.—T. F. B.

*Dyestuffs and Derivatives from Anthracene [Benzothrone Dyestuffs], and their Application in Dyeing and Printing; Production of a Series of New —.* Badische Anilin und Soda Fabrik. Third Addition to March 20, 1905, to Fr. Pat. 349,531, Dec. 21, 1904 (this J., 1905, 192, 726, 840, 841). Under Int. Conv. Feb. 15, 1905.

THE anthraquinones, their sulphonic acids and reduction products, mentioned in the main patent may be replaced by substituted derivatives of these compounds, and their homologues, and these may be condensed with an anhydride of glycerol, or with ethers of such anhydride or glycerol, instead of with glycerol itself.—H. L.

### V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILE YARNS, AND FIBRES.

*Dyestuffs on Animal Fibres; Identification of —.* A. G. Green, H. Yeoman and J. R. Jones. XXI page 1034.

#### ENGLISH PATENTS.

*Silk-like Threads; Manufacture of —.* O. Imray London. From Farbwerke vorm. Meister, Lucius und Brüning, Höchst a/Main, Germany. Eng. Pat. 21,904, Oct. 12, 1904.

SEE U.S. Pat. 779,175 of 1905; this J., 1905, 129.—T. F. B.

*Burner particularly applicable for the Gassing of Textile Yarns and Threads; Improved Atmospheric Gas —.* C. P. Ehmann, Withington, Lancs. Eng. Pat. 22,604, Oct. 20, 1904.

A METAL plate of slightly greater diameter than the orifice is placed over the top of a Bunsen burner, in order to deflect and increase the width of the flame and to prevent charred pieces of thread from falling into and choking the burner tube. Three different types of brackets for supporting the plate from the top of the burner tube are figured and claimed.—W. H. C.

*Textile Piece Goods in Bleaching, Printing, Dyeing and like Operations; Apparatus for Guiding or Guiding and Distending —.* W. Mycock, Manchester. Eng. Pat. 19,953, Sept. 16, 1904.

INSTEAD of the usual central swivel or pivot, the guiding appliances are mounted in yielding end supports arranged to temporarily yield against an increase of pressure at either end, due to the deviation of the cloth from its true course.—H. L.

*Electrodes for Electrolysers used in the Manufacture of Bleaching Liquors.* R. Kother. Eng. Pat. 70,404, April 3, 1905. XI4., page 1021.

*Dyestuffs; Manufacture of Blue — by Oxidation of the Fibre.* O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Höchst a/Main, Germany. Eng. Pat. 406, Jan. 9, 1905.

A VARIETY of blue shades, fast to washing, soap, alkali



acid, is obtained by oxidising on the fibre a mixture of alkylated diaminodiphenylcarbinol and *p*-hydroxy-*p*-aminodiphenylamine. When *p*-hydroxydiphenylamine is used, the leuco base may be prepared separately, subsequently applied to the fibre and oxidised; such leuco base may be prepared by heating 18.5 grms. of oxydiphenylamine with 32.6 grms. of tetraethylaminodiphenylcarbinol, and 10 c.c. of 20 per cent. sulphuric acid to 100° C. for several hours, and then salting the leuco compound, which is dissolved in water, the base liberated by addition of alkali. The substances may be mixed with the requisite solvent, thickening agent and oxidising agent in the usual way; no free mineral acid is necessary: the oxidation may be brought about by organic salts and chlorates. Instead of using a phenylcarbinol derivative, the corresponding diphenylamine derivative may be used; it is probable that in a case the carbinol is formed as an intermediate product. The dyestuff obtained from the leuco base is described as particularly fast to soap and sodium carbonate solutions. The shades of the dyestuffs obtained from hydroxydiphenylamine are, in general, purer and more vivid than those from aminodiphenylamine, but require the addition of a little tannin to render them faster to acids.—T. F. B.

*Large lot of Dyed Textile Fabrics; Manufacture of Dyestuffs for the —.* J. Y. Johnson, London. From dische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 25,284, Nov. 21, 1904.

Third Addition, of Nov. 23, 1904, to Fr. Pat. 297,370, 1900; this J., 1905, 672.—T. F. B.

#### UNITED STATES PATENT.

*Manufacture of Artificial —.* H. Bernstein, Philadelphia, U.S.A., Assignor to Art Fibre Co., New York. U.S. Pat. 254,027, Sept. 5, 1905.

Liquor obtained by boiling raw silk is added to a solution of cellulose in aqueous ammoniacal cupric oxide. The solution is subjected to a gradual increase of temperature, and then formed into filaments, which are treated in an acid bath. The threads may further be treated in a solution of castor-oil, which has been treated with sulphuric acid and sodium hydroxide [sodium sulcinoleate], before or subsequently to the passage through the acid bath.

Products are claimed—one containing cellulose gum from the liquor obtained by boiling off silk, the other containing cellulose, this gum and a gelatinous substance.—H. L.

#### FRENCH PATENTS.

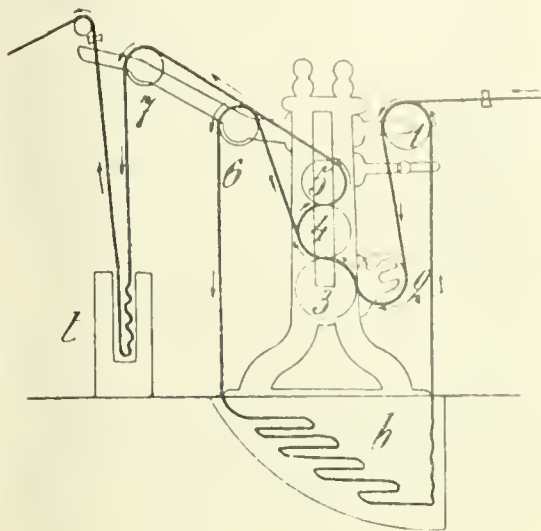
*For Oxide; Process for Recovering —, and for the Preliminary Treatment of Textiles in the Manufacture of Artificial Textile Fibres.* R. Linkmeyer. Fr. Pat. 353,187, April 10, 1905.

The economical manufacture of cellulose threads is important to recover all the copper dissolved (from the alkaline cuprammonium) in the alkaline "forming" solutions. To accomplish this, it is proposed to utilise such alkaline solutions for the preliminary treatment of cotton or other forms of cellulose, previous to their conversion into artificial silk. Cellulose thus treated is said to be readily soluble in ammonia, the extra copper required being added to the solution in the form of ammoniacal copper.—T. F. B.

*Dyeing Vegetable Textiles by Means of Sodium Oxide; Process of —.* E. Saint-Hilaire and E. de Cousseau. First Addition, dated March 28, 1905, to Fr. Pat. 346,831, Oct. 5, 1904.

Substances necessary for carrying out the process described in the principal patent (see this J., 1905, 238), are weighed out and kept as two separate mixtures, ready for solving when required. One mixture consists of the sodium peroxide and boric acid, and the other of the caustic soda and alkali silicate, together with an absorbent earth, such as kieselguhr.—T. F. B.

*Bleaching; Process of —.* E. Ringenbach. Fr. Pat. 353,113, April 7, 1905.



All the operations of bleaching are carried out in a single apparatus, consisting of several units, one of which is shown in the accompanying diagram. The fabric passes over roller 1 and between rollers 2 and 3, and then over roller 6 and down into tank *b*, which contains the necessary liquid; a certain amount of the fabric is allowed to hang slack in the tank so as to permit sufficient treatment. The material leaving the tank again passes over roller 1, and thence between rollers 2 and 3, and 4 and 5, where it is squeezed; it now passes over roller 7 and down into a small receptacle *t*, in which a length is allowed to go slack, in order that, if one of the units has to be stopped for a short time, the whole apparatus need not be stopped.—T. F. B.

*Plants; Preparing Dried — for Bleaching and Dyeing.* Seibt und Becker. First Addition, dated April 7, 1905, to Fr. Pat. 349,323, Dec. 21, 1904 (this J., 1905, 671).

When the alkaline substances, e.g., alkali carbonates, mentioned in the main patent are soluble with difficulty in alcohol, alcoholic solutions are prepared by adding the requisite amount of alcohol to an aqueous solution of the substance.—H. L.

*Warps; Method of and Apparatus for Printing —.* G. Morton. Fr. Pat. 353,543, April 19, 1905.

SEE Eng. Pat. 9341 of 1904; this J., 1905, 616.—T. F. B.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

#### ENGLISH PATENT.

*Dyeing, Cleaning, Washing and the like [Feathers]; Apparatus for —.* J. J. Brossard, London. Eng. Pat. 18,194, Aug. 22, 1904.

The machine is composed essentially of an outer vessel for the dyeing or cleansing liquor, inside which is mounted one or more perforated, corrugated casings capable of being revolved. In operating, the goods (principally feathers) are placed within the latter which are then rotated. A strong current of liquor is thus sent through the casings, and the goods are at the same time (it is claimed) subjected to a very effective rubbing.—H. L.

## FRENCH PATENTS.

*Paper with Designs; Process and Means for Producing Coloured Tones or Darker Shades or Shades as Dark as Desired on the Ground Colour of Coloured —.* R. Schmiedel. Fr. Pat. 353,561, April 20, 1905.

A QUICKLY-DRYING liquid is applied to the face side of the paper with coloured ground. The liquid is made up of a solution of gum arabic, casein, glue, dextrin, or other binding agent soluble in water, to which are added (1) soap to facilitate combination with the ground; (2) saponified oil, to permit of printing while the surface is moist; (3) glycerin, to obtain a pure shade; and (4) denatured alcohol as a sicative, together with a transparent colour when the finished article is to resemble a printed aquarelle.—H. L.

*Leather; Process of Dyeing —.* Act.-Ges. f. Anilinfabr. Fr. Pat. 353,350, April 13, 1905.

SEE Eng. Pat. 18,096 of 1904; this J., 1905, 842.—T. F. B.

## VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

*Nitric Acid; Manufacture of —.* O. Guttman. XXII., page 1031.

*Nitric and Sulphuric Acids; Properties of Mixtures of —.* A. Saposchnikow. XXII., page 1031.

*Chlorine and Alkali; Castner Mercury Process for Making —.* M. Le Blanc and C. Cantoni. XLA., page 1021.

*Aluminium; Iodometric Determination of — in Aluminium Sulphate and Chloride.* S. E. Moody. XXIII., page 1033.

## ENGLISH PATENTS.

*Nitric Acid; Process of Manufacturing —.* H. H. Niedenführ, Halensee, Germany. Eng. Pat. 4353, March 2, 1905.

SEE Ger. Pat. 155,095 of 1903; this J., 1905, 497.—T. F. B.

*Salt Pans; Apparatus for Drawing —, or for similar purposes.* J. Rigby, Winsford, Chester. Eng. Pat. 20,108, Sept. 17, 1904.

time it reaches the upper part. The operating parts, provided with flexible or rigid couplings having a slip, whereby the reciprocation is effected with a tensional pull first on one coupling and then on another instead of a push, and buckling is avoided." The drawings, Figs. 1 and 2, show the salt pan with its drawing apparatus in side elevation and in cross-section. Longitudinal and transverse bars, A and B, are mounted on the pan D by the grooved wheels C, running on rail (Fig. 2), supported on each side of the pan. The bars form the frame carry at intervals the scrapers G, suspended by chains H from brackets J, so that when the scrapers are carried in one direction, they lie with their backs against the brackets, whilst the chains H permit them to yield to inequalities; on the return stroke, they swing clear until on dropping, they are again supported by brackets in a scraping position. Centrally over the pan the stationary cylinder K is mounted with its piston rods L, working through opposite ends, in connection with pipes from the valve-box M, whereby brine, for instance, can be admitted alternately to opposite ends in order to work the scrapers. The drainage platform S may be adjustably mounted, and the hinged extension T, provided with one or more scrapers, may be caused to ride up the platform.—E. S.

*Chlorine; Generation and Application [as Disinfectant] —.* J. Hargreaves, Farnworth-in-Widnes, Lancs. Eng. Pat. 20,835, Sept. 28, 1904.

SOLID acid sulphates, such as aluminium sulphate, sodium or potassium bisulphate, formed for transfer into blocks of suitable size, are mixed with a suitable portion of bleaching powder, in a receptacle, with addition of water. In the case of an open receptacle, it is placed near to the manhole of a sewer, for instance, and a cover is placed over it, also covering the sewer opening, so that the chlorine evolved may enter the drain. Or a closed receptacle may be used, having a pipe passing from its top, leading to any place or building which it is desired to disinfect.—E. S.

## UNITED STATES PATENTS.

*Ore-Roasting Kiln.* J. McNab, Catonsville, Md. U.S. Pat. 798,524, Aug. 29, 1905.

The fireplaces are arranged in series, side by side, extending in two rows in which the opposite fireplaces are

FIG. 1.

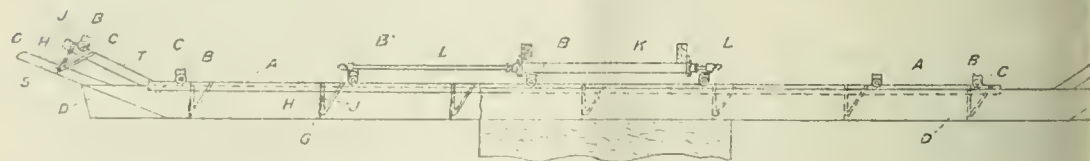
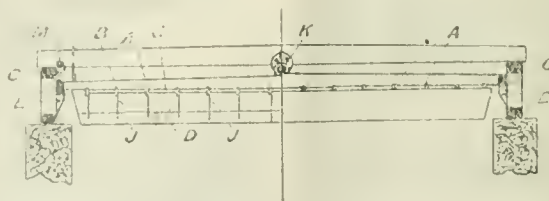


FIG. 2.



In drawing salt pans, an inclined platform is arranged to receive the material, which is caused to ascend by the action of a train of scrapers moving on suitable supports to and fro. The scrapers act only during their forward movement, and are caused to swing up clear of the material in the return movement. The inclined platform is of such length that the material, if wet, may be drained by the

back to back. The main gas-flues extend above the fireplaces of each row, and receive the gas from openings in the key blocks to the arched slabs which cover the crown arch to the furnace, and discharge at one end to a nitre oven. A fines-burning flue extends longitudinally above one of the main gas flues, and has its forward end connected to a return or dust flue, which



er extends at the back, and discharges at its rear end one of the main flues.—E. S.

*Carbonic Acid; Apparatus for Producing* ——. G. Valzel, Assignor to E. Zusi, both of Newark, N.J. U.S. Pat. 798,239, Aug. 29, 1905.

The apparatus consists of a double shaft reduction space combined with one or two regenerators; means of communication between the regenerators and the space and between the regenerators and a hot-blast device, both fitted with devices for shutting off at will either or both regenerators from the furnace or from the hot-blast device; means for conducting producer-gas to this hot-blast device and into the regenerators; a condenser and main receiver; means for drawing the carbonic acid into the main receiver, means between the receiver and hot-blast device for conducting a portion of the carbonic acid to the hot-blast device to be heated therein, means for conducting the heated gas to the regenerators; and steam-pipes leading into the hot-blast device and extending therefrom, these steam-pipes being connected with the pipes through which the carbonic acid passes from the hot-blast device to the regenerators.—A. G. L.

#### FRENCH PATENTS.

*Electrolysis of Alkali Chlorides; Apparatus for the* ——. M. Granier. Fr. Pat. 353,304, March 18, 1905. Id., page 1021.

*Nitrites; [Electrolytic Reduction of Lead Oxide to Metal for Use in the] Manufacture of* ——. P. J. Petit. Fr. Pat. 353,467, April 14, 1905.

The invention relates to the utilisation of the lead oxide occurring in the process of preparing nitrites by acting on nitrates with lead. The lead oxide is made into a paste with an alkaline solution, as, for instance, sodium or potassium carbonate, serving as electrolyte, the mass is spread, to a depth of several centimetres, on a metal base acting as the cathode in a closed vessel communicating with a source of electricity; the anode constituted of sheet iron, corrugated and perforated, oxygen gas collecting on which is conducted to a suitable reservoir. The lead thus electrolytically reduced to the oxide is available for reacting on nitrates for the production of nitrites, or otherwise.—E. S.

*Sulphide and Alkali or Alkaline-Earth Hydroxides; Process for the Simultaneous Manufacture of* ——. W. de Stucklé. Fr. Pat. 353,480, April 17, 1905.

*"Sulphate" [Sulphide] and Alkali or Alkaline-Earth Hydroxides; Apparatus for the Manufacture of* ——. W. de Stucklé. Fr. Pat. 353,496, April 18, 1905. Under Int. Conv., May 21, 1904.

ISOLATED zinc is heated with solution of an alkali oxide, the evolution of hydrogen being, in some cases, initiated by addition of iron filings. When the zinc is dissolved, an alkali sulphide is added, but only as much as may be necessary to precipitate the zinc as sulphide. Hydroxide and sulphide of an alkaline earth may be substituted, though not advantageously, for the hydroxide or sulphide of an alkaline base respectively. The zinc sulphide obtained is stated to be in a very finely-divided state. The apparatus in which the process is conducted includes a closed vat having a double bottom for heating steam, containing receptacles for zinc divided into series of sieves attached to a central shaft by the revolution of which the charge is agitated. The sieves are divided into a great number of radiating compartments, so that the reacting liquid may percolate through the heaped masses of zinc from compartment to compartment.

Provision is made for conducting the hydrogen evolved to a special measuring device, operating to discharge into the tank quantities of alkali sulphide solution proportioned to the zinc dissolved.—E. S.

*Oxygen; Process of Obtaining* ——. from Alkali Peroxide. H. Foersterling and H. Philipp. Fr. Pat. 353,282, Feb. 15, 1905.

SEE U.S. Pat. 788,256, April 25, 1905; this J., 1905, 546.—E. S.

*Nitrogen and Oxygen; Process for the Production of Compounds of* ——. by Electric Means. Soc. West-deutsche Thomas Phosphat-Werke G.m.b.H. Fr. Pat. 353,548, April 19, 1905.

THE gases, during the time that they are submitted to the action of electricity, are under a pressure less than the pressure of the atmosphere. The oxides of nitrogen formed are afterwards brought into contact with solutions of certain salts, of which "sodium chloride" is given as an example, the acids liberated being absorbed by suitable energetic absorbing agents, so that the low pressure is maintained or augmented. In order to convert the lower oxides of nitrogen into compounds richer in oxygen, air is admitted and made to traverse the apparatus.—B. N.

#### GERMAN PATENTS.

*Tower for the Continuous Mechanical and Chemical Purification of Furnace Gases. [Manufacture of Sulphurous Acid].* Metallurgische Ges. A.-G. Ger. Pat. 161,017, Aug. 12, 1902.

THE tower is intended specially for the removal of finely-divided iron oxide and also sulphuric anhydride from the gases from pyrites kilns. It is divided into two parts by a chamber or receptacle in which the washing water, introduced at the top of the tower, collects. This receptacle is at such a distance from the foot of the tower that the ascending gas, at this point, no longer contains any appreciable quantity of sulphuric anhydride. A covered overflow pipe is provided in the centre of the receptacle through which a portion of the washing water passes to the lower part of the tower, in descending which it absorbs any sulphuric anhydride contained in the gas, and at the same time becomes heated, so that any dissolved sulphurous acid is expelled. The water which collects in the receptacle is withdrawn by a pump and introduced again at the top of the tower through a rose; this portion of the washing water, which is circulated through the upper part of the tower, exerts a cooling action on the ascending gas, and purifies it from mechanical impurities.—A. S.

*Magnesium Carbonate Trihydrate and Potassium-Magnesium Carbonate; Process for the Manufacture of* ——. in the Production of Potassium Carbonate by the Magnesia Process. Deutsche Solvay-Werke, A.-G. Ger. Pat. 159,870, March 1, 1903.

IN the preparation of magnesium carbonate trihydrate from magnesia or magnesium hydroxide, and of potassium-magnesium carbonate from magnesium carbonate and a potassium salt by treatment with carbon dioxide under pressure, in the magnesia process for the manufacture of potassium carbonate (compare this J., 1903, 949), claim is made for the application of a pressure of at least 3 atmospheres when gases containing 20 per cent. of carbon dioxide are used, and of a proportionally higher minimum pressure when gases poorer in carbon dioxide are employed. It is stated that under these conditions, the formation of basic magnesium carbonate, or of a carbonate containing less than 3 mols. of water, is prevented. (See also Ger. Pat. 157,354 of 1903; this J., 1905, 442.)—A. S.

# VIII.—GLASS, POTTERY, AND ENAMELS.

*Glass: Iridescent Stains on —.* H. E. Ashley.  
Trans. Amer. Ceramic Soc., 1905, 7, 159—184.

IRIDESCENCE is considered to be produced by the reflection of light from both the upper and lower surfaces of a very thin transparent layer of varying thickness. The production of iridescent effects requires two processes, first the staining of the glass by the introduction into it of metal, in an oxidising atmosphere, and subsequent colouring of the metal in a reducing atmosphere in which at a sufficiently high temperature a large number of chemical substances will affect stained glass so as to change the colour reflected to any of the prismatic colours, or to blacken the stain. All the experiments were made on an Austrian hard crystal glass, which was first stained with silver, and then subjected to further treatment. With most of the chemicals used, the acid radical seemed to have the greater effect on the colour, except in the case of the metal copper, which was extremely active.

Good results were obtained with powders of silver (or copper) sulphide, ochre, and lampblack in the proportions 1:27:2, and 1:97:2. Small proportions of sodium sulphite gave some of the most brilliant results obtained. Tests with lead sulphide and tin sulphide were about parallel to the copper sulphide tests. The use of metallic magnesium appeared to have no advantage, nor the substitution of an atmosphere of ammonium chloride for a carbonaceous reducing atmosphere. A good bronze colour was obtained from copper acetate, sodium thiosulphate and ochre in the proportions of 3:1:396. The tests with nitrates were less satisfactory than with sulphur compounds. The formation of adherent oxides of tin makes stannous chloride almost valueless, but aluminium chloride gives similar colour effects without this disadvantage. Some rich effects were obtained with aluminium chloride and metallic copper.

If the ochre used in the pastes is raw, its shrinkage on firing causes the surface of the glass to crackle into small faces, but it has little effect on the surface if previously heated to as high a temperature as the glass is to reach. When the glass is overheated and sinks slightly, its surface takes on a silky gloss, due to fine horizontal striae, composed of very narrow ridges very close together. The original smooth surface will be preserved, however, if there are patches of ochre, lampblack or plaster of Paris. The article concludes with a list of references to the literature of the subject.—W. C. H.

*Ceramic Bodies: Note on the Action of "Grog" in —.*  
S. Geijsbeek. Trans. Amer. Ceramic Soc., 1905, 7, 133—143.

THE definition adopted by the author is:—Grog is burnt clay or its burnt products in single or compound bodies, in the ground state, coarse or fine, according to the use to which the material is put. It may be refractory or non-refractory, depending upon the class of ware to be produced. The functions of grog in ceramic bodies are:—1. To counteract shrinkage in the green state. 2. To decrease plasticity. 3. To increase the drying qualities. 4. To insure safe burning. 5. To counteract shrinkage in the burnt state. Experiments were made with the object of determining the effects produced (1) by the size of the grog used, and (2) by the amount used. To classify different samples of grog as to size of grain, the samples were screened with sieves of different meshes, for instance, the portion that passed through four meshes to the inch, and was retained by a sieve of eight meshes was designated 4 M. The fine material was the portion that passed through 60 meshes to the inch. The general results obtained were that the size of the grain of the grog has no effect on the shrinkage or porosity, provided the amount used is the same. An increased percentage of grog does not give rise to a proportional decrease in shrinkage nor a proportional increase in porosity. The

first 10 per cent. addition of grog to a clay mixture reduces the shrinkage and increases the porosity far more than any subsequent increase in the percentage of grog. The clay used in these experiments was a fairly plastic potter's clay, burning to a light yellow, and the grog was made broken terra-cotta, burned at a higher temperature than the trial pieces, to eliminate all shrinkage from the grog.

—W. C. H.

*Bone China Bodies.* A. S. Watts. Trans. Amer. Ceramic Soc., 1905, 7, 204—228.

As the result of a large number of experiments, the author finds that as the amount of flint or uncombined silica increases, the ability of bone ash to act as a flux increases. Tests with a series of trial pieces showed that as the silica increased, so did the fusibility, whilst the translucency apparently decreased. At cone 13, the first member of the series, with no free flint gave a perfect bone china, whereas another member with 5.5 per cent of free flint warped badly, yet both gave good bone chinas at cone 8. The author concludes from his experiments, that bone china for a range of from cone 8 to cone 12, can be made from mixtures within the following limits:—

0.2 to 0.4 K<sub>2</sub>O or higher { 1. Al<sub>2</sub>O<sub>3</sub> { 2.8—4.000 SiO<sub>2</sub>  
1.8 to 2.8 CaO { 0.6—0.933 P<sub>2</sub>O<sub>5</sub>

—W. C. H.

*[Pottery] Bodies high in Silica: Some Evidences that —  
Crack by Over-fire.* C. Wcelans. Trans. Amer. Ceramic Soc., 1905, 7, 56—63.

EXPERIMENTS were made upon trial pieces of varying composition, of commercial materials, and burnt "under every-day conditions." The trial pieces were made from a plaster mould, 6½ in. long, one half being round and the other having sharp edges.

The following table gives the composition of the pieces and the results obtained.

Series 0 was fired in the biscuit kiln between cones 14 and 15, being covered with flint in a sagger. The glaze burn was carried on at cone 10.

Series I. When fired at cone 10, all the specimens shivered; the "peeling" was greater as the amount of silica increased. When fired at cone 14, numbers 2 and 4 crazed, whilst the others shivered.

Series II. In this series, Cornish stone was substituted for felspar; each specimen "peeled" worse than the corresponding member of series I., at cone 10; at cone numbers 1 and 2 were good.

Series III. When fired at cone 10 and also at cone 14 all the specimens were good, except No. 1, at both temperatures.

Series IV. All the specimens were good at both cone 10 and cone 14. As the clay content increased, the tendency of the body to crack increased.

Series V. Fired at cones 10 and 14, No. 1 shivered at both temperatures; all the others were good, except No. 5, which crazed at the higher temperature. Glaze formula:—

0.117 ZnO }  
0.313 K<sub>2</sub>O } 0.43 Al<sub>2</sub>O<sub>3</sub> } 2.98 SiO<sub>2</sub>  
0.570 CaO }

Felspar = K<sub>2</sub>O, Al<sub>2</sub>O<sub>3</sub>, 6SiO<sub>2</sub>—combining weight = 557.

Cornwall stone = K<sub>2</sub>O, 2.5Al<sub>2</sub>O<sub>3</sub>, 20SiO<sub>2</sub>—combining weight = 1550.

Kaolin = Al<sub>2</sub>O<sub>3</sub>, 2SiO<sub>2</sub>, 2H<sub>2</sub>O—combining weight = 258.

Flint = SiO<sub>2</sub>—combining weight = 60.



No.	Florida Kaolin.	English Kaolin.	Flint.	Felspar.	Body Formula.	Shrinkage.			Results.
						Length of "green" material.	Length of burnt trials.	Shrinkage.	
	Per cent.	Per cent.	Per cent.	Per cent.				Per cent.	
1	20	24	24	32	0-2520K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 4-76SiO <sub>2</sub>	6-50	5-75	11-50	Crazing tends to increase with each higher number.
2	23	27	27	23	0-1758K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 4-62SiO <sub>2</sub>	6-50	5-80	10-70	
3	25	29	29	17	0-1270K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 4-52SiO <sub>2</sub>	6-50	5-75	11-50	
4	25	29	30	16	0-1206K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 4-58SiO <sub>2</sub>	6-50	5-50	15-30	
5	25	26	33	16	0-1270K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 4-95SiO <sub>2</sub>	6-50	5-45	16-10	
6	25	24	35	16	0-1290K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 5-19SiO <sub>2</sub>	6-50	5-40	16-40	
1	35	15	40	10	0-0845K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 5-49SiO <sub>2</sub>	6-50	5-75	11-50	Shivered.
2	30	15	45	10	0-0930K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 6-27SiO <sub>2</sub>	6-50	5-84	10-10	Shivered. Crazed in harder fire.
3	25	15	50	10	0-1035K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 7-23SiO <sub>2</sub>	6-50	5-80	9-30	Shivered. Crazed in harder fire.
4	20	15	55	10	0-1165K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 8-43SiO <sub>2</sub>	6-50	5-94	8-61	Shivered.
5	15	15	60	10	0-1333K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 9-08SiO <sub>2</sub>	6-50	5-84	8-61	Shivered.
				Cornish stone.					
2	15	35	40	10	0-0341K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 6-44SiO <sub>2</sub>	6-50	5-94	8-61	In this series the spar was replaced by Cornish stone. The series shivered worse than 1. Nos. 1 and 2 when burnt harder were good.
1	15	30	45	10	0-0309K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 5-64SiO <sub>2</sub>	6-50	5-84	8-61	
3	15	25	50	10	0-0379K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 7-43SiO <sub>2</sub>	6-50	6-03	7-23	
4	15	20	55	10	0-0428K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 8-67SiO <sub>2</sub>	6-50	6-03	7-23	
5	15	15	60	10	0-0490K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 10-27SiO <sub>2</sub>	6-50	6-08	6-46	
1	20	20	50	10	0-1035K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 7-23SiO <sub>2</sub>	6-5	5-80	9-30	Shivered.
2	20	20	45	15	0-1479K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 6-71SiO <sub>2</sub>	6-5	5-75	11-50	Stood.
3	20	20	40	20	0-1881K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 6-24SiO <sub>2</sub>	6-5	5-94	8-61	Stood.
4	—	—	—	—	0-2246K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 5-82SiO <sub>2</sub>	6-5	—	—	Stood.
5	20	20	30	30	0-2596K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 5-43SiO <sub>2</sub>	6-5	5-45	16-10	Stood.
6	20	20	25	35	0-2883K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 5-07SiO <sub>2</sub>	6-5	5-41	16-70	Stood.
7	20	20	15	45	0-3426K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 4-43SiO <sub>2</sub>	6-5	5-45	16-10	Stood.
1	20	10	55	15	0-1878K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 9-15SiO <sub>2</sub>	6-5	5-84	10-10	Stood.
2	30	10	45	15	0-1479K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 6-71SiO <sub>2</sub>	6-5	5-84	10-10	Stood.
3	40	10	35	15	0-1218K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 5-13SiO <sub>2</sub>	6-5	5-55	14-60	Stood.
4	50	10	25	15	0-1037K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 4-02SiO <sub>2</sub>	6-5	5-41	16-70	Stood.
5	60	10	15	15	0-0902K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 4-02SiO <sub>2</sub>	6-5	5-50	18-20	Stood.
1	20	10	60	10	0-1340K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 9-98SiO <sub>2</sub>	6-5	5-97	8-15	Shivered.
2	25	10	50	15	0-1654K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 7-79SiO <sub>2</sub>	6-5	5-75	11-55	Stood.
3	30	10	35	25	0-2246K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 5-82SiO <sub>2</sub>	6-5	5-41	16-70	Stood.
4	35	10	25	30	0-2358K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 4-77SiO <sub>2</sub>	6-5	5-47	15-80	Stood.
5	40	10	10	40	0-2698K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> , 3-71SiO <sub>2</sub>	6-5	5-97	8-15	Stood. Started crazing in hard fire.

the author's conclusions are:—

1st: Where the felspar is as high as 20 per cent. of total mixture, no "peeling" will ensue, regardless the quantity of quartz used, providing it does not exceed 50 per cent. of the total mixture, if fired at cone 10. 2nd: That it is safe to use as high as 40 per cent. felspar, the silica not being lower than 20 per cent., out fear of crazing, if the mixture be fired at cone 10.

—W. C. H.

[Pottery] Bodies high in Silica. Discussion on "Some evidences that they Craze by Over-fire". H. E. Ashley. Trans. Amer. Ceramic Soc., 1905, 7, 69—78.

This paper contains a discussion of Weclan's results (see preceding abstract) which the author has expressed by means of triaxial diagrams, that is to say, an equilateral triangle in which each side represents zero per cent. of the three constituents, clays, flint and felspar, each opposite apex denotes 100 per cent. of the constituent. If any point in the diagram is taken, its distance from each of the three sides gives the percentage of each constituent, the sum of which is always 100. One of the trials fired at cone 10 crazed. All trials less than 15 per cent. of felspar shivered, but with a higher percentage were good. The worst shivering occurred with the highest amounts of flint and low amounts of clay. While shivering occurred with 40 to 62 per cent. flint, good glazes were obtained on bodies with from 10 to 55 per cent. Both good and shivered glazes were obtained on bodies with 30 to 50 per cent. of clay. When a body with 10 or more per cent. of felspar in the body was over-fired to cone 14, the glaze crazed.

Many glazes have a limited temperature range in which they are good, smooth and bright; so that apart from the

danger of crazing, other causes would make over-firing undesirable as a cure for shivering.

Diagrams of Hecht's results are also given, and reference is made to Purdy's paper (see following abstract), and to Seger's results.

The combined results of these four investigations show:—

1. That crazing is most likely to occur with bodies with a small amount of flint, a large amount of clay, and with from 20 to 30 per cent. of felspar; and an increase or decrease of this latter constituent tends to decrease the liability.
2. That shivering, when it occurs, takes place with a low percentage of felspar, and is further promoted by a high content of flint, and a low content of clay.
3. That harder burning of the body may increase or decrease the tendency to shiver.
4. That changing from a white ware to a porcelain-like structure, will produce crazing, whether the change be effected by a higher glaze fire (Weclan) or by increasing the ratio of kaolin to plastic clay (Purdy).—W. C. H.

[Pottery] Biscuit Body Composition: Limits of Variation in —. R. C. Purdy. Trans. Amer. Ceramic Soc., 1905, 7, 79—88.

THIS is an account of experiments carried out in reference to Seger's laws as to the correction of crazing and shivering in a glaze by variations—generally supposed to be within narrow limits—of the body composition.

Four series of biscuit bodies were prepared from ball clay, china clay, flint and felspar. In the first, the china clay was increased while the other constituents were kept constant, and no crazing occurred after four years. In the second, the felspar was gradually increased from zero, and in three pieces no crazing occurred after four years, while the other

six crazed at the time of drawing the kiln. In the third series, the flint was increased by degrees, and four pieces did not craze after four years, one of which contained the highest content of flint, one crazed sometime during that period, and two others crazed when drawn from the kiln. In the fourth series, the relative amounts of ball clay and china clay were varied, though the total clay, flint and felspar contents were kept constant. Of these pieces, four stood for four years, one crazed sometime during the period, and one when drawn from the kiln.

The composition of the glaze used was:—

0.49 PbO	} 0.19 Al <sub>2</sub> O <sub>3</sub>	0.571 B <sub>2</sub> O <sub>3</sub> .
0.12 K <sub>2</sub> O		
0.15 Na <sub>2</sub> O		2.25 SiO <sub>2</sub> .
0.24 CaO		

Seger considered that (1) crazing increases in proportion to the increase of the content of clay substance, (2) in tests of equal clay content, those which contain say Zettlitz kaolin craze worse than those which contain more plastic clay, (3) crazing increases with increase of felspar, and (4) it decreases with increase of flint.

The author considers that:—

Seger's laws are not to be construed as operating within close limits under definite conditions.

Owing to the many varying factors in commercial work, the bodies should be so compounded, according to Seger's laws, as to lie safely between the critical points of crazing and shivering.—W. C. H.

*Glazes at High Temperatures; Matt* — C. F. Binns.  
Trans. Amer. Ceramic Soc., 1905, 7, 115—121.

A MATT glaze is defined as one that is either white or coloured, and covers the ware in thick unctuous masses, which is not brilliant, "but which presents to the touch a quality and texture at once sympathetic and firm." Matt glazes have usually been produced at cone 04 to cone 4 or 5, and the author here considers the advantages to be gained by a high-fired glaze. "The ideal pottery is complete as far as density, strength and vitrification are concerned without any glaze," hence high-fired ware is better than low. The high-fired glazes, too, have a better texture than low-fired ones, and the hues obtainable in a high fire are also better, besides the advantage of utilising reducing actions in a high fire. Two matt glazes, said to be used at Sèvres on gres, came to the author's notice, and one had an oxygen ratio of 2.5 and the other of 2.4, whereas in recent practice at cone 03 it had ranged from 1.2 to 1.4, and at cone 6 had not exceeded 1.6. The glazes were tried at cone 9, and the results led to trying two new ones:—

No. 1.	0.3 K <sub>2</sub> O	} 0.8Al <sub>2</sub> O <sub>3</sub> , 2.8SiO <sub>2</sub> .
	0.7 CaO	
	Oxygen ratio, 1.64.	

And No. 2.	0.3 K <sub>2</sub> O	} 0.7 Al <sub>2</sub> O <sub>3</sub> , 2.6 SiO <sub>2</sub> .
	0.7 CaO	
	Oxygen ratio, 1.67.	

The silica content is that due to felspar and kaolin without the addition of any flint. The burn was at cone 9, cone 8 going down inside the saggars. Glaze No. 1 proved too hard, but No. 2 gave a satisfactory matt glaze, with good texture and colours. Taking No. 1 as an upper extreme, experiments were made to determine whether No. 2 was the most satisfactory mixture, the lower extreme being

No. 25.	0.3 K <sub>2</sub> O	} 0.4Al <sub>2</sub> O <sub>3</sub> , 2.0SiO <sub>2</sub> .
	0.7 CaO	
	Oxygen ratio, 1.8.	

Two other series were tried, in one of which the oxygen ratio was kept constant at 2.0, and in the other the alumina content was maintained constant at 0.55. The best results were obtained with the following, an intermediate between No. 1 and No. 25, namely:—

0.3 K <sub>2</sub> O	} 0.64Al <sub>2</sub> O <sub>3</sub> , 2.48SiO <sub>2</sub> .
0.7 CaO	
Oxygen ratio, 1.69.	

In the other two series it was evident that in one the oxygen ratio was too high, and in the other the alumina too low.

For colour, a number of metallic oxides were tried including copper, which, unexpectedly, did not volatilise. Titanium in the form of rutile appears to be only suspended in the glaze, and has the effect of stimulating crystallisation, and so helps the matt surface, which is, however, scarcely as soft as one founded on alumina.

—W. C. H.

#### ENGLISH PATENT.

*Density or Specific Gravity of Liquid* <sup>and</sup>/<sub>or</sub> *Semi-Liquid* Material [Slip, Glaze, Potters' Liquid, &c.]; Apparatus for use in Ascertaining the — J. M. James. Eng. Pat. 18,305, Aug. 24, 1904. XXIII., page 1033.

#### UNITED STATES PATENTS.

*Glass; Method of Shaping* — F. L. O. Wadsworth, Allegheny, Pa. U.S. Pat. 798,642, Sept. 5, 1905.

GLASS articles are formed by compressing the material between surfaces, simultaneously creating a vacuum between the compressing surface and the glass, and maintaining the vacuum until the glass has set.—A. G. L.

*Glass Sheets; Manufacture of* — F. L. O. Wadsworth, Allegheny, Pa. U.S. Pat. 798,643, Sept. 5, 1905.

SHEETS are rolled from plastic glass, pressure being simultaneously applied to the rolled portions by surface extending between the rolling device and the glass, the surfaces being practically stationary relatively to the glass and maintaining the pressure during the setting of the glass. Prism-sheets may be made in this way.—A. G. L.

*Glass; Manufacture of Sheets of* — F. L. O. Wadsworth, Allegheny, Pa. U.S. Pat. 798,644, Sept. 5, 1905.

FIGURED glass sheets, varying in thickness in different parts of the same sheet, are made by first forming or separate table a rough sheet of glass of appropriate varying thickness, and then further forming this sheet a table having a figured surface, without spreading the material laterally.—A. G. L.

*Glass; Manufacture of Sheets of* — F. L. O. Wadsworth, Allegheny, Pa. U.S. Pat. 798,645, Sept. 5, 1905.

GLASS sheets are made by spreading the glass on a supporting surface, and, before the completion of the spreading operation, pressing successive portions of the sheet against the supporting surface and figuring it on the sheet not in contact with the supporting surface; the pressure maintained during the setting of the glass.—A. G. L.

#### FRENCH PATENTS.

*Glass; Process and Apparatus for Making Sheet* — P. T. Sievert. Fr. Pat. 353,344, April 13, 1905. Un. Int. Conv., April 12, 1905.

SEE Eng. Pat. 9211 of 1905; this J., 1905, 926.—T. F.

*Enamelling; Process of* — without Baking. C. Champigneulle. Fr. Pat. 353,373, April 14, 1905.

THE process consists in the use of a vitreous paste which is applied hot to the surface to be enamelled, and hard on cooling. The paste is prepared by treating a solution of an alkali silicate with calcium sulphate, and decant the thick solution from the precipitate produced. The treatment with calcium sulphate is stated to prevent ulterior formation of salts capable of efflorescing in finished enamel.—A. S.

#### GERMAN PATENT.

*Pottery of all kinds; Process for the Manufacture of* — [Utilisation of Waste Product from Thermite Process] C. F. Boehringer und Söhne. Ger. Pat. 160,789, July 22, 1901.

CLAIM is made for the use of alumina which has been formed artificially, in the manufacture of pottery of all kinds, with the exception of grindstones. The alumina is mixed with a clayey binding agent, then formed into the desired shape.



burned. The fused alumina which it is proposed to use in this way, is obtained in considerable quantities as a waste product of the "thermite" process (this J., 1, 253, 1214). It resembles natural corundum in composition, but is superior to the latter as a raw material in the manufacture of pottery, as it is perfectly anhydrous and does not contain chemically combined metallic impurities. Articles manufactured from this waste product are stated to exhibit less shrinkage and to be stronger than those prepared from natural corundum.

—A. S.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

*For Tile Bodies made from Clay; General Consideration of —.* R. C. Parry. Trans. Amer. Ceramic Soc., 1905, 7, 95—114.

The author adopted the following classification of clay tile bodies:—

e Tile	{ vitreous { white. } { coloured. }	{ Prepared facing body on a common clay backing.
e Tile	{ porous...clay colours. }	{ Solid bodies formed into geometric shapes.
e Tesseræ	{ vitreous { white. } { coloured. }	{ Solid bodies formed into geometric shapes.
e Tesseræ	{ porous...clay colours. }	{ Solid bodies formed into geometric shapes.

*Face Tiles.*—Face tiles consist of a prepared facing body backed with a more common body. In the case of face tiles the face of the die is covered to the required thickness with the facing body, and the backing then dried and pressed. For inlaid tiles a "cell frame" is used, the cells being filled with facing bodies of required size. In these experiments, the author used a backing of re-clay, ground in a dry pan to a 16-mesh powder.

*Vitreous facing mixtures,* it was found necessary to adhere the two bodies to have a certain quantity of all clay. In all cases tried the use of feldspar as a flux the facing mixture was unsuccessful, but Cornwall stone always proved satisfactory, and, incidentally, the author points out that the silica is apparently present in a peculiar form in Cornwall stone, which prevents the use of this material being taken, as is usually supposed to be possible, by a mixture of feldspar, kaolin and flint. Samples of granite from New England quarries behaved as fluxes, just like Cornwall stone. All other fluxes tried were unsuccessful; tale and mineral wool diminished the shrinkage, but made the adhesion of the facing very difficult. The necessity for flint in the facing depends on its relative physical properties of the facing and backing bodies; it is best to add it in the form of a sandy clay. The best formula for a vitreous facing mixture under the conditions of these experiments at cone 7 was:—Cornwall stone, 60; ball clay, 25; and sandy clay, 15 per cent. As porous facing bodies buff and red burning clays are used, when on burning become dense without losing their natural surface.

*Tesseræ.*—Tesseræ are generally made from one body alone. Vitreous tesseræ are porcelain compounds used to give the requisite toughness, texture and brilliancy of colour. For this a mixture of ball and china clay fired with feldspar, fired at cone 10 to 12 has been found necessary. The addition of flint makes the body more stable in the fire, less dry in the biscuit, and of a bluish-tint colour and more translucent, and lime is said to strengthen the body. Among fluxes tried, granite chips were used in the same manner as Cornish stone, and the stained ferruginous minerals, according to the fineness of grinding produced the effect of a speckle to a solid surface; the iron content limits the amount of granite that can be used as a flux. Porphyry and basalt are not suitable on this account.

Fluxes were found to be of use as fluxes only in the form of mineral wool. In vitreous facings 5 per cent. of mineral wool counteracted the tendency of the "tile dish" but was of no value in vitreous tesseræ. Tale and hydromica-schist were useless as fluxes, though the former gave a good cream tint to the body. Zinc oxide imparts a sheen or gloss to the tile; it also fluxed fireclays

to a blue stone very readily, and converted dark buffs, salmon, and light reds into shades of seal brown.

Other fluxes such as cryolite, fluor spar, glass, &c., were not found to be of any value.

The remarks as to colours, apply both to facing tiles and tesseræ. The colours may be either vitreous, namely, imparted to vitreous bodies, or naturally coloured clays and not vitrified. The best vitreous colours are obtained with china clay rather than ball clay. It was found desirable to replace pure vitreous white by a light cream or blue tint, and the most uniform results were obtained by the use of an iron-bearing calcine, composed of alumina, or alumina and zinc oxide and ferric oxide, the latter being obtained by precipitation as hydroxide from ferric chloride solutions by sodium carbonate solution. Oxide of iron in a vitreous china clay body on vitrification causes bluestoning, but iron in silicate minerals such as granite schists, &c., does not, but imparts a cream colour. Iron intimately mixed with flint or alumina and calcined at cone 8 behaves similarly. Vitrification of the body is in all cases necessary to produce full colour effect. Iron precipitated as hydroxide gave better colours than those obtained by merely grinding the oxide of iron with alumina. A good cream was obtained with a stain of 95 per cent. of alumina and 5 per cent. of oxide of iron (precipitated) and increase in intensity of colour is only obtained by increasing the amount of iron in the stain and not by increasing the amount of stain used.

Encaustic Tesseræ have buff and red clays as a base, and addition of fluxes to promote vitrification and darken the colour was useless. Buffs, salmon-reds, &c., are due to the clay bodies used, chocolate is produced with a bright red clay by the addition of 0.5 per cent. of finely powdered precipitated manganese dioxide, whilst with 1.5 per cent. a beautiful jet black is obtained.—W.C.H.

*Clays; Plasticity of —.* F. F. Grout. J. Amer. Chem. Soc., 1905, 27, 1037—1049.

The author deals with the causes of the plasticity of clays and the influence of various conditions and additions. The experiments were conducted in connection with the laboratory work of the West Virginia (U.S.A.) Geological Survey. Plasticity is defined as the property developed in a clay by water, by virtue of which it can be moulded, without crumbling, into forms which remain stiff and unchanged after the removal of the moulding force. It is thus a double property, involving strength, and amount of deformation possible before crumbling. The author points out that the methods of measuring plasticity hitherto suggested have invariably neglected the second of these properties. In the present experiments determinations were made of the compression strength and of the amount of possible flow. The strength was measured by the weight (in 100 grm. units) required to force a Vicat needle of 7 sq. cm. section to a depth of 3 cm. into a mass of clay 4 cm. deep in half a minute. The amount of possible flow was determined by the increase in area of the head of a test rod of clay when it was compressed to the point of fracture. The product of these two values was regarded as the measure of plasticity of the clay, at the stage of wetness in question. As the clay dried, each factor varied, and the product or measure of plasticity rose to a well-defined maximum for a definite percentage of water; this maximum value varied from 1 to 30 for lean and plastic material respectively. After discussing the experimental results obtained, the author concludes that the chief cause of the high degree of plasticity found in clays is molecular attraction depending on the chemical constitution of molecules. When clay is kneaded with water, each grain becomes eventually covered on all sides by a film of water. The cohesion of the water, the adhesion of the grains of clay and the water, and the cohesion of the clay through the films of water, unite to make the moist clay hang together. The films of water also act as lubricants, and the combined cohesion and lubrication is regarded as forming the ultimate basis of plasticity. According to this view plasticity will depend on two factors: First, the distance the clay particles can move on each other without losing coherence; and, second, the amount of coherence, or the resistance to movement. With respect to the first factor, the distance

will vary with (a) the shape and size of the grains, and with (b) the distance through the film that they will attract each other. The second factor, or resistance to deformation, will depend on (c) the friction in the film of water, and (d) the friction of the grains on each other, as they become irregular and penetrate the film. The addition of sand to clay injures the plasticity little at first, because the grains are suspended in a plastic mass, but when the grains of sand are abundant enough to come in contact with their neighbours, the effect becomes considerable, both strength and amount of possible flow being injured. Certain organic colloids increase the plasticity by rendering the water viscous. Plasticity tends to increase as the material is more finely powdered. The presence of plane surfaces (thin plates) increases the amount of possible flow. Molecular attraction has a twofold effect in increasing plasticity. As the attraction becomes greater, the coherence and strength of the mass increase, and the amount of possible deformation before crumbling also increases. Greater fineness of division causes an increase in this action, in that a larger surface is exposed and more water is required, the lubrication being thus improved. The presence of various substances, both colloids and crystalloids, in solution may also increase the attraction.—A. S.

*Concrete; Notes on* — C. E. P. Sankey.  
Engineering, 1905, 80, 269—270.

THE specification for concrete is generally given in the form:  $x$  parts of aggregate to 1 part of cement, and further that sufficient sand must be added to fill the voids. This does not take into account the variation in percentage of voids, with material of different sizes. The procedure suggested is:—

1. Settle upon the aggregate to be employed both as to nature and gauge.

2. Measure the amount of contained sand in the aggregate, and this having been removed, determine the proportion of voids; also note the quantity of water absorbed.

3. Choose the quality of concrete for the work.

4. Calculate the amounts of cement, sand and water required, say, for 1 cb. yard, allowing for the sand in the aggregate and the water absorbed.

5. Use measures to hold these amounts, allowing 10 to 20 per cent. overplus in the case of water. To determine the voids, &c., in an aggregate, take a tank containing, say,  $n$  buckets of water, each =  $Q$ . Let  $x$  = the number of buckets of water required to fill up the tank, which contains dry aggregate with contained sand. Allow water to be absorbed thoroughly by the aggregate. Draw off the water, and let  $x$  = the number of buckets of water required to again fill the tank. Let  $y$  and  $z$  be the corresponding quantities required with aggregate free from contained sand. Then voids in  $n.Q$  cubic feet of dry aggregate =  $z.Q$  cubic feet, or  $100 \frac{z}{n}$  per cent. of voids.

Water absorbed by  $n.Q$  cubic feet of dry aggregate free from sand =  $(y-z).Q$ ; and  $100 \frac{(y-z)}{n}$  = percentage of water absorbed.

The sand contained in  $n.Q$  cb. ft. of dry aggregate is  $(z-2).Q$  cb. ft., and  $100 \frac{z-x}{n}$  = percentage of contained sand.—W. C. H.

#### ENGLISH PATENT.

*Stone Compositions; Manufacture of Artificial* — J. Staudt, Bonn, Germany. Eng. Pat. 26,516, Dec. 6, 1904.

SEE Fr. Pat. 348,601 of 1904; this J., 1905, 499.—T. F. B.

#### UNITED STATES PATENTS.

*Lime; Process of Hydrating* — J. Thomlinson, Portland, Oreg. U.S. Pat. 798,755, Sept. 5, 1905.

LIME is added to a hot mixture of sand, sugar, water and petroleum, and the mixture is thoroughly incorporated, dried, and screened.—E. S.

*Fire-Brick*. R. O. Hayt, Corning, N.Y. U.S. Pat. 798,788, Sept. 5, 1905.

THIS invention relates to a process of forming a refractory article by mixing finely-divided siloxicon (see Eng. Pat. 3629 of 1903; this J., 1903, 743), with a liquid silicate sodium so as to form a pasty substance. The latter moulded, and the block subjected to a high temperature so as to burn out the sodium from the compound.—B.

*Cement-Clinker; Manufacture of* — C. Ellis, Assignor to Eldred Process Co., both of New York, N.Y. U.S. Pat. 798,175, Aug. 29, 1905.

THE cement mixture is heated in a progressively advancing stream by the combustion of an oppositely moving stream of fuel. The air required for combustion is heated continuously by the waste heat of the products of combustion a portion of which, together with a determined quantity of air, is passed through a deep bed of ignited gas-produce coal. The producer gas obtained is mixed with the preheated air in proximity to the cement mixture at the igniting temperature. (See following abstract.)—A. G.

*Gas [from Cement Kilns]; Process of Generating* — C. Ellis, Assignor to Eldred Process Co., both of New York, N.Y. U.S. Pat. 798,176, Aug. 29, 1905.

THE gaseous products of combustion and calcination from a cement kiln, which are richer in carbon dioxide and poorer in nitrogen than ordinary products of combustion are withdrawn from the kiln, freed from dust by deposit or filtration, and mixed with a determined quantity of air or oxygen. The mixed gases are then passed through a deep bed of ignited non-flaming fuel and the combustible gas formed is collected.—A. G. L.

*Water-Extracting Device [for Cement "Slurry"]*. J. Hendrickson, Cleveland, Ohio. U.S. Pat. 798,781, Sept. 5, 1905.

THIS invention comprises a machine for extracting water from "slurry" previous to the latter being burnt. The slurry is measured in predetermined quantities by means of a valved charging chamber. A series of water extractors, movable in relation to the charging chamber is used, and each extractor is successively charged. The extractors comprise press chambers arranged in an annular manner, and moving in a circular path. Plungers operate in the presses, an annular incline being arranged so as to depress the plungers as the extractors are moved along their circular path, and means are provided for raising the plungers after each depression. Compressed air delivered to the under surface of each plunger through an air passage in the plunger when the pressing operation is completed, but during the pressing process the supply is cut off. Each chamber has a hinged bottom with means for automatically opening and closing the same.—B. N.

#### GERMAN PATENTS.

*Kilns for Burning or Roasting Lime, Cement, Ores and the like; Method of Working* — A. Vandenberg. Ger. Pat. 159,767, March 19, 1904.

THE kiln is provided with a movable chimney which can be displaced at will in both a vertical and a horizontal direction, so that the intensity of the fire at any particular part of the kiln can be adjusted.—A. S.

*Slag and Quicklime; Process for the Manufacture of Hydraulic Binding Agent from Granulated Blast-Furnace* — E. Renfert. Ger. Pat. 159,865, A. 15, 1904. Addition to Ger. Pat. 150,769, Jan. 8, 1904.

ACCORDING to the main patent a mixture of granulated blast-furnace slag and quicklime was treated with steam under pressure, and ground, but it was frequently found necessary to dry the mixture before grinding. According to the present patent, the slag alone is treated with steam under pressure, and is then mixed with the quicklime, whereby a dry mixture is obtained, which can be ground directly to an impalpable powder.—A. S.



## X.—METALLURGY.

*Alloys: Copper-Aluminium* ——. L. Guillet. *Comptes rend.*, 1905, 141, 464—467.

GRAPHIC and fusing-point examinations of the series these alloys have led to the recognition of the following constituents:—*a.* A solid solution containing 8 per cent. aluminium, forming large polyhedra, formerly confused with the compound  $\text{Cu}_3\text{Al}$ ; it is contained in all alloys less than 8 per cent. of aluminium. *β.* Either  $\text{Al}$  or a solid solution of this composition; it appears increasing quantity (surrounded by *a*) as the content of aluminium rises beyond 8 per cent. *γ.* A solid solution contained in alloys containing 8.6—11.8 per cent. of aluminium by sudden cooling to a temperature just above its transformation point, but not formed when the alloys cool slowly. *δ.* A solid solution containing 30 per cent. of aluminium. *ε.* Probably the compound  $\text{Al}_2\text{Cu}$ ; crystallites contained in alloys with 36 per cent. of aluminium. *η.* Also the compound  $\text{Cu}_3\text{Al}$ ; it is accompanied by a eutectic in the alloys containing 47—66 per cent. of aluminium. As the aluminium content increases, so does the amount of eutectic, till, at 66 per cent., the whole alloy is eutectic. *θ.* Accompanies preceding eutectic in alloys with more than 66 per cent. of aluminium. It is either metallic aluminium or a solid solution containing very little copper.

The melting-point results agree well with those of Chatelier. All alloys up to 8 per cent. of aluminium, or solidify at  $1035^\circ\text{C}$ .; and alloys containing approximately the following percentages of aluminium solidify simultaneously throughout their whole mass—66, 48, 30, 11—12.

Alloys containing under 8 or over 25 per cent. of aluminium have only one transformation-point; those with 5 per cent. have at least one. The transformation eating seems to occur in several stages, whatever the order of heatings; that on cooling is sharper. The point is at  $490^\circ\text{C}$ ., decreasing as the alloy contains more aluminium till it reaches  $390^\circ\text{C}$ . The second point, doubtful, is about  $150^\circ\text{C}$ . (See also this J., 1904, and 1905, 279.)—J. T. D.

*Bismuth Tellurides.* K. Mönkemeyer. *Z. anorg. Chem.*, 1905, 46, 415—422.

THE first of a series of researches to elucidate the constitution of bismuth telluride. Bismuth and tellurium were melted together in various proportions, and the solidifying-point determined. This shows two eutectic points, one at  $110^\circ\text{C}$ . corresponding to nearly 99 atoms per cent. of bismuth, the other at  $388^\circ\text{C}$ ., corresponding to 9 atoms per cent. of bismuth; between these two points is one maximum at  $573^\circ\text{C}$ ., corresponding to 40 atoms per cent. of bismuth, or  $\text{Bi}_2\text{Te}_3$ . Calculation of the point of disappearance of either eutectic, from the observed duration of period of eutectic crystallisation, also gives the composition of  $\text{Bi}_2\text{Te}_3$  as that of the only alloy which crystallises completely without alteration of composition; all other alloys solidify as mixtures of the first eutectic ( $\text{Bi} + \text{Bi}_2\text{Te}_3$ ) or bismuth or  $\text{Bi}_2\text{Te}_3$ , or of the second eutectic ( $\text{Te} + \text{Te}_2\text{Bi}_3$ ) with  $\text{Bi}_2\text{Te}_3$  or tellurium. The compound  $\text{Bi}_2\text{Te}_3$  is then the only compound of bismuth and tellurium which exists. The conclusions drawn from these melting-point determinations are entirely confirmed by the microscopic examination of the alloys.—J. T. D.

*Aluminium Metals; Technical Determination of the* ——. J. Nordenskjöld. XXIII., page 1033.

## ENGLISH PATENTS.

*Manufacture of* —, and the Smelting or Reduction of Iron or other Ores or Metals. E. T. Zohrab, London. *g. Pat.* 22,688, Oct. 21, 1904.

IS derived from the charring of peat in closed ovens, scrubbed, purified by passage over scrap iron, and condensed, for supply, together with air, to tuyères, of which sets enter an upright smelting furnace. The upper set of the tuyères operates on the ore charged into

the furnace; the second set supplies the gases at or about the melting zone; and the lowest set supplies them to slightly above the hearth. The tuyères are of special construction, for delivery of conjoint blasts of the peat gas and of air. Hydrogen gas, obtained by the electrolysis of water, may be supplied to the furnace with the peat gas, or independently thereof. (Reference is made to Eng. Pats. 26,191 of 1896, and 11,085 of 1900; this J., 1897, 1006, and 1901, 587.)—E. S.

*Zinc Blende; Process for Separating by Flotation* — from Ores, Tailings and Concentrates, and for Preparing such Ores to enable such Separation to be effected. A. J. F. de Bayay, Kew, Victoria, Australia. *Eng. Pat.* 18,660, Aug. 29, 1904.

THE ore or tailing, concentrate, &c., containing zinc blende associated with carbonates is first treated with a suitable reagent to effect the separation of the latter. A suitable method is to treat the wet ore pulp in a closed vessel with carbon dioxide under pressure, and then to wash with water. The ore is then mixed with water to a thin pasty consistence and delivered on to an inclined surface at the foot of which is a well of water or other suitable liquid. The particles of zinc blende float over the surface of the water to a receptacle, and are thus separated from the other constituents of the ore, which sink in the water in the well. The latter part of the process may be carried out in the apparatus described in *Eng. Pat.* 25,858, of 1904.

—A. S.

*Tin; Obtaining and Utilising* —, from Tin Slags. C. A. L. W. Witter, Hamburg-Hohenfelde, Germany. *Eng. Pat.* 24,445, Nov. 11, 1904.

TIN slag or tin waste is smelted with lead to obtain a tin-lead alloy, sulphur being added in amount proportional to the iron present, in order that the latter may be removed as a fusible slag. The tin-lead alloy obtained is subjected to a partial oxidation to obtain a mixture of oxides with a dominant proportion of tin, which oxides may be reduced by known means to obtain an alloy rich in tin.—E. S.

## UNITED STATES PATENTS.

*Iron Sponge; Furnace for the Manufacture of* —. G. Gröndal, Djursholm, Sweden. *U.S. Pat.* 799,001, Sept. 5, 1905.

SEE *Fr. Pat.* 330,763 of 1903; this J., 1903, 1091.—T. F. B.

*Alloy.* A. E. Hobson, Meriden, Conn. *U.S. Pat.* 798,181, Aug. 29, 1905.

THE alloy consists of about 90 per cent. of tin, the remainder being "hardening" material, such as copper and antimony with a small proportion of manganese.—E. S.

*Ores, Slimes, and other Materials; Apparatus for Treating Crushed* —. A. Z. Clark, Melbourne, Australia. *U.S. Pat.* 798,568, Aug. 29, 1905.

A GIRDER extending across and supported on the upper portion of a vat or tank, has connected to it, a cylinder depending vertically in the vat. A propeller having a shaft projecting upwards through the centre of the girder, is located in the lower portion of the cylinder, deflecting plates extending from the periphery of the tank to a point slightly beyond the centre of the cylinder, being attached to the opposite side edges of the girder between the tank and the cylinder.—E. S.

*Slime Concentrating Table.* A. Tetrault and E. C. Pohle, Denver, Colo. *U.S. Pat.* 798,842, Sept. 5, 1905.

A PAIR of beams are loosely fitted in a pair of bracket guides rising from the corners of a foundation frame. The concentrating table is supported on rocking arms, mounted upon the upper side of each beam, and adapted to swing at right angles to the length of the beams. Means are provided for oscillating the table.—E. S.

*Ore Concentrating Table; Dry* —. A. Tetrault and E. C. Pohle, Boulder, Colo. *U.S. Pat.* 798,843, Sept. 5, 1905.

A TABLE with a smooth surface has a cover of transparent

material supported at some distance above it, forming a chamber, openings being left across three edges of the table, whilst the fourth edge is closed. Powdered ore is fed into the chamber through a hopper, which delivers at the closed edge of the table, and the concentrate is discharged through the openings at the opposite edge of the table. A casing acting as an exhaust chamber extends across the openings at one of the edges of the table adjacent to the closed edge, and is provided with a suction device at the end next to the closed edge. A "reciprocating bumping movement" is imparted to the table, which is mounted in a slightly inclined position, and currents of air are drawn in through the openings at one of the edges of the table, and pass diagonally across the moving body of ore to ports, at the opposite edge of the table, communicating with the exhaust chamber.—A. S.

*Furnace; Ore-Roasting* ——. F. H. Trego, Potosi, Wis. U.S. Pat. 798,844, Sept. 5, 1905.

A CIRCULAR furnace, bounded by an annular wall, has a central fixed pillar, rising from the foundation, and supporting a domed top or cover. The inner periphery of the hearth lies within an annular groove in the pillar, about which it rotates. A radially disposed hollow bar is mounted at the inner end of the pillar, carrying dependent from it a series of hollow ploughs, means for circulating water in which are provided.—E. S.

#### FRENCH PATENTS.

*Copper; Separation of* —, particularly from Low Grade Ores. P. Weiller and A. Weiller. Fr. Pat. 353,029, April 5, 1905.

THE naturally oxidised or calcined ores are mixed with metallic iron and melted, preferably in a blast-furnace, whereby the copper, which at first passes into the slag, is continually withdrawn therefrom.—J. H. C.

*Furnaces [for Distillation of Zinc]; Gas* —, with Multiple Burners arranged in Stages and with Central Circulation. L. G. Fromont. Fr. Pat. 353,462, April 8, 1905. Under Int. Conv., April 11, 1904.

THE claim is for special modes of arranging the burners and crucibles and directing the gas or flame currents, particularly in reversing or continuous furnaces for the distillation of zinc, with a view to economise fuel and labour.—J. H. C.

*Brazing Metals; Process of and Product for* —. National Brazing Compound Co. Fr. Pat. 353,485, April 17, 1905. Under Int. Conv., April 18, 1904.

SEE U.S. Pats. 777,546 and 777,547 of 1904; this J., 1905, 93.—T. F. B.

*Cupola Furnaces for Reduction, Fusion, Calcination, &c.; Preservation of* —, by Interior Linings. F. C. W. Timm. Fr. Pat. 353,566, April 20, 1905.

UPRIGHT cylindrical furnaces, built of refractory material, and adapted for continuous working, are, under the present invention, provided with an interior lining of courses of bricks, which descend with the charge as the latter subsides, provision being made for its renewal at the periphery of the top, from which also the charge is fed in, while the gases of combustion escape through a pipe in the hood or cover, having a funnel-shaped enlargement below. Means for withdrawing the charge by portions, as may be required, by lowering at a slow rate the platform on which it rests, interposing supports for the upper part of the charge during the removal of the lowered portion from a chamber in the base of the furnace, and again lifting the supporting platform, are provided and described in detail. The material for the furnace lining may, in some cases, be the same as that of the charge. The lining is to be increased in thickness when air, enriched in oxygen, is supplied through the tuyères, the position and action of which are described. The lining may, under specified conditions, be of a material which absorbs heat in undergoing chemical change, such as calcium carbonate, in order to increase the durability of the furnace walls.—E. S.

*Lead; Process for the Enrichment of Auriferous Argentiferous* ——. H. L. Herrenschildt. Fr. 350,012, June 23, 1904.

MOLTEN lead in excess, at a temperature between and 550° C., is poured into molten sodium nitrate at same temperature, and the mixture is agitated so that the sodium nitrate is reduced to sodium nitrite and lead is oxidised. All the gold and silver present will be found concentrated in the excess of lead. The sodium nitrite may be washed out of the oxide of lead and ery used for subsequent use.—J. H. C.

*Gold; Extraction of* — from Minerals rich in Antimony. H. R. Herrenschildt. Fr. Pat. 350,013, June 23, 1904.

THE auriferous minerals are melted with metallic antimony, antimony sulphide and carbon, or any other substance capable of producing metallic antimony, in such proportions that the metallic antimony finally produced shall be about one-tenth as much as that contained in the original mixture. The auriferous antimony thus produced may be fused directly with sodium or calcium bisulphide with sulphur sufficient to convert nine-tenths of the antimony present into sulphide. The resulting alloy of gold and antimony may be finally treated with nitric acid or by any other known method for the separation of gold.—J. H. C.

#### GERMAN PATENTS.

*Iron; Process for the Continuous Production of Rolled Iron* —, and Furnace, with several Tap-holes, the Invention of. O. Thiel. Ger. Pat. 161,191, Feb. 11, 1902.

MOLTEN pig-iron, together with a suitable quantity of highly-heated ore and lime, is refined in a static hearth-furnace until the whole of the silicon, the greater part of the phosphorus and manganese and a portion of the carbon are removed, if the basic process is followed, or until the whole of the silicon and the greater part of the carbon and manganese are removed in the case of the acid process. The whole of the slag and about one-half of the refined molten metal are then tapped off, and a fresh charge introduced. The refined metal tapped off is conveyed to converters or Martin furnaces for further treatment. It is claimed that by leaving one-half of the refined molten metal in the furnace at each tapping operation, and by using a highly-heated mixture of ore and lime, the temperature of the furnace is maintained at such a point that the working is considerably accelerated. One hearth furnace worked by this method is stated to be capable of refining the whole of the pig iron from a blast-furnace plant (800 tons or more per 24 hours).—J. H. C.

*Metals, Metalloids or their Compounds as free from Carbon as possible; Manufacture of* —. E. W. Hoy. Ger. Pat. 161,559, March 23, 1904. Addition to Ger. Pat. 138,808, Nov. 11, 1900.

ACCORDING to the main patent, the impure metal or metalloid was vaporised and forced through a strongly heated layer of its oxide. The use of other suitable oxides instead of the oxide of the metal or metalloid under treatment is claimed in the present patent. In this way, alloy may be obtained of which one of the constituents is not readily volatile at the temperatures attained in practice. For example, an alloy of iron and titanium free from carbon, is obtained by heating a mixture of titanium oxide and charcoal, and forcing the vapours produced through a layer of fused titanic acid. The carbon is then removed from a portion of the titanic acid to titanium, and this is combined with the iron to form an alloy free from carbon. A manganese-copper alloy is prepared by heating manganese oxide with charcoal, and forcing the reaction products through a layer of copper oxide.—A. S.

*Pottery of all kinds; Process for the Manufacture of [Utilisation of Waste Product from Thermite Process]* —. C. F. Boehringer und Söhne. Ger. Pat. 160,780, Nov. 22, 1901. VIII., page 1016.

*Kilns for Burning or Roasting Lime, Cement, Ore, or the like; Method of Working* —. A. Vanderstede. Ger. Pat. 159,767, March 19, 1904. IX., page 15.



and Quicklime; Process for the Manufacture of a Hydraulic Binding Agent from Granulated Blast Furnace —. E. Renfert. Ger. Pat. 159,865, April 15, 1904. Cl. page 1018.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A.)—ELECTRO-CHEMISTRY.

on Monoxide and Carbon Cells. F. Haber and A. Moser. Z. Elektrochem. 1905, 11, 593--609.

The authors have succeeded in producing a cell in which substances which are active in producing E.M.F. are on monoxide or carbon and oxygen.

This cell warm glass (at about 500° C.) serves as the electrolyte. It is constructed of a soft glass test-tube, inner and outer surfaces at the closed end being nised, and thus serving as electrodes. The current is brought in contact with these platinised surfaces by brush or coil of fine platinum wire.

Means are also provided for surrounding the inner and surfaces of the tube with an atmosphere of the par gas mixture under investigation. This was ally carbon monoxide diluted with carbon dioxide on one hand, and air on the other.

Recent measurements have shown that the E.M.F. the boiling points of sulphur and phosphorus pentoxide (about 1.0 volt) correspond very closely with that dated on thermodynamical grounds, and the same s for the effect of change of concentration of the on monoxide, carbon dioxide or oxygen.

When concentrated carbon monoxide mixtures are used, sition of carbon occurs by dissociation of the gas, and ell is transformed into one in which carbon itself forms ictive substance.

The present form the cell is only suitable for potential uments; experiment, however, proves that when a rt is taken from it, it is capable of recovering its initial F. shortly after the current is stopped.—R. S. H.

rine and Alkali; Castner Mercury Process for Making —. M. Le Blanc and C. Cantoni. Z. Elektrochem. 05, 11, 609--612.

A LABORATORY form of the Castner alkali cell suitable for uments and demonstrations is described. An investion with this has shown that, if the current density on mercury cathode be at least 0.1 ampère per sq. cm., mercury be kept in slow motion and the concentration of potassium chloride be high, a current yield of over 90 per (at 40° C.) can be attained.—R. S. H.

### ENGLISH PATENTS.

anic; [Electrolytic] Method of Separating — from Liquid Food Materials whether used as Liquid or Treated with other Materials to Produce a more or less Solid od. O. G. C. L. J. Overbeck. Eng. Pat. 24,174, v. 8, 1904. XVIII.A., page 1027.

rodes for Electrolysers used in the Manufacture of enching Liquors. R. Kother, Cunewalde, Saxony. ig. Pat. 7020, April 3, 1905.

The anode consists of a piece of platinum foil or thin num gauze laid upon one side and folded closely nd the edges of a plate of insulating material. The ode consists of a carbon plate pressed closely against opposite side of the insulating plate.—A. S.

### UNITED STATES PATENTS.

rolytic Process. C. Hering, Philadelphia, Pa. U.S. Pat. 798,790, Sept. 5, 1905.

The invention relates to a process of reclaiming the free and depolariser from a mixture of exhausted liquid lariser and exhausted exciting fluid containing free resulting from the operation of a two-liquid primary

battery. The liquid is electrolysed, using an anode of spongy lead and a cathode of lead peroxide, the anode and cathode combining respectively with the acid and depolariser and forming inert solid compounds on the electrodes. The latter are removed and immersed in a suitable electrolyte with interposition of a porous diaphragm, and a reversed current is passed through the liquid. The electrodes return to their original condition, and the free acid and depolariser are re-formed. The process may also be employed for the removal of an objectionable ingredient from an electrolytic solution containing other substances capable of being electrolysed, such as the removal of an excess of free acid from a solution of a metallic salt, for instance, zinc sulphate, which is being electrolysed for recovery of the zinc at the cathode.—B. N.

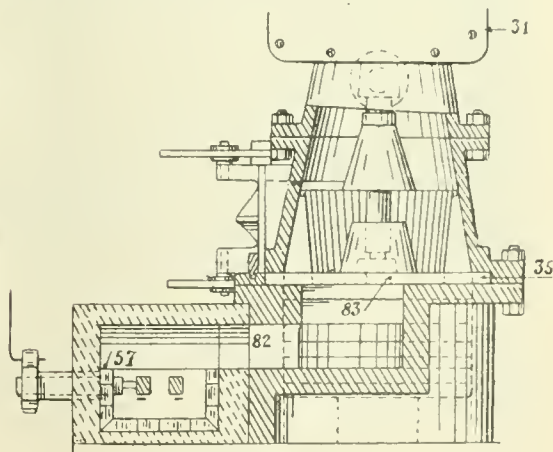
Oxalic Acid and its Derivatives; Method of Reducing — by Electrolysis. E. von Porthcim. U.S. Pat. 798,920, Sept. 5, 1905. XX., page 1030.

### FRENCH PATENTS.

Electrolysis of Alkali Chlorides; Apparatus for the —. H. M. Granier. Fr. Pat. 353,304, March 18, 1905. Under Int. Conv., March 19, 1904.

This invention relates to an apparatus for the direct production of chlorine and caustic alkali from an alkali chloride, and is characterised by the complete separation of the positive and negative liquids by means of "non-filtering" cylindrical water-tight diaphragms, into which are fitted tubular "filtering" diaphragms closed at the top. Between the two sets of diaphragms are interposed rods of iron, which are connected to the negative pole of the apparatus. The filtering diaphragms, containing the negative liquid are arranged in such a manner that the pressure of the liquid may be varied, so as to regulate the rapidity of filtration through the diaphragms.—B. N.

Carbon Bisulphide; Process of Obtaining — after the Carbonisation of Peat to obtain its Carbon, and the Electro-Metallurgical Preparation of the Sulphur Vapour necessary for the Reaction. A. Augier. Fr. Pat. 353,028, April 5, 1905.



THE peat, which supplies the carbon for the manufacture of carbon bisulphide, is led up an inclined tube, surrounded by a jacket containing water at 50°—60° C., by means of a helical conveyor; this brings it to the top of the carbonising chamber, which is of truncated conical shape. The peat descends down this on to a large plate, pierced with holes, covered by baffles; it is kept in motion by a rotating vertical shaft on which conical projections are fixed. The carbonising chamber is heated by the heat arising from an electric furnace containing molten iron, which has been obtained from a suitable mineral (e.g., marcasite or chalcopyrite), the sulphur vapour arising therefrom being led through the holes in the plate above mentioned, where they

mingle and combine with the carbonised peat to form carbon bisulphide. A suitable form of apparatus is shown in the accompanying figure: 31 is a portion of the wall of the carbonising chamber, 35 is the plate on to which the peat falls; the electric furnace is shown on the left, where 57 is the receptacle for the molten iron; the sulphur vapour passes through 82, and thence through the holes 83 in 35 into the carbonising chamber.—T. F. B.

*Nitrites*; [Electrolytic Reduction of Lead Oxide to Metal for Use in the] Manufacture of ——. P. J. Petit. Fr. Pat. 353,467, April 14, 1905. VII., page 1013.

*Chromium Protoxide*; Application of Salts of — in Tanning, with a view of Obtaining a Deposit of Chromium Sesquioxide on the Fibres of the Hide. R. Berthon. Fr. Pat. 353,418, April 17, 1905. XIV., page 1023.

*Nitrogen and Oxygen*; Process for the Production of Compounds of — by Electrical Means. Soc. Westdeutsche Thomas Phosphat-Werke, G. m. b. H. Fr. Pat. 353,548, April 19, 1905. VII., page 1013.

*Sugar Juices*; [Electrolytic] Clarification of ——. R. J. Thomas and W. F. S. Howe. Fr. Pat. 353,568, April 20, 1905. XVI., page 1024.

### (B).—ELECTRO-METALLURGY.

*Calcium*; Preparation of Metallic — for Laboratory Purposes. P. Wöhler. Z. Elektrochem., 1905, 11, 612–618.

A LARGE iron crucible contains the fused electrolyte (100 parts of calcium chloride and 17 parts of fluorspar) which has a m.p.t. of 660° C. A carbon electrode serves as anode and an 8 mm. iron rod as cathode, the latter only just touching the surface of the electrolyte. (See Eng. Pat. 20,655 of 1903; this J., 1903, 1299.) The anode and cathode are about 6 or 8 cm. apart, a current of 40 ampères at 38 volts being employed. The temperature must be kept below the m.p.t. of the calcium (800° C.). Under these conditions, and with a current density of about 100 ampères per sq. cm. at the cathode, rods of calcium of any desired length can be obtained by gradually feeding up the electrode during the electrolysis, and thus only allowing it just to touch the surface of the electrolyte. The current density at the cathode may vary within wide limits (50 to 250 ampères per sq. cm.) without disturbing the progress of the metal separation. At the anode, however, a limit was observed above which large fluctuations in the current are observed. The author suggests that combination occurs between the chlorine and the carbon anode, and that this may have some bearing on the phenomenon. The current yield in two experiments of short duration is said to have been 82.2 and 81.4 per cent. respectively. The preparation progresses much more satisfactorily in a fresh electrolyte than in one which has been frequently used.—R. S. H.

### ENGLISH PATENT.

*Furnaces*; Impts. in Electric ——. P. Girod, Paris. Eng. Pat. 14,333, July 11, 1905.

SEE Addition, of Dec. 24, 1904, to Fr. Pat. 329,822 of 1903; this J., 1905, 740.—T. F. B.

### UNITED STATES PATENT.

*Furnace*; [Electrical] Metallurgical ——. G. H. Benjamin, New York. U.S. Pat. 798,258, Aug. 29, 1905.

THE material is fed in at the top of a series of chambers or hearths inclined alternately in opposite directions. It falls by gravity from chamber to chamber, while being exposed to the combustion gases from a tank furnace at the base. In each chamber, means are provided for adding definite charges of fluxes or other combining material, and electrodes are set in each vertical passage connecting the chambers for heating the material electrically, whilst provision is made for carrying the heated gases around such passages.—E. S.

### FRENCH PATENTS.

*Iron, Steel, Cast Iron, &c.*; Process for Covering by Electrolytic Means the Surfaces of Objects of —, with an Adherent Coating of Another Metal. J. Schiel. Fr. Pat. 353,288, Feb. 28, 1905.

THE metal is first rapidly cleaned, deoxidised, and decarburised to a certain depth, by submitting the articles anodes to electric action in an electrolyte containing hydrochloric acid, nitric acid and water, of a density 18° to 20° B., and with a high current density. Plates of carbon, of a greater area than the surface of the anode are used as cathodes, and the surface of the article acquires a porous structure. The surface of the metal and the interior of the pores are then rapidly covered electrolytically with a deposit of finely-divided metal. This is accomplished by making the objects the cathode in a concentrated electrolyte which is a good conductor of electricity, but which is poor in the salts of the metal to be deposited or which is entirely devoid of these salts. Plates of carbon or soluble anodes are used, the surface of which considerably exceeds in area that of the object, and a high current density is employed. The entanglement of the deposited metal with the spongy structure of the object results in a firm adherence of the deposited metal. The objects are afterwards introduced into ordinary galvanic bath depositing metal.—B. X.

*Aluminium and its Alloys*; Production of Metallic —. A. E. de Souza. Fr. Pat. 353,277, Feb. 3, 1905. Unc. Int. Conv., Feb. 3, 1904.

CRYOLITE, bauxite, hydrargillite, kaolin, or other suitable minerals are treated with nitric, hydrochloric, sulphuric or other mineral acid, or with alkalis, or alkali carbonates, and the alumina which goes into solution is precipitated as hydroxide by means of ammonia; when iron is present in the solution, it must, of course, be separated by carbon dioxide or other suitable means. The aluminium hydroxide is separated by filtration, dried, heated to 120° C., mixed with lime and carbon and electrically reduced, calcium carbide being simultaneously produced.—J. H. C.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*Palm [Cocanut] Oils and Butter*; Contribution to Knowledge and Determination of the Volatile Fatty Acids in ——. O. Jensen. XVIII.A., page 1025.

*Glycerol*; Comparison of Methods of Determining — in Fats, Soaps and Glycerin Preparations. F. Schulz. XXIII., page 1038.

### ENGLISH PATENTS.

*Oil*; Extracting — from Seeds and the like. T. Silcock and W. A. Silcock, Liverpool, and E. Stephens. Hull. Eng. Pat. 1040, Jan. 19, 1905.

CLAIM is made for a process of extraction in which seeds are placed in a rotatable vessel mounted on a hollow shaft divided into compartments by means of a partition. The solvent is introduced at one end of this shaft and passes into the vessel, which is then made to rotate. After the extraction the bulk of the solvent and the extracted oil pass away through an exit pipe, and steam then introduced through the same opening as the solvent in order to cook the seeds and expel the residual solvent. The steam and the vapours pass through perforations in a scraper fixed to the shaft and thence through connecting pipes into the other compartment of the shaft, the end of which is attached to a condenser.—C. A. M.

*Oil or other Liquids*; Presses for Expressing — from Materials containing them. F. C. Caldwell, Chicago, Ill., U.S.A. Eng. Pat. 8696, April 25, 1905.

IS the type of press claimed, the pressure roller acts with a rotatory and gyratory motion within a pressure chamber.



ch is conical in the case described) provided with ages on its inner walls for the escape of the expressed oil. The material introduced at the top falls between walls and the conical roller which has spiral corrugations on one side at the upper part and all round near bottom. As the roller revolves vertically, the gyratory motion causes the seed to be pressed by the plain surface against the side of the chamber, whilst the spirally corrugated surface subsequently removes the crushed substance and carries it downwards. When the material reaches the lowermost portion of the chamber where the corrugations go right round the roller, it is driven into a large discharge chamber, whence it can be removed without interrupting operation of the press.—C. A. M.

*Recipients; Impts. in* — L. A. A. Hennequin and J. B. Cayeux. Eng. Pat. 11,679, June 3, 1905. L., page 1008.

*Substitutes such as Margarine and the like; Manufacture of* — K. Mann. Eng. Pat. 15,311, July 25, 1905. XVIII.A., page 1027.

#### FRENCH PATENT.

*Process of Making Solid* — [from Refinery residues]. H. P. J. B. Goffart. Fr. Pat. 350,001, June 17, 1904.

The process is particularly applicable to the treatment of black oily residue extracted from the filtering material refining colza oil. This black oil is heated with lard zinc to a temperature of 110°–120° C. for about minutes. After cooling to 75° C. the oil is run off and excess of zinc remaining at the bottom of the vessel is for treating more oil. When quite cold the treated forms a solid mass which has usually a m. pt. above 2. (See also this J., 1904, 978.)—W. P. S.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc

#### (A.)—PIGMENTS; PAINTS.

##### ENGLISH PATENT.

*Lead; Process for Manufacturing* — Gebr. Heyl und Co., and A. Wultze, Charlottenburg, Germany. Eng. Pat. 24,238, Nov. 9, 1904. Under Int. Conv., June 11, 1904.

Fr. Pat. 347,311 of 1904; this J., 1905, 338.—T. F. B.

##### FRENCH PATENT.

*Antimony Compounds for Use as Pigments, &c.; Process for the Preparation of* — E. Chatillon. Fr. Pat. 356,655, April 20, 1905.

A mixture of antimony ore and combustible material is fed in a cupola furnace, the latter being connected with a number of exhaust-condensers, where the fumes from the furnace are treated with sprays of water holding solution or suspension sulphides, carbonates, sulphites, hydroxides of the alkalis or alkaline-earths. These combine with the sulphur dioxide, carbon dioxide and gaseous antimony oxide to form various coloured pigments. By heating the ore with an excess of coke and sture in a closed vessel, a yellow colour is produced. To obtain a violet colour, the gases coming from the furnace are passed through a chamber heated to a temperature of 900° C. and then condensed. Compounds of sulphur may be added to the charge in the cupola.—W. P. S.

#### (B.)—RESINS, VARNISHES.

*Resin Oils [Kauri and Manila]*. L. Schmoelling. Chem.-Zeit., 1905, 29, 955–956.

The volatile oil obtained in the preparation of kauri oil is a bright yellow mobile liquid with a pleasant

smell. It is soluble in most organic solvents except light petroleum. The constants are: Sp. gr., 0.8677 at 15° C.; acid value, 3.0; saponification value, 4.9; iodine value (Waller), 288.9. It distils mostly between 150 and 160° C., and contains pinene. The volatile oil from manila copal has a rose colour, which deepens on exposure. Its constants are: Sp. gr., 0.9069 at 15° C.; acid value, 28.3; saponification value, 45.7; iodine value (Waller), 230.4. The acid and saponification values decrease if the oil is exposed. It distils between 60° and 250° C., and contains an aldehyde. No evidence of the presence of limonene or pinene was found. (See also this J., 1901, 729.)—F. S.

### XIV.—TANNING, LEATHER, GLUE, SIZE.

#### UNITED STATES PATENTS.

*Hides; Process of Treating* — F. J. Oakes, New York. U.S. Pat. 798,070, Aug. 29, 1905.

A CLAIM is made for the use of sulphur and putrefying albuminous matter in a bath in which the hides are treated before tanning. The amount of each substance used in this process may be 5 per cent. of the weight of the hides.—W. B. H.

*Hides; Process of Treating* — F. J. Oakes, New York. U.S. Pat. 798,293, Aug. 29, 1905.

The process consists in soaking hides in a bath containing sulphur, a carbohydrate such as glucose, and an alcoholic ferment such as yeast. The amount of the principal materials (sulphur and glucose) used may be 5 per cent. of the weight of hides treated.—W. B. H.

*Hides; Process of Treating* — F. J. Oakes, New York. U.S. Pat. 798,294, Aug. 29, 1905.

THE hides are soaked in an aqueous bath containing sulphur and a putrefying excrementitious substance.—W. B. H.

*Leather and Leather Cloth; Manufacture and Waterproofing of* — P. C. D. Castle, Bebington. U.S. Pat. 798,951, Sept. 5, 1905.

SEE Eng. Pat. 2167 of 1904; this J., 1905, 36.—T. F. B.

#### FRENCH PATENTS.

*Tanning; Process of* — J. R. Riviere and P. F. Verrone. Fr. Pat. 350,026, June 29, 1904.

SKINS, after liming and pickling, are rapidly dried and then treated with an infusion of dung from horses (or other herbivorous animals), made by digesting 100 kilos. of the dung in 100 litres of water for 24 hours, and afterwards adding a further 100 litres of water every two hours until the whole measures 500 litres.

The tannage is commenced in the drum or paddle, using a weak solution of the horse dung infusion, which is gradually strengthened until thorough penetration through the skins has been secured; the time required is from 2 to 3½ hours.—M. C. L.

*Chromium Protoxide; Application of Salts of* — in Tanning, with a view of Obtaining a Deposit of Chromium Sesquioxide on the Fibres of the Hide. R. Berthou. Fr. Pat. 353,418, April 17, 1905.

NEUTRAL solutions of chromous salts when exposed to the air are oxidised, either a mixture of chromium sesquioxide and a chromic salt, or a basic chromium salt being formed. In presence of animal tissues, such as hides, the basic chromium salt is decomposed, chromium sesquioxide being deposited on the fibres of the hide and a neutral chromic salt left in solution. The present patent relates to the employment of chromous salts in tanning, and it is stated that the leather produced is superior to chrome-tanned leather produced by the usual processes. The chromous salt may be prepared either by a chemical or by an electrical method. In the first case a solution containing 10 per cent. each of chrome alum and sodium chloride is passed

through a closed vessel containing granulated zinc, then through the vat containing the hides to be tanned, and then again through the zinc box, and so on. In working by the electrical process, a 5 per cent. solution of pure chromic chloride, prepared in any suitable manner, is subjected to electrolysis with the aid of a low E.M.F. in a cell furnished with a porous pot. The electrolyte is circulated through the tanning vats, and then again through the electrolytic cell, to which from time to time suitable quantities of chromic chloride are added.—A. S.

*Glue; Process for the Manufacture of* —, from Bones, Hide Pieces, &c. O. Schaidner. Fr. Pat. 350,017, June 24, 1904.

The process consists in treating bones, pieces of hide and other similar substances with a phosphate, preferably sodium phosphate, followed by an after treatment with dilute sulphuric acid. It is claimed that the sodium sulphate and phosphoric acid produced during the treatment, do not render the finished product less transparent.—M. C. L.

## XVI.—SUGAR, STARCH, GUM, Etc.

### UNITED STATES PATENT.

*Starch; Process of Obtaining Soluble* —, R. Hartwig, Assignor to Siemens and Halske Aktienges, Berlin. U.S. Pat. 798,509, Aug. 29, 1905.

In this process, soluble starch, especially maize starch, is obtained by subjecting dry raw starch at ordinary temperatures (50° to 86° F.) to the action of an excess of gaseous chlorine for four to eight days, or until perfectly soluble in hot water.—W. B. H.

### FRENCH PATENTS.

*Masseccites [Sugar]; Continuous Preparation of* —, H. Roy. Fr. Pat. 353,317, March 29, 1905.

The process of withdrawing the finished masseccite without interrupting the work of the pan is effected by means of the principle described in Fr. Pat. 337,227 (see this J., 1904, 616; 1905, 980) in which the boiling syrup is circulated outside the pan by means of a pump, re-heater and telescopic tubes. When the charge has been concentrated to the final point, the supply of feed syrup being cut off, the telescopic circulating tubes are raised above the level of the masseccite, the suction tube being always at a higher level than the return tube. The feed-supply valve is then opened and the new syrup is boiled as a separate charge on the top of the layer of finished masseccite, circulating independently of the latter. Meanwhile, a valve is opened in the bottom of the pan through which the lower layer of finished masseccite is withdrawn without disturbing the boiling of the top layer of thinner syrup. A sufficient residue of masseccite remains in the pan to serve as a graining base for the new charge.—J. F. B.

*Sugar Juices; [Electrolytic] Clarification of* —, R. J. Thomas and W. F. S. Howe. Fr. Pat. 353,568, April 20, 1905.

The hot juice is subjected to the action of an electric current, and the coagulated impurities are removed by decantation or filtration.—J. F. B.

*Sugars; Process of Refining* —, J. V. P. Lagrange, H. Le Secq des Tournelles and B. Baud. Fr. Pat. 353,639, April 22, 1905.

Raw sugar of No. 3 quality, clean except for contamination with molasses, is purified either by "maceration" or "precipitation." In the maceration process, the sugar is placed in a closed centrifugal apparatus, and treated whilst in motion by a current of air saturated with expanded steam. The saturated air passes from the outside of the layer of sugar to the inside, and liquefies the molasses dried on the grain, so that it is whirled away. In the deposition process for obtaining fine grain sugar, a syrup of very high density is produced by the use of a temperature gradually rising from 115° to 120° C., and the

product so obtained is crystallised systematically in one of the crystallising malaxeurs commonly employed for the purpose of crystallising refinery masseccites.—J. F. B.

## XVII.—BREWING, WINES, SPIRITS, Etc.

*Malt; Increasing the Brewery Yield of Extract from — by Separate Mashing of the Grits.* G. Merz. W. f. Brau., 1905, 22, 493—495.

The exhausted grains of the brewery always retain from 0.5 to 1.4 per cent. of undissolved extract (calculated the weight of the malt) in the form of the steely unmodified points of the corns. By adopting the principle of separating the steely points from the hulls before mashing, about 50 per cent. of this loss of extract may be avoided. The mechanical difficulty of separating the steely grits from the hulls, without unduly damaging the filtering properties of the latter, can be accomplished with the aid of a Seeker Sieves of suitable meshes are inserted in a four-roller machine, these first separate the hulls, together with the firmly adherent steely grits from the normal grist and flour, and deliver the two last into separate compartments of grist-case. The hulls and steely grits are then milled a second time in such a manner that the hulls are not broken up, whilst the steely particles of grit are brought into a suitable condition for separation by the sieves. The hulls are then delivered into the compartment containing flour, and the steely grits are mixed with the normal grist. In the brew-house, the mixed grist is mashed in hot water for 15 minutes to effect a preliminary saccharification, and the mash is then boiled for 30 minutes, the absence of hulls permitting a prolonged boiling without ill effects. This boiled gelatinised mash is then discharged into a plain infusion of the mixed hulls and flour previously prepared in the mash-tun, and the whole is saccharified in the usual manner.—J. F. B.

*Maltoxydase.* W. Issajew. Z. physiol. Chem., 1905, 331—350; Chem. Centr., 1905, 2, 688.

An extract of malt made with 50 per cent. glycerol contains both a direct acting oxydase and an indirect peroxidase. Malt oxydase somewhat resembles Bertrand's laccase, is weaker in its action and does not react with tyrosine. It acts only on auto-oxidisable bodies, intensifying the oxidation, e.g., on pyrogallol, *p*-aminophenol, &c. Pyrogallol is oxidised to purpurogallin only when hydrogen peroxide is present, similarly, the guaiacum reaction is shown in presence of hydrogen peroxide. Malt oxydase is weakened by the action of high temperatures, but is not entirely destroyed even by steam of 1½ atmos. pressure. It acts best in neutral media. Mercuric chloride and tannin destroy its activity, and 20—40 per cent. alcohol weakens it considerably. A dilute solution of manganous sulphate is without influence, but stronger solutions are harmful; this is a further differentiation from laccase. The oxydase is active during the germination of the barley; its activity increases up to the third day, and then remains constant. Malt extract contains small quantities of easily oxidisable substances, the greater part of which are precipitated by 80 per cent. of alcohol.—J. F. B.

*Wines; Ageing of* —, P. Malvesin. Bull. A. Chim. Sucr. Dist. 1905, 23, 130—133.

The deposits eliminated from wine during ageing are composed of crystals of potassium bitartrate and other mineral salts, also of coagulated colouring matter, tannates, fatty matters, and micro-organisms. In order that any artificial ageing process may simulate the natural process, the formation and elimination of all these matters must be ensured. This elimination can only be produced properly by the alternate or simultaneous influences of oxidation and cold. Experience has shown that the suitable oxidising agent is the air; ozone, oxygen, hydrogen peroxide produce special flavours and odours which cannot be regarded as equivalent to natural ageing. A successful ageing process must also include: increase of bouquet due to the formation of aldehydes, esters and acetals; a sufficient degree of "décoloration."



due to the disappearance of a portion of the lactic acid during esterification and to the precipitation of a portion of the tannins by the action of the oxygen of the air, and cold; double decompositions which convert bitartrates into neutral tartrates. These various reactions constitute a complex process which cannot be effected in a single operation, but only by a series of appropriate treatments, which, however, may be made to proceed each other rapidly in practice. Any process depending on the introduction of foreign substances into wine, or on contact between the wine and such reagents defective in practice owing to the abnormal flavour which is thus imparted.—J. F. B.

*Formic Acid in the Distillery; Use of —.* H. Lange. Z. Spiritusind., 1905, 28, 341–342.

The author draws attention to the extremely favourable results obtained in the distillery by the addition of formic acid to the acidified [lactic acid] yeast mash. The formic acid in small doses stimulates the fermentative activity of the yeasts, preserves the diastase in an active condition throughout the fermentation, and protects the mash from the action of acid-forming bacteria, whereby maximum yields of alcohol are obtained. The fermentation of mashes containing formic acid starts more quietly than usual and is more uniform in intensity; a very characteristic feature of such mashes is the exceptional vigour of the secondary fermentation. This uniformity of fermentative intensity enables the tuns to be filled higher than is usually the case. For a fermentation tun of 100 litres capacity, 50–60 c.c. of pure formic acid is used. In practice the strong formic acid is diluted to the ratio of 1 part to 8 parts of water. The yeast mash is prepared and acidified in the usual manner; after it has cooled to 37°–38° C., 100 c.c. of the diluted formic acid are added for every 100 litres of mash, and the yeast is pitched at a suitable temperature. After the yeast has been run in this manner through three successive fermentations, the dose of formic acid is raised to 200 c.c. per hectolitre, at which it is maintained for six further fermentations; the final proportion of formic acid, viz., 100 c.c. of diluted acid to 100 litres of mash is then employed constantly. When employing the full proportion of formic acid it is advisable to raise the temperature at which the yeast is pitched by 1.5°–2° C.—J. F. B.

*Upper Pipes; Action of Brine on —.* H. Keil. L., page 1003.

*Yield; Determination of Yield of Extract in —.* Bergdolt. XXIII., page 1038.

*Yield in Liqueur Wines; Determination of —.* X. Rocques. XXIII., page 1038.

*Yield in Spirits; Determination of —.* R. Duchemin and J. Douren. XXIII., page 1039.

#### ENGLISH PATENTS.

*Distilling Processes; Impts. in —.* O. and W. T. Deichmann, Cologne. Eng. Pat. 18,013, Aug. 19, 1904. Under Int. Conv., Aug. 26, 1903.

Eng. Pat. 349,478 of 1904; this J., 1905, 746.—T. F. B.

*Wort; Processes of Preparing —.* L. Rübsam, Bamberg, Germany. Eng. Pat. 23,597, Nov. 1, 1904.

Eng. Pat. 347,590 of 1904; this J., 1905, 341.—T. F. B.

*Wort or Mash; Process for Separating By-Products of Alcoholic Fermentation from —.* O. Pampe, Halle on the Saale, Germany. Eng. Pat. 5930, March 21, 1905.

The mash or wort is delivered from a distributor into two (or more) worms of a dephlegmator. In this part of the apparatus it is heated to a temperature of 75° C. and is kept under slight pressure by a constriction or jet of steam in the discharge pipe. The latter leaves the bottom of the dephlegmator and supplies the wort to the top of a carbon dioxide separator. This contains a number of

concave and convex trays, over which the liquid falls in thin layers, heated to a temperature of 75° C., whereby the liberation of the carbon dioxide is facilitated. The liberated carbon dioxide, charged with aldehydes, &c., escapes through a pipe at the top of the apparatus. By collecting and cooling the gas, the aldehydes, &c. are separated, and may be used for methylation purposes.

—W. P. S.

*Aerated Waters, Alcoholic and other Drinks. [Containing Formates].* J. C. Richardson, London. Eng. Pat. 17,749, Aug. 16, 1904.

The patentee claims the manufacture of beverages such as aerated waters, wines, spirits and other liquids, to which have been added from 5 to 15 grs. of sodium formate per pint. The formates of the other alkalis or of alkaline-earths may also be used.—W. P. S.

*Spirits; Preliminary Treatment and Ageing of —.* C. A. Petersen-Schepelern, Vejle, Denmark, and C. W. Schwanenflügel, Copenhagen. Eng. Pat. 13,922, June 23, 1905.

To promote the oxidation of fusel oil, from 10 to 20 c.c. of 3 per cent. hydrogen peroxide and 1 grm. of powdered blood-charcoal are added to each litre of spirit. After standing for 24 hours, the rectification is proceeded with in the usual manner. An alternative way is to treat the spirit with 30 c.c. of hydrogen peroxide per litre and then to store it for three or four months in barrel, when it will be fit for use.—W. P. S.

*Arsenic; [Electrolytic] Method of Separating — from Liquid Food Materials whether used as Liquid or Treated or Combined with other Materials to Produce a more or less Solid Food.* O. G. C. L. J. Overbeck. Eng. Pat. 24,174, Nov. 8, 1904. XVIII., page 1027.

#### FRENCH PATENTS.

*Grape Mares as Cattle Food; Recovery and Utilisation of —.* L. M. V. Chaboissier. Fr. Pat. 353,333, April 12, 1905. XVIII., page 1027.

*Grape Mares; Extraction of Cream of Tartar from —.* G. Tarulli. Fr. Pat. 353,459, April 6, 1905. XX., page 1030.

#### GERMAN PATENT.

*Spirit Distilling Apparatus; Control Device for the Receivers of —.* E. G. Hager. Ger. Pat. 160,636, Oct. 21, 1904.

The control device is for the purpose of indicating any illegal withdrawal of untaxed spirit at the outlet of the condenser connected to the distilling apparatus. If the liquid in the still be heated too strongly, the flow of spirit to the condenser becomes too rapid, and the condensed liquid rises under the bell above the outlet of the condenser, and eventually flows out between the bell and the lower support or stand, and can then be removed illegally. The control device claimed, registers the number of periods of excessive heating, and also the highest level attained by the spirit under the bell. It consists essentially of an apparatus fitted with two floats, of which one remains fixed in the highest position to which it rises, whilst the other at definite levels sets free balls which are directed into an open basin or cavity, where they can be counted.

—A. S.

### XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

#### (1.)—FOODS.

*Palm Oils [Cocount Oil] and Butter; Contribution to the Knowledge and Determination of the Volatile Fatty Acid in —.* O. Jensen. Z. Untersuch. Nahr.- u. Genussm., 1905, 10, 265–283.

In these investigations, the volatile fatty acids concerned were separated from one another by a method of fractional

precipitation of their silver salts. The properties of these acids, and their relative proportions in butter and coconut oil are discussed at some length, and for the detection of small quantities of coconut oil in butter the determination of the "caprylic and capric acid values" is recommended. As a preliminary to the separation of the volatile fatty acids with silver nitrate, the solubility of the silver salts of the acids, both in water and in the presence of a definite quantity of silver nitrate per 100 c.c., was determined, and the results for butyric, caproic and caprylic acids are given in the following table:—

Silver salt of:	Gms. dissolved in:	
	100 c.c. of water.	100 c.c. of N/20 silver nitrate solution.
Butyric acid .....	0.489	0.347
Caproic acid .....	0.089	0.029
Caprylic acid .....	0.018	0.005

With the aid of these figures, the proper degree of concentration for any particular separation can be chosen, and the correction for the influence of any excess of silver nitrate made. The solubility of the three higher volatile fatty acids themselves has been carefully determined. Capric acid is insoluble in water at 15° C., whilst 100 c.c. of water dissolve 0.079 gm. of caprylic and 0.872 gm. of caproic acid respectively. Though caproic acid is so much more soluble than caprylic acid, it is noteworthy that if a saturated solution of caproic acid be shaken with a little caprylic acid, the acid value of the solution falls rapidly, and the liquid is changed into a saturated solution of caprylic acid, whilst most of the caproic acid is thrown out of solution. The presence of butyric acid on the other hand has no influence on the solubility of either of these acids.

The percentage of butyric and caproic acids in pure butter-fat varies very considerably and the author has collected the figures of the Reichert-Meissl value from different laboratories in the chief butter-producing countries. To obtain from the Reichert-Meissl value, the relative proportions of butyric and caproic acids present, the author has worked out the following formula:—

$$C = (R.M.V. - 1.7) \frac{1}{1+x} \cdot \frac{100}{96}$$

$$\text{and } B = (R.M.V. - 1.7) \frac{x}{1+x} \cdot \frac{100}{88}$$

where C and B are the caproic and butyric acid values respectively, and x is the ratio B/C. To obtain the real proportion of butyric to caproic acid in the butter-fat itself, this value B/C must be multiplied by  $\frac{96}{88}$  or 1.09.

		Ash.	Proteina.	Gladiu No.	Acidity.	Size of Loaf.	Commer rank
		Per cent.	Per cent.		Per cent.	inches.	
Mill No. 1.	{ First patent flour .....	0.39	13.56	59.07	0.07	28.62 x 25.32	I.
Average of 11 tests.	{ Second patent flour .....	0.47	14.70	56.25	0.08	28.67 x 25.72	II.
	{ Clear grade flour .....	0.84	17.27	54.21	0.12	24.29 x 21.09	III.
Mill No. 2.	{ Patent flour .....	0.44	15.05	58.33	0.09	20.47 x 26.42	I.
Average of 8 tests.	{ Clear grade flour .....	0.82	18.01	54.88	0.14	24.29 x 20.83	III.
	{ First patent flour .....	0.35	12.90	58.28	0.09	28.51 x 25.39	I.
Mill No. 3.	{ Second patent flour .....	0.46	14.17	56.20	0.10	28.62 x 25.31	II.
	{ Clear grade flour .....	0.86	17.01	50.03	0.15	23.91 x 20.43	III.

—A. S.

When this calculation is made, it is found that the ratio B/C in all these butters of different origin varies from 1.3 to 4.4 with an average of 2.8, and the figures show that roughly the proportion of caproic acid is greater in mild than in more severe climates, though there are occasional exceptions to this rule. The average percentage of the two acids in all the butter-fats taken is 3.92 per cent. of butyric, and 1.88 per cent. of caproic acid.

Coconut oil contains no butyric and little caproic acid, but chiefly caprylic and capric acids, and owing to this

small proportion of soluble fatty acids, the Reichert-Meissl value varies very greatly with the weight of fat taken. In estimating the percentage of coconut oil in an adulterated sample of butter, this fact makes the generally accepted theory that a mixture of "A" parts of fat of R.M.V. "R" with "a" parts of a fat of R.M.V. "r" must have itself the R.M.V.  $\frac{AR + ar}{A + a}$ , a source of

considerable error. The author has prepared mixtures of butter-fat with 50, 25 and 10 per cent. of coconut oil, and submitted them to a thorough examination. The R.M.V. value was determined in the three samples, and by the use of the above formula, only 40, 16 and 5 per cent. of coconut oil were found, instead of 50, 25 and 10 per cent. respectively.

Determinations of the Polenske, Kirschnner, iodine and saponification values are all useful for the identification and rough estimation of coconut oil adulterated butter, but for the detection of small quantities (less than 10 per cent.), the determination of the caprylic acid by precipitation with silver, and also of the insoluble capric acid, is strongly recommended. In the case of capric acid, the "capric acid value" i.e., the acid expressed in N/10 c.c. per 5 grms. of fat increases by 1.3 for an addition to a butter-fat of 5 per cent. of coconut oil, a rise that is well outside the limits of experimental error.—A. N. C.

#### Wheat Flour; Testing — for Commercial Purposes H. Snyder. J. Amer. Chem. Soc., 1905, 27, 1068—107

In testing wheat flour for commercial purposes, determinations of the moisture, ash, total nitrogen, gliadin nitrogen, degree of granulation, and absorptive capacity should be made. The presence of more than 13 per cent. of moisture tends to induce fermentation. The proportion of ash is a measure of the commercial grade of the flour. The first and second grades of "patent" flour invariably contain less than 0.48 per cent. of ash, "straight grade" flour rarely contains more than 0.55 per cent., while the first and second "clear grades" may contain 0.8 to 1.75 per cent. of ash respectively. The amount of total nitrogen in flour is useful only as a general index of bread-making value. A low nitrogen content, less than 1.5 per cent., indicates deficiency in gluten, and this results in a lower absorptive capacity of the flour, lack of expansion in the loaf, and poorer physical properties of the bread. On the other hand, flours containing more than 13 per cent. of proteid substances (N x 6.25) do not, as a rule, have improved bread-making qualities. The percentage of gliadin in flour is of use in determining the grade of different grades of flour milled from the same wheat showing different proportions of gliadin. The bread-making value of a flour can be accurately determined only by comparative bread-making tests. The results of analyses of some samples of flour are given in the following table:—

#### ENGLISH PATENTS.

*Flour; Process for Restoring to White — certain Properties and Materials or Ingredients Lost in Milling for use in the Manufacture of Bread, Cakes, Pastries, Puddings and other Articles of Food in which Flour is or may be used.* H. Roberts, London. Eng. Pat. 23,576, Nov. 1, 1904.

To every 80 lb. of white flour are added 0.75 lb. each of potassium and magnesium phosphates, 0.5 lb. of sodium



osphate, and 2 oz. of calcium phosphate, together with 1.5 oz. of soluble proteid, such as dry, powdered milk proteid.—W. P. S.

*Leads and Grain; Means for Bleaching* —. C. Trocker, Owensboro, Ky., U.S.A. Eng. Pat. 6939, April 1, 1905.

The grain is treated with a current of air which has been passed through a mixture of nitric acid and metallic per.—W. P. S.

*enic; [Electrolytic] Method of Separating* — from Liquid Food Materials, whether used as Liquid or Treated or Combined with other Materials to Produce a more or less Solid Food. O. G. C. L. J. Overbeck, Grimsby Eng. Pat. 24,174, Nov. 8, 1904.

Liquids, such as those employed in brewing or in the manufacture of food extracts, are passed through a vessel which are placed a number of copper plates, alternately rising nearly to the top and bottom of the vessel. These plates form electrodes, and, when connected with a current of low voltage, cause any arsenic present in the liquid to be electrolytically deposited.—W. P. S.

*et Powder; Manufacture of Soluble* —. A. Glas, Berlin. Eng. Pat. 7982, April 14, 1905. Under Int. Conv., May 17, 1904.

Fr. Pat. 347,739 of 1904; this J., 1905, 432.—T. F. B.

*amin Preparations; Process for Producing Blood* —. L. Langer, Friedrichsberg, Germany. Eng. Pat. 7830, April 12, 1905.

EMULSIFIED animal blood is treated with organic iron salts soluble in water, such as calcium glyceryl-phosphate or phospholactate, in presence of inorganic iron compounds, such as calcium carbonate, oxide, hydroxide, or phosphate. For example, 4 kilos. of calcium glyceryl-phosphate are dissolved in 250 kilos. of emulsified ox blood. About 12 kilos. of calcium hydroxide, containing "from 40 to 50 per cent. of  $\text{CaH}_2$ ," are then added. In a few hours the whole is set, when it is powdered and washed with water. The amount of organically combined iron in the washed product is stated to be about 33.3 per cent.—W. P. S.

*er Substitutes such as Margarine and the like: Manufacture of* —. K. Mann, Zurich. Eng. Pat. 15,311, July 25, 1905. Under Int. Conv., Nov. 30, 1904.

OUT 100 parts of vegetable or animal fats or oils are roughly incorporated in a closed vessel with from 50 to 100 parts of milk and a suitable quantity of colouring matter. The mixture is then caused to ferment by the introduction of kephir fungus or kephir milk. When fermentation is complete, the fat is freed from the milk, washed, and worked as usual. The product is claimed to have the flavour and odour of natural butter.—W. P. S.

#### FRENCH PATENTS.

*ter; Treatment of* —, with Carbon Dioxide or other inert Gas, either alone or mixed with an Oxidising or Reducing Agent. M. A. Eybert and C. P. Eybert. Fr. Pat. 353,179, April 10, 1905.

During the bolting process the flour is surrounded with an atmosphere of dry, cold carbon dioxide or other inert gas. The flour may, at the same time, be bleached by using either a reducing or an oxidising gas with the carbon dioxide.—W. P. S.

*pe Marcs as Cattle Food; Recovery and Utilisation* —. L. M. V. Chaboissier. Fr. Pat. 353,333, April 12, 1905.

WASTED grape marcs are deficient in sugar, but rich in proteids, other carbo-hydrates and fat. These marcs are dried, preferably at an initial temperature sufficient to destroy the germs of putrefaction; the dried marcs are then incorporated with saccharine substances such as molasses, beetroot slices or wheat-bran, and utilised as cattle food.—J. F. B.

#### (B).—SANITATION; WATER PURIFICATION.

##### FRENCH PATENT.

*Air for Respiration Purposes; Apparatus for Regenerating Breathed Out* —. M. Baumberger, F. Böck, and F. Wanz, all of Vienna. Eng. Pat. 9185, May 2, 1905.

IMPROVEMENTS in the apparatus described in Eng. Pat. 8865, 1904 (this J., 1904, 833) are claimed. The peroxides are filled into vessels which are afterwards hermetically closed, and the apparatus is so constructed that those vessels may be readily put into and removed from the same. After the contents of the vessels have been exhausted, fresh ones may be substituted without exchanging any other parts of the apparatus. The vessel containing the peroxide is placed between two movable frames provided with perforating crowns and connected by tubes with the mouth-piece of the apparatus. A valve is placed on the tube leading to the mouthpiece, by means of which only one peroxide vessel is in communication with the mouthpiece at the same time.—W. P. S.

##### UNITED STATES PATENTS.

*Sewage or Drain Water; Apparatus for Carrying out Bacterial Purification of* —. C. Kremer, Gross Lichterfelde, Germany. U.S. Pat. 798,908, Sept. 5, 1905.

SEE Eng. Pat. 20,889 of 1904; this J., 1904, 1155.—T. F. B.

*Water; Method of Purifying* — [by Distillation]. H. F. Hodges and J. Kuen, Philadelphia, Pa., Assignors to American Water Purifying Company, Delaware. U.S. Pat. 798,964, Sept. 5, 1905.

HIGH-PRESSURE steam is passed through a layer of coke and then conducted into a condenser submerged in water contained in an evaporating chamber. The steam arising from the heated water is led into a second condenser surrounded by water, and so on through a succession of evaporators until the last produced steam is reduced to the desired temperature and pressure. Additional steam may be admitted to each condenser. The gases liberated during the evaporation are conducted away, whilst the distillate from each condenser is cooled by passing it through a chamber surrounded by the incoming water, and is finally filtered through charcoal.—W. P. S.

#### (C).—DISINFECTANTS.

##### ENGLISH PATENT.

*Chlorine; Generation and Application [as Disinfectant]* of —. J. Hargreaves. Eng. Pat. 20,835, Sept. 28, 1904. VII., page 1012.

##### GERMAN PATENTS.

*Carbon Bisulphide Emulsions, Miscible with Water, suitable for Destroying Insects on Plants.* Chem. Fabr. in Billwärd, vorm. Hell und Stahmer A.-G. Ger. Pat. 161,266, Oct. 17, 1903.

EMULSIONS of carbon bisulphide, miscible with water, and suitable for the destruction of phylloxera, &c., on plants, are prepared by mixing with the bisulphide some organic compound soluble in water, e.g., molasses, dextrin or "schlempe." For example, 750 kilos. of carbon bisulphide, 166 kilos. of dextrin and 84 kilos. of water may be rubbed into an emulsion.—T. F. B.

*Aluminium Acetate [Antiseptic]; Process of Preparing an Insoluble Basic* — by Heating Aluminium Acetate Solution. R. Reiss. Ger. Pat. 160,348, April 30, 1904.

A BASIC aluminium acetate, quite insoluble in water, is obtained by heating, under pressure, a solution of aluminium acetate (containing at least 5 per cent. of the salt) either alone or with acetic acid. The product is a mildly astringent, non-poisonous, antiseptic powder. It is of constant composition, and the yield is satisfactory. The products obtained by simply heating aqueous solutions are of variable composition, and not always insoluble.—T. F. B.

## XIX.—PAPER, PASTEBOARD, Etc.

*Paper Testing: Use of Logarithmic Co-ordinates in —.*  
R. Naoumof. *Papier Zeit.*, 1905, 30, 2802.

In expressing diagrammatically the results obtained for the resistance of paper to folding, by means of the Schopper folding machine, the tensions between the springs holding the paper are plotted as abscissæ, whilst the number of double folds which the paper resists is plotted on the ordinate axis. The resulting curves have the form of hyperbolæ. The author points out that these hyperbolæ may be reduced to straight lines by plotting the numbers proportionally to their logarithms, which may be done on paper ruled for that purpose. The inclinations of the straight lines so obtained indicate the law according to which the resistance of the particular paper varies with the tension, whilst any point lying outside the main line may be recognised as an experimental error and corrected as such; lastly, when a large number of tests have to be made, it is sufficient to determine with care the resistance at two different tensions and to interpolate the other values from the line obtained on the diagram by joining the two points.—J. F. B.

### ENGLISH PATENTS

*Celluloid or Nitric Cellulose Compounds: Process for Rendering — Non-inflammable.* W. C. Parkin and A. Williams, Sheffield. *Eng. Pat.* 22,381, Oct. 18, 1904.

SEE *Fr. Pat.* 347,446 of 1904; this J., 1905, 344.—T. F. B.

*Celluloid Waste: Process and Apparatus for Utilising — [Recovery of Camphor].* E. Garbin, G. Gérard and C. Gérard, Genoa. *Eng. Pat.* 10,319, May 16, 1905.

The celluloid waste is cleansed in a warm bath of slightly alkaline water, and is then treated either by a dry or a wet process. The dry process consists in packing the celluloid in a tube perforated at one end, which communicates with a condensing tube and receiver. The charge is ignited by inserting a heated plug in a small hole at the closed end of the tube. A slow combustion of the celluloid is thus induced, whereby camphor and nitric acid distil over and are collected. In the wet process the celluloid is decomposed by means of a solution of caustic alkali and the camphor is distilled off by steam, purified in a bath of sodium bisulphite, and finally collected in cold water. At the end of the process of decomposition, the acid liquid from the dry process is mixed with the alkaline liquid from the wet process, the camphor is distilled off, and the sodium nitrate is recovered.—J. F. B.

### UNITED STATES PATENT.

*Pulp from Sugar-cane, Cornstalks, Sorghum, and Analogous Pithy Stalks: Process of Manufacturing Soft Absorbent — and Product of such Process.* V. Drewsen, New York. *U.S. Pat.* 798,887, Sept. 5, 1905.

SEE *Fr. Pat.* 344,692 of 1904; this J., 1904, 1233.—T. F. B.

### FRENCH PATENTS.

*Peat Half-Stuff [for Paper Manufacture]: Manufacture of —.* A. Kirner. *Fr. Pat.* 353,538, April 19, 1905.

The peat is broken up and washed through a sieve, the large pieces being collected for further treatment, whilst the finer portions suspended in the water are agitated in a special vessel and discharged into a chamber containing two or more reciprocating sieves placed one above the other. The matters collected on the different sieves are transferred to horizontal roller-mills, in which the pressure of the rolls is regulated according to the coarseness or fineness of the material fed between them, the coarser material receiving the heavier pressure. Each pair of rolls revolves at a differential speed, so that the fibrous material is thoroughly resolved and converted into half-stuff.—J. F. B.

*Copper Oxide: Process for Recovering —, and for Preliminary Treatment of Textiles in the Manufacture of Artificial Textile Fibres.* R. Linkmeyer. *Fr. P.* 353,187, April 10, 1905. V., page 1011.

### GERMAN PATENT.

*Half-Stuff [Paper]: Process of Making —.* E. Berg hoff. *Ger. Pat.* 160,651, Dec. 24, 1903.

The waste liquors from the manufacture of sulphite cellulose are used in this process, which consists in heating small pieces of wood, sawdust, &c., in the liquors, where they are said to be so far disintegrated that they can very easily be converted into fibre suitable for paper making by mechanical means. The papers prepared from the resulting half-stuff are said to be characterised by extreme toughness.—T. F. B.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Zirconosulphuric Acids.* R. Ruer and M. Levin. *Z. anorg. Chem.*, 1905, 46, 449—455.

The authors have previously shown that an aqueous solution of normal zirconium sulphate behaves as though the zirconium formed part of a complex anion, so that substance has possibly the constitution  $\text{H}_2\text{SO}_4 \cdot \text{ZrO}_2 \cdot \text{SO}_4$ . They now find that by dissolving zirconium hydroxide in an aqueous solution of the sulphate, a series of compounds can be obtained, all of which seem to be zirconosulphuric acids containing complex ions similar to, but containing more zirconium oxide than, those of the solution of normal sulphate.—J. T. D.

*Zirconium Oxychloride. [Detection of Zirconium].* R. L. XXIII., page 1033.

*Mercuric Acetate: Action of Aldehydes and Acetone —.* M. A. Lasserre. *J. Pharm. Chim.*, 1905, 246—249.

When aldehyde is added to an aqueous solution of mercuric acetate, and the solution allowed to stand, plates of mercurous acetate separate after a few hours. The same action takes place if, instead of acetic aldehyde, propylic or butylic aldehyde is added; precipitation is also brought about by the aldehydic substances. Alcohols and acetone give no precipitate under the same conditions. If sodium hydroxide be added to an aqueous solution of mercuric acetate and aldehyde cooled to 0° C., a grey precipitate is formed. The precipitate is insoluble in water or alcohol, but is soluble in mercuric acetate solution, and has the formula,  $\text{CH}_3\text{COH} \cdot \text{HgO}$ . If excess of sodium hydroxide be added to an aqueous solution of mercuric acetate and acetone, and the solution allowed to stand, an amorphous reddish precipitate is formed; this substance is probably an addition compound of 1 mol. of acetone with 2 of mercuric oxide.—C. E.

*Barium Cacodylate: Preparation of —.* A. Aron. *Boll. Chim. Farm.*, 1905, 44, 485—488. *Chem. C.* 1905, 2, 751.

Barium cacodylate, which is widely used in the preparation of other cacodylates, can be obtained in a pure condition by the following method:—A mixture of equal parts of crystallised barium hydroxide and cacodylic acid, finely ground in a mortar, and barium hydroxide solution is added gradually until the mixture is faintly alkaline to phenolphthalein. The solution is decanted, filtered, after standing for several hours, rendered neutral by a small crystal of cacodylic acid, evaporated in *vacuo* at low temperature, and the residue heated at 115°—120° for at least three hours in a well-closed oven in presence of potassium hydroxide, quicklime, and calcium chloride. After cooling in the oven, the dry hygroscopic mass is rapidly powdered, and stored in coloured bottles with fitting stoppers.—A. S.



*Phellandrene*; *Synthetic and Natural* — J. Kondakow and J. Schindelmeiser. *J. prakt. Chem.*, 1905, 72, 13—196.

Purposes of comparison, *d*-phellandrene was isolated from the oil of *Phellandrium aquaticum* and treated with rocholic acid in acetic acid. On fractional distillation the monochloride,  $C_{10}H_{17}Cl$ , was obtained, boiling  $6^{\circ}$  at 11 mm., and melting near  $110^{\circ}$  C. This substance closely resembles artificial camphor and solid ethyl chloride.—F. S.

*Mandarin Oil*. E. Berté and S. Gulli. *Chem. and Druggist*, 1905, 67, 445—446.

Mandarin oil is obtained by hand pressure with a thin edge from the slight and green peel of the fruit of *Citrus madurensis*, *C. deliciosa*, or *C. bigaradia sinensis*, such as mandarins, the yield being about 400 grms. of oil from 1000 mandarins. The oil is a golden-yellow liquid with a characteristic slight bluish fluorescence, which becomes more pronounced when the oil is diluted with alcohol (see this J., 1900, 848, 1237). The pure oil has the following constants:—Sp. gr. at  $15^{\circ}$  C., 0.854—0.858; optical rotation,  $+67^{\circ}$  to  $+73^{\circ}$ ; b. pt.,  $171^{\circ}$ — $173^{\circ}$  C. The greater part of the commercial mandarin oil sold at a relatively low price, is stated to be composed of a mixture of more or less sweet or bitter orange oil (arade), lemon oil or terpenes, and mandarin oil. Adulteration can be detected by determination of the refractive constants and by the fractional distillation method of Soldaini and Berté (this J., 1897, 266; 1898, 1160; 1904, 881; compare also this J., 1896, 925): pure mandarin oil gives a distillate with a rotatory power 2 degrees higher, and a residue with a rotation equally low as that of the original oil. Some analytical results obtained with genuine mandarin oil are given, also (see table) some obtained with adulterated oils.

Sp. gr. at 15°C.	Boiling point.	Fractional distillation of 50 per cent. of the Oil.			Remarks.
		Optical rotation.			
		Direct.	Distillate.	Residue.	
0.8564	171°—174°	+ 71°35'	+ 74°15'	+ 68°00'	Presence of about 5 per cent. of limonene.
0.8557	171°—176°	+ 71°50'	+ 74°30'	+ 68°50'	
0.8558	—	+ 71°50'	+ 74°35'	+ 69°10'	Presence of sweet orange oil.
0.8557	172°—175°	+ 71°10'	+ 73°45'	+ 68°10'	Presence of lemon oil.
0.8557	—	+ 68°25'	+ 70°53'	+ 64°40'	Presence of sweet orange oil.
0.8557	173°—175°	+ 70°15'	+ 72°23'	+ 66°20'	
0.8558	—	+ 71°20'	+ 73°30'	+ 67°30'	
0.8569	170°—173°	+ 69°10'	+ 71°30'	+ 67°20'	Presence of sweet orange and lemon oils.
0.8547	172°—175°	+ 69°20'	+ 71°15'	+ 66°20'	
0.8544	171°—174°	+ 72°35'	+ 74°50'	+ 69°00'	Presence of lemon oil and fats.
0.8558	170°—173°	+ 72°30'	+ 74°00'	+ 71°10'	
					Presence of lemon terpenes.
					Presence of sweet orange and turpentine oils.

—A. S.

*Oil*; *Constituents of* — O. Wallach. *Nachr. k. Ges. Wiss. Göttingen*, 1905, 1—2. *Chem. Centr.*, 1905, 2, 674.

Essential oil from broad-leaved sage (*Salvia grandifolia*) has the sp. gr. 0.9084 at  $15^{\circ}$  C.; and  $\alpha_D = -10.06^{\circ}$ . It contains *l*-pinene, cineol, *l*-camphor, and a hydrocarbon which has somewhat similar properties to phellandrene. On treatment with nitrous acid, a compound melting at  $85^{\circ}$ — $86^{\circ}$  C. is formed.—A. S.

*Phellandrene from the Essential Oil of Schinus Molle*, L.; *Phellandrene from the Essential Oil of Schinus Molle* — O. Wallach. *Nachr. k. Ges. Wiss. Göttingen*, 1905, 2—3. *Chem. Centr.*, 1905, 2, 674.

Phellandrene from the essential oil of *Schinus molle*, (sp. gr. 0.829 at  $15^{\circ}$  C.;  $\alpha_D = +57^{\circ}$ ), after being distilled with steam, yields a nitrite, which can be separated by fractional crystallisation from acetone into two portions melting at  $111^{\circ}$  and about  $96^{\circ}$  respectively. The nitro-phellandrene prepared from the nitrite gives on reduction only carvotanacetone, and the hydrocarbon of *Schinus molle* must therefore consist chiefly of  $\alpha$ -phellandrene.—A. S.

*Eucalyptus Globulus*; *Occurrence of Pinocarveol in the Essential Oil of* — O. Wallach and F. Jäger. *Nachr. k. Ges. Wiss. Göttingen*, 1905, 3—6. *Chem. Centr.*, 1905, 2, 674—675.

The authors isolated from the high-boiling portion of the oil of *Eucalyptus Globulus*, an alcohol,  $C_{10}H_{16}O$ , which, after purification by means of its acid phthalate, was found to consist of the optically active modification of pinocarveol. It boiled at  $92^{\circ}$  C. under 12 mm. pressure, had the sp. gr. 0.9745 at  $20^{\circ}$  C.,  $n_D^{20} = 1.49630$ ,  $[\alpha]_D = -52.45^{\circ}$  in 12.75 per cent. ethereal solution.—A. S.

*Dextro- and Lævo-Fenchone*; *Semicarbazones of* —, and *Occurrence of Esters of l-Borneol in Thuja Oil*. O. Wallach. *Nachr. k. Ges. Wiss. Göttingen*, 1905, 6—12. *Chem. Centr.*, 1905, 2, 675.

Fenchone reacts only very slowly with semicarbazide, but its semicarbazone can be obtained by mixing together solutions of 10 grms. of pure fenchone in 50 c.c. of alcohol, and of 10 grms. each of semicarbazide hydrochloride and sodium acetate in 20 c.c. of water, and allowing the mixture to stand at the ordinary temperature for at least two weeks. On pouring into water a solution of the semicarbazone in the excess of fenchone, separates, from which the fenchone can be removed by distillation with steam. If the raw material used for the preparation of the semicarbazone is a crude fenchone, containing other constituents capable of reacting with semicarbazide, the fenchone semicarbazone does not crystallise so readily. In a *l*-fenchone from thuja oil, the presence of *l*-camphor, which reacts with semicarbazide much more readily than fenchone does, was detected, and it was found that treatment with semicarbazide solution affords an easier means of separating camphor from fenchone, than oxidation with nitric acid. The occurrence of camphor in crude fenchone points to the presence of esters of *l*-borneol in thuja oil.—A. S.

*Formaldehyde*; *Hydrogen Peroxide Method of Determining* — J. K. Haywood and B. H. Smith. *XXIII.*, page 1039.

*Copal-Resin Oils* [*Kauri and Manila*]. L. Schmoelling. *XXIII.*, page 1023.

#### ENGLISH PATENTS.

*Barbituric Acids*; *Manufacture of Dialkylated* — A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 19,411, Sept. 8, 1904.

SEE U.S. Pat. 780,421 of 1905; this J., 1905, 151.—T.F.B.

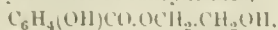
*Dialkylbarbituric Acids*; *Manufacture of* — O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brünig, Höchst a/Maine, Germany. Eng. Pat. 2031, Feb. 1, 1905.

SEE U.S. Pat. 790,116 of 1905; this J., 1905, 749.—T.F.B.

*Pharmaceutical Compound* [*Salicylic Acid Monoglycol Ester*]; *Manufacture of a New* — H. E. Newton,

London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4035, Feb. 27, 1905.

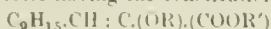
THE monoglycol ester of salicylic acid,



is prepared by esterifying 40 parts of salicylic acid and 80 parts of ethylene glycol with 3 parts of sulphuric acid (60° B.), by heating at 100° C. for 24 to 36 hours. The product is diluted, made alkaline with sodium carbonate and extracted with ether; the dried ethereal solution is distilled *in vacuo*, the ester being obtained at first as an oil of b. pt. 173° C. (15 mm.), which solidifies to a solid, melting at 37° C. It is resolved into glycol and salicylic acid by alkali hydroxides. It is stated to be of value for the treatment of rheumatism.—T. F. B.

*Violets; Manufacture of Substances with the Odour of —*. A. Maschmeyer, Amsterdam. Eng. Pat. 13,347, June 28, 1905. Under Int. Conv., July 22, 1904.

CITRAL is condensed with an ester of a monohalogenated acetic acid in presence of an alkali alcoholate. The condensation product may be regarded as a citrylidene-alkoxyacetic ester having the constitution:—



in which R and R' are variable alkyl radicals. The aliphatic compounds so produced are converted into their cyclic isomers which exist in two modifications, the  $\alpha$ - and  $\beta$ -. The  $\beta$ -series are predominant when concentrated sulphuric acid at 0° C. is employed, whilst the  $\alpha$ -series are formed principally when hot dilute acids are used. These cyclic compounds possess an odour of violets.

—J. F. B.

*Celluloid Waste; Process and Apparatus for Utilising —*. [Recovery of Camphor]. E. Garbin, G. Gérard and C. Gérard. Eng. Pat. 10,319, May 16, 1905. XIX., page 1028.

*Lubricants; Impts. in —*. L. A. A. Hennequin and G. J. B. Cayeux. Eng. Pat. 11,679, June 3, 1905. III., page 1008.

#### UNITED STATES PATENTS.

*Dialkylbarbituric Acid; Process of Making —*. J. Altschul, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 798,863, Sept. 5, 1905.

SEE Eng. Pat. 8302 of 1904; this J., 1905, 289.—T. F. B.

*Oxalic Acid and its Derivatives; Method of Reducing —*, by *Electrolysis*. E. von Porthheim, Prague, Austria-Hungary. U.S. Pat. 798,920, Sept. 5, 1905.

GLYOXALIC acid, its esters and amides, may be obtained from compounds containing the oxalyl radical ( $C_2O_2$ ), by dissolving the compound to be treated in dilute sulphuric acid, and then electrolysing the solution at a low or moderate temperature in the cathode compartment of an electrolytic apparatus.—B. N.

#### FRENCH PATENTS.

*Tartar, Cream of; Process for Producing —*. The California Products Co. Fr. Pat. 353,276, Feb. 2, 1905.

SEE U.S. Pat. 783,524 of 1905; this J., 1905, 290.—T. F. B.

*Grape Marcs; Extraction of Cream of Tartar from —*. G. Tarulli. Fr. Pat. 353,459, April 6, 1905.

THE marcs are lightly packed in diffusion vessels in which they are treated, either simultaneously or alternately, with steam and with water, which may be introduced either from above or below, with internal distributors, if desired, so that they penetrate through all parts of the mass. The liquors are distributed and raised or lowered and successively discharged as they become richer in cream of tartar. The first liquors, rich in extractive matter, are separated from the subsequent liquors, the latter being kept at the boiling point and used for further extractions, whilst the former are treated for the recovery of the tartar. After the extraction of the cream of tartar, the marcs are exhausted with a mineral acid in a similar manner in order to dissolve the calcium tartrate.—J. F. B.

*Dialkylbarbituric Acids; Process of Preparing —*. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 353,276, Feb. 7, 1905. Under Int. Conv., March 29, 1904.

SEE U.S. Pat. 789,902 of 1905; this J., 1905, 749.—T. F. B.

*Camphor from Isoborneol; Process of Preparing —*. C. F. Boehringer und Soehne. First Addition, dated April 1, 1905, to Fr. Pat. 352,888, March 31, 1905.

SEE Eng. Pat. 28,035 of 1904; this J., 1905, 249.—T. F. B.

#### GERMAN PATENTS.

*Sulphur Derivatives of Mineral Oils; Process for Preparing Sulphonated —*. G. Hell and Co. Ger. Pat. 161,663, Dec. 23, 1900. III., page 1008.

*Tannin with Formaldehyde and Urea or Urethane; Process of Preparing Condensation Products of —*. A. Winkel. Ger. Pat. 160,273, Nov. 6, 1903.

IN addition to the condensation of tannin with formaldehyde and urea described in Eng. Pat. 23,549 of (this J., 1905, 103), this specification covers the condensation of tannin substances, formaldehyde and urethane in which the tannin combines with the anhydroformyl-urethane formed as intermediate product; methenediurethane is also obtained as a product of the condensation.—T. F. B.

*Bornylenediamine; Method of Preparing —*. P. De Wink. Ger. Pat. 160,103, Nov. 13, 1903.

BORNYLENEDIAMINE (diaminocamphane) may be prepared by reducing the oxime of amino-, isonitroso- or isonitro-camphor, either with sodium and alcohol with sodium amalgam, or electrolytically. The base is extracted by ether, and is obtained as a waxy substance, b. pt., 246° C., and very easily soluble in water. It is poisonous, and a powerful antipyretic.—T. F. B.

*Cotarnine Hydrochloride and Ferric Chloride; Process of Preparing a Double Salt of —*. A. Voswinkel. Pat. 161,400, Dec. 3, 1903.

A DOUBLE salt is obtained by the action of 1 mol. of ferric chloride on 2 mols. of cotarnine hydrochloride in presence of a suitable solvent, at the ordinary temperature. The double salt is precipitated as orange plates, which filtered off, washed with alcohol and dried. The salt has a m. pt. of 104°–105° C., is easily soluble in water and dilute alcohol, sparingly so in absolute alcohol. The aqueous solution is composed by heating into a precipitated cotarnine and iron oxychloride. When medicinally it is stated to combine the properties of cotarnine and ferric chloride.—T. F. B.

*4,5-Diamino-2,6-dioxypyrimidines; Process of Preparing —*. E. Merck. Ger. Pat. 161,493, March 1, 1904.

4-AMINO-5-ISONITROSO-2,6-DIOXYPYRIMIDINES can be converted into the 4,5-diamino compounds by reduction with metals in acid solution; the acid is found not to be a hydrolysing agent on the product, as no hydroxyl isonitrosobarbituric acid is produced. The reduction has only been found possible previously by boiling the ammonium sulphide solution, when the isolation of the product was a difficult matter. In the present process sparingly soluble derivatives are simply filtered off, when easily soluble compounds are obtained, the metallic salt is removed by addition of ammonia.—T. F. B.

*Endiminotriazoles; Method of Preparing —*. E. Merck. Ger. Pat. 161,235, July 27, 1904. Addition. Ger. Pat. 159,692, March 6, 1904.

INSTEAD of treating the triarylaminoguanidine with carbon dioxide as in the process of the principal patent (see this J., 1905, 814), it is condensed with an aldehyde, and the resulting aminodihydrotriazole oxidised to an endiminotriazole with a suitable oxidising reagent. The preparation of the following compounds is described:—Endaminotriazole, endanilotriphenyltriazole and phenyltolylendotoluidotriazole (the latter from phenyltolylaminoguanidine and formaldehyde).—T. F. B.





Nitric acid of sp. gr. 1.40 is thus affected in a similar manner to acid of sp. gr. 1.48 by addition of sulphuric acid. The acid of sp. gr. 1.40 is used in the manufacture of different kinds of nitrocellulose containing up to 12 per cent. of nitrogen, and also in the preparation of picric acid and other products. When mixed with sulphuric acid, it is distinctly less active than the acid of sp. gr. 1.48, but by preparing a mixed acid of suitable composition, it is probable that highly-nitrated products could be prepared with it. For example, the mixture No. 9 (see table) is not much different in composition from the mixed acid with which Lunge and Bebie prepared an insoluble pyroxylin containing 13.2 per cent. of nitrogen. Experiments on the effect of addition of water to the mixed acids, showed that a mixture having a composition between the limits represented by mixtures Nos. 9 and 10 is practically unaffected by addition of small quantities of water. For nitrating purposes, therefore, a mixed acid should be used having a composition between these limits.

In the following table the results of some experiments on pure nitric acid of various strengths are given :—

Percentage Composition of Acid.		Sp. gr. at Vapour pressure 15° 4".	of HNO <sub>3</sub> at 15°C. in mm.	Percentage of Nitrogen in the Vapour.
HNO <sub>3</sub> .	H <sub>2</sub> O.			
98.00	2.00	1.5100	46.2	23.75
92.93	7.07	1.4970	42.6	23.5
88.65	11.35	1.487	29.7	23.05
82.10	17.90	1.462	16.64	22.62
78.10	21.90	1.453	9.40	22.52
65.30	34.70	1.400	1.90	19.32

—A. S.

## UNITED STATES PATENT.

*Blasting Powder.*—W. A. Gill, Tarrytown, N.Y. Assignor to Rendrock Powder Co., New York. U.S. Pat. 798,780, Sept. 5, 1905.

THE compound consists of about 80 per cent. of potassium chlorate, 18 per cent. of resin, and 1 per cent. each of asphalt and of nitrated wood fibre.—E. S.

## FRENCH PATENTS.

*Explosives ; Process for Prevention of Humidity of* —. Soc. Gen. pour la Fabrication de la Dynamite. Fr. Pat. 349,992, June 15, 1904.

It is proposed to add kieselguhr to explosives containing hygroscopic constituents, for the purpose of absorbing any moisture originally present or subsequently taken up on storage. If kieselguhr is present, it is stated that the explosive constituents proper remain in a dry state. An example given is ammonium nitrate (70 parts), nitroglycerin (29.1 parts), nitro cotton (0.9 part) and kieselguhr (3 parts).—G. W. McD.

*Explosives ; Process for the Manufacture of New Detonating and Propellant* —. G. Schulz and F. Gehre. Fr. Pat. 352,990, March 9, 1905.

CLAIM is made for a series of explosives containing the di- and trinitro-derivatives of mesitylene and pseudo-cumene. A detonating explosive is produced by incorporating these bodies with an oxygen-bearer, such as ammonium nitrate, with or without the addition of finely-divided iron or copper. These metals are claimed as a substitute for magnesium and aluminium, already used in this type of explosive. A smokeless propellant is produced by mixing the above nitro-bodies with nitro-cellulose.—G. W. McD.

*Explosive ; New* —. P. de Golovine. Fr. Pat. 353,299, March 15, 1905.

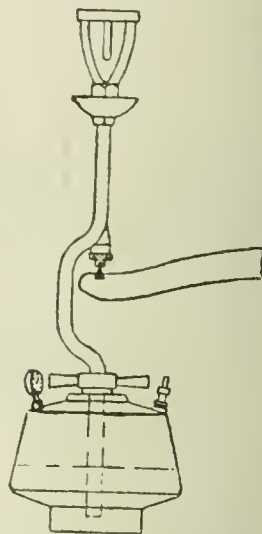
THE explosive, which is stated to be suitable for military

purposes, and also for use in mines and quarries, consists of a mixture of potassium chlorate (39 parts), yellow potassium borate (18), ammonium chloride (2), coke or wood charcoal (2) and glycerin or refined petroleum (2 parts). The solid constituents are finely powdered and passed through a fine sieve. The potassium chlorate is then intimately mixed with the coke or charcoal, ammonium chloride and potassium borate added in order given, and the whole triturated to a homogeneous mass with the glycerin or petroleum.—A. S.

## XXIII.—ANALYTICAL CHEMISTRY.

## APPARATUS, ETC.

*Calorimeter ; Junkers' —.* T. Immenkötter. Gasbeleucht, 1905, 48, 780—783.



THE capabilities of this instrument (this J., 1895, 631) have been extended so as to deal with (1) poor (2) liquid fuels.

(1) Cheap generator gases, &c., with a calorific value below 900 Cal. are difficult to burn in the ordinary way. By burning the gas with the smallest quantity of oxygen in an oxyhydrogen burner, instead of using a Bunsen burner, good results were obtained with a mixture giving 670 Cal. This is sufficient; as the poorest generator gas present use have an average calorific value of 800 Cal. per ch. m.

(2) The difficulty of burning heavy oils has been overcome by the use of pressure in the reservoir. A slightly modified "Primus-burner" was found to give very satisfactory results, and by means of a special apparatus the most suitable pressures for various oils were determined. The results below were obtained with a tube of 3 mm. diameter.

	Boiling temperature.	Pressure.	Time of burning per test.
Gasoline .....	30°C.	mm. 820	8"
Benzine .....	62°—74°C.	450	3"
Petroleum (motor-oil, b.pt., 160°—293°) .....	160° before 163° after	450	5"
Heavy oil .....	413°C.	130	4"

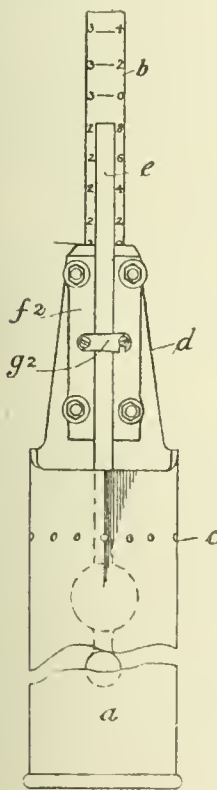


About 50 per cent. by volume of the quantity of oil taken is burnt. For spirit a nozzle-tube of 1.1 mm. diameter at a pressure of 60 mm. of mercury were required. With the modified apparatus shown (see Fig.), the whole burner and oil reservoir can be suspended by life-edges from the arm of a balance throughout the experiment, in order to ascertain the weight of oil consumed. The calorimeter is so arranged that the burner, after lighting, can be introduced and then the apparatus hung on the balance-arm. A small manometer is attached to the reservoir and the necessary pressure obtained by bicycle pump. During an experiment the pressure remains almost constant.

The advantages claimed are (1) the requisite air is sucked into the calorimeter by the flame itself (2) there is uniform combustion of all constituents of the oil, if a latter is a mixture. Even the heaviest oils can be successfully tested.—F. SPOV.

#### ENGLISH PATENT.

*Density or Specific Gravity of Liquid and or Semi-liquid Material [Slip, Glaze, Potters' Liquid, &c.]; Apparatus for use in Ascertaining the —.* J. M. James, Stoke-on-Trent. Eng. Pat. 18,305, Aug. 24, 1904.



A CONTAINING vessel *a* provided with a row of perforations to ensure that it is always filled to a constant level, has a graduated scale *b* fastened upon the projecting back piece. A hydrometer or weighted float rod *e* is immersed in the liquid contained in the vessel *a* and is kept in an upright position by the projecting check-pieces *f* and the "latch" *d*, which are so arranged that the free vertical movement of the hydrometer *e* is not impeded. The position of the top of the float rod indicates the density which is read off from the scale. The apparatus may be fastened to a stand and immersed in the liquid or semi-liquid or it may be filled by pouring into the top in the ordinary way.

—W. H. C.

#### GERMAN PATENT.

*Thermo-Element consisting of an Antimony Alloy and a Metal or Alloy fusible with difficulty; Method of Joining the Two Components of a —.* A. Wolf, Jupp. and Co. Ger. Pat. 160,305, Nov. 18, 1903.

Is the manufacture of a thermo-element consisting of a high-melting metal or alloy and an antimony alloy, the strip of the high-melting body is heated to the melting point of the antimony alloy, and is then rubbed firmly and evenly with a piece of antimony or antimony alloy till it is covered with a thin but adherent and uniform coating of the latter, without the formation of a film of oxide. The hot coated strip of high-melting metal or alloy is then pressed into the antimony alloy which is to form the second component of the thermo-element, and in this way a good junction is obtained without the use of a solder.—A. S.

#### INORGANIC—QUALITATIVE.

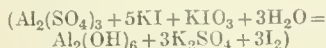
*Zirconium Oxychloride [Detection of Zirconium].* R. Ruer. Z. anorg. Chem., 1905, 46, 456—459.

If from an aqueous solution of a zirconium compound the hydroxide be precipitated by ammonia, washed, removed from the filter, dissolved in hydrochloric acid, the solution evaporated in the water-bath almost to dryness, taken up with a little water, and concentrated hydrochloric acid be added, drop by drop, to the cooled solution, zirconium oxychloride is precipitated. On warming, this dissolves, and is deposited again, on cooling, in the form of silky crystals of very characteristic appearance under the microscope. This can be used (especially by comparison with crystals prepared from a known source) as a reaction to identify zirconium.—J. T. D.

#### INORGANIC—QUANTITATIVE.

*Aluminium; Iodometric Determination of —, in Aluminium Sulphate and Chloride.* S. E. Moody. Z. anorg. Chem., 1905, 46, 423—427.

THE reaction of potassium iodide and iodate with aluminium sulphate



utilised by Stock as the basis of a gravimetric method for determining aluminium (this J., 1900, 276), also allows of a volumetric determination by titrating the liberated iodine. A measured quantity (25 c.c. of approximately N/10 solution) of the aluminium salt (containing no free acid) is placed in a Voit flask, and 19 c.c. of solution of potassium iodate (30 grms. in the litre) with 1 gm. of potassium iodide are added; the flask is then connected with a Drechsel flask containing 3 grms. of potassium iodide dissolved in water, a stream of hydrogen is passed through the apparatus, and the mixture is heated till practically colourless (15—25 minutes). The iodine collected in the Drechsel flask, and any small quantity still contained in the evolution flask, are then titrated with thiosulphate. Results are accurate with aluminium chloride or potassium alum; with ammonium alum the solution in the receiver must contain free acid sufficient to neutralise any ammonia carried over.—J. T. D.

*Platinum Metals; Technical Determination of the —.* J. Nordenskjöld. Svensk Kemisk Tidskrift, 1905, 54. Chem. Centr., 1905, 2, 790.

OF the platinum metals, iridium and rhodium are not dissolved by *aqua regia*. Osmium is oxidised by concentrated *aqua regia*, but can be removed in the form of the volatile perosmic acid. Palladium, which is also soluble in other acids, is removed by a preliminary treatment. The dilute platinum solution is treated with metallic magnesium, warmed for a quarter of an hour

on the water-bath, and filtered. The precipitate is washed, gently ignited, again washed after moistening with hydrochloric acid, ignited in a current of hydrogen, allowed to cool in an atmosphere of carbon dioxide, and weighed. The residue is then treated with dilute *aqua regia*, the platinum re-precipitated by magnesium, washed well, finally, after moistening with hydrochloric acid, ignited and weighed. On the first occasion the finely-divided platinum metals must not be ignited too strongly or for too long a time, or an iridium-platinum alloy, insoluble in *aqua regia*, may be formed.—A. S.

### ORGANIC—QUALITATIVE.

*Dyestuffs on Animal Fibres; Identification of* —  
A. G. Green (assisted by H. Yeoman and J. R. Jones).  
J. Soc. Dyers and Col., 1905, 21, 236–243.

Is the scheme of analysis proposed by the author, use has been made, in the first place, of stripping tests, and in the second place, of a modification of the method suggested by A. G. Green for the analysis of dyestuffs in substance (this J., 1893, 3–7), depending on the behaviour of the different reduction products on oxidation. The modifications consist in using sodium hydrosulphite (in place of zinc dust) for the reduction and a persulphate (for chromic acid) for the re-oxidation. It is found that the leuco compounds remain, in great part, attached to the fibre, whilst the "splitting-products" of azo dyestuffs are entirely removed therefrom by washing.

The following is the general behaviour of the various groups of dyestuffs on animal fibres:—

Decolorised by hydrosulphite.			Not decolourised, but changed to brown. Original colour restored by air or persulphate.
Colour restored on exposure to air.	Colour not restored by air, but on oxidation with persulphate.	Colour not restored either by air or persulphate.	
Azines, Oxazines, Thiazines, Indigo.	Triphenylmethane group.	Nitro-, Nitroso-, and Azo-groups.	Pyrene, Acridine, Quinoline, and Thiazol groups. Some members of Anthracene group.
			Most dyestuffs of the Anthracene group.

Having ascertained both the dyeing group and the chemical relationship of the colouring matter, and taking the shade also into consideration, the question is usually narrowed down to a single representative or to a choice between a very few closely related dyestuffs. For distinguishing between these, the behaviour with concentrated sulphuric acid or strong hydrochloric acid can be frequently employed. In the appended tables the subdivision of the groups has been usually omitted as unnecessary, but is given in a few instances (see Table II.) in order to illustrate the general method. For additional confirmation it is well to compare the sample both as to shade and reactions with a dyed pattern of the dyestuff to which it is believed to correspond.

**Reagents.**—The following reagents are employed:—Dilute ammonia (1:100); aqueous alcoholic ammonia (1 c.c. of ammonia, 50 c.c. of alcohol, 50 c.c. of water); 5 per cent. acetic acid; dilute alcohol (1:1); dilute hydrochloric acid (1:10); caustic soda (10 per cent.); hydrosulphite A (10 per cent. solution of formaldehyde-sodium hydrosulphite); hydrosulphite B. (200 c.c. of hydrosulphite A and 1 c.c. of glacial acetic acid); a cold saturated solution of potassium persulphate; a 5 per cent. solution of crystallised sodium acetate.

**Procedure.**—The reactions are performed in test-tubes with pieces of the material about  $\frac{3}{4}$  in. to 1 in. square, which

are covered with about 1 in. to  $1\frac{1}{2}$  in. of the reagent. making "stripping tests" the degree of stripping is judged by comparing the depth of shade remaining with that of original pattern. It is found advantageous in boiling with dilute acetic acid and dilute ammonia to repeat extraction, as a better stripping is thereby obtained and also with acid dyestuffs any staining of the cotton by the first strong extract is avoided. In testing with dilute ammonia or sodium acetate, the piece is placed in a test-tube with a somewhat smaller piece of white mercerised cotton cloth, and boiled for the time prescribed. If the shade is a pale one the size of the sample should be increased and that of the cotton diminished. The dilute ammonia is replaced by aqueous alcoholic ammonia in the case of the violet and black dyestuffs (Tables III. & VII.), as in these cases the acid dyestuffs are less easily extracted, and the cotton is more liable to be stained by them. In making reduction tests, the sample is boiled from one-quarter to one minute with the hydrosulphite, then rinsed well under the tap, and allowed to lie on white paper for an hour or so. With most dyestuffs which form air-oxidisable leuco compounds, the colour returns immediately or in a few minutes, but with others a long time is required. The reaction is accelerated by exposure to the pattern to ammonia vapour. If the colour does not return, the pattern is heated to boiling in a test-tube with a little water, and potassium persulphate is added drop by drop, carefully avoiding an excess. If this also fails to cause any return of colour, the dyestuff is to be regarded as an azo or nitro compound. The depth of the restored colour varies greatly in different cases; whilst with some dyestuffs the colour reappears with nearly its original depth with others (probably on account of the greater solubility of their leuco compounds) only a light shade may return. Safranine and its azo derivatives yield on reoxidation the leuco compound a violet colour. This is due to condensation of the leuco-safranine with the formaldehyde present in the hydrosulphite NF.

The reactions given in the annexed analytical table were mostly ascertained upon the wool fibre, but from a number of tests which were also conducted for comparison upon silk, there seems no reason to believe that the latter fibre will exhibit any variations in behaviour. On the other hand, cotton and vegetable fibres require rather different treatment, which it is proposed to deal with in a later paper.

**Mixtures.**—Although it is not intended to deal fully with the detection of mixtures, a few general principles may be mentioned which will be found useful by those who wish to extend the scheme to such cases. If a mixture consists of two or more dyestuffs of the same chemical and dyeing group, it will behave as a whole similarly to a single dyestuff, though sufficient differences will usually exist in the rate of solution or of attack by the group reagent to render it possible to distinguish or even to separate the constituents. Thus a green, consisting of a mixture of an acid azo yellow with an acid azo blue, will be distinguishable upon careful reduction with hydrosulphite, since the azo blue will be reduced first, and the shade will therefore change from green to yellow before it is decolorised. Neither colour will return on oxidation. Further, if such a compound shade be extracted fractionally with dilute ammonia, the yellow is generally stripped first, and may be transferred to another piece of wool for subsequent tests. Mixtures of colours belonging to different groups will usually exhibit at once the diverse composition. For example, a navy blue shade dyed with Patent Blue and an azo orange will, on reduction, first change to bright blue, then become colorless, and upon reoxidation with persulphate the blue alone will return. If a mixture of an azine, oxazine, or thiazine dyestuff with a triphenylmethane colour has been employed, only the first will return upon exposure of the leuco compound to air, the latter being also restored by treatment with persulphate. Fractional extraction of the fibre with dilute alcohol or dilute acetic acid can also be employed in many cases to effect a separation or partial separation of the dyestuffs, the extracted colour being then transferred to fresh wool or silk and separately tested.



Hydrosulphite B									
Not decolourised or only very slightly Treat fibre with conc. H <sub>2</sub> SO <sub>4</sub>			Much colour is stripped but cotton remains white.—Acid dyestuff. Boil with hydrosulphite B.						
Colourless solution with dilute HCl if 10.			Decolourised. Colour restored by air or by persulphate.—Azo group.						
Green fluorescein solution.—Acridine group.			Fibre and solution pale yellow.		No change of colour.		Becomes colourless.		Becomes violet or violet red.
Colours solution with dilute HCl if 10.			Decolourised. Colour not restored by air or more persulphate.—Azo group.						
Completely decolourised.			The cotton is stained.—Salt dyestuff. Boil with hydrosulphite B.						
Fibre and solution pale yellow.			The cotton remains white.—Mordant dyestuff. (Confirm by staining ash for metallic mordants) Boil with hydrosulphite B.						
Completely decolourised.			Not affected.—Flavones and Ketone group.						
Fibre and solution pale yellow.			Colour changed to yellowish green.—Alizarine group.						
Completely decolourised.			Decolourised. Colour not restored by air or more persulphate.—Azo group.						
Fibre and solution pale yellow.			Not affected or slightly stained in alkali.—Thiazol group.						
Completely decolourised.			Decolourised. Colour restored by exposure to air or quickly by persulphate.—Gulbene group.						
Fibre and solution pale yellow.			11.—CURCUMINE S, MIRABOL YELLOWS, AND ORANGES, STREBENE YEL-LOWS, &c.						
Fibre and solution pale yellow.			12.—CHRYSOPHENINE (CONGO), OR DIAM-YELLOW, BENZO-CITRON, WELD, LOW A, &c.						
Fibre and solution pale yellow.			13.—PUSTIC, QUERCITRON, WELD, LOW A, &c.						
Fibre and solution pale yellow.			14.—ALIZARIN ORANGE.						
Fibre and solution pale yellow.			15.—ALIZARIN YEL-LOW G AND R, ANTHRACENE, YELLOW C, FLAVAZOL, CHROME ORANGE, &c.						

* Weld is partly discharged by acetic acid though the solution remains colourless.									
TABLE II.—RED COLOURS.									

### TABLE II.—RED COLOURS.

\* Weld is partly discharged by acetic acid though the solution remains colourless.

Boil twice for one minute with 5 per cent acetic acid.

[illegible]





The colour is stripped.—Basic dyestuff. Boil with hydrosulphite A.		The colour is not stripped.—Acid, Salt, or Mordant dyestuff. Boil twice for one minute with dilute ammonia II. 100 and a small piece of white cotton. Little or no colour is stripped. The cotton remains white after 2 or 3 minutes with 5 per cent. sodium acetate and a piece of white cotton.		The cotton remains white*—Mordant dyestuff. Confirm by testing for metallic mordant in ash. Boil with hydrosulphite A.	
Decolourised. A dark violet colour returns on exposure to air.—Azo group.	Decolourised. Original colour returns on exposure to air.—Azo group.	Decolourised. Colour returns on exposure to air.—Azo group.	Decolourised. Colour returns on exposure to air.—Azo group.	Decolourised. Colour returns on exposure to air.—Azo group.	Decolourised. Colour returns on exposure to air.—Azo group.
1.—DIAMINE GREEN OR	2.—FAST GREEN M. AZINE GREEN, &c.	3.—MALACHITE GREEN, BELLANT GREEN, SETO, &c.	4.—AZINE GREEN S.	5.—ACID GREENS, LIGHT GREEN, WOOL GREEN, &c.	6.—CHIEFLY MIXTURES OR ANZO BLUE AND YELLOW
7.—DIAMINE GREEN, CHLORAMINE GREEN, &c.	8.—COERULEINE OR ALIZARIN GREEN OR	9.—ALZARIN CYANINE GREEN, VIOLETTINE, &c.	10.—ALZARIN GREEN, G OR B (D).	11.—GABRINES, DI-ONINE, DARK THOT GREEN, &c.	12.—DIAMOND GREEN, CHROME GREEN, &c.

\* With azo mordant colours the cotton may be slightly tinted, especially if the fastness by chrome is not complete.

TABLE VI.—BROWN COLOURS.

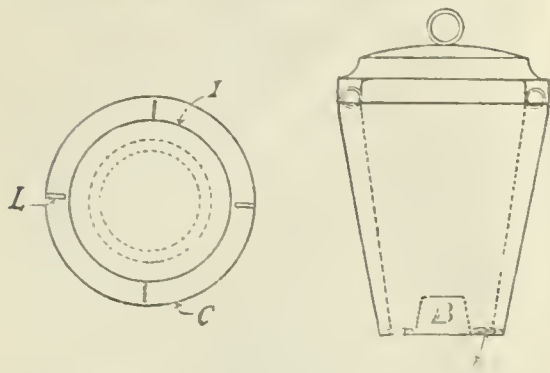
Boil twice for one minute with 5 per cent. acetic acid.		Boil twice for one minute with dilute ammonia.	
Little or no colour is stripped.—Acid, Salt, or Mordant dyestuff.	Little or no colour is stripped.—Acid, Salt, or Mordant dyestuff.	Little or no colour is stripped.—Acid, Salt, or Mordant dyestuff.	Little or no colour is stripped.—Acid, Salt, or Mordant dyestuff.
1.—ACID BROWN R, &c.	2.—FAST BROWN O, &c.	3.—DIAMINE BROWNS, BENZO BROWNS, TOLYLENE BROWNS, &c.	4.—MIRADO BROWNS
5.—ANTHRACILOL (Anthracene Brown).	6.—CUTCH.	7.—CHROMOGEN.	8.—ANTHRACENE ACID BROWNS, BROWN, PALATINE BROWN, CHROME BROWN, &c. ALSO MAR- (In ash)

TABLE VII.—BLACK AND GREY COLOURS.

Boil twice for one minute with 5 per cent. acetic acid.		Boil twice for one minute with 5 per cent. acetic acid.	
The colour is not stripped.—Acid, Salt, or Mordant dyestuff.	The colour is not stripped.—Acid, Salt, or Mordant dyestuff.	The colour is not stripped.—Acid, Salt, or Mordant dyestuff.	The colour is not stripped.—Acid, Salt, or Mordant dyestuff.
1.—DIAMINE BLACK, JAMES BLACK, METHYLENE BLACK, &c.	2.—NAPHTHOL BLACK, NAPHTHOL PALATINE BLACK, &c.	3.—UNION BLACK, HAIR-WOOL BLACK, COLUMBIA BLACK, &c.	4.—ANTHRACENE CHROME BLACKS, PALATINE CHROME BLACK, CHROMOTOPES, &c.
5.—A "VATTED BLACK" (Indigo and logwood).	6.—LOGWOOD ON CR.	7.—LOGWOOD ON FE. OR BONSORS BLACK.	8.—NAPTRAZARIN BLACK, ALZARIN BLACK, BLUE BLACK SW.
9.—LAVEND BLACKS.	10.—ALZARIN BLACK.	11.—DIAMOND GREEN, THOT GREEN, &c.	12.—DIAMOND GREEN, CHROME GREEN, &c.

## ORGANIC—QUANTITATIVE.

*Sulphur and Halogens in Organic Substances; Inner Crucible Method for Determining* — S. S. Sadtler. J. Amer. Chem. Soc., 1905, 27, 1188—1192.



For the determination of sulphur, halogens and phosphorus in organic substances, especially volatile substances, the following method has been found to give good results. The platinum apparatus used is shown in the accompanying illustration. The outer crucible *C* is furnished with a tightly-fitting lid, and has, in its bottom, an indentation *B* in order to extend the highly-heated zone into the inner crucible *I*. The latter has small rings of platinum *L* soldered to the wide closed end to keep it in position within the outer crucible. The open end of the inner crucible is made as thin as possible, and it fits about midway between the indentation *B* and the outer crucible. The substance is weighed out into the smaller crucible, and if it is a liquid, is covered with a sufficient quantity of a mixture of equal parts of dried magnesia and sodium carbonate to absorb it. The crucible is then filled nearly to the top with the same mixture, and magnesia added till the crucible is completely filled. A layer of freshly-ignited white asbestos *A* (see Fig.) is placed on the bottom of the larger crucible, which is then placed over the smaller one, the whole inverted, and the determination completed in the usual manner.—A. S.

*Oil in Water from Condensing Engines; Determination of* — J. McFarlane and J. Mears. Chem. News, 1905, 92, 108.

Two litres of the water (or 1 litre if the amount of oil exceed 0.4 gr. per gall.) is heated "nearly to boiling" with 5 c.c. of a solution of ferric chloride, prepared by dissolving 10 grms. of iron in 200 c.c. of hydrochloric acid, oxidising with nitric acid and diluting to 1 litre. Ammonia is now added in excess, and the solution boiled for two minutes and filtered through a filter paper which has been extracted with ether. The precipitate (which is said to contain all the oil) is washed with hot water, dried at 100° C., and extracted with ether in a Soxhlet extractor, the ethereal extract being subsequently evaporated and the oil weighed.—T. F. B.

*Glycerol; Comparison of Methods of Determining* — in *Fats, Soaps and Glycerin Preparations*. F. Schulze. Chem.-Zeit., 1905, 29, 976—980.

THE author has continued his series of comparative determinations (this J., 1905, 943), and gives tables of the results obtained with fats, soaps and preparations containing glycerin. Here, again, he finds the permanganate method unreliable, whether carried out as originally devised by Benedikt and Zsigmondy or by Herbig's or Mangold's modifications. Although serviceable results may be obtained in this way it is impossible to be certain whether the oxidation is complete, or has gone too far. The acetin method has not given concordant figures in the author's hands, and he considers it essential to take the mean of several determinations if the method is still to be employed. The bichromate method is stated to give too high results as a rule, and to obviate this the figures

should be lowered by 10 per cent., or Helmer's bichromate solution taken as corresponding to more glycerol (74.86 grms. of  $K_2Cr_2O_7 = 11$  grms. instead of 10 grms.) Gannter's method of measuring the carbon dioxide evolved generally yields too low results, and the value should be increased by 2 to 3 per cent. The bichromate method appears to be only reliable in the absence of phosphoric acid. Zeisel and Fanto's iodide method is regarded as the best, but is too expensive for factory work and should only be used as a means of checking the volumetric bichromate method.—C. A. M.

*Glycerol in Liqueur Wines; Determination of* — X. Roeques. Ann. Chim. anal. appl., 1905, 10, 306—309. Chem. Centr., 1905, 2, 930.

IN order to distinguish between genuine liqueur wine and those prepared by addition of alcohol to unfermented must, a determination of the glycerol present is useful. If the proportion of glycerol be less than 0.1 grm. per 100 c.c., the liqueur must be regarded with suspicion. For the determination of the glycerol, the following method has been found trustworthy by the author. 200 c.c. of the liqueur wine are evaporated on the water-bath to syrupy consistence, and the residue triturated with quantity of finely-powdered quicklime equal to that of the sugar present. After allowing the mixture to stand for half an hour, 200 c.c. of 96—97 per cent. alcohol are added gradually with continuous stirring, and, after further half an hour, the whole is filtered, and the filtrate washed with alcohol. The filtrate is acidified with a alcoholic solution of tartaric acid, a few small pieces of pumice are added, and the greater portion of the alcohol is distilled off. The residue (15—20 c.c.) is well mixed in a shallow dish with 3—5 grms. of quicklime and 10 grms. of fine sand, and dried *in vacuo* in an exsiccator. The dry mass is treated in a closed flask with 80 c.c. of ethyl acetate and 20 c.c. of alcohol for two hours, with vigorous agitation at intervals. The mixture is then filtered, and a measure portion of the filtrate (75 c.c.) evaporated to dryness *in vacuo* over sulphuric acid, and the residue weighed after three days.

Ethyl acetate recommended as a solvent by Trilla dissolves per 100 grms., only 1.34 grms. of glycerol at 20° C. whereas the mixture of ethyl acetate and alcohol used by the author dissolves 8.06 grms. of glycerol, without an appreciable quantities of other constituents of the wine. —A. S.

*Malt; Determination of Yield of Extract in* — Bergdolt. Z. ges. Brauw. 1905, 28, 597—601, 617—620.

THE author has studied comparatively three methods for the determination of the yield of extract from malt when mashed under the standard laboratory condition.

(1) The "proportionality" method, adopted as the standard by the Berlin Congress of 1903, the concentration of the wort being based on the weight of water added plus the moisture of the malt.

(2) The "two filtrates" method. The cooled mash from 50 grms. of malt is made up to a weight of 450 grms. 250 c.c. of the wort are filtered off and the residual mass is mixed, without loss, with 250 c.c. of water and again filtered. The extract in 100 grms. of air-dry malt is the

calculated by the formula: Malt Extract =  $2 \frac{250E}{E - e}$

where *E* is the percentage of extract in the first filtrate and *e* is that in the second filtrate.

(3) The absolute "washing out" method. The whole mash is allowed to settle for two hours at 70° C., the portion is first poured through a hot-water filter maintained at 70° C., and the entire residue is then washed on the same filter with water at about 80° C., until fully exhausted. The wort is weighed and the quantity of extract is determined from its specific gravity.

The results showed that the "two filtrates" method gives the same values as the "washing out" method which may be taken as correct, but that the "proportionality" method gives constantly higher numbers, the difference being about 1.7 per cent. The error involved in the "proportionality" method lies in the fixation of water by the chemical reaction of hydrolysis and in the



selective absorption of water by the solid residues of the grains.

With dark and steely malts, even in the case of fine meal, the full yield of extract is not obtained by the infusion method. In such cases, when a rigorous comparison between laboratory and brewery yields is required, the three-mash decoction principle should be followed in the laboratory. The increased yield so obtained by the theoretically correct "washing-out" or "two-filtrates" method is, however, never so high as to compensate the error inherent in the Berlin Congress standard method of determination.—J. F. B.

*Esters in Spirits; Determination of* — R. Duchemin and J. Dourlen. Bull. Assoc. Chim. Sucr. Dist., 1905, 23, 109–113.

The authors have investigated the errors caused by the oxidation of the alcohol in contact with the air during the operation of boiling with alkali for the saponification of the compound esters. Owing to the formation of acetic acid, and the consequent neutralisation of the alkali, these errors are liable to be very serious. It was found that the errors increased with the time of boiling, decreased with increased intensity of ebullition, owing to the exclusion of air from the condenser, increased with the proportion of aldehydes present in the spirit, these being more readily oxidised than the alcohol, and varied with the surface conditions of different flasks and condensers. The authors, therefore, propose to effect the saponification of the esters *in vacuo*, exhausting the flask containing the spirit and alkali by means of a mercury air pump. The evacuated flasks are immersed in a bath of boiling water, maintained at a constant level, the level of the water being below that of the spirit inside the flasks. It is shown that a period of one hour under these conditions is sufficient to complete the saponification of the esters, even when present in relatively large proportions, and that the results obtained are very satisfactory.—J. F. B.

*Formaldehyde; Hydrogen Peroxide Method of Determining* — J. K. Haywood and B. H. Smith. J. Amer. Chem. Soc., 1905, 27, 1183–1188.

The authors find that the Blank and Finkenbeiner method of determining formaldehyde (this J., 1899, 79, 614) occasionally gives incorrect results, probably owing to a secondary action of the formaldehyde on the 2N-caustic soda solution employed. By using N/1 caustic soda solution, and mixing it with the whole of the hydrogen peroxide before adding the formaldehyde, this source of error is avoided, but the time required is about 30–45 minutes at the ordinary temperature. At 100° C., however, only a few minutes are required, and the following method of working has been found to give safe, accurate results. Fifty c.c. of N/1 caustic soda solution are mixed in a flask with 50 c.c. of pure 3 per cent. hydrogen peroxide solution, and then 3 c.c. of the formaldehyde solution under examination (the sp. gr. of which has been previously determined) are added from a pipette, the point of which almost reaches the liquid in the flask. A funnel is placed in the neck of the flask, and the whole is heated on the steam-bath for five minutes, with occasional shaking. The funnel is then rinsed with distilled water, the flask cooled to the ordinary temperature, and the excess of sodium hydroxide titrated with N/1 acid, using litmus as indicator. See also this J., 1905, 693.)—A. S.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Fluorescent Screens; Regeneration of* — Bordier. Arch. d'Elect. Med., Aug. 24, 1905. Electrician, 1905, 55, 859.

Screens of barium platinocyanide occasionally change colour from green to yellow and brown under the influence of prolonged exposure to X-rays, and, at the same time, lose their fluorescence. This change is due to loss of moisture owing to the ionising action of the X-rays; it can also be effected by desiccating the screens by gentle heat, or by absorbing the moisture with sulphuric acid. Screens prepared with a material which is readily permeated by

water can be regenerated by exposure to steam, but those prepared with collodion must be broken up and extracted with water, the barium platinocyanide being subsequently crystallised out from the solution.—A. S.

*Gold-coated Teeth in Sheep; So-called* — A. Liveridge. Chem. News, 1905, 92, 115–116.

STATEMENTS have appeared recently that gold-coated teeth have been found in sheep. The teeth of the lower half of a sheep's jaw-bone, examined by the author, were more or less completely incrustated with a yellow metallic substance, more closely resembling iron pyrites (marcasite) or brass than gold. The incrustation was brittle, and readily came off in scales when even lightly scratched with the point of a penknife. The surface of the tooth under the scale was found to be black but apparently not decayed, for when the black coating was scraped off, the surface of the tooth was white. The thickness of the deposit did not apparently exceed the  $\frac{1}{16}$  of an in. or less than 1 mm. Only one tooth was sealed.

The scale partly dissolved in dilute acid. The residue consisted of filmy organic matter, still possessing a metallic sheen, although white in colour instead of yellow. When heated on platinum foil the scale blackened, partly fused and left a white residue soluble in dilute hydrochloric and nitric acids.

The residue contained phosphoric acid, and apparently consisted mainly of calcium phosphate. Under the microscope, the scale appeared to be translucent, and of a pale brownish colour, and with a  $\frac{1}{2}$  in. objective it was seen to be made of thin layers, but there was no recognisable organic structure. The metallic lustre is due to the way in which the light is reflected from the surfaces of the superimposed films: the incrustation on the teeth is apparently a deposit of tartar, and perhaps accompanied by slight superficial decay of the tooth.—T. F. B.

## Trade Report.

### II.—FUEL, GAS, AND LIGHT.

#### COAL INDUSTRY OF BRITISH INDIA IN 1904.

*Bd. of Trade J., Sept. 21, 1905.*

According to an official memorandum received through the India Office, the division of mining properties show considerable changes in Bengal, the number of mines in that province in 1904 being 61 fewer than in 1901, while there was an increase in 1904 of 17 mines in other provinces, mainly owing to small workings started in the Jhelum district of the Punjab. The total number of coal mines in operation in 1904 was 296 (256 in Bengal), compared with 302 (279 in Bengal) in 1903. The production in Bengal in 1904 represents more than six-sevenths of the whole Indian output of coal, which has been as follows in the last five years:—

	Tons.		Tons.
1900 .....	6,118,692	1903 .....	7,438,386
1901 .....	6,635,727	1904 .....	8,216,706
1902 .....	7,424,402		

#### COAL PRODUCTION OF U.S.A. IN 1904.

*Bd. of Trade J., Sept. 21, 1905.*

According to the "Bulletin of the American Iron and Steel Association" the production of all kinds of coal in the United States in the calendar year 1904 amounted to 314,562,881 tons, against 319,068,229 tons in 1903, a decrease of 4,505,348 tons. Of the total production of last year 65,318,490 tons were Pennsylvania anthracite

and 249,244,391 tons were bituminous. In 1903 the production of Pennsylvania anthracite amounted to 66,613,454 tons and of bituminous coal to 252,454,775 tons. This was a decrease in 1904 as compared with 1903 of 1,294,964 tons of Pennsylvania anthracite and of 3,210,384 tons of bituminous.

The value of the anthracite produced decreased from 152,036,448 dols. in 1903 to 138,971,020 dols. in 1904, a loss of 13,062,428 dols., or 8.6 per cent., while the value of the bituminous produced declined from 351,687,933 dols. in 1903 to 305,842,265 dols. in 1904, a decrease of 45,845,665 dols., or 13.04 per cent. The average price per ton for the marketed sizes of anthracite coal in 1904 was 2.35 dols., as compared with 2.50 dols. in 1903, 2.35 dols. in 1902, and 2.05 dols. in 1901. The average price per net ton of the bituminous coal produced in 1904 was 1.10 dol. compared with 1.24 dol. in 1903, 1.12 dol. in 1902, and 1.05 dol. in 1901.

There were 31 States and Territories in the United States in which coal was produced in 1904, an increase of one over 1903. A small amount of coal produced in Nevada last year adds that State to the list of producers.

NOTE.—The ton referred to is the ton of 2,240 lb.

#### COKE PRODUCTION OF U.S.A. IN 1904.

*Ed. of Trade J. Sept. 21, 1905.*

The "Bulletin" further reports that, including the production of coke from by-product ovens, which in 1904 amounted to 2,608,229 net tons, the total production of coke in the United States last year was 23,621,520 net tons, against 25,274,281 net tons in 1903. The decrease in 1904, as compared with the preceding year, was 1,652,761 net tons, or 6.54 per cent. The total value of the coke declined in much greater proportion, viz., from 66,498,664 dols. in 1903 to 46,026,183 dols. in 1904, a decrease of 20,472,481 dols., or 31 per cent. The average price for all the coke made and sold in 1904 was only 9 cents less than that in 1901, and was higher than that of any year from 1893 to 1899 inclusive. In 1903 the value of the coal used in the manufacture of coke was 42,447,449 dols., while in 1904 it was 37,133,832 dols. Of the total production of coke in 1904 Pennsylvania produced over 62 per cent., or 14,861,064 net tons out of a total of 23,621,520 tons.

NOTE.—Net ton = 2,000 lb.

#### III.—TAR PRODUCTS, PETROLEUM, Etc.

##### ASPHALTUM AND BITUMINOUS ROCK PRODUCTION IN 1904.

*Eng. and Mining J., Sept. 9, 1905.*

The production of asphaltum and bituminous rock in the United States during 1904, according to Dr. E. O. Hovey (Press Bul. 196, U.S. Surv.), amounted to 81,752 short tons (903,741 dols.), a decline of nearly 28 per cent. from that of 1903, which was 101,255 short tons (1,005,446 dols.). This decline is explained by the low price obtained and by the competition of the companies producing natural asphalt.

In reporting on asphaltum and bituminous rock, Dr. Hovey uses the term "asphaltum" to cover oil asphaltum as well as all the natural asphalts. The term "bituminous rock" covers the asphaltum-bearing sandstones and limestones which are quarried and used alone or mixed with other broken rock in the making of street pavements.

The output of bituminous sandstone decreased from 38,633 short tons (118,001 dols.) in 1903 to 19,641 short tons (71,465 dols.) in 1904. "Mastic" is given at 961 short tons (11,532 dols.) in 1903, most of which was produced from bituminous sandstone quarried in Kentucky; this increased to 1,200 short tons, valued at 10,800 dols. in 1904. The production of hard and refined or "gun asphalt" shows an increase in quantity from 12,896 short tons (343,799 dols.) in 1903 to 15,012 short tons (224,440 dols.) in 1904, though there was a decrease in value in 1904 of 119,353 dols. The production of liquid asphaltum,

or "maltha," was 3,360 short tons (36,260 dols.), reported from California, and three short tons (60 dols.) from Texas. The production of oil asphaltum decreased from 46,187 short tons (522,164 dols.) in 1903, to 36,030 short tons (376,135 dols. in 1904; the average value per ton decreased from 11.31 dols. to 10.44 dols.

During the fiscal year ending June 30, 1904, asphaltum and manufactures of asphaltic material of domestic production to the total of 160,186 dols. were exported from the United States. The corresponding exports to the fiscal year ending June 30, 1903, amounted to 104,580 dols.

Nearly two-thirds of the asphaltum which is imported into the United States from foreign countries comes from Trinidad. Other important sources of the material are Venezuela (Burmudez), Cuba and France.

The imports from Trinidad decreased from 129,133 long tons (367,003 dols.) in the fiscal year ending June 30, 1903, to 110,031 long tons (368,623 dols.) in the fiscal year ending June 30, 1904; while the imports from Venezuela increased from 16,445 long tons in 1903 (74,874 dols.) to 50,194 long tons (217,017 dols.) in 1904. The imports from the British West Indies in 1904 include 649.5 short tons (manjak, valued at 28,578 dols. The total importation in 1904 were 175,640 long tons, valued at 643,785 dols. as compared with imports of 172,892 long tons, valued at 585,865 dols. in 1903.

#### IV.—COLOURING MATTERS, Etc.

ORCHIL AND ORCHIL EXTRACT: U.S. CUSTOMS DECISION. Aug. 18, 1905.

Orchil, invoiced as orchil R.C.E.P., is free of duty "orchil or orchil liquid" under paragraph 628 of the tariff the assessment of duty at 30 per cent. *ad valorem* as "colour" under paragraph 58 was overruled. Evidence was presented on the part of the importer that the merchandise was obtained from orchil lichens and not from orein derived from toluol or coal tar.—R. W. M.

#### V.—TEXTILES, YARNS, AND FIBRES.

GREASE; SOLUBLE — [ALIZARIN ASSISTANT]: U.S. CUSTOMS DECISION. July 17, 1905.

Following a decision of the Circuit Court, the Board General Appraisers decided that soluble grease made from tallow by sulphonation is dutiable at 20 per cent. *valorem* under section 6 as a "manufactured article unenumerated," and not under paragraph 32 as "alizerin assistant not specially provided for, i.e., not made from castor oil."—R. W. M.

#### VII.—ACIDS, ALKALIS, Etc.

BORAX: U.S. CUSTOMS DECISION. Aug. 31, 1905.

Merchandise invoiced as borate of soda, and consisting of 97.51 per cent. of crystallised borax and 2.59 per cent. of sodium carbonate, is held to be in fact "borax" and dutiable at 5 cents per lb. under paragraph 11 of the tariff.—R. W. M.

COPPER ACETATE: U.S. CUSTOMS DECISION. Aug. 15, 1905.

The Treasury Department has ordered the refund of duty on acetate of copper which had been assessed for duty 25 per cent. *ad valorem* as a "chemical salt," under paragraph 3 of the tariff. The Circuit Court decided that article was free of duty as "subacetate of copper" under paragraph 694.—R. W. M.

#### CHEMICAL AND OTHER INDUSTRIES OF LYONS IN 1904.

*For. Off. Misc. Series, No. 638.*

The accompanying table shows the consumption of pyrites for the production of sulphuric acid:—



	Quantity.		
	1902.	1903.	1904.
	Tons.	Tons.	Tons.
Production of mines, St. Bel ..	315,000	320,000	200,000
Imported .....	65,000	117,000	41,000
Consumption in France of St. Bel pyrites .....	250,000	203,000	228,000
Import of pyrites .....	171,000	205,000	195,000
Consumption .....	421,000	408,000	423,000

The above consumption of 423,000 tons of pyrites presents about 1,100,000 tons of sulphuric acid at £ 13. The decline in the production of St. Bel was due to a strike; nevertheless the home sales were heavier than in 1903. Owing to the revival of the superphosphate industry the French industry in sulphuric acid seems to have regained the activity that marked it in 1902. The concentrated sulphuric acid industry remained much the same as in 1903.

The year 1904 was marked by a fall of 20 to 25 per cent. in the prices of mineral superphosphates, brought about by competition amongst producers. This fall caused an increase in the home consumption. The total consumption of superphosphates is estimated at 1,400,000 tons, which represents a consumption of 7,800,000 tons of sulphuric acid.

The fall in the prices of bone manure, coinciding with the decline in price of glues, placed the latter industry in a very unfavourable position, and caused the closing of several manufactories in France. Factories that do not exclusively produce low-quality glues maintained their activity by producing high-grade glues, which sold well.

The exports of French glue fell from 7940 tons in 1903 to 523 tons in 1904, the imports for the corresponding periods being 2428 and 2129 tons. The fall in imports could have partly compensated for the decrease in exports had there not been a considerable decline in the home consumption, owing to the depression of the trade. Production has fallen off, and several manufactories have been closed.

This reduction has been incidental with a falling-off in the production of leather trimmings throughout the French tan yards. The import of bones, another raw material, was also less, falling from 38,000 tons in 1903 to 3,000 tons in 1904. The export, on the other hand, which is principally to Belgium and Germany, increased from 6,500 to 9,000 tons.

No change was noticeable in the stearine and soap industry during 1904. The export increased from 43,813 quintals in 1903 to 49,251 quintals in 1904.

#### VIII.—GLASS, POTTERY AND EARTHENWARE.

##### GLASS EXPORTS OF BELGIUM.

For. Off. Ann. Series, No. 3501.

The exports of glass again showed a considerable falling-off in comparison with the year 1903, the decline amounting to 47,655 tons and 555,520<sup>l</sup>, the figures for 1904 being 189,846 tons, valued at 3,022,600<sup>l</sup>. The decrease in the exports is largely due to the diminished quantity of glass of all kinds sent to the United Kingdom, the United States of America, Japan, Canada, Denmark and Egypt. The decrease in the exports to Japan was very marked, amounting to nearly two-thirds of the total exports to that country in 1903.

This dulness in the glass export trade is due to the smaller output of the factories owing to a general strike in the industry in the early part of 1904, and a consequent cessation of the glass supply. Orders have been placed more freely since the month of June in the present year (1905), and prices are keeping up to a fair standard, particularly in regard to special quantities of glass exported to Japan, China and Canada. The trade with the United Kingdom is not, however, very prosperous, and the lack of orders from that quarter has necessitated the lowering of prices for certain qualities of glass.

##### ELECTRITE; U.S. CUSTOMS DECISION.

Electrite, an earthy substance obtained by heating bauxite in the electric furnace and intended to be used after grinding as a substitute for emery, was held to be dutiable at 2 dols. per ton, under paragraph 93 of the tariff, as an "earth wrought or manufactured," and not at 20 per cent. *ad valorem*, as a "manufactured article unenumerated," under section 6, as assessed for duty.

—R. W. M.

#### IX. BUILDING MATERIALS, Etc.

##### TIMBERS OF NEW SOUTH WALES.

Bull. Imp. Inst., 1905, 3, 119—124.

A description of the more important timbers exhibited in the New South Wales Court of the Imperial Institute is given, the timbers being grouped according to their suitability for special purposes.

*Paving Timbers.*—Tallow-wood (*Eucalyptus microcorys*, F. v. M.), blackbutt (*E. pilularis*, Sm.), red mahogany (*E. resinifera*, Sm.), forest red gum (*E. tereticornis*, Sm.), bloodwood (*E. corymbosa*, Sm.) and brush box (*Tristania conferta*, R.Br.). The red gum, spotted gum, and blue gum trees, which are species of *Eucalyptus*, and the "turpentine" tree are also used for paving purposes.

*Timbers for Staves.*—Silly-oaks (*Grevillea robusta*, A. Cunn. and *Orites excelsa*, R.Br.), red silly-oak (*Stenocarpus salignus*, R.Br.), mountain hickory (*Acacia penninervis*, Sieb.), blackwood (*Acacia melanoxylon*, R.Br.) and coachwood (*Ceratopetalum apetalum*, D. Don.).

*White Ant-resisting Timbers.*—Cypress pine (*Callitris* species), native teak (*Flindersia Bennetiana*, F. v. M.), red mahogany, brush box, red cedar (*Cedrela australis*, F. v. M.), and "turpentine."\*

*Teredo-resisting Timbers.*—"Turpentine,"\* tallow-wood, red mahogany, and ironbarks (*Eucalyptus* species).

Timbers suitable for railway wagons and sleepers, for carriage building, cabinet-making, veneers, gunstocks, turnery, and for panels, picture frames and walking sticks are also described.—A. S.

##### CEMENT EXPORTS OF BELGIUM.

For. Off. Ann. Series, No. 3501.

The exports of home-manufactured cement from Belgium declined from 599,091 tons in 1903 to 588,295 tons in 1904, the respective values for the two years being 623,040<sup>l</sup>. and 564,762<sup>l</sup>. The exports to the United Kingdom show an increase of 11.6 per cent. in volume, and of 2.6 per cent. in value, the figures for 1904 being 231,213 tons, of a value of 221,964<sup>l</sup>. While large amounts are sent to the United States of America, the Netherlands, Brazil, Argentine Republic and other countries, the amount exported to the United Kingdom far exceeds any of these, and comprises alone more than one-third of the total exports. The average prices for cement during 1904 continued to be very low and the profit to manufacturers was but small. The prices quoted for Belgian cement are still below those of Germany and the Netherlands, and it is, therefore, very probable that the exports of home-manufactured cement will show a satisfactory increase by the end of 1905.

During the first five months of 1905, 257,960 tons were exported, compared with 189,715 tons in the same period of 1904, forecasting a large increase for 1905.

##### CEMENT IN LYONS IN 1904.

For. Off. Misc. Series, No. 638.

The total annual production of cement of the Department of the Isère is about 180,000 tons. The Department of the Ain produces 100,000 tons; the Departments of Savoie and Haute Savoie conjointly about 30,000 tons. There is, besides, a small production in the Jura.

Argillaceous and calcareous strata are found in the neighbourhood of Grenoble. Fuel, which enters largely

\*N.B.—The Australian turpentine tree, *Tristania Albicans*, is a species of myrtle.

into the cost of manufacture of cement, is provided by the anthracite mines of Lamure in close proximity to Grenoble, and a cheap and plentiful supply is always available. Rotary kilns, however, cannot be used, as the Lamure anthracite does not contain the necessary amount of gas, and produces abundant ash in combustion. Water-power is easily obtainable, and about 3,000 horse-power are now used for the manufacture of cement in the Department of the Isère. The amount of coal used is about 35,000 tons at 16s. per ton. The cost of labour is estimated at 60,000*l.* per annum.

In 1885 the cement produced in the Grenoble district amounted to 175,000 tons of all qualities, representing a value of 320,000*l.* and employing 1,250 hands.

To-day the cement industry is represented in the Department of the Isère by nine firms, employing 1,500 workmen, producing 180,000 tons, of which 135,000 tons are for home consumption and 45,000 tons or 25 per cent. for export via Belfort, Vallorbes, Geneva, Modane and Marseilles. The sale price at works varies from 12s. to 1*l.* 16s. per ton.

Whereas the price of fuel used in the manufacture of cement has increased of late years, and labour has become dearer, the sale prices of Grenoble cement tend to decrease. This has been brought about (1) by the excessive cost of transport in a district where the absence of canals gives a monopoly to the railways; (2) because cement works have been started in many other parts of France; and (3) because exports are daily decreasing. There are now cement factories in Algeria, Tunis, and Egypt, and excessive customs rates in Italy and Switzerland have killed the trade.

## X.—METALLURGY.

### IRON MINES IN TUNIS.

*For. Off. Ann. Series, No. 3492.*

The following particulars with reference to five important iron mines discovered in the north-west of Tunisia within recent years, are extracted from the report of H.M. Consul-General at Tunis:—

The concession for the working of the Djebel Zerissa mine was granted in 1901. This iron mine is situated at a distance of about 122 miles from the port of Tunis and about three-quarters of a mile from the railway running from Tunis to Kalâa-es-Senam, which will probably be opened to traffic during the latter part of this year. It is calculated at present that some 4,000,000 tons are available, and it is reported that there is a likelihood that this amount may be doubled when the mine is in full working order. The assays have shown this mineral to contain from 50 to 60 per cent. of iron and  $\frac{1}{2}$  to 2 per cent. of manganese.

The concession for the Djebel Slatâ mine, which lies in the Kef district (to the north-west of Tunis), has been applied for by a Brussels syndicate. It is situated 131 miles from the Port of Tunis and about half a mile from the railway line running from Tunis to Kalâa-es-Senam. From recent researches which have been made in this mine it has been found that about 5,000,000 tons of ore are available. The analysis of the extracts is reported to be as follows:—55.77 per cent. of iron, 2.25 per cent. of manganese.

The concession for the Djebel Hammeima mine, which lies in the Kef district, has recently been applied for by the same syndicate. It is situated about 137 miles from the port of Tunis and about two and a half miles from the line running between Tunis and Kalâa-es-Senam. It is reported that some 6,000,000 tons of the mineral are available. From 70 assays the following result has been obtained:—59.53 per cent. of iron, 2.05 per cent. of manganese.

The Nabeur mine is situated 112 miles from the port of Tunis and about 19 miles from the railway station of Souk-el-Arba (about 100 miles from Tunis) and lies at the feet of the Kef mountains. From several assays it has been found that it contains 48 to 53 per cent. of iron, and 2 to 4 per cent. of manganese.

The Djebel-Hallouf mine, which is said to extend for

about three-quarters of a mile, is situated 122 miles from the port of Tunis. The extracts are reported to contain 53.29 per cent. of iron and 0.90 per cent. of manganese.

In conclusion, Mr. Berkeley says, "It is asserted that between phosphates and these new iron mining developments something like 30,000,000 tons of extracts will be available for shipment within the near future."

## ORE EXPORTS OF NEW CALEDONIA.

*Bd. of Trade J., Sept. 21, 1905.*

The "Quinzaine Coloniale" gives the exports of ore from New Caledonia during the first half of 1904 as follows:

	1904.	First half of 1905
	Kilos.	Kilos.
Nickel ore .....	98,655,104	65,172,164
Cobalt ore .....	8,964,183	5,283,222
Chrome ore .....	42,197,477	26,942,109

## ALLOY; U.S. CUSTOMS DECISION. June 26, 1905.

The United States Circuit Court held that an alloy composed of 62 per cent. of iron, 32 per cent. of tin, and 6 per cent. of manganese, used as hardener in the manufacture of manganese bronze, is dutiable at 20 per cent. *ad valorem* as a "metal unwrought" under paragraph 183 of the tariff and not at 45 per cent. *ad valorem* as a "manufacture of metal" under paragraph 193.—R. W. M.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### KRYPTOL; U.S. CUSTOMS DECISION. July 19, 1905

Kryptol, a resistance material consisting of practically pure carbon, was held to be dutiable at 35 per cent. *ad valorem*, under paragraph 97 of the tariff, as an "article composed of carbon."—R. W. M.

## XII.—FATTY OILS, FATS, Etc.

### SOAP; U.S. CUSTOMS DECISION. July 27, 1905.

An analysis of the merchandise showed water, 62.89 per cent.; fatty acids, 28.81 per cent.; alkali as sodium carbonate, 7.49 per cent.; insoluble matter, 0.81 per cent. and the article was assessed for duty as "soap" under paragraph 72. The importer claimed it was free of duty as "soap stock" under paragraph 568. The Board of General Appraisers affirmed the assessment of duty and overruled the claim of the importer.—R. W. M.

### OIL DISTILLED FROM WOOL GREASE ["WOOL OIL"] U.S. CUSTOMS DECISION. June 23, 1905.

An oil distilled from yellow grease and variously invoiced as wool oil, pure oleine, and pure oleine grease is dutiable at 25 per cent. *ad valorem* under paragraph 1 of the tariff as an "expressed or rendered oil." The analysis of the sample showed:—Specific gravity at 15° 0.9085; free fatty acids, 53.90 per cent.; neutral fat 1.32; unsaponifiable matter, 44.78 per cent. The testimony showed that it was distilled from grease recovered from the suds resulting from wool scouring. The claim of the importer that it was dutiable as "wool grease" at  $\frac{1}{2}$  cent. per lb. under paragraph 279 was overruled on the ground that it was no longer wool grease but a product obtained from wool grease.—R. W. M.

## XIII.—PIGMENTS, PAINTS, Etc.

### COLOURS FOR GLASS AND CHINA CONTAINING LEAD U.S. CUSTOMS DECISION. Aug. 30, 1905.

Colours used to colour glass and china containing lead are dutiable at five cents per lb. under paragraph 54



colours containing lead." The assessment of duty at per cent. *ad valorem* as "colours" was overruled.

—R. W. M.

#### UNT MIXED WITH VARNISH. U.S. CUSTOMS DECISION. July 17, 1905.

Following a decision of the Circuit Court, the Board of General Appraisers held that enamel white, consisting of int ground in varnish, is dutiable at  $1\frac{1}{2}$  cents per lb. under paragraph 57 of the tariff act, and not as "varnish" 35 per cent. *ad valorem*, nor as "paint" at 30 per cent. *ad valorem*. The Department has ordered an appeal on this decision if representative samples of the merchandise have been retained.—R. W. M.

#### OIL AND PAINT IMPORTS OF CAPE COLONY.

*Chem. and Drug.*, Sept. 23, 1905.

Owing to the increasing importations of adulterated white and red lead, white zinc, linseed oil, and turpentine to Cape Colony, representations have been made to the Cape Government with the object of making illegal such spurious trade descriptions. Instructions have now been issued stating that all importations of white-lead, white-zinc, red-lead, and similar compositions, linseed oil, and turpentine shall only be passed by the customs authorities when marked "reduced," "mixed," "boiled," "mineral," but that if adulterated to the extent of 50 per cent. or more the actual percentage of such adulteration must also be conspicuously marked.

#### XIIIC.—INDIA-RUBBER.

##### RUBBER INDUSTRY OF FEDERATED MALAY STATES.

*Bd. of Trade J.*, Sept. 28, 1905.

The Report on Experimental Plantations in the Federated Malay States in 1904 states that agricultural interest in those States is almost entirely centred in the cultivation of the "Para" rubber tree. This cultivation has now got well beyond the experimental stage, and there is no longer any doubt as to whether the tree is suited to the conditions obtaining in the Federated Malay States, or whether its cultivation will prove remunerative. Tapping on a commercial scale has commenced on several estates, and exports for the year ending Dec. 31 last amounting to 105 pikuls (about 14,000 lb.) valued at over 28,000 dols. It, as the oldest estates are just coming into bearing, its amount will be greatly exceeded in the near future. The prices realised have exceeded the most sanguine expectations, having averaged almost 1s. per lb. more than fine Para," the price of which has advanced nearly 10 per cent. during the last 12 months. The fact that the "plantation Para" advanced 1s. 6d. per lb. during the year 1904, as against a rise of 1s. 2d. per lb. for "line Para" would seem to show that, in the opinion of the manufacturer, the value of "plantation Para" increases on acquaintance. The Report adds:—"There is little doubt, if the quality is kept up to the present high level, that if the supply of high-grade rubber ever exceeds the demand, the cultivated product will be the last to suffer; moreover, it seems more than probable that, owing to its quality, the facility and comparatively low cost at which it can be harvested, 'plantation Para' will eventually outstrip the native product from the markets of the world."

#### XIV.—TANNING, LEATHER, GLUE, Etc.

##### UTCALLS: EXTRACT OF ——. U.S. CUSTOMS DECISION. June 14, 1905.

The United States Circuit Court decided that aqueous extract of nutgalls is dutiable at  $\frac{1}{4}$  cent per lb. and 10 per cent. *ad valorem*, under paragraph 20 of the present tariff, as "drugs such as nutgalls advanced in value or condition." This decision reverses a decision of the Board of General Appraisers, which held the merchandise to be dutiable as "tannin," at 50 cents per lb., under paragraph 1, and sustains a former decision of the Board. The Court also found that the extract was not com-

mercially known as tannin or tannic acid, and not dutiable as such nor as a "chemical compound," since the only chemical added was a preservative and maintained rather than changed the character of the extract. It is understood that this decision will be appealed, on the part of the Government, to the Circuit Court of Appeals.—R. W. M.

#### LEATHER IN LYONS IN 1904.

*For. Off. Misc. Series*, No. 638

The Department of the Rhone is advantageously placed as regards leather, and raw material is easily obtained. Oxen, cows, calves and sheep slaughtered at Lyons provide skins of good quality. The Dauphiny and Italy furnish kid and lamb-skins, Algeria, Tunis and Morocco contribute goat-skins through Marseilles.

The quantity of hides and skins treated are:—(1) 100,000 ox and cow hides, valued raw at 140,000*fr.*, and representing between 200,000*fr.* and 240,000*fr.* finished; (2) 500,000 to 600,000 calf-skins of a value of 200,000*fr.* to 240,000*fr.* raw and of 240,000*fr.* to 320,000*fr.* finished; (3) 1,500,000 goat-skins of an estimated value of about 200,000*fr.* raw and about 280,000*fr.* in the finished state; (4) 300,000 sheep-skins, valued at 28,000*fr.* to 32,000*fr.* raw and 40,000*fr.* finished.

The total production of leather at Lyons is estimated at about 850,000*fr.* The immediate neighbourhood consumes about one-third of the total output, one-third is consumed in other parts of France and the remaining third is exported.

For the last 10 years, however, the hide and skin trade has not been flourishing. The dressed calf and kid-skins, which formed the speciality of the Lyons industry, were rejected by buyers, who preferred chrome-tanned skins. The introduction of chrome tanning was somewhat slow, and this revolution in the industry caused many failures among the less prosperous factories. At the present time, however, the French tanning industry is well equipped and capable of holding its own against foreign competition. Three years ago the "Ecole française de tannerie" was started in Lyons, with excellent results, and now supplies the scientific branch of the leather industry with capable experts.

#### XVI.—SUGAR, STARCH, Etc.

##### SUGAR PRODUCTION OF GERMANY.

*Bd. of Trade J.*, Sept. 21, 1905.

The "Reichsanzeiger" for 13th September publishes statistics of the production of sugar in Germany during the campaign 1904-5 (from Sept. 1st, 1904, to Aug. 31st, 1905). In 1904-5 the quantity of raw beet used in sugar manufacture was 10,080,538 metric tons as compared with 12,677,099 metric tons during the 1903-4 campaign; the amount of raw sugar produced in 1904-5 was 1,362,732 metric tons against 1,665,352 metric tons in 1903-4, whilst the production of refined sugar amounted to 1,298,515 metric tons in 1904-5 as compared with 1,410,553 metric tons in 1903-4. The total output of sugar (raw and refined) during the period 1904-5, expressed in terms of raw sugar, was 1,615,189 metric tons as compared with 1,929,415 metric tons in 1903-4.

##### SUGAR PRODUCTION OF ITALY.

*For. Off. Ann. Series*, No. 3496.

As was anticipated in a former report, the production of sugar in Italy has continued to increase largely, resulting in a considerable loss to the customs on the duties on imported sugar. There are now 34 factories in Italy for the production of the article, of which the most important produces 61,309 quintals annually. The total output of Italy for the year 1903-04 is 1,308,606 quintals, or 354,515 quintals\* more than in 1902-03. The supply is, in fact, greater than the demand, and there are considerable stocks standing over.

\* Quintal=110.2 lb.

The duty on the home-grown sugar produced 64,115,000 lire in 1902-03 in contrast to 52,558,000 lire in 1903-04, a loss to the revenue of 11,557,000 lire (462,280*l.*).

This loss, however, is due in part to the new methods of collection of the duty. Formerly the duties were paid at fixed and frequent periods, now they are collected when the sugar is sent out for consumption. For example, on the old system the whole tax on the sugar produced (1,308,606 quintals) that is to say, 88,973,246 lire, would have been levied and would have figured to the credit of the revenue, but by the new system as only 782,107 quintals were issued to consumers, the tax received amounted only to 52,558,000 lire.

The importation of foreign sugar is reduced to a negligible quantity, and has been falling steadily for the last four years. Thus we have:—

Year.	Quantity.
	Quintals.
1900 .....	552,559
1901 .....	371,895
1902 .....	200,095
1903 .....	52,678
1904 .....	4,599

#### XVII.—BREWING. WINES, SPIRITS, Etc.

##### ALCOHOL TAX: FRENCH — : U.S. TREASURY DECISION.

Aug. 25, 1905.

The Treasury Department has ordered the refund of the excess of duties exacted on certain brandy and preserved fruits containing alcohol, in which the French revenue taxes known as "Octroi" and "droit de ville" had been included in the market value on appraisal. This addition had been declared unwarranted by the United States Circuit Court of Appeals.—R. W. M.

##### BREWERIES OF BRITISH INDIA.

*Bd. of Trade J., Sept. 28, 1905.*

According to a memorandum received at the Board of Trade through the India Office, the quantity of beer brewed in India in 1904 amounted to 6,219,761 galls., of which 46 per cent. was bought by the Army Commissariat. There are 27 breweries, of which one at Delhi was idle. 21 are private property. The quantity of beer brewed in India and imported compare as follows, in galls.:—

Year.	Brewed in India.	Year ended 31st March.	Imported.
1900 .....	4,947,841	1900-01 .....	3,226,534
1901 .....	5,554,453	1901-02 .....	3,673,852
1902 .....	6,474,860	1902-03 .....	3,820,938
1903 .....	6,067,041	1903-04 .....	4,062,016
1904 .....	6,219,761	1904-05 .....	4,606,827

#### XX.—FINE CHEMICALS, Etc.

##### OIL OF GARDENIA: U.S. CUSTOMS DECISION.

June 26, 1905.

Oil of gardenia, containing 27.7 per cent. of alcohol, was held to be dutiable at 60 cents per lb., and 45 per cent. *ad valorem*, as an "alcoholic compound," under paragraph 2 of the tariff.—R. W. M.

##### CHRYSAROBIN: U.S. CUSTOMS DECISION.

The Treasury Department has decided not to appeal from a decision of the United States Circuit Court which held chrysarobin to be dutiable under paragraph 20 of the

tariff, at  $\frac{1}{4}$  cent per lb., and 10 per cent. *ad valorem*, as "drug advanced in value or condition by refining," &c. The contention of the Government that it was dutiable at 25 per cent. *ad valorem*, under paragraph 68, as a "medicinal preparation," was not sustained.—R. W. M.

##### ACETIC ANHYDRIDE: U.S. CUSTOMS DECISION.

June 28, 1905.

The Treasury Department has decided not to contest the decision of the Circuit Court which held acetic anhydride to be dutiable as "acetic acid" under paragraph 1 of the present tariff at 2 cents per lb. The claim of the Government that it was dutiable at 25 per cent. *ad valorem* under paragraph 3 as a "chemical compound" was not sustained.—R. W. M.

##### CHLORIDES OF PLATINUM, IRIUM AND RHODIUM: U.S. CUSTOMS DECISION Aug. 25, 1905.

The above-mentioned salts were held to be dutiable at 25 per cent. *ad valorem* as "chemical salts" under paragraph 3 of the tariff. The Board held that they were not free of duty as "minerals crude" under paragraph 6; or as "mineral salts obtained by the evaporation of water from a mineral spring," under paragraph 615.—R. W. M.

##### MUSK: ARTIFICIAL — : U.S. CUSTOMS DECISION

Sept. 5, 1905.

Artificial musk, or trinitro-isobutylxylool, which results from the interaction of 106 parts of xylool, 74 parts isobutyl alcohol and 189 parts of nitric acid, is not "preparation or product of coal tar," dutiable at 20 per cent. *ad valorem* under paragraph 15 of the tariff, but "chemical compound" dutiable at 25 per cent. under paragraph 3.—R. W. M.

## Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journal in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open inspection at the Patent Office immediately, and to opposite within two months of the said dates.

#### I.—PLANT, APPARATUS, AND MACHINERY.

- [A.] 18,833. Boulton (Goldman and Co.). Filters. \* Sept. 18.  
 „ 18,838. House. Heating apparatus. Sept. 18.  
 „ 18,876. Dunsmore. Pumps for dealing with impure or gritty or chemical liquors. Sept. 19.  
 „ 19,076. Eastman and Camacho. Processes of evaporating, drying, concentrating, distilling, & substances or solutions, and apparatus for producing a vacuum employed therein. \* Sept. 21.  
 „ 19,109. Aktiebolaget Separator, and Ericsson. Centrifugal separating apparatus. \* Sept. 21.



A.] 19,216. Lake (Aktiebolaget Separator). Centrifugal separating apparatus.\* Sept. 22.

19,385. Theisen. Method of and apparatus for evaporating, distilling, and concentrating liquids and semi-liquids, with continuous re-utilisation of the heat employed.\* Sept. 25.

19,386. Theisen. Method of and apparatus for producing steam or vapour from liquids without boiling action, applicable for generating high pressure steam, for evaporating and concentrating liquids, &c. Sept. 25.

S.] 20,801 (1904). Stirling. Raising liquids by compressed air. Oct. 4.

23,336 (1904). Burgess. Condensers. Oct. 4.

24,363 (1904). Green. Separation of volatile compounds by distillation and apparatus therefor. Sept. 27.

24,903 (1904). Capell. *See under II.*

1287 (1905). Hesketh. Apparatus for recovering volatile liquid from air and gas. Oct. 4.

8406 (1905). Seitz. Filters. Sept. 27.

10,738 (1905). Day and Yerbury. Condensers, evaporators, heaters and like vessels. Sept. 27.

11,780 (1905). Evans. Apparatus for separating solids from liquids. Sept. 27.

## II.—FUEL, GAS, AND LIGHT.

A.] 18,814. Thompson (Deuts. Gasglühlicht Akt.-Ges.). Electric incandescence lamp with filament of metallic tungsten.\* Sept. 18.

18,930. Boyd and McKay. Motive fluid. Sept. 19.

19,052. Thomson, Skinner and Hamilton. Fuel calorimeter. Sept. 21.

19,058. Brotherhood. Producer gas generating apparatus. Sept. 21.

19,212. Fitzpatrick. Manufacture of briquettes. Sept. 22.

19,379. Deuts. Gasglühlicht Akt.-Ges. Production of incandescent filaments for electric incandescence lamps. [Ger. Appl., Jan. 17, 1905.]\* Sept. 25.

19,410. Grice. Gas producing plants. Sept. 26.

19,496. Morton. Producer gas plant. Sept. 27.

19,539. Van der Heyden. Manufacture of briquettes of dust coal or powdered peat. [Fr. Appl., Oct. 7, 1904.]\* Sept. 27.

19,617. Bemelmans. Gas generator furnaces.\* Sept. 28.

S.] 20,558 (1904). Mewes. Producing hydrogen incandescent light. Oct. 4.

20,870 (1904). Koppers. *See under III.*

24,903 (1904). Capell. Washing gases and apparatus therefor. Sept. 23.

25,844 (1904). Thorn. Incandescent gas mantles. Oct. 4.

26,246 (1904). Busse. Manufacture of illuminating gas. Sept. 23.

27,707 (1904). Michand and Delasson. Manufacture of an indestructible filament for gas and electric lamps. Sept. 27.

[C.S.] 1917 (1905). Otto-Hilgenstock Coke-Oven Co., Ltd. (Otto and Co.). Coking of coal. Sept. 27.

3089 (1905). Schlatter and Deutsch. *See under XXIII.*

13,381 (1905). British Thomson-Houston Co., Ltd. (Gen. Electric Co.). Electrodes for electric arc lamps. Oct. 4.

## III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 19,540. Van der Heyden. Solidification of hydrocarbons such as petroleum and benzene. [Fr. Appl., Oct. 26, 1904.]\* Sept. 27.

[C.S.] 20,870 (1904). Koppers. Obtaining by-products in the dry distillation of fuel. Oct. 4.

## IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 19,100. Newton (Bayer und Co.). *See under XIII.*

19,106. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new sulphurised dyestuffs.

19,132. Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthracene derivatives and of colouring matters therefrom.\* Sept. 21.

19,186. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new sulphurised dyestuffs. Sept. 22.

19,199. Badische Anilin und Soda Fabrik. Manufacture of anthracene derivatives. [Ger. Appl., Jan. 3, 1905.]\* Sept. 22.

19,200. Badische Anilin und Soda Fabrik. Manufacture of anthraquinone derivatives. [Ger. Appl., April 3, 1905.]\* Sept. 22.

19,353. Bloxam (Becker). Manufacture of indigo from phenylglycine or its derivatives.\* Sept. 25.

[C.S.] 27,373 (1904). Newton (Bayer und Co.). Manufacture of oxyanthraquinones and of an intermediate product. Sept. 27.

27,374 (1904). Newton (Bayer und Co.). Production of oxyanthraquinones and derivatives thereof. Sept. 27.

27,843 (1904). Newton (Bayer und Co.). Manufacture of new azo dyestuffs and intermediate products. Oct. 4.

28,150 (1904). Newton (Bayer und Co.). *See under XIII.*

## V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 19,205. Sunderland, and The Bradford Dyers' Association, Ltd. Method for dyeing khaki on vegetable fibres. Sept. 22.

19,328. Longley. Calico, paper, and like printing. Sept. 25.

[C.S.] 23,651 (1904). Wray and Wray. Apparatus for spraying and conditioning yarn. Oct. 4.

6356 (1905). Linkmeyer. Devices for the manufacture of artificial silk threads. Oct. 4.

## VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

- [A.] 19,250. Longley. The dyeing of wood and similar pulp. Sept. 23.  
 „ 19,328. Longley. *See under V.*

## VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 18,929. Major. Manufacture of chlorine compounds for bleaching and other purposes. Sept. 19.  
 „ 19,078. Edwards. Table salt. Sept. 21.  
 „ 19,189. Bailey. Manufacture of nitrate of soda and recovery of by-products. Sept. 22.  
 „ 19,269. Ruddle. Obtaining ammonia. Sept. 23.  
 „ 19,700. Fairweather (Beaver and Nordenflyt). Dissolver or boiling tank for nitrate plant. Sept. 29.  
 [C.S.] 17,985 (1904). Lake (Soc. Romana Solfati). Treatment of leucite and similar aluminous silicates for the production of aluminium hydrate and potash salts. Sept. 27.  
 „ 28,297 (1904). Oudin. Apparatus for producing ozone. Sept. 27.  
 „ 2346 (1905). Tsuji. Apparatus for slaking lime, &c., to produce efflorescence therein. Oct. 4.  
 „ 8662 (1905). Gebr. Heyl und Co., and Wultze. Process for producing lead acetate. Sept. 27.

## VIII.—GLASS, POTTERY, AND ENAMELS.

- [C.S.] 21,018 (1904). Bottomley and Paget. Attachment of metals to objects of fused silica and analogous material. Oct. 4.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 18,806. Schumacher. Manufacture of artificial stone from slag. Sept. 18.  
 „ 19,108. Mathis. Coatings for floors, roads, &c. Sept. 21.  
 „ 19,180. Peters. Manufacture of Portland cement. Sept. 22.  
 „ 19,686. Freakley and Bill. Manufacture of materials for the construction of dustless roads and like surfaces.\* Sept. 29.  
 [C.S.] 22,990 (1904). Lake (Rütgerswerke A.-G.). Preservation of wood. Sept. 27.  
 „ 23,364 (1904). Van der Vijgh. Manufacture of artificial stone. Sept. 27.  
 „ 14,239 (1905). Harcastle, and Kay Bros., Ltd. Compound which emulsifies with water to be applied to roads. Sept. 27.

## X.—METALLURGY.

- [A.] 18,828. Maunder. Smelting and treatment of complex refractory and other ores. Sept. 18.  
 „ 18,925. Fries. Process of soldering aluminium and alloys rich in aluminium. [Swiss Appl., Oct. 5, 1904.]\* Sept. 19.

- [A.] 19,182. Atkinson. Preliminary treatment of refractory ores. Sept. 22.  
 „ 19,198. Jacobsen. Manufacture of metallic alloys. Sept. 22.  
 „ 19,282. Claessen. Process for improving aluminium alloys by heating and chilling.\* Sept. 23.  
 „ 19,338. Faraday. Metallic alloys. Sept. 25.  
 „ 19,373. Schwier. Process for manufacturing ingot iron and ingot steel in a basic furnace. Sept. 2.  
 „ 19,525. Lean (Maschinenbau Anstalt Humboldt). Apparatus for separating ores.\* Sept. 27.  
 „ 19,638. Borchers, Günther and Frankf. *See under XI.*  
 „ 19,655. Dor-Delattre. Zinc furnaces.\* Sept. 2.  
 „ 19,709. Sulman. Ore concentration. Sept. 29.  
 „ 19,781. Simpson. Method of refining metals and apparatus therefor.\* Sept. 30.  
 „ 19,824. Stanley. Methods and means of treating pulp or sands of ores after being crushed. Sept. 30.  
 [C.S.] 20,543 (1904). Armstrong. Furnaces for obtaining zinc. Sept. 27.  
 „ 21,077 (1904). Ker and Ker. Engraving metal surfaces. Sept. 27.  
 „ 24,386 (1904). Stanley. Apparatus for crushing, washing and separating ores. Oct. 4.  
 „ 3185 (1905). Baggaley and Allen. Production of copper or copper matte. Sept. 27.  
 „ 6931 (1905). Newton (Falding). Roasting furnaces. Oct. 4.  
 „ 8387 (1905). Allen. Conversion of copper matte. Sept. 27.  
 „ 9199 (1905). Thiel. Manufacture of iron. Oct. 4.  
 „ 13,351 (1905). Langer. Treating with carbon oxide nickel ores or other material containing nickel, and apparatus therefor. Oct. 4.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- [A.] 18,931. Ruzicka. Primary batteries. Sept. 19.  
 „ 19,035. British Thomson-Houston Co., Ltd. (G. Electric Co.). Insulating material. Sept. 20.  
 „ 19,111. Hess. Manufacture of a substance suitable for electrical insulation. Sept. 21.  
 „ 19,234. Cowper-Coles. Manufacture of electrolytic types. Sept. 23.  
 „ 19,257. Bagnall. Plating or similar vats. Sept. 23.  
 „ 19,616. Schauli. Electric batteries. Sept. 28.  
 „ 19,631. Christensen. Primary batteries. Sept. 28.  
 „ 19,638. Borchers, Günther and Frankf. Electrolytic production of copper. [Ger. Appl., Oct. 1904.]\* Sept. 28.  
 [C.S.] 2001 (1905). Wood and Oaksford. Apparatus for agitating solutions used in electrodeposition of metals. Sept. 27.  
 „ 11,861 (1905). Hubbell. Secondary battery plant. Oct. 4.



## II.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

### (A.)—PIGMENTS, PAINTS.

- A.] 19,100. Newton (Bayer und Co.). Manufacture of colouring matter lakes. Sept. 21.  
 „ 19,190. Fireman. Manufacture of printing ink pigments. [U.S. Appl., Jan. 19, 1905.]\* Sept. 22.  
 S.] 28,150 (1904). Newton (Bayer und Co.). Manufacture of new colour lakes. Oct. 4.

### (B.)—RESINS, VARNISHES.

- S.] 21,887 (1904). Catesby. Linoleum, carpets, &c. Oct. 4.  
 „ 22,114 (1904). Melville, Rees and Rees. Substitute for oilcloth and linoleum. Sept. 27.  
 „ 13,180 (1905). Thiemann. Process for utilising waste amber. Sept. 27.  
 „ 6601 (1905). Haddan (Lactoleum Werke G. m. b. H.). Covering for floors, walls, and other surfaces. Oct. 4.

## IV.—TANNING, LEATHER. GLUE, SIZE, ETC.

- A.] 19,029.\*Kelk (Kelk). Tanning. Sept. 20.  
 „ 19,443. Magnus and Davis. Process of preparing leather.\* Sept. 26.  
 S.] 23,099 (1904). Southworth. Method of and apparatus for moulding raw hide. Oct. 4.  
 „ 25,077 (1904). Hatmaker. Drying blood and fluid extracts and preparations of animal tissue. Oct. 4.

## XV.—MANURES, Etc.

- A.] 18,990. Gooding. *See under XVIII.A.*

## XVI.—SUGAR, STARCH, GUM, Etc.

- S.] 8898 (1905). Stein and Loewenthal. Manufacture of levulose. Oct. 4.

## XVII.—BREWING, WINES, SPIRITS, Etc.

- A.] 28,547A (1904). Lichtenstein. Preparation of caramel and its application as a colouring matter in the production of beer and other beverages. Sept. 28.  
 „ 18,835. House. Maltsters, germinators, and kilns. Sept. 18.  
 „ 18,836. House. Fermenting gas. Sept. 18.  
 S.] 25,774 (1904). Gates. Brewing. Oct. 4.  
 „ 8576. (1905). Baeger and Güttner. Method of and apparatus for separating wort from mash by centrifugal action. Sept. 27.

## XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

### (A.)—FOODS.

- [A.] 18,990. Gooding. Treatment of kiln dirt and refuse screenings from grain refuse, and production of a cattle food and a manurial product.\* Sept. 20.  
 „ 19,521. Holgate and Jessop. Process of treating milk to produce artificial human milk. Sept. 27.  
 [C.S.] 20,480A (1904). Williamson. Malt extracts and preparations, aerated and other beverages and alimentary substances.  
 „ 22,639 (1904). Hatmaker. Cacao, sugar and milk compound in dry flaky form. Sept. 27.  
 „ 26,654 (1904). Mitchell. Production of proteid. Oct. 4.

### (B.)—SANITATION; WATER PURIFICATION.

- [A.] 19,214. Wixford. Purifying water. [U.S. Appl., Sept. 23, 1904.]\* Sept. 22.  
 „ 19,215. Wixford. Process of preparing and feeding reagents. [U.S. Appl., Sept. 23, 1904.]\* Sept. 22.  
 „ 19,502. Butterfield and Watson. Method of sterilising sewage sludge and utilising its constituents. Sept. 27.  
 „ 19,526. Dobson. Method of and means for treating sewage and effluent liquids arising therefrom. Sept. 27.  
 [C.S.] 25,591 (1904). Neilson. Treatment of sewage. Oct. 4.

### (C.)—DISINFECTANTS.

- [A.] 18,839. Power. Solid deodorizers or disinfectants. Sept. 18.

## XIX.—PAPER, PASTEBOARD, Etc.

- [A.] 19,330. Miles. Cellulose derivative and process of making same.\* Sept. 25.  
 „ 19,808. Evans. Treatment of paper pulp. Sept. 30.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 18,992. Schimmel und Co. Process for manufacturing protocatechuic aldehyde. [Ger. Appl., Oct. 17, 1904.]\* Sept. 20.  
 „ 19,152. Rivers. Carbon compound. Sept. 22.  
 „ 19,352. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of diamides of dialkylmalonic acids.\* Sept. 25.  
 „ 19,375. Ellis (Chem. Fabr. von Heyden). Manufacture of a new salicylic acid compound.\* Sept. 25.  
 [C.S.] 4565 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of a new derivative of *p*-phenetidine. Sept. 27.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[C.S.] 1290 (1905). Gillard and Molyneux. Coating or preparation of media for photographic purposes. Oct. 4.

## XXII.—EXPLOSIVES, MATCHES, Etc.

- [A.] 19,112. Smith. Explosives and process of manufacturing same.\* Sept. 21.  
.. 19,780. Holliday and Sons, Ltd., and Turner. Mixtures for use as explosives. Sept. 30.

[C.S.] 28,256 (1904). Ceipek. Manufacture of safety explosives. Sept. 27.

.. 159 (1905). Thorn. Matches. Oct. 4.

.. 9335 (1905). Bruhlmann. Matches, firelighters, and the like. Sept. 27.

## XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[C.S.] 3089 (1905). Schlatter and Deutsch. Apparatus for indicating the amount of carbonic acid contained in combustion gases. Oct. 4.



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## I.—PLANT, APPARATUS, AND MACHINERY.

*Vacua; Dewar's Method of Producing High* —. Lord Blythswood and H. S. Allen. Phil. Mag., 1905, 10, 497—512.

Dewar's method for producing high vacua, depending on the absorption of gases by charcoal at low temperatures (see this J., 1905, 793), can be applied to the exhaustion of large receivers, it being only necessary to increase the size (or number) of the charcoal receptacles. Only moderate amounts of liquid air are necessary for the method. The volume of air absorbed by charcoal (at the temperature of liquid air) is, "to a first approximation," independent of the quantity originally present in the apparatus. The rate of absorption was found to be practically independent of the pressure, and to stand in a constant ratio to the amount of air which the charcoal is still capable of absorbing.—T. F. B.

## ENGLISH PATENTS.

*Volatile Liquids; Apparatus for Separating and Condensing the Vapours of* —. H. Heymann, Bradford; and H. Hoy, J. Smith, H. L. Mitchell, and W. H. Askham, Dowsbury. Eng. Pat. 17,435. Aug. 10, 1904.

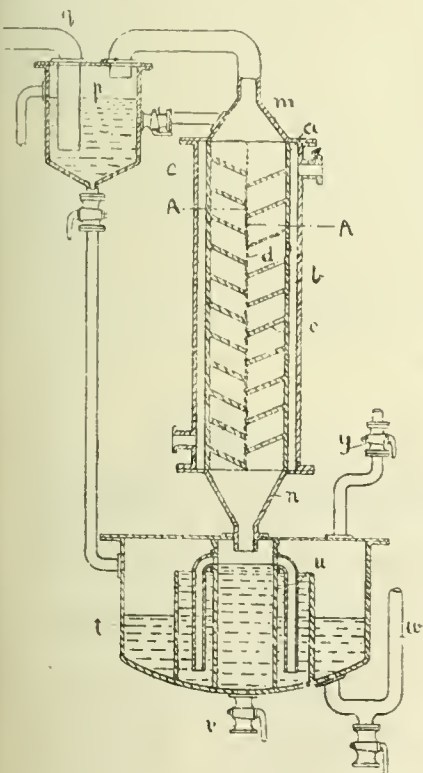


FIG. 1.

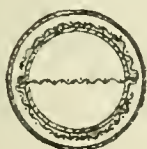


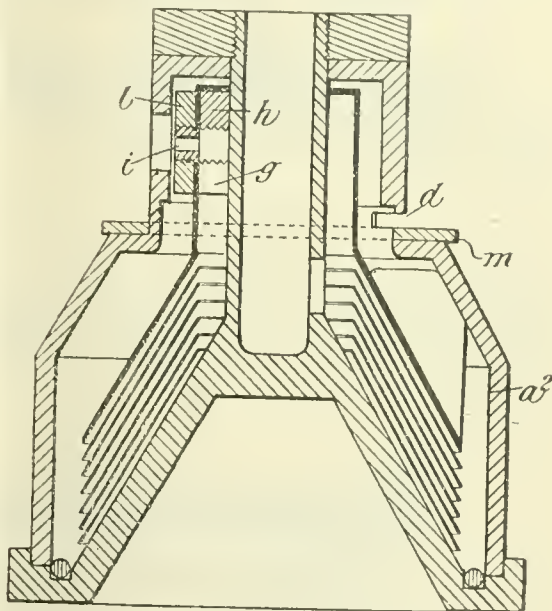
FIG. 2.

IMPROVEMENTS are claimed for condensers and separators or use in connection with the vapours of volatile liquids or solvents used in the cleaning of woollen cloth and other goods in india-rubber waterproofing, &c. One form of the condensing and separating apparatus consists of a cylinder *a* (see fig.), terminating in two funnels *m* and *n*,

and containing baffle-plates *c* and a vertical sheet of wire gauze *d*, the latter of which projects into a cooling jacket *b* surrounding the cylinder. The vapour to be condensed is forced through a pipe *g* into a vessel *p* filled with oil. The unabsorbed vapour passes thence, with or without oil from the vessel *p*, through the cylinder *a*, downwards to a casing *t* at the bottom of the cylinder. Here the mixture of oil and condensed vapour or the condensed vapour alone, being lighter, collects as an upper layer, floating on the top of the simultaneously condensed water. The former flows over the partitions *u* into the outer part of the casing, whence it is withdrawn through the pipe *w*, whilst the latter is removed through a tap *v*. Air and uncondensed vapours escape through a pipe *y*.

Another form of the condenser consists of a cylinder in which a system of vertical tubes is arranged in layers between horizontally placed baffle-plates and sheets of wire gauze. The outer cooling-jacket is, in this modification, dispensed with, the cooling water circulating directly outside the pipes.—E. B.

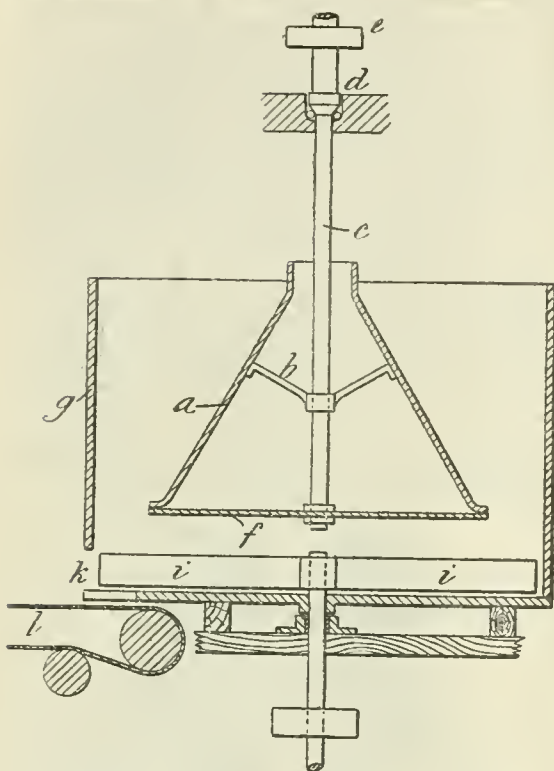
*Separators; Impts. in Centrifugal* —. Aktiebolaget Separator, Stockholm. Eng. Pat. 20,276, Sept. 20, 1904. Under Int. Conv., Oct. 3, 1903.



The claim relates to improvements in centrifugal separators described in Eng. Pat. 14,128 of 1902. The heavier liquid, instead of being discharged through a hollow screw in the neck of the drum, is discharged through a slot or slots *d*, formed in the neck of the drum and the discharged liquid is thrown clear of the drum casing *a2* by the flange or collar *m*. The lighter liquid is discharged through the hollow screw *h*, *l*, *i*, placed in the upper portion of the neck of the drum and provided with the inlet *g*. —W. H. C.

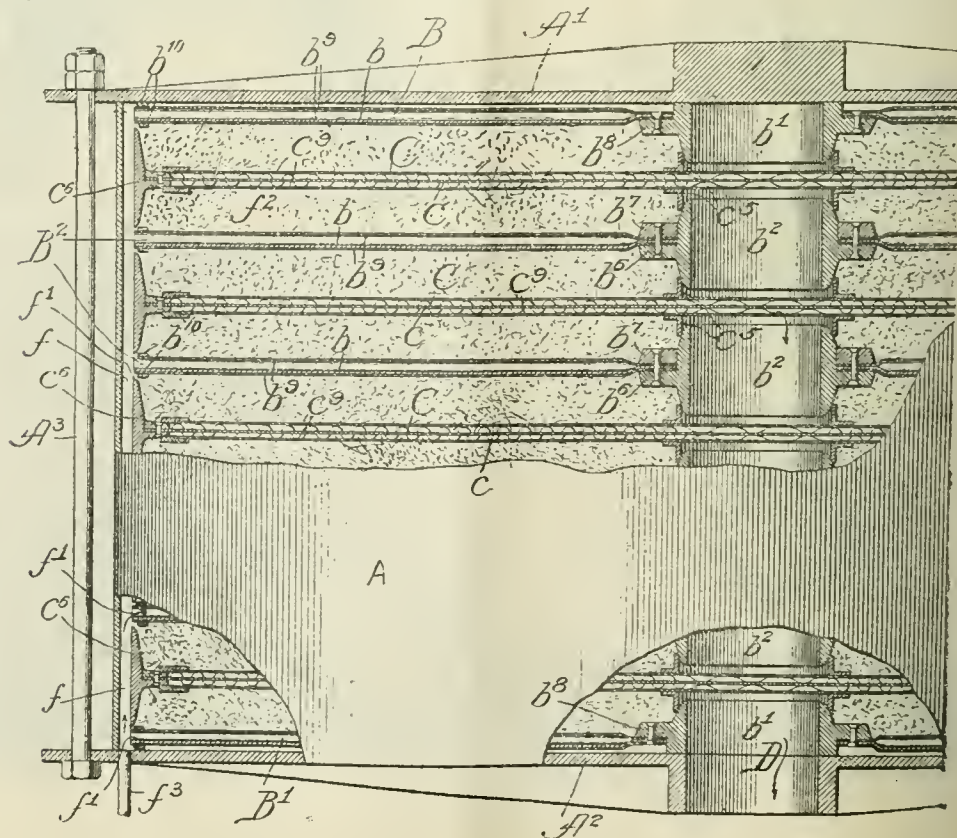
*Separators; Impts. in Centrifugal* —. M. K. Bamber, Colombo, Ceylon. Eng. Pat. 23,070, Oct. 26, 1904.

THE separator consists of a conical drum *a*, carried by the spider *b* on the shaft *c*, which is rotated in the bearing *d*, by the pulley *e*. The bottom of the drum is formed by a plate of "spring steel" *f*, secured to the shaft *c*, and abutting against, but not fastened to the bottom flange of the drum *a*. The material to be separated is fed into the drum and the solid matter collects in the angle at the bottom; when the weight of the accumulated solids is sufficient to overcome the elasticity of the "spring steel" bottom, the edge of the latter is deflected downwards and allows some of the solid matter to pass out. The extruded solids collect in the outer casing *g*, from which they are expelled on to the conveyor *l*, by the scrapers *i*, *i*, through



the opening *k*. (See also Eng. Pat. 27,473 of 1902; this J. 1903, 1188).—W. H. C.

*Water or other Liquid; Extraction of — from Mineral, Vegetable and Animal Substances.* Meister, Lucius und Brüning. Eng. Pat. 24,670, Nov. 14, 1904. *XIA.*, page 1072



*Secret Manufacturing Processes of Chemical Treatment; Means for and Methods of Carrying out —.* G. Wilkinson, Harrogate. Eng. Pat. 1769. Jan. 30, 1905.

THE reservoir containing any liquid of secret composition, the nature of which it is desirable to hide from the men engaged in any process in which it is to be added to another body, is enclosed in a locked casing along with a measuring and diluting apparatus. The manipulation is effected from without the casing and the "secret" liquid is delivered by a siphon passing through the wall into a mixing tank placed without. The apparatus may be so arranged that the liquid is not delivered by the siphon into the mixer until the agitator in the latter has begun to work. In this way no sample of the secret liquid can be got until it is mixed with the liquid previously placed in the mixer. This may be effected by causing the agitator to revolve before the vacuum pump, which starts the siphon, has begun to work.—W. H. C.

*Furnaces; Impts. in —.* T. Suzuki, Tokio. Eng. Pat. 3015, Feb. 14, 1905.

THE invention relates to furnaces having a distilling chamber located within the primary combustion chamber air-heating flues in the walls of the furnace, a trunk in which the products of distillation and primary combustion are mixed with heated air and from which they are delivered into a secondary combustion chamber, placed below the boiler or other apparatus for the utilisation of the heat. The claim is for providing the secondary combustion chamber with a jacket, so that a second supply of heated air is added to the mixture at its entry into the secondary combustion chamber.—W. H. C.

*Furnaces and the like; Manufacture of Refractory —.* J. Bach, Riga, Russia. Eng. Pat. 7599, April 10, 1905.

FURNACES constructed of ordinary hard burnt bricks are rendered highly refractory by lining them with an unburnt material, in the moist state, which is composed of 10–80 per cent. of pure aluminium hydroxide, mixed with pulverised quartz, fire-clay, or washed and purified chromium ore. The furnaces are slowly heated until the material is dried and completely burnt.—R. L.

*Filters; Impts. in —.* A. J. Boulton, London. From E



Goldman and Co., Chicago, Ill. Eng. Pat. 8984, April 28, 1905.

THE filter consists of a cylindrical casing A closed by the top and bottom plates  $A^1$  and  $A^2$  secured by bolts  $A^3$ . The outlet of the filter is made up of the tube sections  $b^1$ ,  $b^2$  and  $c^5$ , arranged as shown in the figure. The sections  $b^1$  and  $b^2$  carry distributing plates B,  $B^1$ , and  $B^2$ , composed of radially corrugated discs  $b$  covered with filter-cloth  $b^9$  secured to the discs by the rings  $b^{10}$  and fastened to the flange rings or sections  $b^1$  and  $b^2$  by the flanges and collars  $b^6$ ,  $b^7$  and  $b^8$ . The sections  $c^5$  carry the collecting plates C placed alternately with the distributing plates and formed of radially and concentrically corrugated discs  $c$ , covered with filter-cloth discs  $c^9$  on both sides, and provided with flanged outer edges  $c^6$ . The space  $f^2$  between the discs contains the filtering medium, and the liquid to be filtered enters through the pipe  $f^3$ , passes into the annular space  $f$  and thence through the openings  $f^1$  into the distributing plates and through the filtering medium into the collecting plates C. It then flows through the corrugations into the central discharge channel D.—W. H. C.

Filter; An Improved —. H. Lieberich, Neustadt, Germany. Eng. Pat. 13,247, June 27, 1905.

THE claim is for a filter in which the delivery pipes pass through rings on the frames of the filter-plates, the delivery pipes having slots which register with openings in the plates, through which the filtered liquid flows into the slots and pipes. Should only a few plates be needed, the slots in the parts of the delivery pipes projecting beyond the last plate are closed by means of long caps which fit over the pipes and are held in position by screws passing through the closed ends of the delivery pipes. The screws and caps also serve to keep the plates pressed together and the joints are made with strips of rubber or the like, provided with rings to admit the passage of the delivery pipes.—W. H. C.

ases, Dust-laden Air, and the like; Method of and [Centrifugal] Apparatus for Purifying Blast Furnace —, and for dissolving Gases and other matter in Liquids. E. Barthelmess, Neuss am Rhein, Germany. Eng. Pat. 12,533, June 16, 1905.

VERTICAL rotary disc is mounted within an upright casing, which it divides into two compartments, communicating with each other all round the periphery of the disc. The disc is provided on both sides with concentric series of horizontal pins or rods which, as the disc rotates, pass between similar pins or rods, extending inwards from the sides of the casing, the whole presenting the appearance of a disintegrator cage. The gas to be washed, and the wash-water, are introduced at one side of the disc, near its centre; they are thrown violently to the periphery by the centrifugal action; the water and impurities flow out through a drain at the bottom of the casing; whilst the gas passes through the peripheral space round the disc into the next compartment, then upwards towards the axis, and out through a central opening in the casing.—H. B.

#### UNITED STATES PATENTS.

Extractor. W. H. Teas, Ridgway, Pa., U.S.A. U.S. Pat. 799,111, Sept. 12, 1905.

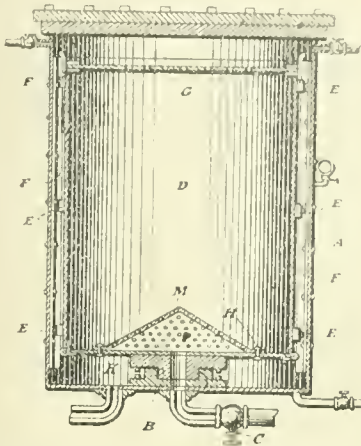
THE apparatus claimed, comprises a boiler, an extracting chamber, an internal vessel with perforated bottom for holding the material, a dome provided with a condenser, and an automatic siphon for returning the extract from below the perforated bottom to the boiler, and a second siphon, having its bend at a somewhat lower level than that of the automatic one, and with its longer leg, which can be closed by a stopcock, opening outside the extractor.—M. J. S.

Filter-press. C. C. Thompson, East Liverpool, Ohio. U.S. Pat. 799,417, Sept. 12, 1905.

THE plates or sections forming the filter are recessed on both sides, and the filter-cloth is hung over the upper edge and covers the recessed portion of the plate. The

upper edge of the plate is cut away to form an opening through which the material to be filtered is fed into the spaces between adjacent plates. An expansible top piece is bolted on to the upper edge of each plate to clamp the cloth in position, and to form a cover to the space through which the material is fed.—W. H. C.

Retort. G. Ketchum, Cutler, Ga. U.S. Pat. 799,470, Sept. 12, 1905.



THE retort consists of an outer casing A fitted with the "socket" B connected to a steam pipe C. An inner casing D fits into the outer casing A, and is kept in position by the blocks E, which fit on the guide-rails F. The inner casing has a perforated cover G and a hinged bottom H, which has a "nipple" K fitting into the socket B, and a perforated steam-distributing cone M arranged over the steam inlet.—W. H. C.

#### FRENCH PATENTS.

Emulsifying, Subdividing and Rendering Homogeneous, Liquids and Semi-liquids, and for Crushing Fatty or Albuminous Particles; Apparatus for —. C. Petitpierre. Fr. Pat. 353,753, April 28, 1905.

THE apparatus claimed consists of a hollow cylinder capable of resisting high pressure and provided with two branch pipes, one at the bottom and one at the side, for the introduction and removal of material. At the top is a chamber in which slides a piston rod, the end of which is hollowed out. At the bottom of the cylinder is fixed a central rod, the button-shaped head of which can pass into the hollow of the piston; and this rod supports several perforated discs, each with radiating grooved channels on their surface. The liquid material introduced into the chamber surrounding the discs, is driven by the pressure through the channels, and thus becomes intimately mixed and sub-divided, as it passes into the central channel formed by the central openings in the discs.—C. A. M.

Separating Solids from Liquids; Centrifugal Apparatus for —. Aktiebolaget Separator. Fr. Pats. 354,414 and 354,415, May 18, 1905. Under Int. Conv., May 27, 1904.

SEE Eng. Pats. 10,862 and 10,873 of 1905; this J., 1905, 958.—T. F. B.

#### II.—FUEL, GAS, AND LIGHT.

Coals; Contribution to our Knowledge of —. E. Donath. Chem.-Zeit., 1905, 29, 1027–1028.

THE author describes the action of nitric acid (1:10) on coals, and shows that a distinction can be drawn between lignites (brown coals) and pit-coals. On gentle heating

with nitric acid, lignite is attacked with formation of a large number of products, some of which produce a red coloration. Pit-coals are not attacked. As a red coloration is not given by heating cellulose with nitric acid, but is obtained from several varieties of wood and wood charcoal, lignite is supposed to have its origin in substances which contain lignin. (See also Friswell, this J., 1905, 482 and 526; also Proc. Chem. Soc., 1892, 9.)

—C. E. F.

*Nernst Lamp; Inter-relation of Ballast and Glow in the —.* L. A. Terven. Elect. World and Eng., 1905, 46, 305—308; Electrician, 1905, 55, 906—908.

To compensate for the large increase in current and the consequent destruction of the Nernst filament by increase of voltage of the line above the normal, a ballast or bolstering resistance is employed, placed in series with the glow. This ballast consists of a fine iron wire sealed into a glass tube containing hydrogen. Iron wire is employed since this metal has a large positive temperature coefficient of resistance, and it is so proportioned that its normal temperature is of that value at which this coefficient is a maximum. The author shows by curves the sensitiveness of the ballast, and the impossibility of replacing it by an ordinary resistance in series with the filament.—R. S. H.

*Tantalum Lamp; Tests of the —.* W. Ambler. Electrician, 1905, 55, 941—942.

THE following measurements indicate the efficiency of the 110 volt tantalum lamps, as compared with the ordinary incandescent carbon filament.

	Watts per mean horizontal candle power.	Watts per mean spherical candle power.
Clear bulb, tantalum...	1.75	2.23
Frosted bulb, tantalum.	2.0	2.67
Carbon .....	3.1	3.72

Curves are given showing the distribution of the light from the three lamps. From these, it is evident that although the tantalum lamps give much more light in a horizontal direction, the amount from the tip of the lamp is much less than from the carbon filament lamp, despite the fact that this was one with a single-curl filament. The change of candle power, with change of voltage, is much less marked in the case of tantalum than with the ordinary filament of carbon. It requires practically twice the percentage change of voltage across the tantalum lamp of that across the carbon lamp, to cause the same change of light. In conclusion, the author enters into calculations, which show that at the present high price of the new lamp, its adoption only results in marked economy when the cost of electric current for lighting is fairly high.—R. S. H.

*Coal; Determination of Sulphur in —.* O. Brunck. XXIII., page 1086.

*Petroleum and Liquid Fuels; Determination of Sulphur in —.* A. Goetzl. XXIII., page 1086.

#### ENGLISH PATENTS.

*Incandescent "Fuel" for Gas and Oil-Gas Fires.* T. D. Kelly and W. J. Billington, Southend. Eng. Pat. 1671, Jan. 27, 1905.

"METALLIC or basic oxides or carbonates and a silicate and an alkali or alkaline earth" (for example, bog ore in its natural state, mixed with barium carbonate), are powdered together, mixed with water, moulded into desired forms, and baked in an atmosphere of carbon dioxide, for the production of gas-fire "fuel."—H. B.

*Smoke; Means for Treating Coal — for Effecting its Combustion.* W. Thomas, London. Eng. Pat. 7499, April 8, 1905.

To effect the combustion of the particles of carbon in smoke, the latter is passed, together with steam, into a diffusion chamber of considerably larger area than that

of the chimney, and of considerable height in relation to its diameter. The chamber is provided with two diaphragms, the lower one being perforated with large, and the upper one with smaller holes. The space between the perforated plates is closely packed with asbestos. The asbestos packing is heated to incandescence by a gas-rising burner, located below the lower diaphragm.—R. L.

*Gas; Process and Apparatus for the Manufacture of, Illuminating —.* P. Busse, Crosta, Saxony. Eng. Pat. 26,246, Dec. 2, 1904.

SEE Fr. Pat. 348,411 of 1904; this J., 1905, 540.—T. F. B.

*Gas Producers.* J. S. Daniels and T. H. and J. Daniels Ltd., Stroud. Eng. Pat. 1307, Jan. 23, 1905.

To overcome the difficulty experienced in quickly obtaining the supply of steam required for the proper production of gas, on starting a suction producer, a chamber, adapted to provide a large evaporating surface for generating steam from water fed upon it, is arranged below the enclosed ashpit, and through this chamber the gases from the producer are led on their way to the scrubber. The top of the chamber consists preferably of flat sheet- or plate-iron, forming the floor of the ashpit. Water is fed into the ashpit, on to this plate, and the steam generated is taken up by the air supply, which is drawn through the ashpit into the producer.—H. B.

*Gas Producing Apparatus and Method of Working Same.* L. G. Vedy and J. Bilbie, London. Eng. Pat. 3174 Feb. 15, 1905.

To the gas outlet of the generator is attached a vertical water-vaporiser, constructed of four concentric tubes. The annular spaces between the central tube and the second tube, and between the third and outermost tubes are adapted to be filled with water, whilst the hot gas flow first downwards between the second and third tubes and then up through the central tube to the scrubber. The steam dome surmounts the tubes, and the steam collect within it is led into the generator beneath the fire-bar. On starting the generator, water is admitted slowly to the innermost annular space, which then constitutes a starting vaporiser of small water-capacity and large heating surface; and afterwards, larger quantities of water are passed through it, so that it serves to cool the gases, and water is also led through the outermost annular space, which then serves as the main vaporiser.—H. B.

*Gas Producers; Impts. in.* [Three-way Cock.] W. H. Moore and F. H. Livens, Lincoln. Eng. Pat. 12,059, June 9, 1905.

THE pipe connecting the producer with the scrubber and with the blow-off pipe is provided with a three-way cock having a cylindrical or tapered plug, to either end of which the handle may be attached, so that the cock may be worked from either side.—H. B.

*Gas; Apparatus for Washing and Scrubbing —* Kirkham, Hulett and Chandler, Ltd., and S. Hersey Westminster. Eng. Pat. 24,467, Nov. 11, 1904.

IN gas-washing apparatus of the type in which discs rotating in tanks containing the washing liquor, are built up of segments of material affording a large wetted surface, the patentees construct each segment of several sheets of corrugated metal or wire gauze, laid one against the other, with the corrugations of the sheets alternately at right angles, or at some other angle, to prevent the sheets from fitting closely together; or the sheet may be laid upon flat boards or plates for separating the corrugated portions. The free passage of gas and water into and from the interior of the segment is thus allowed.—H. B.

*Gas; Impts. in the Testing of —* [Argand Burner.] C. C. Carpenter. Eng. Pat. 13,553, July 1, 1905. XXIII., page 1085.

*Sulphur [from Spent Oxide, &c.]; Extraction and Purification of —.* A. V. Cornillaux, Eng. Pat. 7616, Apr. 10, 1905. VII., page 1066.



*Filament for Gas and Electric Lamps for Lighting and Heating Purposes; Manufacture of an Indestructible* — G. Michaud, Paris, and E. Delasson, Montreuil sous Bois. Eng. Pat. 27,707, Dec. 19, 1904.

SEE Fr. Pat. 346,307 of 1904 and Addition thereto; this J., 1905, 125 and 612.—T. F. B.

*Electrodes for Arc Lamps.* H. H. Lake, London. From Cie. Gén. d'Electricité, Paris. Eng. Pat. 1507, Jan. 25, 1905.

SEE Fr. Pat. 349,928 of 1904; this J., 1905, 884.—T. F. B.

#### UNITED STATES PATENTS.

*Boilers; Process for Heating and Firing* — by means of Oil. E. Körting, Hanover, Germany. U.S. Pat. 800,219, Sept. 26, 1905.

SEE Eng. Pat. 24,928 of 1901; this J., 1902, 331.—T. F. B.

*Gas; Process of Producing* — B. E. Eldred, New York. Assignor to Eldred Process Co., New York. U.S. Pat. 799,317, Sept. 12, 1905.

INTO one extremity of the mass of fuel in the producer there is introduced a hot blast of air containing sufficient carbon dioxide (products of combustion) to keep the temperature of the fuel below the slagging point; and above the place of introduction of the first blast, a current of air is blown in, sufficient to raise the temperature so as to distil the volatile matters from the fuel and to maintain a substantial uniformity of temperature throughout the mass.—H. B.

*Gases; Apparatus for Purifying* — H. Boyd, Thornton, England. U.S. Pat., 799,589, Sept. 12, 1905.

SEE Eng. Pat. 1182 of 1903; this J., 1903, 1342.—T. F. B.

#### FRENCH PATENTS.

*Briquettes from Coal Dust or Fine Coal; Process of Making* — T. Rouse and H. Cohn. Fr. Pat. 353,829, May 1, 1905.

SEE Eng. Pat. 9071 of 1904; this J., 1905, 611.—T. F. B.

*Briquettes or Blocks of Compressed Coke; Process and Apparatus for Making Non-porous* — The Gas and Fuel Manufacturing Co. of America. Fr. Pat. 353,879, May 2, 1905.

SEE U.S. Pat. 788,558 of 1905; this J., 1905, 611.—T. F. B.

*Gases; Method for Regulating and Controlling Furnace* — and for Firing Furnaces. J. W. Dougherty. Fr. Pat. 354,128, May 9, 1905.

SEE U.S. Pat. 789,844 of 1905; this J., 1905, 667.—T. F. B.

*Gas Producer.* A. Fichet and R. Heurtey. Fr. Pat. 350,047, July 8, 1904.

THE apparatus consists of two superimposed producers; the fuel is burned partially in the upper one, and falls into the lower one, where the combustion is completed. An annular space, for withdrawal of the gas produced in both generators, is left round the opening by which they communicate, and an annular boiler, for generating the necessary steam, is provided at the same place. Air, or air and steam, are admitted to the upper producer through water-cooled pipes, which extend more or less, as desired, into the mass of fuel. The lower producer, if the ash of the fuel is but slightly fusible, is of the ordinary type; but if the ash is very fusible and apt to clinker, the base of the producer is formed like a eupola, with crucible, tuyères, and tap-hole, a fluxing material being added, to enable the ash to be removed in the form of slag.—H. B.

*Coal; Process of Distilling* — for the Production of Coal Gas and Coke. Cie. pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. Fr. Pat. 350,063, July 15, 1904.

THE distillation of the coal is effected in a generator, by passing through the fresh fuel a current of coal-gas, which has been heated by leading it through a body of red-hot

coke. The apparatus may consist of two generators, side by side, the first containing fresh coal, and the second red-hot coke from a previous operation. Coal-gas is passed downwards through the coke in the second generator and then upwards through the coal in the first; when the distillation is completed, the second generator is emptied, and charged with fresh fuel, the first generator now acting as heater for the gas. When the heating column has been cooled somewhat by the stream of gas, it is raised to incandescence by admitting temporarily a blast of air, the products of combustion being led off by a special conduit. Instead of two or more generators, a single generator, resting in a water seal, may be employed, fresh coal being fed in at the top, and coke withdrawn at the bottom. Inlets for coal-gas are provided near the bottom, and outlets at the top; whilst, for heating the coke, when it has cooled to the permitted degree, inlet pipes for air and outlet pipes for the products of combustion are arranged at suitable intermediate points.—H. B.

*Gas and Air [Carburetted Air] rich in Combustible matter; Process and Apparatus for the Production of a Mixture of* — M. Caracristi. Fr. Pat. 353,674, April 25, 1905.

THE apparatus consists of three superimposed chambers. The top chamber is a reservoir for the volatile hydrocarbon to be used. The second one, constituting the carburettor proper, contains a series of horizontal plates, on to which the hydrocarbon flows from above, pursuing a zig-zag course downwards over the plates, whilst the air supply, which enters beneath the lowest plate, passes upwards in the contrary direction. The lowest chamber encloses a rotating pump, of the meter drum type, driven by clock-work or the like, and serving to draw air through the carburettor and discharge the carburetted air.—H. B.

*Suction Gas Generator Plant.* C. Whitfield. Fr. Pat. 353,712, April 26, 1905. Under Int. Conv., April 27, 1904.

SEE Eng. Pat. 9608 of 1904; this J., 1905, 793.—T. F. B.

*Gas Producer.* T. Stapf. Fr. Pat. 353,802, April 29, 1905.

TO prevent the adhesion of clinker to the walls of the producer surrounding the hottest zone of the fuel, the masonry at this part is replaced by an annular metallic section, serving as a cooler, which is bolted on to the metal shell of the producer, or otherwise affixed to an easily accessible part, to facilitate renewals. The cooler may be provided with closed, or partly closed, channels for the circulation of water, steam, or air; or, if the fuel is of a wet nature, such as peat, the channels may be dispensed with and the annular body may be provided with a fluted surface, the loss of heat by radiation being then sufficient.—H. B.

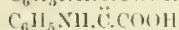
*Gas Furnace having Multiple Vertical Retorts for the Simultaneous Production and Admixture of Coal Gas and Water Gas.* A. Rummens. Fr. Pat. 353,865, May 2, 1905.

SEVERAL vertical retorts are grouped together in one setting and are heated by means of one or more generators, operating by natural draught. Each retort has double walls, the exterior wall having parallel sides, whilst the interior wall, which is provided with vertical slots to let the gas pass off without ascending through the hot coke, is of conical form, to facilitate the discharge of the coke. Under each retort is a closed chamber, into which the coke is discharged and which encloses a vaporiser, heated by the coke and designed to generate sufficient steam for the production of a limited proportion of water-gas. The vaporiser consists of three vertical, concentric tubes, surrounding a rod, which may be used as a poker; water is admitted into the annular spaces between the tubes, and the steam produced is led up into the retorts.—H. B.

*Sulphur and Cyanides from Spent Oxide, &c.; Process and Apparatus for the Extraction of* — J. J. M. Bérigneul. Addition dated April 26, 1905, to Fr. Pat. 345,071, July 23, 1904. VII., page 1067.







is liberated by acetic acid. It is only slightly soluble in water and has both acid and basic properties. On heating 0.5 gm. of dianilidomaleic acid dimethyl ester with 2.5 grms. of dry potassium hydroxide over a naked flame and pouring into ice and water, a blue coloration, due to indigo, was obtained, and was increased by passing a current of air through the liquid, but the yield was very small. On merely heating to 320° C. no indigo was obtained. Better results were obtained by melting either the dimethyl ester or the sodium salt with sodium amide. 1.5 grms. of finely-powdered sodium amide is mixed with a very little potassium hydroxide and heated in a test-tube in a paraffin bath to 200° C. 0.5 gm. of the disodium salt of dianilidomaleic acid is then added during a few minutes with constant stirring. In five to six minutes the melt is finished and the evolution of ammonia becomes less. Water is carefully added, a current of air blown through the solution, the indigo filtered off and washed successively with dilute hydrochloric acid, water, alcohol, pyridine, alcohol and ether. The yield is very variable and usually unsatisfactory.—E. F.

*$\alpha$ -Anthramine and  $\alpha$ -Anthrol.* H. Dienel. Ber., 1905, 38, 2862—2867.

When anthraquinone- $\alpha$ -monosulphonic acid is reduced with zinc dust and ammonia, the zinc-ammonium salt of anthracene- $\alpha$ -monosulphonic acid is obtained in the form of colourless needles. By converting the latter into the potassium salt, melting with potassium hydroxide at 250°—260° C. and decomposing the melt with hydrochloric acid,  $\alpha$ -anthrol  $\text{C}_{14}\text{H}_9\text{OH}$  is formed in light brown flocks, easily soluble in most solvents with blue fluorescence, and crystallising from alcohol in leaflets or small needles melting at 150°—153° C. The acetyl derivative forms colourless needles, which melt and decompose at 128°—130° C., and yield on oxidation acetyl-erythrohydroxy-anthraquinone.  $\alpha$ -Anthramine  $\text{C}_{14}\text{H}_9\text{NH}_2$  is formed by heating 1 part of anthrol with 3 parts of acetamide for eight hours at 260° C. and thereafter for one day at 235° C. From alcohol, in which it dissolves readily with yellowish brown colour and green fluorescence, it separates in golden yellow leaflets melting at about 130° C. It is more readily soluble in most solvents than the  $\beta$ -compound, behaves like the latter in its reaction with bromine and nitric acid, but differs therefrom in its behaviour with arsenic acid, the  $\alpha$ -compound when heated therewith melting to a mass having a greyish-green colour, whilst the  $\beta$ -compound yields a fine blue colour. The acetyl compound forms green needles melting at 198° C. and is converted into the corresponding amino-hydroxyanthraquinone by oxidation with chromic acid. The dihydride obtained by reduction crystallises from alcohol in colourless needles, whilst  $\alpha$ ,  $\alpha$ -dianthramine obtained by boiling  $\alpha$ -anthramine with glacial acetic acid forms greenish-yellow leaflets melting at 204° C.—D. B.

*2,3-Dihydroxyanthracene.* K. Lagodzinski. Annalen, 1905, 342, 90—111.

The author describes the synthesis of 2,3-dihydroxy-anthracene. By the action of phthalic anhydride and aluminium chloride on veratrol, 3,4-dimethoxy-1',2'-benzoyl-*o*-benzoic acid is obtained. It forms colourless prisms, yields soluble salts with alkalis and ammonia, and reacts with phenylhydrazine with the production of 2-phenyl-4-veratryl-phthalazone. When heated with strong sulphuric acid, it is converted into the dimethyl ether of hystazarin, which yields hystazarin in theoretical quantity when hydrolysed with hydrogen bromide at 170° C. and 2,3-dimethoxyanthracene when reduced with zinc dust and dilute ammonia. The dimethoxy compound crystallises from alcohol in white, short prisms, melting at 204° C. and is converted into 2,3-dihydroxyanthracene on hydrolysis with hydrogen iodide. The latter forms straw-yellow leaflets, readily soluble in organic solvents, does not react with oxidising agents at the ordinary temperature, but is decomposed when heated therewith and apparently without the formation of a quinone.—D. B.

*1,2-Anthraquinone.* K. Lagodzinski. Annalen, 1905, 342, 59—89.

2-ANTHROL was prepared in a pure form by fusing sodium 2-anthracenesulphonate with potassium hydroxide at 300°—310° C. for 30 minutes, cooling the melt and decomposing it with hydrochloric acid diluted with ice water. From this compound 1,2-nitroso-anthrol was obtained by dissolving in boiling alcohol, filtering the hot solution, cooling the filtrate to 30° C., adding zinc chloride, gradually introducing sodium nitrite, heating for two hours at 50°—60° C., and finally boiling for two or three hours in a reflux apparatus. It forms orange-yellow needles sparingly soluble in organic solvents. By reducing the nitroso compound with stannous chloride and hydrochloric acid or hydrogen sulphide in an alkaline solution 1,2-amino-anthrol was obtained. By treating the salts of the latter compound in the cold with weak chromic acid or ferric chloride and dilute sulphuric acid, 1,2-anthraquinone was formed in theoretical quantity. It crystallises from alcohol in orange needles, dissolves sparingly in organic solvents, although more readily than the 9,10-compound, melts and decomposes at 185°—190° C., reacts with nitric acid to form a mononitro derivative, and gives with strong sulphuric acid a characteristic bluish violet solution. By gently heating its solution in acetic anhydride with *o*-phenylenediamine, 1,2-anthraphenazine was obtained in the form of yellow leaflets melting at 221°—222° C. without decomposition. When 1,2-triacetylaminanthrol is subjected to oxidation, the corresponding anthraquinone is obtained crystallising in pale yellow needles which melt at 189° C. and yielding on hydrolysis 1,2-amino-hydroxyanthraquinone identical with Liebermann's  $\alpha$ -aminoalizarin. The conversion of the latter into alizarin was effected by heating with strong hydrochloric acid at 250° C. 1,2-anthrahydroquinone formed by reducing the new anthraquinone with zinc dust and acetic acid crystallises in yellowish-green leaflets melting at 131° C. It dissolves readily in organic solvents and regenerates 1,2-anthraquinone when subjected to oxidation. The diacetyl derivative forms pale yellow crystals, dissolves extremely readily in solvents, melts at 145° C. and gives on oxidation diacetylalizarin, identical with Bayer's product. The formation of alizarin in the foregoing experiments, affords a new synthesis of this dyestuff from anthracene whilst the quantitative production of anthraphenazine is direct evidence as to the ortho-position of the two hydroxyl groups in alizarin.—D. B.

*Azo Dyestuffs; General Method for Determining the Constitution of —, and a New Mode of Formation of Diazo Compounds.* O. Schmidt. Ber., 1905, 38, 3201—3210.

THE author finds that azo dyestuffs are decomposed smoothly, by strong nitric acid, generally with formation of the corresponding diazo compound on the one hand, and of the nitro derivative of the second component on the other. The reaction thus affords a means of determining the constitution of azo dyestuffs, and also represents a new mode of formation of diazo compounds. In carrying out the reaction, the dyestuff is introduced gradually into 10—20 times its weight of red fuming nitric acid at the ordinary temperature, and the mixture is cooled by ice. The dyestuff dissolves in the acid and is decolorised. After standing for about 10 minutes, the solution is poured on to ice. The following cases may now arise:—(1). Both the diazo compound and the nitro derivative are insoluble in water. They are filtered off, and the nitro derivative is separated by extraction with an organic solvent. (2). Both the diazo compound and the nitro derivative are soluble in water. The nitro derivative is extracted from the solution by an organic solvent, either before or after precipitation of the diazo compound as an insoluble azo dyestuff. (3). If one of the products is soluble and the other insoluble, they can be separated by filtration. (4). In the case of polyazo compounds, several different diazo compounds and nitro derivatives may be produced, and a special process of separation must be worked out for each case.

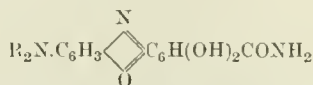
Azo dyestuffs containing hydroxyl or primary amino groups are alkylated before treatment, otherwise the

fuming nitric acid oxidises the phenol and diazotises the amino group. Up to the present the following facts have been demonstrated:—(1). Azo dyestuffs containing auxochrome amino or hydroxyl (or alkoxy) groups in the position para to the azo group, are split up into their components by red fuming nitric acid. (2). If the amino or hydroxyl (or alkoxy) group is ortho to the azo group, the decomposition proceeds smoothly only in the case of  $\beta$ -naphthol dyestuffs, whilst with dyestuffs from *p*-cresol, the reaction only takes place to a limited extent. (3). If the auxochrome group is in the *m*-position, the reaction either fails entirely or takes place only to a very limited extent. (4). Other azo compounds such as azobenzene and *p*-azotoluene are not converted into diazo compounds by nitric acid or only in a very limited degree. (5). On decomposing azo dyestuffs with fuming nitric acid, the alkylated amino compound or the alkoxy compound, is obtained in the form of its nitro derivative, whilst the other portion of the molecule is recovered as the diazo compound. (6). Azoxy compounds containing an amino group para to the azoxy group are also decomposed by red fuming nitric acid, with formation of diazo compounds. The reactions mentioned under (1) and (6) are also caused by chromic acid and permanganic acid dissolved in glacial acetic acid. In the case of azo compounds the action appears to be in the first place an oxidation to the corresponding azoxy compound, the latter being afterwards split up owing to the replacement of the azoxy group by the nitro group.

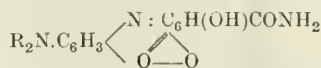
The following examples of the reaction are given:—Helianthin (sodium salt of dimethyl-*p*-aminoazobenzene-*p*-sulphonic acid) gave good yields of diazobenzenesulphonic acid—isolated in the form of its compound with  $\beta$ -naphthol—and of *o*-*p*-dinitrodimethylaniline and tetranitromethyl aniline. *p*-Nitro-*p*-methoxyazobenzene yielded *p*-nitro-diazobenzene and *o*-*p*-dinitroanisole. Orange II (sodium salt of the dyestuff from  $\beta$ -naphthol and diazotised sulphanic acid) yielded the diazo compound of sulphanic acid and an impure nitro derivative of  $\beta$ -naphthol. Good yields of the corresponding diazo compounds were also produced from  $\beta$ -naphtholazobenzene-*o*-carboxylic acid (from diazotised anthranilic acid and  $\beta$ -naphthol), *p*-ethoxy-*p*-hydroxyazobenzene, *p*-hydroxyazobenzene-sulphonic acid, benzene-azo- $\beta$ -naphthol, *p*-ethoxybenzeneazo- $\beta$ -naphthol, and tetramethyl-*p*-*p*-diaminoazoxybenzene. On the other hand, *m*-hydroxyazobenzene, the dyestuff from diazotised anthranilic acid and *p*-cresol, azobenzene, *p*-azotoluene, and tetramethyl-*m*-*m*-diaminoazobenzene gave only small yields of diazo compounds.—A. S.

*Oxazones; Contribution to the Knowledge of* — R. Gnehm and L. Bauer. J. prakt. Chem., 1905, 72, 249–277.

THE authors prepared Gallamine Blue, Celestine Blue B, and Corein Blue 2R under various conditions, and give a detailed description of what they consider to be the best method. The yields obtained are shown in tabular form. Gallamine Blue (*p*-dimethylaminodihydroxycarboxylic acid amide-phenoxazonium chloride) and Celestine Blue B (*p*-diethylaminodihydroxycarboxylic acid amide-phenoxazonium chloride) are obtained by the action of *p*-nitrosodimethyl- and *p*-nitrosodiethylaniline respectively on gallamic acid (see Eng. Pat. 2941 of 1889; this J., 1889, 981). The free bases obtained by pouring a solution of the dyestuff in dilute sulphuric acid into dilute ammonia are blue substances insoluble in water. The formula

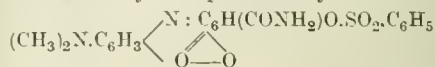


agrees best with the analytical results in each case; but the authors consider the anhydride constitution



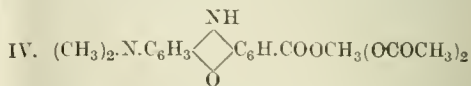
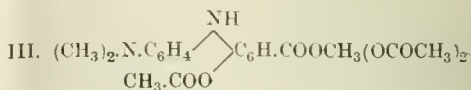
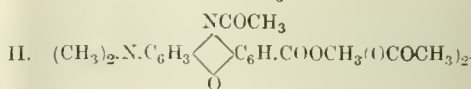
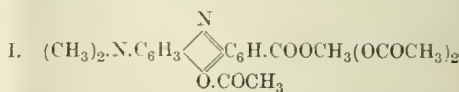
far more probable in view of the behaviour of the bases towards arylsulphonic chlorides.

The benzenesulphonic acid ester of Gallamine Blue and Celestine Blue B bases and the benzene-, *o*-toluene-, and *p*-toluene-sulphonic acid esters of Prune base (the methyl ester of Galloxyaniline) were prepared, and it is shown clearly that these bases react with only one molecule of arylsulphonic chloride, and that therefore the galloxyaniline dyestuffs contain only one hydroxyl group. The benzene sulphonic acid ester of Gallamine Blue is insoluble in dilute alkalis. It was obtained in microscopic moss-green crystals decomposing gradually above 230° C. Its constitution may be represented by the formula



The aryl sulphonic esters of Prune base have a similar constitution, but contain a methoxyl group in place of the amino group in the above formula. It is therefore remarkable that Prune should yield a triacetyl derivative, when heated with acetic anhydride and fused sodium acetate (see also Nietzki and Otto, Ber., 21, 1736, this J., 1888, 559; also this J., 1893, 139, and also Möhlau and Klimmer, Z. Farben. u. Text. Chem. I., 65; and that the arylsulphonic esters of Prune base yield diacetyl derivatives under similar conditions.

The authors acetylated Prune and its arylsulphonic esters in the presence of a reducing agent and also acetylated the leuco compound of Prune. Both methods lead to the production of identical products, a diacetyl derivative of the leuco compound of Prune and monoacetyl derivatives of arylsulphonic esters of the same. These substances are not changed into the triacetyl compounds by boiling with acetic anhydride and sodium acetate. Moreover the substances of each series behave very differently on hydrolysis with hydrochloric acid. The triacetyl derivative of Prune on hydrolysis yields a product which may be reconverted into the triacetyl body by treatment with acetic anhydride and sodium acetate, but which is not the same as, and could not be converted into Prune hydrochloride. The diacetyl derivative of the leuco compound of Prune, on the other hand, is readily converted into the corresponding hydrochloride by hydrolysis and thence to Prune by oxidation with hydrogen peroxide. The triacetyl derivative of Prune crystallises in lemon-yellow needles, m. pt. 225° C. It is insoluble in water, but soluble in the cold with greenish colour in alcoholic caustic soda. The diacetyl derivative of the leuco compound of Prune is obtained in yellow needles, m. pt. 168° C.; it is insoluble in water. Both substances dissolve in concentrated sulphuric acid with greenish-blue colour. The constitution of the triacetyl derivative of Prune may be represented by formula I., II., or III. The former two are supported by the behaviour towards alkali and concentrated sulphuric acid; the open chain formula III. by the behaviour towards hydrolysis. Formula IV. represents the constitution of the diacetyl derivative of the leuco compound of Prune.



Zinc or stannous chloride double salts of a number of leuco galloxyaniline dyestuffs were also prepared (see Eng. Pat. 21,415 of 1898; this J., 1899, 827). All were found to be unstable substances with the exception of



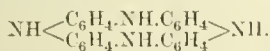
the Prune derivatives. The preparation of the stannous chloride double salt of leucoprune hydrochloride m. pt. 268° C., is described in detail. It is a fairly stable substance which may be dried at 110°–120° and kept for months without decomposition.

The following diethylaminoazo bodies used for the foregoing experiments have not previously been described. They were prepared by combining diazobenzene, toluene, &c., with diethylaniline in acetic acid solution.

*Benzeneazodiethylaniline* crystallises from alcohol in orange-brown needles melting at 97.8° C. The hydrochloride crystallises from absolute alcohol in flat, golden orange needles, m. pt. 182° C. The sulphate forms garnet red leaflets, m. pt. 137° C. *p-Tolueneazodiethylaniline* is very similar, m. pt. 113° C. The hydrochloride and sulphate both melt at 179° C. *Naphthalene-α-azodiethylaniline* crystallises in shimmering, green needles from glacial acetic acid, m. pt. 108° C. The sulphate crystallises from alcohol in brownish leaflets, insoluble in water, m. pt. 189.5° C. *Naphthalene-β-azodiethylaniline* is obtained from ligroin (light petroleum) in dark brown needles or leaflets melting at 137.6° C. The hydrochloride (golden brown leaflets) melts at 174° C.; the sulphate at 171° C. The above bases are insoluble in water, but readily soluble in many organic solvents. The salts of the two first-named are decomposed by water even in the cold.—H. L.

*Aniline Black; Constitution of* —. R. Vidal. Z. Farben- und Textil.-Ind., 1905, 4, 458.

*p*-AMINOHYDROXYDIPHENYLAMINE was produced by heating quinol with *p*-phenylenediamine in alcoholic or phenolic solution in presence of zinc, to about 180° C., in a closed tube. By prolonging the reaction, the "auto-condensation" product was obtained, *viz.*, the leuco base of Emeraldine and Azuline. These two dyestuffs, obtained by oxidation of the leuco base with air in acid and alkaline solution respectively, both give Aniline Black on oxidation with chromic acid. This process serves as further confirmation of the synthesis of Aniline Black by anhydride formation, starting from *p*-aminophenol. It is also considered as a further confirmation of Goppelsroeder's formula for Aniline Black:—



—T. F. B.

*Hydroxybenzoic Acids; Some Oxidation Products of the — and the Constitution of Ellagic Acid.* A. G. Perkin and M. Nierenstein. XXIV., page 1087.

*Ellagic Acid.* G. Goldschmiedt. XXIV., page 1087.

*Gambier or Yellow Catechu; Determination of the Value of* —. M. Greshoff. XXIII., page 1087.

#### ENGLISH PATENTS.

*Arylnaphthylaminesulphonic Acid; Manufacture of 1.6- or 1.7- —.* C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 24,669, Nov. 14, 1904. SEE Fr. Pat. 348,149 of 1904; this J., 1905, 434.—T. F. B.

*Indigo and Similar Colouring Matters; Reduction of* —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 25,889, Nov. 28, 1904.

SEE Fr. Pat. 348,360 of 1904; this J., 1905, 495.—T. F. B.

*Oxyanthraquinones [Anthracene Dyestuffs]; Manufacture of — and of an Intermediate Product therefor.* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 27,373, Dec. 15, 1904.

SEE Fr. Pat. 348,926 of 1904; this J., 1905, 541.—T. F. B.

*Oxyanthraquinones and Derivatives thereof [Anthracene Dyestuffs]; Production of* —. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 27,374, Dec. 15, 1904.

SEE Fr. Pat. 348,927 of 1904; this J., 1905, 541.—T. F. B.

*Colouring Matters [Azo Dyestuffs]; Production of Blue Black* —. T. R. Shillito, London. From Aniline Colour and Extract Works, formerly J. R. Geigy, Basle, Switzerland. Eng. Pat. 1368, Jan. 24, 1905.

A VERY soluble dyestuff, especially suitable for machine dyeing, is produced by sulphonation of the azo dyestuff obtained by combining 1-diazo-2-naphthol-4-sulphonic acid, or its anhydride, with β-naphthol. The new dyestuff shows, when dyed on wool and subsequently treated with bichromate, the same excellent fastness against light, milling and potting as the original product.—H. L.

#### FRENCH PATENTS.

*Dyestuffs; Process of Preparing Yellow Mordant [Azo]* —. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 350,046, July 7, 1904.

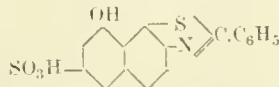
SEE Ger. Pats. 158,148 and 160,040 of 1904; this J., 1905, 542 and 796.—T. F. B.

*Dyestuffs susceptible to Chroming and Treatment with Copper Salts on the Fibre; Process of Making Orthohydroxymonoazo [Azo]* —. Fabr. de Couleurs d'Aniline et d'Extraits, *ci-dev.* J. R. Geigy. Fr. Pat. 350,055, July 12, 1904.

SEE Eng. Pat. 15,025 of 1904; this J., 1905, 668.—T. F. B.

*Thiazol Sulphonic Acids; Production of* —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 353,928, March 6, 1905. Under Int. Conv., May 13, 1904.

BENZYLIDINE compounds obtained by condensing aromatic aldehydes with aromatic aminosulphonic acids are heated with alkali sulphides and sulphur, or with alkali polysulphides, or with substances or mixtures reacting in an analogous manner. In place of these benzylidineaminosulphonic acids, mixtures of aldehydes and aromatic aminosulphonic acids may be employed. Thus benzaldehyde and 2.8-aminonaphthol-6-sulphonic acid yield the compound



a product which combines with diazo substances, producing substantive cotton dyestuffs, which may be re-diazotised on the fibre and combined with β-naphthol, &c. Other aminosulphonic acids, such as 2.5-aminonaphthol-7-sulphonic acid, 1.5-aminonaphthol-7-sulphonic acid, 1.8-aminonaphthol-4.6-disulphonic acid, 1.5-, 2.6-, naphthylamine-sulphonic acids, 2-naphthylamine-6-chloro-4-sulphonic acid, *p*- or *m*-sulphanilic acid, &c., and also other aldehydes may be employed.—H. L.

*Dyestuffs of the Anthracene Series, and Intermediate Products for their Production; Preparation of* —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 354,076, April 28, 1905. Under Int. Conv., Sept. 23, 1904.

1.4.8-TRIHIDROXYANTHRAQUINONE (see Eng. Pat. 17,589 of 1904; this J., 1905, 725), and 1.2.5.8-Tetrahydroxyanthraquinone (Alizarin Bordeaux) are sulphonated in the presence of boric acid. A good yield of a monosulphonic acid, probably the 1.4.8-trihydroxyanthraquinone-7-sulphonic acid and 1.2.5.8-tetrahydroxyanthraquinone-3-sulphonic acid respectively, is produced in each case, and may be isolated directly from the melt in a pure state. Both acids are stated to be of great technical value, as they yield green dyestuffs on condensation with primary aromatic amines. The dyestuff obtained by condensing 1.4.8-trihydroxyanthraquinone-sulphonic acid with *p*-toluidine (2 mols.) is identical with that prepared by sulphonating 1.4-di-*p*-tolylidiamino-8-hydroxyanthraquinone in the presence of boric acid. (See Fr. Pat. Application, April 19, 1905.)—H. L.

*Dyestuff especially suitable for the Manufacture of Lakes; Production of an [Azo]* —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 353,816, April 29, 1905. Under Int. Conv., Jan. 13, 1905.

DIAZOTISED benzidinesulphonic disulphonic acid is combined

with 2 mols. of phenylmethylpyrazolone. The resulting dyestuff dyes wool orange shades. It is particularly adapted to lake manufacture in the usual way, the lakes being of a brilliant reddish-orange colour, and very fast to light, water and alkalis.—T. F. B.

*Dyestuffs; Preparation of Diazo Derivatives of Ortho-aminonaphthol Sulphonic Acids and Conversion of these Derivatives into [Monoazo] —.* Kalle und Co. Fr. Pat. 353,786. April 28, 1905.

A NEW process for diazotising 1,2-aminonaphthol sulphonic acids is claimed (compare Eng. Pat. 10,235 of 1905; this J., 1905, 433; and Ger. Pat. 155,083 of 1903; this J., 1905, 542); as well as the monoazo dyestuffs obtained by combining the diazo bodies with  $\beta$ -naphthol or its sulphonic acids, dihydroxynaphthalenes, resorcinol or aminophenol. (Compare Eng. Pats. 15,025 of 1904, and 16,566 of 1905; this J., 1905, 668, 724; also Fr. Pat. 351,125 of 1905; this J., 1905, 840.) The metallic salts of the diazo-oxy-sulphonic acids in question are obtained by the action of alkali nitrites and the salts of certain metals, such as zinc sulphate or chloride, nickel or copper sulphate, preferably in the presence of a small amount of the hydroxides of these metals, on *o*-aminonaphthol-sulphonic acids in concentrated solution or aqueous suspension.

Example: 48 kilos. of 1,2-aminonaphthol-4-sulphonic acid are mixed and well stirred with a solution of 33 kilos. of zinc sulphate in 33 litres of water, containing a little zinc hydroxide. The latter is formed by the addition of about 3 kilos. of ammonia to the solution. A concentrated aqueous solution of 14 kilos. of sodium nitrite is then added.

Expt. No.	Diazo Compound.	Free HCl.	Free HNO <sub>2</sub> .	Sodium Acetate.	Salt.	Time. Hrs.	Temperature C.	Loss. Per cent.
In grms. per litre.								
1a	25.0	2.0	—	—	—	24	19	0.1
1b	25.0	2.0	—	—	90	24	19	0.45
2a	18.0	1.2	—	30	—	24	19	9.3
2b	18.0	1.2	—	30	60	24	19	4.1
3a	24.2	1.6	—	—	—	24	19	0.3
3b	24.2	1.6	0.19	—	—	24	19	1.0
4a	18.0	1.2	—	30	—	24	19	8.0
4b	18.0	1.2	0.19	30	—	24	19	15.8
5a	18.0	1.2	0.19	30	—	24	19	18.1
5b	18.0	1.2	0.19	30	60	24	19	11.8
6a	18.0	1.2	0.19	30	—	24	20	19.9
6b	18.0	1.2	0.38	30	—	24	20	31.1
7a	24.4	1.2	0.19	—	—	22	22	6.8
7b	24.4	2.4	0.10	—	—	22	22	1.5
8a	17.2	2.1	0.07	—	—	24	22	9.84
8b	88.2	10.5	0.35	—	—	24	22	2.4
9a	18.7	1.2	0.19	30	—	22	22	50.8
9b	25.4	1.2	0.19	30	—	22	22	54.6

The reaction is completed by warming for two hours at about 40° C., and the mass is then acidified with acetic acid. By filtration and recrystallisation, brilliant bronze needles of the composition  $C_{10}H_7(SO_3Zn) \begin{smallmatrix} N:N \\ \diagdown \quad \diagup \\ O \end{smallmatrix}$  may be obtained.

The diazo body need not be isolated for the preparation of the dyestuff, but may be directly combined in very concentrated alkaline solution with  $\beta$ -naphthol, &c., forming, it is stated, the zinc salt of the dyestuff. The latter may be converted by treatment with hydrochloric acid into the free acid, which produces fast black shades on wool, when dyed in an acid bath and with after-treatment with bichromate; but the same result, it is stated, can be obtained by employing the zinc salt directly.

—H. L.

*Indophenols; Preparation of Acetylated —.* [Sulphide Dyestuffs.] Act.-Ges. f. Anilinfabrikation. Fr. Pat. 353,866, May 2, 1905.

ACETYL-*p*-PHENYLENEDIAMINE is oxidised at a low temperature with phenol or one of its derivatives with a free para position. Excellent yields are thus obtained it is stated. The products may be employed for the production of sulphide dyestuffs, either directly or after elimination of the acetyl group.—H. L.

## GERMAN PATENT.

*Haematoxylin: Process for Preparing a Solid Colouring Matter [Dyestuff] from —.* R. Haack. Ger. Pat. 162,010, July 1, 1904.

SODIUM nitrite acts on haematoxylin or logwood extract in the cold, in concentrated solutions, producing a precipitate which, unlike that obtained by oxidation of haematoxylin in the warm by alkali nitrite, is completely soluble in water; it is probably a condensation product. Its aqueous solution is brown, and dyes chrome-mordanted silk grey shades from dilute solutions, and pure black from more concentrated baths; in this respect also it differs from the above-mentioned oxidation product, which dyes silk in blue to blue-black shades.—T. F. B.

## V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

*Paranitraniline; Stability of Diazotised —.* C. Schwalbe. Z. Farben- und Textil-Ind., 1905, 4, 433—438.

THE subjoined table gives the results of a series of experiments on the stability of diazotised *p*-nitraniline solutions under varying conditions; the diazo solutions were prepared from purified Nitrosamine Red, and the determination of the strength of the solutions was carried out by titration with  $\beta$ -naphthol solution:—

Nos. 3a and 3b in the above table show the harmful effect of free nitrous acid on solutions containing free hydrochloric acid; in solutions containing free acetic acid (4a and 4b) this influence is much more marked. In Nos. 2a and 2b, the beneficial influence of salt in presence of free acetic acid is exhibited. In mineral acid solution (1a and 1b) the effect is unnoticeable, since the solution is very stable. The good effect of salt in presence of free nitrous and acetic acids is seen in Nos. 5a and 5b. In Nos. 7a and 7b the effect of excess of hydrochloric acid in presence of free nitrous acid is clearly brought out. The decrease of stability with the increase of concentration of the solutions appears in Nos. 8a and 8b. Nos. 6a and 6b show the large decrease of stability due to increased excess of nitrous acid. In practice, excess of nitrous acid should therefore be carefully avoided. Solutions containing free nitrous acid are also more sensitive to light than those from which it is absent. In conclusion, it is stated that, when great stability is desired (e.g., in printing), Azophor Red, the Nitrazols, or purified Nitrosamine Reds should be employed.—T. F. B.

*Sulphur in Albuminoid Substances [Wool]; Condition of —.* P. N. Raikow, XXIV., page 1088.



## ENGLISH PATENTS.

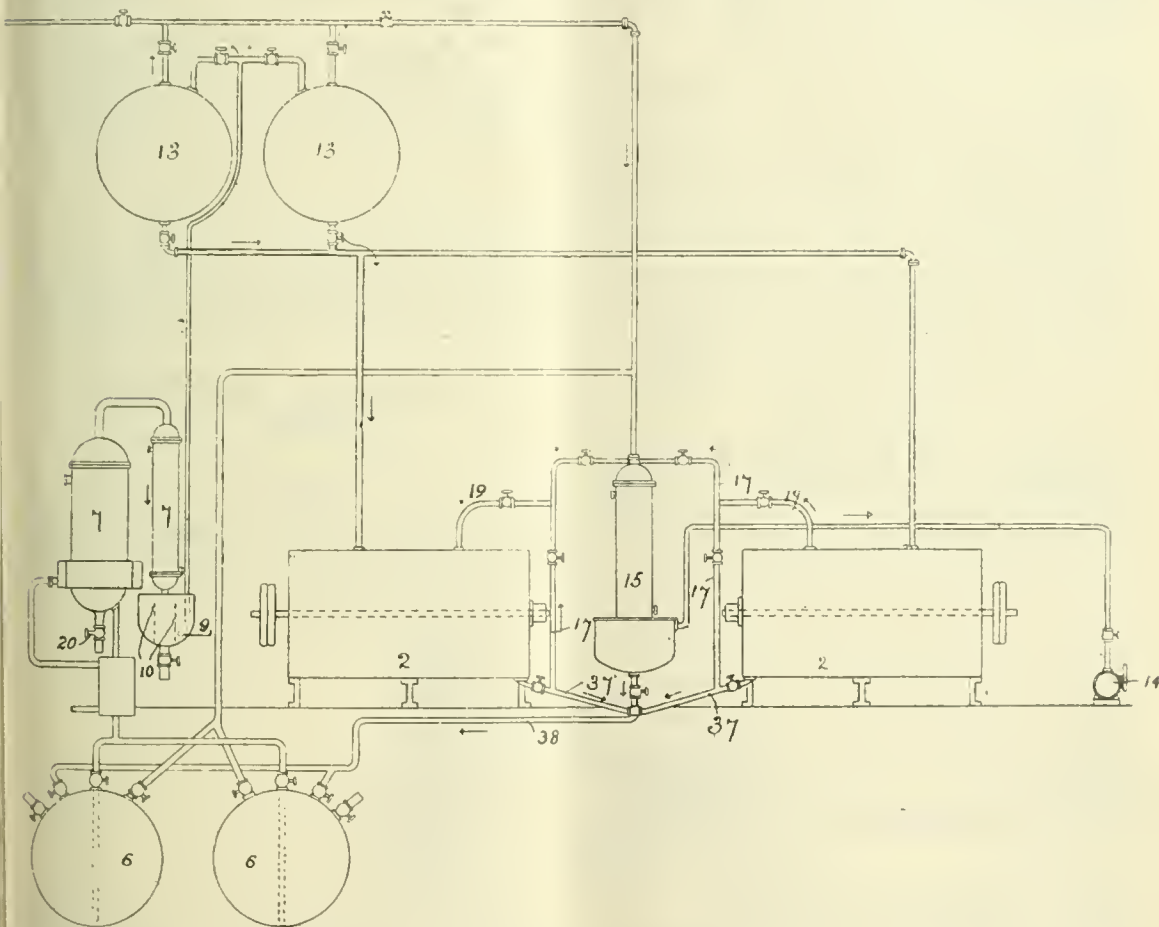
*Silk or Hair [from Casein]; Process for the Preparation of Artificial* — F. Todtenhaupt, Köln a/ Rhein, Germany, Eng. Pat. 25,296, Nov. 21, 1904.

CASEIN is dissolved in an alkali solution, which is then passed through forming nozzles into a dilute acid bath; the threads thus formed are stated to be insoluble and very tough and to contain 15 to 16 per cent. of nitrogen; they resemble natural silk very closely, and burn with difficulty. The alkaline casein solution may be prepared by dissolving 1 part of casein in 3 parts of 10 per cent. ammonia and 4 parts of water.—T. F. B.

*Woolen and other Materials; Method and Plant for Removing [by means of Volatile Solvents] Grease and other Impurities from* — H. Heymann, Bradford; and H. Hey, J. Smith, H. L. Mitchell and W. H. Askham, Dewsbury, Eng. Pat. 17,437, Aug. 10, 1904.

Two cylinders 2 (see Fig.), fitted with steam pipes or

the material has been sufficiently treated, the solvent is withdrawn from the cylinder. If it be still in a suitable condition, it is again used in the same manner in the second cylinder, being finally allowed, when sufficiently saturated with grease, &c., to run off, through the pipes 37 and 38, into the storage-tanks 6, which, during this operation, are connected with the pump 14. The storage-tanks 6 are then put into communication with the lower part of the cylinder from which the solvent has been withdrawn, and the axle is set rotating at a much higher speed than before, whilst heat and reduced pressure are applied to vaporise the solvent still left in the materials. The materials are thus rendered dry and fit for removal from the cylinder. The solvent received in the tanks 6 is passed from these, through a preliminary heater into a still 7, air being admitted into the tanks to enable this to be done. The oils, &c., which are left in the still are withdrawn through a tap 20, while the vaporised solvent, along with water, is condensed



steam jackets, for heating purposes, and with tightly fitting lids, are provided internally with suitable apparatus for carrying the materials to be treated, *e.g.*, with winches for tissues, or with cages for garments and loose materials, mounted upon axles passing through the cylinders, so as to be rotatable by means of external gearing. When the materials have been placed in the cylinders, a grease-solvent is run to a suitable height into one of the latter from a storage tank 13, while the axle is revolved at a slow speed, to effect the saturation of the materials and the extraction of the grease and other matters from them. Any vapours produced during the operation are drawn by means of a vacuum-pump 14, through a pipe 19, to a separator 15, where they are condensed and whence the recovered solvent is removed for further use. When

and received in a collector 9, whence, after removing the water by means of a tap 10, the solvent passes again to the storage-tanks 13.

The circulation of the solvent is effected better, it is declared, by means of reduced pressure than with compressed air or gas, as, less evaporation takes place by the first than by the second method, and the vapours which are formed are much more easily condensed than is the case when they are mixed with air; in fact, it is stated, if during the working of the apparatus, the vapour be allowed to flow direct from the cylinders 2 through the pipe 19, 17, 37 and 38 to the tanks 13, it will condense on its way and reach the latter in a liquefied state.

Instead of two cylinders, one alone may be employed in the process.—E. B.

*Volatile Liquids; Apparatus for Separating and Condensing the Vapours of* — H. Heyman, H. Hey, J. Smith, H. L. Mitchell and W. H. Askham. Eng. Pat. 17,435, Aug. 10, 1904. I., page 1053.

*Benzine Employed for Cleaning Fabrics; Apparatus for Recovering the* — E. Delhotel, Paris. Eng. Pat. 7807, April 12, 1905. Under Int. Conv., July 16, 1904.

SEE FR. Pat. 344,848 of 1904; this J., 1904, 1213.—T. F. B.

*Velvets, Velveteens and other Pile Goods; Production of Ornamental Patterns on* — O. St. L. Davies, Castleton. Eng. Pat. 22,098, Oct. 14, 1904.

IN place of depressing the pile on the portions of the fabric, which it is desired to obtain in relief, by the use of gum, &c., as described in Eng. Pat. 21,427 of 1903 (see this J., 1904, 932), it is found that sufficient depression is produced by merely embossing the fabric with an embossing roller, and subsequently singeing the portions of the pile which are still raised, finally raising, by any suitable means, the parts which have been depressed.—T. F. B.

#### UNITED STATES PATENTS.

*Flax; Process of Retting* — C. Vansteenkiste and L. Legrand, Antwerp. U.S. Pat. 799,281, Sept. 12, 1905.

THE flax, contained in a suitable receptacle, is introduced repeatedly (being frequently raised and lowered) by mechanical means, into a scouring tank, and then similarly into a retting tank, filled with water, and containing a constant amount of ferments. The retting tank may be heated by steam or otherwise. After it has been sufficiently treated, the flax is next introduced into a rinsing tank. The water from this latter is passed successively into the retting and scouring tanks, which are provided with false bottoms of linen or similar material. (Compare this J., 1900, 143; 1904, 249; 1905, 84).

—T. F. B.

#### FRENCH PATENTS.

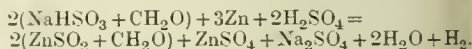
*Alfa [Esparto] and other Similar Plants; Conversion of — into Paper Pulp or Textile Fibres.* Mme. M. Kuess, née Solley. Fr. Pat. 354,092, May 8, 1905. XIX., page 1081.

*Wool-Washing Machine.* G. W. and A. P. Tatterson. Fr. Pat. 352,153, March 7, 1905.

A LOOSE-WOOL washing tank 2 (see fig.) has at its exit-end two squeezing-rollers 1, in front of which is placed a series of rollers 3 which act in the same manner as a travelling-apron. A main driving-shaft 5, communicates its motion to a fork 10, carried by a revolving and oscillating shaft 9, and to a frame 31, bearing a system of rakes 45, and attached to the shaft 9 by means of an arm 42. The apparatus is arranged to operate in the following manner:—As the shaft 9 is moved away from the squeezing-rollers, the fork 10 is lifted above it and is upon the point of entering the water in the tank when the shaft has moved as far back as it can go. During the return of the shaft the fork dips into the bath and lifts upon its prongs a quantity of the loose wool contained in the bath. As the fork approaches the rollers 3, it attains a horizontal position. It then descends upon the rollers for the purpose of enabling the rollers to remove the fibres from it. Simultaneously with this action of the fork, the rake-frame is lifted above the bath, carried back, lowered, and moved forward in the bath.—E. B.

*Hydrosulphite [Compound]; Insoluble, Stable, Pulverulent* — M. Muntadas. Fr. Pat. 353,765, April 8, 1905.

AN insoluble, stable, pulverulent formaldehyde-zinc hydrosulphite compound is formed by boiling a mixture of sodium bisulphite, formaldehyde, zinc dust and sulphuric acid. The following reaction is stated to take place:—



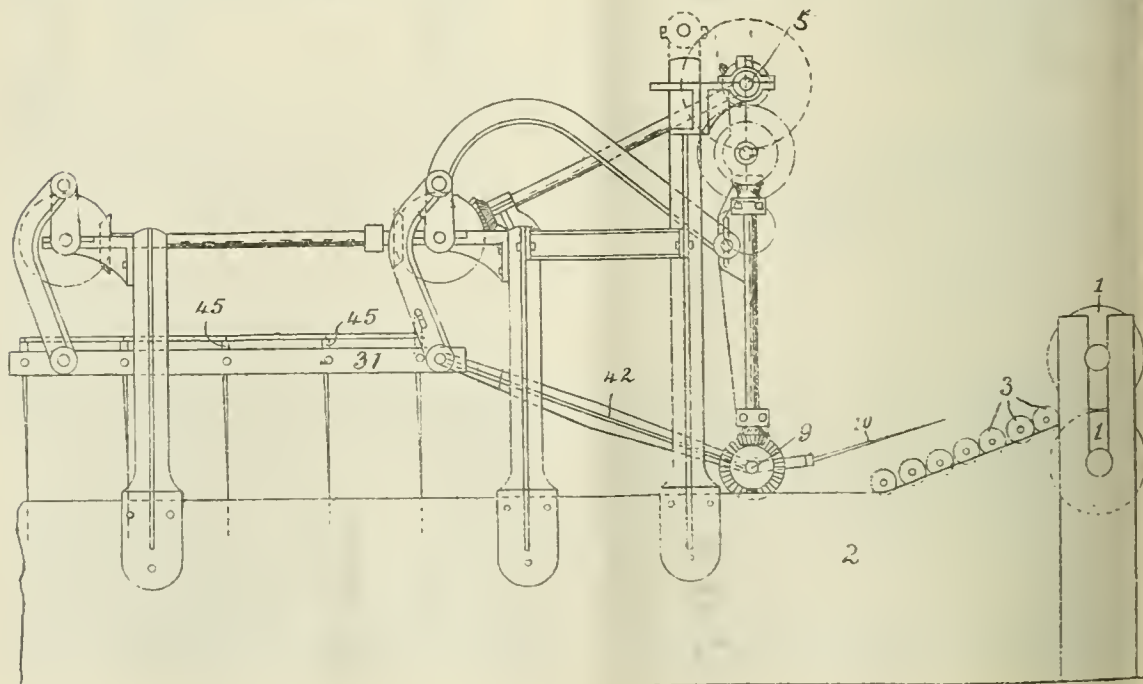
The insoluble hydrosulphite compound is filtered off, washed, dried, and passed through a sieve. The compound is said to be insoluble in water, acids and alkalis. It can be employed advantageously in discharging dyed textile fabrics; with caustic soda it is said to form a satisfactory discharge for *a*-Naphthylamine Red.—T.F.B.

#### VI.—COLOURING WOOD, PAPER, LEATHER, &c.

##### ENGLISH PATENT.

*Wood; Method of Colouring* — R. Kornmann, Freiburg, Germany. Eng. Pat. 16,316, Aug. 10, 1905.

By treating wood with a solution of 4 parts of hydrogen





peroxide (10 vols.) and 1 part of a mineral acid (e.g., hydrochloric acid) and drying, it is stated that it assumes the appearance of old wood: the acid may be subsequently neutralised by ammonia.—T. F. B.

## UNITED STATES PATENT.

*Feathers; Process for the Preservation of* —. R. Wolfenstein, Berlin. U.S. Pat. 800,197, Sept. 26, 1905. See Eng. Pat. 11,712 of 1903; this J., 1901, 439. T. F. B.

## VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

*Sulphuric Acid: Refractive Index of —, at Different Concentrations.* V. H. Veley and J. J. Manley. Proc. Roy. Soc., 1905, 76A., 469—487.

THE refractive indices of acids containing from 1 to 99 per cent. of sulphuric acid were determined for the three hydrogen lines  $\alpha$ ,  $\beta$ , and  $\gamma$  and the sodium line, and the temperature coefficients in the neighbourhood of 15° C. measured. The results are tabulated in the paper. The refractive indices show a maximum corresponding approximately with the hydrate  $\text{H}_2\text{SO}_4 \cdot \text{H}_2\text{O}$ , but there are no clear indications of the existence of other hydrates. The refractive indices, the constants of Cauchy's dispersion formula, and the Lorentz factor, all show irregularities between 92 and 100 per cent., consistent among themselves, and with a maximum density about 97 per cent. and a minimum point between 99 and 100 per cent. On this ground the authors doubt the existence of the substance represented by the simple formula  $\text{H}_2\text{SO}_4$ .—J. T. D.

*Sulphuretted Hydrogen and Arsenic Pentoxide; Interaction of — in presence of Hydrochloric Acid.* F. L. Usher and M. W. Travers. Chem. Soc., Trans., 1905, 87, 1370—1373.

IN the purification of commercial hydrochloric acid by treatment with sulphuretted hydrogen, the arsenic present in the trivalent condition is immediately and completely precipitated, but that present in the quinquevalent condition separates slowly and is precipitated sometimes as arsenic pentasulphide, sometimes as the trisulphide mixed with sulphur. Experiments at 15° C. with hydrochloric acid of different strengths, but containing in every case 0.3664 per cent. of arsenic pentoxide gave the following results:—

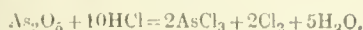
Hydrogen Chloride. Per cent.	Composition of Precipitate.
1.8 .....	$\text{As}_2\text{S}_5$ , 91 per cent.
7.9 .....	$\text{As}_2\text{S}_5$ pure.
10.76 .....	$\text{As}_2\text{S}_5$ pure.
14.34 .....	$\text{As}_2\text{S}_5$ pure.
23.10 .....	$\text{As}_2\text{S}_5$ , 58 per cent.
32.27 .....	$\text{As}_2\text{S}_3$ pure.

It was found that the effect of the presence of hydrochloric acid in the reaction between arsenic acid and sulphuretted hydrogen is due to its influence on the arsenic acid. The rate of reduction of a solution containing 0.684 per cent. of arsenic pentoxide by a solution of sulphur dioxide in presence of varying concentrations of hydrochloric acid is shown in the following table:—

Sulphur Dioxide.	Hydrogen Chloride.	Result.
Per cent.	Per cent.	
3.272	4.9	Complete reduction in 45 secs.
3.272	20.3	28.3% reduced in 45 secs.
3.272	32.0	Complete reduction in 45 secs.

IN the reaction between arsenic acid and either sulphuretted hydrogen or sulphur dioxide in presence of con-

centrated hydrochloric acid, the first change is probably that expressed by the equation:—



further instantaneous reactions then taking place involving the formation of arsenic trisulphide and sulphur from the sulphuretted hydrogen. As the concentration of the hydrochloric acid increases, the condition of equilibrium expressed by the equation is rapidly displaced to the right. —A. S.

*Vanadium Compounds; Some — [and the Detection of Hydrochloric Acid].* C. Matignon. Chem.-Zeit., 1905, 29, 986—987.

IN the decomposition of ammonium metavanadate ( $\text{NH}_4\text{VO}_3$ ) by heat, any reduction of the resulting vanadic anhydride may be avoided by proper working. The pure salt should be roasted in an oxidising muffle with slowly-rising temperature, and care exercised to prevent melting until the decomposition of the ammonium salt is complete. A platinum dish must be employed, since silicates are attacked and iron causes reduction. In the above decomposition an intermediate product may be isolated. By slow heating of a thin layer, the colour is seen to pass through yellow, brown, ruby-red, and a metallic steel-blue, and finally to become brick-red. The metallic-looking body proved on analysis to have the formula  $5\text{V}_2\text{O}_5 \cdot 2\text{VO}_3 \cdot \text{NH}_3$ .

A paper soaked in ammonium metavanadate solution is coloured yellow immediately by a trace of hydrochloric acid, an acid vanadate being formed. This test may be used for the detection of hydrochloric acid.—F. SDN.

*Carbon Dioxide; Disintegration of Iridium in —, and Dissociation of the Gas.* F. Emich. Monatsh. f. Chemie, 1905, 26, 1011—1020.

THE author has attempted to utilise the disintegration of iridium by oxygen at high temperatures (see this J., 1902, 1332; 1903, 633) for the purpose of determining the degree of dissociation of carbon dioxide at high temperatures. Thin strips of iridium were heated by an electric current to temperatures measured by a Holborn and Kurlbaum optical pyrometer, in a current of carbon dioxide, comparative experiments being made in mixtures of nitrogen with oxygen, the proportion of oxygen being varied till the loss of weight of the iridium during a given time in the carbon dioxide was the same as that in the mixture, or lay between those in two neighbouring mixtures. The proportion of free oxygen in the carbon dioxide was then assumed to be the same as that in the mixture of equal disintegrating power, and the percentage dissociation calculated from that. Check experiments showed that the disintegration caused by nitrogen or carbon monoxide was negligible. The results as yet obtained are as follows, the corresponding figures calculated by Le Chatelier in 1888 and by Trevor and Kortwright in 1894 being given for comparison:—

Temperature °C.	Percentage dissociation.		
	Emich.	Le Chatelier.	T. & K.
1500	about 0.1	0.8	1
1970	4.5	4.0	8
2150	10—11	9.0	14

—J. T. D.

*Phosphoric Acid; Determination of — as Ammonium Phosphomolybdate.* G. P. Baxter and R. C. Griffin. XXIII., page 1086.

*Nitrates of Potassium, Sodium and Lithium; Electrolysis of — in the Fused Condition.* A. Bogorodski. XI.A., page 1071.

## ENGLISH PATENTS.

*Aluminium Hydrote and Potassium Salts; Treatment of Leucite and Similar Aluminous Silicates for the Production of —.* H. H. Lake, London. From Soc. Romana Solfati, Rome. Eng. Pat. 17,985, Aug. 18, 1904.

SEE Fr. Pat. 352,275 of 1905; this J., 1905, 926.—T. F. B.

*Aluminous Compounds; Manufacture of —.* H. Spence and P. Spence and Sons, Ltd., Manchester. Eng. Pat. 23,036, Oct. 26, 1904.

BAUXITE or the like is dissolved in sulphuric acid, and the solution, which should preferably have the sp. gr. 1.25 or 1.3 at 80° C. is treated with a suitable quantity of a soluble potassium salt (about 2 mols. of potassium sulphate for each molecule of ferric oxide present in solution), and heated to a temperature not exceeding 80° C. The solution is then continuously agitated at this temperature, with, if necessary, an occasional addition of a cream of lime or calcium carbonate to keep it neutral, until a test shows that the desired purification has been attained. The precipitated iron and other insoluble compounds are then removed, and the purified solution treated according to known methods for the manufacture of aluminium sulphate or other aluminium compounds.—A. S.

*Lead Acetate; Process for the Production of —.* Gebr. Heyl und Co., and A. Wultze, Charlottenburg, Germany. Eng. Pat. 8662, April 22, 1905. Under Int. Conv., June 11, 1904.

SEE Fr. Pat. 352,050 of 1905; this J., 1905, 892.—T. F. B.

*Oxygen Gas; Treatment of Alkali Peroxides for use in the Obtaining of —.* J. Y. Johnson, London. From H. Foersterling and H. Philipp, Perth Amboy, U.S.A. Eng. Pat. 3820, Feb. 23, 1905.

SEE U.S. Pat. 788,256 of 1905; this J., 1905, 546.—T. F. B.

*Sulphur [from Spent Oxide, &c.]; Extraction and Purification of —.* A. V. Cornillaux, Deville, France. Eng. Pat. 7616, April 10, 1905.

THE spent material, which has been used for the removal of sulphur from coal gas, is treated with carbon bisulphide, which extracts the sulphur along with some tarry matters, and the resultant solution is then passed through a bed of acidulated coke or coke dust, which absorbs the tarry matters. On evaporation of the bisulphide solution, the sulphur obtained is yellow and of saleable quality. Preferably coke, the hydrocarbons of which are not exhausted (such as that coming from metallurgical workshops) is employed, and it may either be acidulated with 2–10 per cent. of concentrated sulphuric acid, or not acidulated.—H. B.

## UNITED STATES PATENTS.

*Sulphuric Acid; Process of Making —.* R. Knietisch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 800,218, Sept. 26, 1905.

SEE Eng. Pat. 1904 of 1901; this J., 1902, 116.—T. F. B.

*Insulating Material. [Utilisation of Waste Product of Solvay Soda-ash Process.]* D. W. Sharkey. U.S. Pat. 799,678, Sept. 19, 1905. *XLA.*, page 1072.

*Alkali and Alkaline-Earth Metal Hydrides; Process of Producing —.* F. J. Machalske, Brooklyn, N.Y., Assignor to F. Darlington, Great Barrington, Mass. U.S. Pat. 800,380, Sept. 26, 1905.

A COMPOUND of an alkali, or of an alkaline-earth metal, is electrically heated to a high temperature, and is then acted upon by a saturated hydrocarbon, such as methane (marsh gas) for instance, to produce the hydride. (Compare U.S. Pats. 742,340 and 745,637 of 1903; this J., 1903, 1298, and 1904, 24.)—E. S.

*Sulphur; Process of and Apparatus for Mining —.* H. Frasch, New York. U.S. Pats. 799,642 and 800,127, Sept. 19, 1905.

THE invention relates to a process of mining sulphur from porous rock, and consists essentially in melting the sulphur in the deposit and forcing it up to the surface of the ground by pressure. Water is heated to a temperature above that at which molten sulphur begins to darken, by bringing it in contact with high-pressure steam, and is then, together with the water of condensation, forced by steam pressure through two concentric pipes into the deposit. The outer pipe opens near the upper part of the mine cavity, whilst the inner one is closed at the bottom, but has a discharge outlet, a little above its closed end, opening near the lower part of the mine cavity. The hot water melts the sulphur and passes away through the porous rock, means being provided to prevent its return to the surface of the ground. The molten sulphur separates by gravity from the water, and is forced, by the steam pressure, up through an inner pipe which passes down through the closed end of the smaller hot-water pipe, and is provided at its lower end with a strainer. The hot water entering the mine cavity is kept under a steam pressure less than that of a column of molten sulphur, equal to the depth of the deposit below the level of the ground, but compressed air or the like is forced through a pipe, provided at its discharge end with a perforated piece of a metal not corroded by molten sulphur, into the column of molten sulphur, whereby the density of the latter is reduced to near or below that of water, and the molten sulphur is then readily forced up to the surface of the ground by the available pressure in the mine cavity.—A. S.

## FRENCH PATENTS.

*Sulphuric Acid; Manufacture of —, with Production of Cupric Sulphate and Recovery of Nitrous Products as Nitric Acid.* L. J. Ménard-Decz. Fr. Pat. 354,073, April 21, 1905.

THE pyrites kiln, of cupola form, and increasing in diameter downwards, is fed from the top with pyrites in lumps ("pyrite en roche"). The dust-collecting chambers are, relatively, of constricted size, and after passing through them, the gases enter a packed tower in which they are washed by a stream of sulphuric acid and cooled to a temperature not exceeding 500° C. Between the dust chambers and the washing tower, or after the latter, the products of the decomposition of sodium nitrate are introduced. From the washing tower, the gases are led to a second packed tower designed to effect the concentration of dilute sulphuric acid by the passage of the hot gases; the acid flows from one obstruction to another in a thin stream, and is received in a closed vessel, from which the vapours which continue to be emitted, are withdrawn. The gases, now charged with sulphuric acid and water vapours, are led through a series of cylinders, packed with copper turnings, or with an oxide copper ore, and the cupric sulphate solution formed is collected for crystallisation. From these cylinders the gases pass to any ordinary system of lead chambers. The residual nitrous gases, instead of being led through a Gay-Lussac tower, for absorption by sulphuric acid, are treated in packed cylinders, such as those used in prior stages of the process, with air and water, for direct recovery of nitric acid.—E. S.

*Hydrocyanic Acid; Manufacture of —.* H. C. Woltereck. Fr. Pat. 354,081, May 5, 1905.

A GAS-GENERATOR filled with wood charcoal, is lit at the grate, below which air is continuously admitted; as the heat increases, ammonia gas is introduced in a zone sufficiently hot to reduce (in presence of carbon) carbon dioxide to the monoxide, and to decompose the water formed by the reaction ( $\text{NH}_3 + \text{CO} = \text{HCN} + \text{H}_2\text{O}$ ), since in the presence of carbon dioxide or of water vapour, other nitrogenous compounds than the hydrocyanic acid desired, are liable to be formed. The hydrocyanic acid produced may be absorbed by, for instance, a caustic alkaline solution (See also Eng. Pat. 19,804, of Sept. 10, 1902; this J. 1903, 1129.)—E. S.



*Sulphur and Cyanides from Spent Oxide, &c.; Process and Apparatus for the Extraction of* — J. J. M. Bécigneul. First Addition, dated April 26, 1905, to Fr. Pat. 345,071, July 23, 1904. (See this J., 1904, 1216.)

INSTEAD of the toluene specified in the principal patent, a mixture of toluene and carbon tetrachloride, which is practically non-inflammable, is employed for the extraction of the sulphur. The hot solvent, at about 105° C., is admitted into the vessel containing the spent oxide, from below, through the false bottom; and the solvent, containing the sulphur and tarry matter, is treated with carbon (coke, charcoal, carbonised tar, &c.) in a jacketed tank provided with an agitator, until all the tarry matter has been absorbed. The hot, filtered solvent is then passed through inclined pipes enclosed in a cooling tank, the precipitated sulphur being retained by a filter, through which the solvent passes on its way to the receiver. The upper parts of all the vessels in the apparatus are connected by means of pipes, to equalise the pressure throughout.

—H. B.

*Sulphur; Process for Extracting and Purifying the — contained in Materials which have been used for Purifying Illuminating Gas.* A. V. Cornillaux. Fr. Pat. 353,932, March 25, 1905.

SEE Eng. Pat. 7616 of 1905; preceding these.—T. F. B.

*Sulphur; Sublimation of* — E. L. Lalbin. Fr. Pat. 353,830, May 1, 1905.

THE invention consists in subliming free sulphur from sulphuretted ores or earths in a furnace or chamber by means of products of combustion furnishing a neutral, or slightly reducing flame. The ore is delivered into the top of a vertical tower or furnace, into the sides of which tuyères pass, conveying fire-gases from a neighbouring gas-producer or furnace, and air, in proportions to give the conditions necessary for heating the ores and subliming the sulphur. Powdered ores are treated in a slowly revolving horizontal chamber, under similar conditions adapted to the case. If required, combustibles, such as oil or the like, may be added to the ores, the air admitted being suitably adjusted for burning the same. (Compare Fr. Pat. 333,094 of 1903; and First Addition thereto; this J., 1903, 1292, and 1901, 62.)—E. S.

*Ammonium Salts and other Bodies; Process and Apparatus for Obtaining* — [from Pressed Olives]. W. Guerrero de Smirnof. Fr. Pat. 353,970, May 4, 1905. Jll., page 1058.

*Chlorine and Citrate-soluble [Calcium] Phosphate; Simultaneous [Electrical] Production of* — A. Clemm. Fr. Pat. 354,109, May 8, 1905.

A SOLUTION of bone or other like phosphate in hydrochloric acid is concentrated until a deposit begins to form, and is then electrolysed, to obtain chlorine at the anode, and at the cathode, a calcium phosphate readily soluble in dilute citric acid. Or, a solution of acid calcium phosphate is mixed with a solution of calcium or magnesium chloride, and subjected to electrolysis as described, to obtain the same products.—E. S.

*Hydrosulphites; Production of Anhydrous and Perfectly Stable* — Badische Anilin und Soda Fabrik. Fr. Pat. 354,273, May 13, 1905. Under Int. Conv., April 1, 1905.

SEE Eng. Pat. 8816 of 1905; this J., 1905, 673.—T. F. B.

## VIII.—GLASS, POTTERY, AND ENAMELS.

*Glass; Physical Properties of — in Relation to Chemical Composition.* E. Zschimmer. Z. Elektrochem., 1905, 11, 629—638.

IS a review of the successful production of new glasses for various technical purposes by Schott, the author gives the results of the hitherto unpublished researches of Schott and Abbe into the connection between the

refractivity of a glass and its chemical composition. By treating certain series of glasses as solutions of metallic oxides in vitreous silica, boron trioxide, and alkali silicate, curves are obtained which show (1) that the addition of metallic oxides to these solvents raises the refractivity, roughly in the order of the molecular weights of the oxides; (2) that the optical effect of lithium oxide upon boron trioxide, sodium oxide upon silica, and zinc oxide upon boron trioxide or alkali silicate decreases relatively with increasing concentration; and (3) that the effect of heavy oxides, such as baryta and lead oxide, increases relatively as the concentration increases. The optical effect of boron trioxide upon vitreous potassium silicate reaches a maximum at about 15 per cent., then decreases, and eventually proceeds in a negative direction.

Attention is drawn to the recent researches towards producing glasses having selective transparencies towards certain parts of the spectrum. The author's own U V glass, which transmits ultraviolet rays relatively very well, and is useful for stellar photography and for applications of the mercury vapour lamp, is now being improved upon in the direction of selective transmission of definite lines of the mercury spectrum by special glasses.

—W. A. C.

## UNITED STATES PATENT.

*Glass; Process and Apparatus for the Manufacture of Sheet* — E. Rowatt, Anveclais, and L. Franço, Obourg, Belgium. U.S. Pat. 800,402, Sept. 26, 1905.

SEE Eng. Pat. 9033 of 1904; this J., 1901, 660.—T. F. B.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

### ENGLISH PATENTS.

*Wood; Treatment of — for Rendering it Fireproof.* W. H. Perkin, jun., and Whipp Bros. and Todd, Ltd., Manchester. Eng. Pat. 22,169, Oct. 11, 1904.

THE process consists in treating wood so as to cause, within its pores, interaction between a salt, especially sodium stannate, containing in its acid radical the oxide of a metal and a salt not containing such metallic oxide in its acid radical, or an ammonium salt, with or without addition of ammonia or an organic acid. For example, the wood is treated in a closed vessel for six hours under a pressure of 500 lb. per sq. in. with a solution of sodium stannate of 32° B., or a mixture of 2 parts of sodium stannate solution of 11° B. and 3 parts of sodium tungstate solution of 32° B., or with a solution of sodium arseniate of 18° B. After draining, the wood is dried by hot air, and may then be further treated under pressure with a solution of ammonium sulphate of 11° B., or a solution of zinc acetate or sulphate of 17° B., or with a mixture of 1 part of the zinc solution and 1 part of tartar emetic solution of 6° B. The wood is now again allowed to drain, and is then dried, after which it may be used, or it may be washed with water and again dried before being used.—A. S.

*Stone; The Colouring of [and Producing Grain in]* — H. H. Lake, London. From Chem.-Technische Fabrik, Dr. A. R. W. Brand und Co., G.m.b.H., Charlottenburg, Germany. Eng. Pat. 23,292, Oct. 28, 1904.

SEE Fr. Pat. 351,591 of 1905; this J., 1905, 892.—T. F. B.

*Gypsum Mortar; Method of Improving — and Utilizing Dead Burnt Gypsum.* C. Heintzel, Lüneburg, and E. Cramer, Berlin. Eng. Pat. 2343, Feb. 6, 1905. Under Int. Conv., March 21, 1904.

SEE Fr. Pat. 349,260 of 1904; this J., 1905, 674.—T. F. B.

## UNITED STATES PATENT.

*Furnace; Clay-Treating* — D. B. Williams, Assignor to J. R. Stauffer, both of Scottsdale, Pa. U.S. Pat. 799,127, Sept. 12, 1905.

THE furnace comprises an upright covered furnace casing

provided with a fixed interior chamber of lesser height and width. This interior charge-chamber is open at the top and is provided with a side test-opening at the bottom and with bracing webs in the space between it and the furnace walls. Supporting arches adjoin the bottom of the charge-chamber, being spaced apart to provide intervening fuel-spaces in communication with the fuel-space at the sides of the charge-chamber. The furnace casing is provided with a blast-connection at its bottom.—A. G. L.

## X.—METALLURGY.

*Steels; Thermal Transformations of Carbon* ——. J. O. Arnold and A. McWilliam. Iron and Steel Institute, Sept. 1905. [Advance Proof.]

The general summary of the authors' results is as follows:—*Unsaturated Steel* (0.21 per cent. of carbon). 1. On cooling from 950° C., the hardenite and ferrite remain in mutual solution as a homogeneous mass till  $A_{r_2}$  is reached (about 810° C.), when segregation of the two constituents begins. This segregation, if the cooling be slow, is probably completed in the  $\beta$  range of temperature; so that in both the  $\alpha$  and  $\beta$  ranges of temperature hardenite is insoluble in ferrite. The hardenite remains as such from the end of  $A_{r_2}$ , about 720° C., to the beginning of  $A_{r_1}$ , about 680° C., below which temperature it begins to decompose into pearlite. 2. On heating from a low temperature, pearlite at  $A_{c_1}$ , about 710° C., begins to change into hardenite (so that the B carbide of pearlite is soluble in ferrite in the  $\alpha$  range). At 720° C., when  $A_{c_1}$  merges into  $A_{c_2}$ , the change to hardenite is far advanced, and the hardenite occupies the space formerly occupied by the pearlite, up to  $A_{c_3}$  (about 810° C.) when the hardenite and ferrite begin mutually to dissolve, and ultimately form a homogeneous substance. *Saturated Steel* (0.89 per cent. of carbon). 1. On cooling, much heat is evolved at the single point  $A_{r_{1,2,3}}$  (690°–660° C.), marking the transformation of hardenite into pearlite. According as the cooling from 660° C. to the ordinary temperature is very rapid, ordinary, or very slow, the pearlite contains the carbide in a very finely divided or "emulsified" state, is normal, or laminated. "Emulsified" pearlite may also be obtained by tempering hardenite. Osmond has called it "sorbite," but the authors claim that it is simply pearlite. 2. On heating, an absorption of heat occurs at  $A_{c_{1,2,3}}$  (710°–730° C.), when the pearlite changes into hardenite. *Supersaturated Steel* (1.78 per cent. of carbon). On cooling, cementite begins to separate out at about 900° C., with slight evolution of heat, and is completely segregated long before the point  $A_{r_{1,2,3}}$  is reached. On heating, the pearlite changes to hardenite at  $A_{c_{1,2,3}}$ , the cementite gradually segregates into larger masses, and above 900° C. the cementite and hardenite mutually dissolve to a homogeneous substance. The transformations of cementite and hardenite seem to have no connection with any of the three critical points, but to be influenced only by temperature. *Pure Iron*.—Test-pieces of pure iron were heated in nitrogen to 990° C., and then quenched from various temperatures in iced brine. The ductility was found to be practically unaltered, whatever the quenching temperature. The tenacity is unaltered up to a quenching temperature of 500° C., and between that temperature and 900° C., it is proportional to the excess of temperature above 500° C. The transformations at  $A_{r_3}$  and  $A_{r_2}$  seem to be absolutely without influence on the mechanical properties of the iron.

The authors consider that the carbide  $Fe_3C$  of pearlite is not identical with the carbide of the same composition contained in cementite, and propose to distinguish them as the B and A carbides respectively. Their reasons for this are, first, that the B carbide dissolves in iron in the  $\alpha$  range of temperature, while the A carbide does not, but dissolves only in the  $\beta$  range; second, that the A carbide is strongly electronegative to the B carbide.

The question of the transformation of cementite into ferrite and amorphous graphite is also touched on, the authors putting forward tentatively the view that in the

slow cooling of a supersaturated steel from 1100° C., the dissolved cementite separates completely at 900° C., and then gradually segregates into nodules. After the  $A_{r_{1,2,3}}$  change, the pearlite separates and becomes laminated, then the carbide of the cementite attracts to it the carbide of the pearlite, over a certain range, leaving the ferrite of the pearlite. Below a red heat the joint carbides dissociate into graphite and ferrite, the graphite occupying the space formerly filled by the carbide masses, and the ferrite adding itself to that arising from the decomposition of the pearlite.

The work is illustrated by many photomicrographs, and includes an appendix defining the terms used, and describing the various constituents of iron-carbon alloys.

—J. T. D.

*Steel; Elastic Properties of* ——, *at High Temperatures*. B. Hopkinson and F. Rogers. Proc. Roy. Soc., 1905, 76. A, 419–245.

A SMALL test-piece was heated in an electric furnace to temperatures ranging up to 800° C., in a non-oxidising atmosphere, and stresses far below the elastic limit were applied for periods of a minute, with intervals of rest of two minutes between each two successive applications of the stress. The curves of stress show that after the instantaneous elongation, the metal is overstrained and continues slowly to elongate, while on removing the stress the instantaneous contraction is followed by a slow additional contraction or recovery, though some permanent strain remains. The amount of permanent set produced by each loading is less than that produced by the preceding loading, showing that the metal hardens under the process. With iron, the same phenomena were observed as with steel containing 0.5 per cent. of carbon, but the metal flowed at a lower stress; and with both bars the effect at 600° C. was much less than at 750° C., the permanent extension being practically zero. The slow creep in the steel bar at 600° C. amounted to about 15 per cent. of the total deformation.

When the period of application of the stress was much diminished, the observed strain approached a limit; and taking Young's modulus as the quotient of the stress by this limiting instantaneous strain, the authors find that approximately, within the limits of experimental error, the value of Young's modulus for both iron and steel is about 0.6 at 600° C., and about 0.5 at 750° C., the value in the cold being taken as unity.—J. T. D.

*Iron; Influence of Nickel and Carbon on* ——. G. B. Waterhouse. Iron and Steel Inst., Sept., 1905. [Advance Proof.]

THE author's experiments were made with a series of nine ingots of nickel steel containing a practically constant amount (about 3.5 per cent.) of nickel, with percentages of carbon varying from 0.40 to about 1.60 per cent. The ingots were prepared from puddled bar iron ("muck bar"), wood charcoal and pure electrolytically-deposited nickel. The ingots were analysed, tested mechanically after various heat treatments, and examined micrographically. The heating and cooling curves were also determined. *Heat Treatment*. A.—Test-bars, 12 in. long, were heated to 1000° C. in a gas-fired muffle-furnace in the course of 1 hour and 25 minutes, and kept at this temperature for 25 minutes, after which they were cooled in air, the object being to re-crystallise the steels, and to remove any distortion or strain produced during rolling. B.—The bars were placed in an annealing furnace at 500° C., and heated to 870°–880° C. in the course of 5½ hours. After a further three hours at this temperature, they were allowed to cool slowly in a pit, the wrought iron tube containing them being covered with ashes. The results shew that nickel causes a distinct increase in the tenacity of the steel, without materially lowering the ductility. The elastic ratio or the ratio of the elastic limit to the ultimate strength is only slightly greater in pure nickel steels than in carbon steels. The high elastic ratio of commercial nickel steels is probably due to the large amount of manganese present. On annealing nickel steels, the tenacity is markedly reduced, whilst the ductility is not greatly increased. Steels with low percentages of



nickel contain, in the unquenched state, ferrite, pearlite, cementite, and graphitic carbon; the pearlite readily segregates into ferrite and cementite, the latter having the composition  $\text{Fe}(\text{Ni})_3\text{C}$ . The eutectoid ratio in the steels examined appears to lie at about 0.7 per cent. of carbon, but in the rolled steels, no free cementite appeared until the amount of carbon reached about 1.0 per cent. The transformation points  $\text{Ar}_{3.2}$  and  $\text{Ar}_1$  were lowered about  $20^\circ \text{C}$ . for every 1 per cent. of nickel. It was observed that the cementite showed considerable tendency to separate as "temper graphite." A bibliography is appended to the paper.—A. S.

*Steel; Overheated*. — A. W. Richards and J. E. Stead. Iron and Steel Inst., Sept. 1905. [Advance Proof.]

AFTER reviewing the opinions of those who have specially studied the question, the authors give the following definitions to prevent the confusion which appears to have arisen from confounding "burnt" with "overheated" steel. Overheating is heating at any point below that which produces incipient disintegration and results in the formation of large crystals.

Burning is heating at or above the point at which

especially in places where the martensite is in contact with ferrite or cementite. In distinguishing between troostite and sorbite, the author states that troostite is found when the martensite or austenite has already begun to undergo transformation which ultimately results in pearlite, whilst sorbite occurs when the martensite has not been completely resolved into pearlite. In other words troostite is the first, sorbite the last stage of transformation between martensite and pearlite. For example, if the bulk of a section of the metal is composed of martensite (+austenite), but certain parts become dark on etching, these are called troostite; if the bulk is composed of pearlite, the parts which become dark on etching are called sorbite.—A. S.

*Irons; Note on the Occurrence of Copper, Cobalt, and Nickel in American Pig*. — E. D. Campbell. Iron and Steel Inst., Sept., 1905. [Advance Proof.]

THE author determined the copper, cobalt, and nickel in a number of samples of pig iron procured from charcoal or coke blast-furnaces in various parts of North America, especially in the United States. The results are shown in the following table:—

No.	Kind of ore.	Source of ore.	Fuel used.	Copper.	Cobalt.	Nickel.
				Per cent.	Per cent.	Per cent.
1	Mixed limonite, carbonate and hematite	Nova Scotia	Coke	0.011	0.012	0.015
2	Local hematites	Mexico	Charcoal	0.012	0.009	0.006
3	† Mesabi; † Vermilion Range	Minnesota	Coke	nil	nil	nil
4	Gogebic hematite	Wisconsin	Charcoal	nil	nil	nil
5	Magnetic concentrates	New York	Charcoal	0.039	trace	trace
6	Salisbury brown hematite	Connecticut	Charcoal	0.018	0.029	trace
7	† Local hematite; † magnetite	Virginia	Coke	0.169	trace	0.009
8	Local brown hematite	Alabama	Charcoal	0.038	0.048	0.072
9	Native hematite and magnetite	Colorado	Coke	0.039	nil	nil

such disintegration occurs; burnt steel is nearly always coarsely crystalline. The authors believe that burnt steel cannot be completely restored by reheating, but after making a large series of experiments, the details of which are fully recorded, they conclude that overheating reduces the power of the steel to resist fatigue; that reheating such steel more than restores the original good qualities of the rolled bars; and that when the steel has its carbon in the sorbitic condition, its power of endurance is more than doubled. In giving certain "hypothetical conclusions," the authors remark that it would be an ideal condition if free ferrite were absent from carburised steels which are to be subjected to severe vibratory stresses. They also desire to emphasize the fact that they do not maintain that steel, initially bad, brittle, and dangerous, can be made good by any kind of heat treatment (short of fusion).—J. H. C.

*Steel used for Motor-Car Construction in France*. L. Guillet. Iron and Steel Inst., Sept., 1905 [Advance Proof.]

THE chief steels used are:—Ternary: nickel steels, chrome steels, silicon steels (so-called silico-manganese steels), and tungsten-steels. Quaternary:—chrome-nickel steels, and other steels of unknown composition.

The composition, characters and uses of many varieties of these steels are described and discussed.

—J. H. C.

*Troostite; Nature of*. — C. Benedicks. Iron and Steel Inst., Sept., 1905. [Advance Proof.]

THE author discusses the nature of troostite, more especially with a view to refute the recent conclusions of Boynton (this J. 1904, 608) and Kourbatoff (1904, 1149; 1905, 621). He concludes that Osmond's conception of troostite as an intermediate form between martensite and pearlite is correct. There is a continuous transition between troostite and pearlite, and the former must be regarded as a pearlite with ultra-microscopically small particles of cementite (containing also more or less hardening carbon). It is probable that troostite is formed by a transformation *in situ* of martensite; it is produced by suitable lessening of the intensity of the hardening,

It is noteworthy that samples No. 6 and 8, which are the only ones containing any considerable amount of cobalt or nickel, are stated to have gained a reputation for their valuable properties for car-wheel castings.—A. S.

*Vanadium; Use of*. — in *Metallurgy*. L. Guillet. Iron and Steel Inst., Sept., 1905. [Advance Proof.]

THE preparation, characters, treatment and uses of ferro-vanadium, vanadium steels (normal, quenched and forged), nickel-vanadium steels, manganese-vanadium steels, chromium-vanadium steels, silicon-vanadium steels and tungsten-vanadium steels; as also of copper-vanadium bronzes, alloys of aluminium and vanadium, and certain other vanadium alloys are described and discussed, and the author reaches the following conclusions:—

1. On normal steels vanadium produces a very distinct increase in the tensile strength and elastic limit, and has no influence, or an insignificant one only, on elongation and contraction and upon resistance to shock. It slightly increases the hardness.

2. On quenched steels, vanadium considerably increases the tensile strength and elastic limit; it acts in this way with almost as great an effect as carbon, yet, notwithstanding this, it does not increase the brittleness.—J. H. C.

#### ENGLISH PATENTS.

*Copper or Copper Matte; Process for Producing*. — R. Baggaley, Pittsburg, and C. M. Allen, Lo Lo., Mont. Eng. Pat. 3185, Feb. 15, 1905. Under Int. Conv., March 17, 1904.

SEE U.S. Pat. 789,648 of 1905; this J., 1905, 624.—T. F. B.

*Furnace; Roasting*. — F. Klepetko, Great Falls, U.S.A. Eng. Pat. 8808, April 26, 1905. Under Int. Conv., Sept. 6, 1904.

SEE U.S. Pat. 779,717 of 1905; this J., 1905, 124.—T. F. B.

*Blast Furnaces and the like; Starting or Blowing in of*. — J. W. Dougherty, Steelton, U.S.A. Eng. Pat. 9774, May 9, 1905.

SEE U.S. Pat. 789,844 of 1905; this J., 1905, 667.—T. F. B.

*Gases, Dust-laden Air and the like; Method of and [Centrifugal] Apparatus for Purifying Blast-Furnace —, and for Dissolving Gases and other Matter in Liquids.* E. Barthelmess. Eng. Pat. 12,533, June 16, 1905. 1., page 1055.

*Nickel; Apparatus for Obtaining — from Nickel Carbonyl.* C. Langer, Ynyspenllwch, Glamorgan, S. Wales. Eng. Pat. 13,350, June 28, 1905.

THE vessels containing the nickel carbonyl (see Eng. Pat. 1106 of 1898; this J., 1899, 49) are heated by a number of gas flames, each of which is situated in a chamber formed by ribs on the vessel and the outer casing; the liberated gases pass away by an escape pipe, which is surrounded by an annular cooling chamber.—J. H. C.

*Silver Alloys; Impts. in —.* A. E. Hobson, New Haven, Conn., U.S.A. Eng. Pat. 13,613, July 3, 1905.

THE alloy is composed of silver and manganese with or without small proportions of copper or zinc, the silver being not less than 925/1000ths of the whole.—J. H. C.

#### UNITED STATES PATENTS

*Iron Sponge; Producing Wrought —.* D. Reynolds, Albany, N.Y. U.S. Pat. 799,189, Sept. 12, 1905.

GRANULATED oxide of iron, mixed with carbonaceous material in sufficient quantity is placed within a suitable movable furnace, the inner walls of which have been previously sufficiently heated to deoxidise and carburise the iron. The furnace is then closed and the mixture is agitated until the required sponge is produced.—J. H. C.

*Gold; Process of Extracting — from its Ores.* F. W. Dupré, Leopoldsdorf, Germany. U.S. Pat. 799,548, Sept. 12, 1905.

SEE Ger. Pat. 160,738 of 1904; this J., 1905, 894.—T. F. B.

*Ores; Treatment of Sulphide and Complex —.* C. H. Ward, Sydney, N.S.W. U.S. Pat. 799,696, Sept. 19, 1905.

CRUSHED sulphide ores are roasted, with access of air and water, by passing them through a current of gases, heated to a temperature sufficient to cause the decomposition of the sulphides, and moving in a direction opposite to the movement of the ore. The ore is then mixed with a substance containing chlorine, such as sodium chloride, and subjected to the action of the hot gases produced in the first stage of the process. In this latter stage of the process the ore and hot gases are caused to move together in the same direction, and the temperature is reduced by the introduction of a cooling medium, such as air or water.—A. S.

*Zinc Ores; Process of Treating —.* P. A. Mackay, Wenona, Ill. U.S. Pat. 799,743, Sept. 19, 1905.

SULPHIDE ores containing cadmium and zinc are subjected to a "dead" roast, whereby the zinc is converted into oxide and the cadmium into sulphate. The product is treated with water to remove the cadmium sulphate, and is then ground and distilled to recover the zinc.—A. S.

*Nickel; Process of Separating — from Mattes.* R. H. Aiken, Winthrop Harbour, Ill. U.S. Pat. 800,130, Sept. 26, 1905.

NICKEL-COPPER sulphide mattes are heated in a converter to a temperature between 800° and 1700° C., treated with a suitable quantity of a highly-heated flux, containing at least 70 per cent. of silica, and the mixture subjected to an oxidising blast. The amount of flux added at first is only sufficient to slag the iron; after removing the iron silicate slag, a further quantity of flux is added, and the mixture again "blown." The nickel silicate slag produced is removed before the blast has acted appreciably on the copper.—A. S.

*Furnace; Roasting —.* F. Klepetko, New York. U.S. Pat. 799,063, Sept. 12, 1905.

THE furnace consists of a hollow rabble-shaft divided

into a series of contiguous compartments having structural members radiating from the shaft and forming portions of the division walls between the compartments, with suitable complementary formations located within the shaft for completing said division walls. Hollow arms are provided, passing over said members and forming conduits therewith, these arms establishing communication between two consecutive compartments through the conduits.—J. H. C.

*Furnace; Roasting —.* A. R. Meyer, Assignor to The United Zinc and Chemical Co., both of Kansas City, Mo. U.S. Pat. 800,588, Sept. 26, 1905.

THE furnace has side and end walls of masonry, with external buttresses at opposite sides, connected by cross-beams. A number of arches, one above the other, extend from end to end of the furnace, and a series of hearths are formed above each arch. Below the hearth-arches are other arches, each of which forms with the hearth-arch above a heating flue; these flues are connected in series. The furnace is also provided with a number of shafts carrying rabblers which pass over the different hearths.—A. S.

*Furnace; Metallurgical —.* P. A. Mackay, Newcastle, N.S.W. U.S. Pat. 799,745, Sept. 19, 1905.

THE plant claimed has parallel passages or chambers extending longitudinally along its middle and regenerative furnaces extending longitudinally along its sides, with passage ways between the furnaces and chambers. Between the chambers are hollow partitions forming reduction chambers, which communicate by passage-ways with oxidising chambers extending longitudinally over the regenerative furnaces. Each reduction chamber has an opening in its top for the introduction of the material to be treated, and a trap-door in its bottom, through which the treated product is conveyed to a passage-way below.—A. S.

*Furnace; M. Leitch, Brooklyn, N.Y. Assignor to Sheet Metal Recovery Co., New Jersey. U.S. Pat. 800,222, Sept. 26, 1905.*

THE furnace is intended for the separation of materials melting at different temperatures. It consists of a chamber provided with a sealed inlet and with a discharge outlet dipping into a liquid seal. A centrifugal separating receptacle is mounted in the chamber on a central shaft, which also carries a feeding hopper projecting downwards into the separator and provided on its inner surface with a spiral groove forming, with a similar groove on the shaft, a conveyor by which the material fed into the receptacle is moved forwards to the discharge opening. A "deoxidised atmosphere" having a temperature sufficiently high to melt the more easily fusible constituent of the material under treatment is maintained in the chamber; the melted material is thrown off by the centrifugal force, whilst the unmelted portion is continuously discharged through the sealed outlet of the chamber.—A. S.

*Tin Scrap; Treating —.* M. Leitch, Brooklyn, N.Y. U.S. Pat. 800,223, Sept. 26, 1905.

THE process relates to the preliminary treatment of tin scrap from which the tin is subsequently recovered by a de-tinning bath. The scrap is heated, for example, in an apparatus such as that described in the preceding abstract, in a "deoxidised atmosphere" to a temperature insufficient to melt the tin, but sufficient to volatilise the volatile matter and carbonise the carbonaceous matter of the "filth" adhering to the scrap. The heated material is subjected to centrifugal force, and to mechanical blows to separate the carbonised matter.—A. S.

#### FRENCH PATENTS.

*Iron; Manufacture of —.* O. Thiel. Fr. Pat. 354,104, May 8, 1905.

SCORIA or other material containing oxide of iron is introduced into a bath of molten iron, in an apparatus in which the mass can be maintained in a fused condition.



The oxide of iron is reduced by means of carbon or substances rich in carbon, the reduced iron being drawn off from below.—J. H. C.

*Steel; Process for the Carburisation of* ——. P. E. Buret. Fr. Pat. 354,138, May 9, 1905.

CRUDE potassium tartrate, alone, or in combination with other substances, is employed to carburise the steel either in the mass or superficially.—J. H. C.

*Iron Minerals; Process of Treating Finely Divided* ——. D. Baker and W. W. Hearne. Fr. Pat. 353,811, April 29, 1905.

SEE U.S. Pat. 788,813 of 1905; this J., 1905, 624.—T. F. B.

*Zinc Ores; Treatment of* ——. E. Demenge. First Addition, dated April 22, 1905, to Fr. Pat. 348,733, Dec. 9, 1904 (this J., 1905, 549).

ACCORDING to the present Addition, the furnace described in the main patent is provided with several rows of tuyères, to ensure that the whole of the zinc is converted into oxide or carbonate.—A. S.

*Autoclave for Continuous Saponification and other Purposes [Application to the Treatment of Tin Ores]*. L. Rivière. Addition, dated April 28, 1905, to Fr. Pat. 352,182, March 8, 1905 (this J., 1905, 933).

SPECIAL claim is made for the use of autoclaves of this type in the continuous treatment of tin ores, and notably sands rich in tin and sometimes containing gold. The mineral is disintegrated by being made to circulate through the autoclave at varying pressures in contact with strong caustic soda lye, which brings the tin into solution and effects the separation of iron oxide and of gold when present. The sodium stannate is decomposed by treatment with an acid, and the resulting sodium salt reconverted into hydroxide by the action of lime in an autoclave. The oxide of tin is reduced by the usual methods.—C. A. M.

*Copper and its Alloys; Process for Extracting and Refining* — contained in Ashes, Sand, and Foundry or other Refuse. C. Casman. Fr. Pat. 353,784, April 28, 1905. Under Int. Conv., May 7, 1904.

SEE Eng. Pat. 11,073 of 1905; this J., 1905, 929.—T. F. B.

*Bronzes and other Alloys; Impts. in* — and in the Process of Manufacturing the same. A. Jacobsen. Fr. Pat. 353,999, May 5, 1905.

CLAIM is made for an alloy prepared by fusing together two atomic proportions each of copper and iron and one of aluminium, with 1, 2, 3 or 4 atomic proportions of nickel; the iron may be replaced by a ferro-manganese containing 80 per cent. of manganese. A bronze is obtained as described in Fr. Pat. 342,054 of 1904 (this J., 1904, 903) with the exception that a portion (from 1 to 15 per cent.) of the copper is replaced by ferro-manganese, a small portion of tin (1 to 3 per cent.) may be added to the bronze. Claim is also made for a bronze consisting of 40 per cent. of zinc, 59—50 per cent. of copper and 1—10 per cent. of the alloy of copper, iron (or ferro-manganese), aluminium and nickel described above, and also for a bronze of the same composition except for the substitution of ferro-manganese for a portion of the copper.—A. S.

*Soldering; Process for* — different Metals. M. Dünkelsbühler and H. Wachwitz. Fr. Pat. 354,163, May 10, 1905.

A PLATE composed of thin alternate layers of copper and aluminium is interposed between the bodies to be joined, and the process is completed under the combined action of heat and pressure in any convenient way.—J. H. C.

*Furnaces with Superimposed Hearths; Cooling Apparatus for* —. F. Klepetko. Fr. Pat. 353,787, April 28, 1905. Under Int. Conv., Sept. 6, 1904.

SEE U.S. Pat. 792,053 of 1905; this J., 1905, 737.—T. F. B.

*Crucibles or Receivers; Method of Making* — for Metallurgical Use. A. L. J. Queneau. Fr. Pat. 354,319, May 16, 1905. Under Int. Conv., May 21, 1901.

THE principal body of the crucibles or receivers is formed of a mixture of refractory clay and sand; linings of refractory clay mixed with a substance capable of resisting the chemical operations concerned are placed inside or outside this; in addition thin linings of clay alone are sometimes interposed or superposed, and the whole is firmly compressed before baking.—J. H. C.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

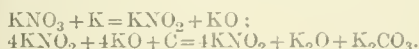
### (A.)—ELECTRO-CHEMISTRY.

*Nitrates of Potassium, Sodium and Lithium; Electrolysis of* — in the Fused Condition. A. Bogorodski. J. russ. phys.-chem. Ges., 1905, 37, 703—759. Chem. Centr., 1905, 2, 954—955.

THE fused nitrates of potassium, sodium and lithium were separately electrolysed at temperatures near their melting points in U-shaped tubes, and the gaseous decomposition products and the portions of the electrolyte surrounding the anode and cathode were analysed. A platinum anode was used with an aluminium or graphite cathode. The gases evolved at the anode consisted exclusively of oxygen and nitrogen peroxide, whilst the aqueous solutions of the electrolyte were found to contain the nitrite and oxide of the metal. During the electrolysis of potassium and sodium nitrates with currents of from 5 to 35 volts, the electrolyte became bright yellow to orange-red in the neighborhood of the cathode, with separation of yellow precipitates which redissolved in the surrounding liquid. These coloured precipitates are probably higher peroxides of the metals. Fused lithium nitrate on electrolysis remained colourless near the cathode, but became orange-coloured at the anode. With an E.M.F. of more than 6 volts, the separation of metallic lithium at the cathode was observed. Analysis of the gases evolved at the anode gave results corresponding to the equation:  $\text{KNO}_3 = \text{K} + \text{NO}_2 + \text{O}$ , but the ratio of alkali oxide to nitrite in the cathode-liquid varied according to the cathode employed, as is shown in the following table:—

	Graphite cathode.	Aluminium cathode.
$\text{K}_2\text{O} : \text{KNO}_2$ .....	1:2.0	1:1.0
$\text{Na}_2\text{O} : \text{NaNO}_2$ .....	1:1.6	1:0.8
$\text{Li}_2\text{O} : \text{LiNO}_2$ .....	1:1.0	1:1.0

The author considers that when graphite cathodes are used in the electrolysis of potassium nitrate, the potassium separated is oxidised by the electrolyte to KO, which latter then reacts with the carbon of the cathode, according to the equations:



With aluminium cathodes only the process represented by the first equation takes place. Under the same conditions, lithium appears to be oxidised only to the oxide  $\text{Li}_2\text{O}$ . When aluminium cathodes are employed in the electrolysis of sodium nitrate or potassium nitrate, it is probable that the metal separated is partially oxidised to higher peroxides. This view finds confirmation in the fact that if, after electrolysis, the melt be dissolved in water, oxygen is evolved.—A. S.

*Nernst Lamp; Inter-relation of Ballast and Glower in the* —. L. A. Terven. II., page 1056.

*Tantalum Lamp; Tests of the* —. W. Ambler. II., page 1056.

## ENGLISH PATENTS.

*Accumulator Plates; Method of Regenerating Negative — of Diminished Capacity, or for Avoiding the Diminution in Capacity of New Plates.* R. Kieseritzky, Vorhalle on Ruhr, Germany. Eng. Pat. 21,211, Oct. 3, 1904.

SEE Fr. Pat. 346,760 of 1904; this J., 1905, 243.—T. F. B.

*Accumulators; Process for Regenerating Electric —.* C. Luckow, Cologne. Eng. Pat. 11,353, May 30, 1905.

THE electrodes to be regenerated are immersed in an electrolyte consisting of a very dilute solution of a metallic salt, preferably one containing 1 to 3 per cent. of sulphate, carbonate, or borate of potassium or sodium, or the hydroxides of these metals may be used. The current is passed in the opposite direction to a charge for four to eight days at 2 to 3 volts., and with a current density of 15 to 20 ampères per sq. m. of positive electrode, and the current then reversed for three to six days, when the regeneration is complete.—B. N.

*Water or other Liquid; Extraction of — from Mineral, Vegetable, and Animal Substances.* O. Imray, London. From Meister, Lucius and Brining, Höchst a/Maine. Eng. Pat. 24,670, Nov. 14, 1904.

IMPROVEMENTS in the electro-osmotic process of extracting water or other liquids from materials, described in Eng. Pat. 22,301 of 1901 (this J., 1902, 1335) are claimed. The material is caused to travel either continuously or intermittently between two bands which may be either stationary or which may one or both move in the direction in which the material to be treated moves. The wires carrying the electric current may be attached to these bands if they are formed of conducting materials, or, if they are non-conductors, then the current is connected to electrodes placed behind the pervious bands, and which are caused either intermittently or continuously to touch them. The essential point of the improvement claimed is the prevention of any material alteration in the relative position of the component particles of the substance treated.—W. H. C.

*Ozone [from Liquid Air]; Apparatus for the Production of —.* P. M. Oudin, Paris. Eng. Pat. 28,297, Dec. 23, 1904.

SEE Fr. Pat. 347,148 of 1904; this J., 1905, 282.—T. F. B.

## UNITED STATES PATENTS.

*Electrolytic Apparatus and Electrodes therefor.* C. Kelher, Hallein, Austria. U.S. Pat. 799,061, Sept. 12, 1905.

SEE Eng. Pat. 16,057 of 1896; this J., 1897, 684.—T. F. B.

*Electrodes [for Electrolytic Apparatus]: Method of Producing —.* H. Specketer, Griesheim, Assignor to Chem. Fabr. Griesheim-Elektron., Frankfurt a/Maine, Germany. U.S. Pat. 800,181, Sept. 26, 1905.

SEE Fr. Pat. 334,684 of 1903; this J., 1904, 119.—T. F. B.

*Insulating Material [Utilisation of Waste Product of Solvay Soda-ash Process].* D. W. Sharkey, New York. U.S. Pat. 799,678, Sept. 19, 1905.

THE material is composed of a mixture of fibrous material, such as asbestos fibre, and the deposited waste product of the Solvay soda-ash process.—B. N.

*Furnace; Incandescent Electrical —.* F. J. Tone, Niagara Falls, N.Y. U.S. Pat. 800,515, Sept. 26, 1905.

THIS invention relates to an incandescent electrical furnace having side containing-walls converging in a downward direction, and composed of structural strengthening metal frames lined with refractory material. The walls are made in sections movable relatively to the charge, each section consisting of a number of "refractory units." The vertical end walls are stationary, and are provided with stationary electrodes.—B. N.

## FRENCH PATENTS.

*Accumulators; Process of Regenerating Electric —.* C. Luckow, Fr. Pat. 354,371, May 9, 1905. Under Int. Conv., May 10, 1904.

SEE Eng. Pat. 11,353 of 1905; preceding these.—T. F. B.

*Furnace; Electric Resistance —.* F. A. J. Fitzgerald and P. McN. Bennie. Fr. Pat. 354,207, May 11, 1905.

SEE U.S. Pat. 792,255 of 1905; this J., 1905, 738.—T. F. B.

*Ozoniser; Rotatory —.* M. Otto. Fr. Pat. 354,020, May 6, 1905.

THE fixed electrode of the apparatus, which is connected to the earth, consists of a vertical pipe provided on the outside with a series of horizontal ribs or flanges. Concentrically within this pipe are two tubes, the outer one of which has on its exterior a number of longitudinal ribs. A current of cold water passes up the innermost tube and then down through the annular space between it and the enclosing tube. The air or oxygen to be ozonised is forced up through the annular space between the outer pipe and the intermediate tube, escapes through perforations in the former, and is then led away through a conduit provided for the purpose. The rotating electrode consists of a series of hollow metal rings, encircling the perforations in the fixed electrode, and secured to arms mounted on three vertical insulated shafts, equidistant in a radial direction from the central perforated pipe, and connected to the source of current. These shafts are caused to travel in a circular path by means of a motor. The electric discharge is produced between the metal rings and the lateral surfaces of the horizontal flanges or ribs on the fixed electrode.—A. S.

*Ozone; [Electrical] Generator of —.* A. Bomsel. Fr. Pat. 354,331, May 16, 1905.

A LIQUID, acting as the dielectric, is circulated through the apparatus, and is continuously subjected to the action of the electric discharge. If necessary, contact of the liquid with the ozone may be avoided by the use of a light solid dielectric, such as stretched silk, placed on the surface of the liquid. Two forms of apparatus are described, in one of which a vertical sheet of liquid is delivered over a cylindrical electrode, whilst in the other the liquid forms a series of horizontal sheets, being delivered to one angle of a horizontal basin, and falling through a suitable opening, in the angle diametrically opposite to the angle of delivery, to the basin below.—B. N.

*Chlorine and Citrate-soluble [Calcium] Phosphate; Simultaneous [Electrical] Production of —.* A. Clemm. Fr. Pat. 354,109, May 8, 1905. VII., page 1067.

*Plumbago; Manufacture of Stratified Blocks of — [for Electrical Purposes].* The Morgan Crucible Co., Ltd. Fr. Pat. 354,399, May 17, 1905.

SEE Eng. Pat. 9875 of 1905; this J., 1905, 805.—T. F. B.

## (B.)—ELECTRO-METALLURGY.

## UNITED STATES PATENT.

*Furnace; Revolving Electric —.* E. Stassano, Rome. U.S. Pat. 799,105, Sept. 12, 1905.

A CIRCULAR closed chamber, with its axis inclined at an angle to the vertical, is provided with means for rotation, and the two electrodes are connected to the pistons of two hydraulic cylinders, the latter having their ends connected by water pipes, so that the anode and cathode may be fed towards each other. The electrodes are enclosed within "double-walled carbon-holder casings," through which water is continuously circulating, the casings rotating together with the electrodes and the furnace. The casings communicate with a disc rotating on a stationary disc, the latter being fitted with grooves connected to the pipes of a water-pressure supply. Conductors are connected to the electrodes, the conductors ending in brushes sliding on two discs fixed to a stationary pipe.



forming a chimney, the discs being in connection with the electric supply. The chimney is in connection with the waste-gas passage of the chamber, and the pipe dips into an annular cup which is filled with sand or other finely-pulverised heat-resisting material so as to form a seal at the joint, the cup being fixed to the rotating body of the furnace.—B. N.

*Metal; [Electrolytic] Process of Depositing — on Non-metallic Bodies.* C. F. Blackledge, Washington, D.C. U.S. Pat. 799,218, Sept. 12, 1905.

A MOULD of non-conducting material is prepared, and coated with a substance that will conduce to the precipitation of metallic silver. Ammonia is added to a solution of silver nitrate until the precipitate is redissolved, and formaldehyde added to the liquid, the mixture being then applied to the coated mould; a metal, such as nickel, is then deposited on the silver surface of the mould by electrolysis.—B. N.

*Electro-plating Apparatus.* L. Potthoff, Brooklyn, N.Y. U.S. Pat. 799,402, Sept. 12, 1905.

A TRAVELLING belt carries a series of hooks which form the cathode terminal for supporting the work in a horizontal position, and means are provided for moving the bars or rods to be coated with metal from one portion of the hook to another, in order to change the point of contact. An arrangement, for automatically discharging the bars from the belt after leaving the tank, is provided.—B. N.

*Galvanising Wire; [Electrolytic] Process of —.* G. L. Meaker, Evanston, Ill., Assignor to The American Steel and Wire Co., of New Jersey. U.S. Pat. 799,860, Sept. 19, 1905.

THIS invention relates to a method of depositing zinc on a wire, and consists in continuously passing the latter as a cathode through a "ferri-ferrous zinc solution" in the presence of a series of insoluble anode-sections. The latter have a greater surface area than the cathode in order to render the iron insoluble, and the solution is oxidised by aeration. The solution is regenerated by retaining therein the active dissolving agents, and by circulating it over a mass of zinc or zinc-bearing compound. A current density of at least 400 ampères per sq. ft. of cathode surface is used, and the current is conducted from the moving cathode wire at a series of connection points, so as to superpose on the deposit formed at the latter points, the deposit formed at intermediate parts by giving the wire an adequate speed of travel.—B. N.

*Electrolytic Apparatus.* G. L. Meaker, Evanston, Ill., Assignor to The American Steel and Wire Co. of New Jersey. U.S. Pat. 799,861, Sept. 19, 1905.

THIS invention consists of an electrolytic apparatus comprising a series of anode-sections of insoluble material, such as carbon, each provided with a number of channels to receive cathode wires dropped into them from above. Between the anode-sections is interposed a series of cathode contacts provided with yielding surfaces so as to permit of the passage of a joint in the wire. Each cathode-contact consists of a pocket or receiver of conducting material, open on one side to receive the wire and with slots on the opposite side, through which the wire may enter and leave the pocket. A number of loose balls is contained in the pocket, of a size larger than the openings for the wire. A series of independently-journalled sheaves is provided at each end of the apparatus, these corresponding to the number of anode channels, and in line therewith. Insulating guides, covering the anodes and having openings in line with the channels, prevent contact of the wires with the adjacent surfaces of the anode-sections. Metallic rods extend along the anodes, opposite and transverse to each of the channels, and connect a "bus-bar" to the anode-sections, an electric switch between each of the rods and the bus-bar acting as a regulating means to equalise the potential at each of the channels.—B. N.

*Zinc Compounds; [Electrolytic] Process of Separating "Ferri-ferrous" —.* G. L. Meaker, Evanston, Ill., Assignor to The American Steel and Wire Co. of New Jersey. U.S. Pat. 799,862, Sept. 19, 1905.

THIS invention relates to a process of separating "ferri-ferrous compounds of zinc, and consists in dissolving the compounds by circulating over them an acid solution, afterwards passing the solution through an electrolytic cell containing an insoluble anode adjacent to a moving cathode of smaller superficial area. The solution is oxidised, the iron being precipitated in an insoluble basic ferrous or ferric form, and the zinc is deposited on the cathode. A current density of at least 400 ampères per sq. ft. of cathode surface must be employed.—B. N.

*Tantalum Metal; Process for Purifying —.* W. V. Bolton, Assignor to Siemens and Halske Akt.-Ges., Berlin. U.S. Pat. 799,141, Sept. 12, 1905.

SEE Eng. Pat. 21,766 of 1904; this J., 1901, 1225. T F B.

*Iron or Steel; Process of Cementing —.* C. C. Davis, Germantown, Pa. U.S. Pat. 799,512, Sept. 12, 1905.

THE articles are maintained at 800° to 850° C. while packed in contact with carbonaceous material between two metal plates, and a direct electric current of suitable strength and character is passed through them, from a common positive electrode placed between the plates. J H. C.

#### FRENCH PATENTS.

*Furnace; Electro-Metallurgical —.* Soc. D'Exploitation des Brevets Dolter. Fr. Pat. 353,391, April 15, 1905.

THIS invention relates to an electro-metallurgical furnace shown in sectional elevation in Fig. 1 and in plan in Fig. 2. The metallic bath is composed of two channels *b* and *b'* united together, the channels being concentric with, and at the same height as the bobbins of the primary *d* of a transformer, the bath of metal acting as the secondary. The

FIG. 1.

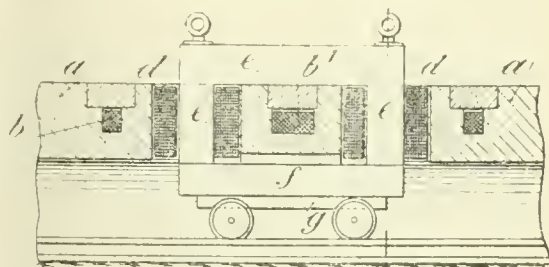
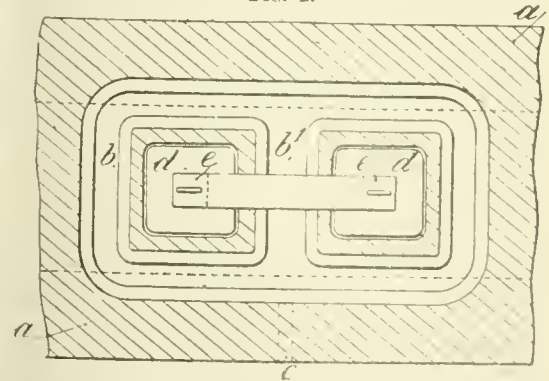


FIG. 2.



portion *b'*, which connects the channels and which is adjacent to the tapping hole *c*, has a transverse section twice that of the other parts of *b* so as to increase, at this point, the fluidity of the metal. The transformer is made in two separate movable pieces, one portion *c*,

which carries the primary *d*, fitting into appropriate cavities in the stonework *a* of the furnace, and the other portion *f*, carried by a waggon *g*, completing the magnetic circuit. A single alternating monophasic transformer may thus be used to serve a series of such furnaces.

—B. N.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*Sesame Oils of Different Origin; Characteristics of — [and Detection of Sesame-Oil in Butter].* H. Sprinkmeyer and H. Wagner. Z. Untersuch. Nahr. u.- Genussin., 1905, 10, 347—353.

SAMPLES of Indian, Levant and African sesame oil obtained by hot and cold expression were examined by the authors, but no material differences were observed in the chemical or physical values of the two first-named. The African oil, however, had a considerably higher iodine value, optical rotation and refractometer reading than the other two. Thus:—

Sesame Oil (cold-drawn).	Iodine Value.	Rotation.	Refractometer Reading at 25°C.	Iodine Value of Fatty Acids.	Iodine Value of Liquid Fatty Acids.
Indian .....	103.31	+ 1.03°	68.2	115.83	127.2
Levant .....	103.84	+ 1.11°	68.0	113.63	126.31
African .....	114.11	+ 1.42°	69.2	120.64	132.69

Similar differences were observed between the oils obtained by extraction of the press-cake with ether or petroleum spirit, and extraction of the original seeds with a solvent. The African seeds also gave a larger yield of oil on extraction, viz., 52.54 to 54.14 per cent., as against 47 to 49.76 per cent. for Indian seeds and 47.57 to 50.14 for Levant seeds. The following modification of Bandonin's test was found to be capable of detecting with certainty 0.1 per cent. of sesame oil (corresponding to 1 per cent. of margarine) in butter fat:—50 to 100 grms. of the clarified and filtered butter fat are thoroughly shaken in a separatory funnel with 20 to 30 c.c. of glacial acetic acid, preferably at a temperature of 60° C. The acid extract is drawn off, and the extraction repeated with a fresh portion of acetic acid. The united extracts are evaporated on the water-bath, the residue saponified with 5 c.c. of a saturated solution of barium hydroxide and 10 c.c. of alcohol, and the soap dried on the water-bath. The dried mass is now powdered in a mortar and extracted several times with petroleum spirit, which dissolves the substance giving the characteristic coloration in the Baudouin reaction, whilst the dyestuffs added to butter and margarine are left in the insoluble residue. The united petroleum spirit extracts are filtered through a baryta filter and the colourless filtrate concentrated to 1 or 2 c.c. in a porcelain basin, and shaken in a narrow test tube with 1 c.c. of hydrochloric acid (sp. gr. 1.19) and 2 drops of a 1 per cent. solution of furfural in alcohol.—C. A. M.

*Wheat Oil and Maize Oil.* H. Snyder. Der Seifenfab., 1904. Z. Spiritusind., 1905, 28, 369.

THE wheat germ contains only 17.5 per cent. of oil, whereas the maize germ contains about 50 per cent. For the separation of the maize oil, the corn is steeped in water containing sulphurous acid, and is then crushed between fluted rolls. The elastic germ resists this treatment, whilst the starch of the endosperm is liberated. The separation of the starch is completed by beating the mass between blunt knives rotating at a high speed in a trough. The milky fluid is then diluted to 8° Beaumé, and the germs are separated, dried and pressed. The oil of the wheat amounts to 1.0—1.8 per cent. of the corn. It cannot be obtained by pressure, but is separated by extracting the wheat germs by solvents. The crude oil has a pure yellow colour; it is a non-drying oil, showing a

slight tendency to go rancid. A ton of wheat germs yields about 280 lb. or 30 galls. of oil. The oil is applicable for soap making and might be refined for purposes of food. The extracted cakes are more suitable for cattle fodder than the original germs. The extraction of the oil increases the yield of flour from the wheat, since the oil is an obstacle to the complete separation of the flour.—J. F. B.

### ENGLISH PATENTS.

*Sewage and other similar Sludges; Treatment of — [Recovery of Fatty Substances].* F. M. Spence, H. Spence and P. Spence and Sons, and R. Ockel. Eng. Pat. 23,640, Nov. 2, 1904. XVIII B., page 1080.

*Linseed Oil; Apparatus for Heating and Cooling —* J. Buchanan. Eng. Pat. 10,326, May 17, 1905. XIII B., page 1075.

*Soap; Manufacture of — [Cooling Process].* A. E. Boardman, Warrington, Lancs. Eng. Pat. 24,023, Nov. 7, 1904.

THE hot liquid soap is pumped up through a pipe to a

chamber placed at the top of a vertical tower. The soap then passes through perforations in the bottom of the chamber and falls in small clots on to a receiving table at the base of the tower. In its descent the soap is cooled by a current of air blown into the tower. The latter consists of two casings, the internal one being perforated to allow the air which is blown into the space between the casings to enter the central part of the tower. A revolving scraper is provided for directing the cooled soap from the receiving table to a plodding machine or drying chamber.—W. P. S.

### FRENCH PATENTS.

*Emulsifying, Subdividing and Rendering Homogeneous Liquids and Semi-liquids, and for Crushing Fatty or Albuminous Substances; Apparatus for —.* C. Petit-pierre. Fr. Pat. 353,753, April 28, 1905. I., page 1055.

*Ammonium Salts and other Bodies; Process and Apparatus for Obtaining — [from Pressed Olives].* W. Guerrero de Smirnoff. Fr. Pat. 353,970, May 4, 1905. III., page 1058.

*Emulsions; Preparation of Hydrocarbon —, and their Use as Detergents.* E. St. Hilaire and E. de Grousseau. Addition dated April 29, 1905, to Fr. Pat. 348,501, Nov. 15, 1904. III., page 1058.

### GERMAN PATENT.

*Fats, Oils, Waxes and the like; Process for the Hydrolysis of — by means of Steam.* O. Mannig. Ger. Pat. 160,111, Dec. 29, 1903.

STEAM under a pressure of 8—10 atmospheres is projected against the under side of a plate or baffle mounted in a closed vessel. The neutral fat or oil is forced into the vessel under strong pressure, and on striking against the upper side of the baffle is converted into a spray, which becomes intimately mixed with the steam rising round the edges of the baffle-plate. It is stated that by this process the hydrolysis of the fat is effected in so short a time that the fatty acids do not become discoloured.

—A. S.



### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

#### (A.)—PIGMENTS, PAINTS.

##### ENGLISH PATENTS.

*Lakes [from Azo Dyestuffs]; Manufacture of New Colour* —. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 26,457, Dec. 5, 1904.

See Fr. Pat. 348,426 of 1904; this J., 1905, 506.—T. F. B.

*and Carbonates [Pigments]; Process for Manufacturing* —. A. Wultze, Charlottenburg, Germany. Eng. Pat. 6139, March 27, 1905.

See Fr. Pat. 352,049 of 1905; this J., 1905, 898.—T. F. B.

##### UNITED STATES PATENTS.

*Lake and Process of Making same; Azo Dye* —. C. Immerheiser, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 799,058, Sept. 12, 1905.

See Eng. Pat. 15,493 of 1903; this J., 1904, 670.—T. F. B.

*Pigments; Process of Making Paint* —. J. A. Titzel, Sen., Newcastle, Pa., U.S.A. U.S. Pat. 799,113, Sept. 12, 1905.

The "waste material thrown out of converter-stacks and like" is finely comminuted, and roasted with the oxidising flame from the combustion of natural gas, a subsequent treatment with superheated steam being given to cause complete oxidation.—M. J. S.

*Lead Carbonates [for Pigments]; Process of Making* —. A. Wultze, Charlottenburg, Germany. U.S. Pat. 799,770, Sept. 19, 1905.

See Fr. Pat. 352,049 of 1905; this J., 1905, 898.—T. F. B.

##### FRENCH PATENT.

*Dyestuff especially suitable for the Manufacture of Lakes; Production of an [Azo]* —. F. Bayer und Co. Fr. Pat. 353,816, April 29, 1905. IV., page 1061.

#### (B.)—RESINS; VARNISHES.

##### ENGLISH PATENTS.

*Insect Oil; Apparatus for Heating and Cooling* —. J. Buchanan, Aberdeen. Eng. Pat. 10,326, May 17, 1905.

The oil is conducted from a reservoir through a tubular apparatus and then passes to a heating device of any convenient type, but preferably composed of a series of tubes arranged in a hot fluid. The heated oil is now allowed to flow through a perforated pipe on to the outside of the tubes through which the cold oil is passing on its way to the heater, and is collected in a receptacle whence it is led to a receiving tank. The flow of oil may be regulated by a cock. The apparatus is designed for heating linseed oil without driers.—W. P. S.

*Driers for Oils, Paints, Lacquer and the like.* J. Menge, Cologne. Eng. Pat. 11,063, May 26, 1905.

Neutral or only very slightly acid resin is melted by heating, and, after cooling somewhat, is treated with one-half of its amount of oil of turpentine. Finally, after further cooling to a temperature of 60–80° C., about one-tenth part of alcohol or wood spirit is stirred in.—M. J. S.

*Amber; Process of Utilising Waste* —. H. Thiemann, Stolp, Germany. Eng. Pat. 13,180, June 26, 1905. Under Int. Conv., June 25, 1904.

See Fr. Pat. 345,196 of 1904; this J., 1904, 1226.—T. F. B.

##### UNITED STATES PATENTS

*Varnish Gum; Process of Making* —. A. Kronstein, Karlsruhe, Germany. U.S. Pat. 799,065, Sept. 12, 1905.

See Eng. Pat. 1387 of 1901; this J., 1902, 261.—T. F. B.

*Sugar; Composition [Sulphonated Rosin Oil] for Cleaning—, and Process of Making same.* C. A. Spreckels and C. A. Kern, Assignors to Federal Sugar Refining Co. U.S. Pat. 799,876, Sept. 19, 1905. XVI., page 1077.

### XIV.—TANNING, LEATHER, GLUE, SIZE.

*Pelts; Plumping Effect of Various Organic Acids on* —. J. Paessler and W. Appellius. Deutsch. Gerber-Zeit., 1905; through Collegium, 1905, 295–300; 302–305.

The authors have previously examined the plumping action of lactic, oxalic and other acids (see this J., 1902, 1461) and they have now extended the investigation to formic acid and acid oxalate of potassium, which have lately been recommended for the same purpose.

The quantity of acid absorbed by the pelt and the time in which the maximum of plumping is attained does not depend upon the concentration of the plumping solution only, but largely upon some other insufficiently known factors. The pelt increases in weight as it swells, but it may be considered plump without showing an excessive (maximum) increase of weight and volume. The results tend to show that there is no means of expressing numerically the degree of swelling attained, even if both increase of weight and volume are known. Oxalic acid acts very quickly, and care should be exercised when it is used for plumping purposes. Acid oxalate of potassium, as anticipated, is slower in its action and equally suitable as formic or lactic acid for the plumping process.

—F. K. K.

*Leather; Composition of Japanese* —. J. Paessler, Deutsche Gerber-Zeit., 1905; through Collegium, 1905, 257–260; 265–266.

The leather examined is manufactured in Jakagimure in the vicinity of the town of Iimeji, chiefly from cow and ox hides, without the use of tannin substances. The treatment consists in sprinkling the hides with common salt to prevent putrefaction, and immersing them repeatedly in the river Iehikawa at a certain spot. It is stated that the water of this river exerts a specific tanning action. The hides are finished by "striking out" and oiling them with rape oil. A specimen of white Japanese leather gave the following results on analysis:—

	Per cent.
Water .....	11.6
Ash .....	0.6
Fat .....	4.6
Nitrogen .....	17.7
Hide substance (calculated from nitrogen) .....	82.8

##### Composition of Ash in Per cent.

Alumina (including traces of ferric oxide) .....	0.14
Lime .....	0.08
Magnesia .....	0.09
Sodium chloride .....	0.02
Sulphuric acid .....	0.17

The resistance to tearing of the leather amounted to 5.8 kilos. per sq. mm. of cross-section, and the extension at the moment of breaking was 36 per cent.—A. S.

*Gambier or Yellow Catechu; Determination of the Value of* —. M. Greshoff. XXIII., page 1087.

*Hydroxybenzoic Acids; Some Oxidation Products of the — and the Constitution of Ellagic Acid.* A. C. Perkin and M. Merenstein. XXIV., page 1087.

*Ellagic Acid.* G. Goldschmiedt. XXIV., page 1087.

## ENGLISH PATENTS.

*Parchment-like Skin; Improved Manufacture of* — B. Trenckmann, Berlin-Schöneberg, Germany. Eng. Pat. 12,266, June 13, 1905. Under Int. Conv., Oct. 3, 1904.

THE upper skin of animal gut, more particularly of the blind gut (which, when dry, is known as gold-beaters' skin) is deprived of its fat, mechanically and by means of potash. It is then soaked for 30 minutes in a soap bath, treated in strong alkaline solution, and finally stretched on frames and dried quickly at 30° to 50° C. It is most important that the drying (contrary to general practice) should take place as quickly as possible to obtain the white product required. The product is stated to be white, very strong, and non-porous. —W. B. H.

*Corneous Substances; Method of Treating* — L. E. Nottelle, Paris, and L. A. Leroux, London. Eng. Pat. 23,619, Nov. 1, 1904.

SEE Fr. Pat. 347,702 of 1904; this J., 1905, 450. —T.F.B.

*Bone; Process for Treating* — J. R. Hunter, Philadelphia. Eng. Pat. 2441, Feb. 7, 1905.

SEE U.S. Pat. 781,883 of 1905; this J., 1905, 245. —T.F.B.

## UNITED STATES PATENTS.

*Tanning Extracts; Process of Making* — R. Lepetit and E. Tagliani, Susa, Italy. U.S. Pat. 799,246, Sept. 12, 1905.

SEE Eng. Pats. 8382 of 1896 and 2603 of 1898; this J., 1897, 436 and 1899, 286. —T. F. B.

*Casein-Glue*. F. X. Govers, Oswego, N.Y. Assignor to Americus Manufacturing Co., New York. U.S. Pat. 799,599, Sept. 12th, 1905.

THE glue consists of a mixture of casein, trisodium phosphate, sodium hyposulphite, formaldehyde and water. (Compare Fr. Pat. 330,304 of 1903; this J., 1903, 1096.) —W. B. H.

## FRENCH PATENTS.

*Leather; Manufacture of Recovered* — Printed in Sheets. Soc. Anon. "Productos Químicos para la Agricultura e Industria." Fr. Pat. 354,094, May 8, 1905. Under Int. Conv., June 18, 1904.

LEATHER cuttings of all kinds are disintegrated, washed carefully to get rid of all foreign matter, and ground to a paste. The latter is mixed with a certain proportion of a tanning liquor and then formed into sheets. Designs are printed or embossed upon the sheets by means of a press, or between rollers, heat being used in both cases. The machines employed throughout the process are those used in the manufacture of paper or cardboard. —W. B. H.

## XV.—MANURES, Etc.

*Phosphoric Acid; Determination of* — as Ammonium Phosphomolybdate. G. P. Baxter and R. C. Griffin. XXIII., page 1086.

## FRENCH PATENTS.

*Manure; Manufacture of a* — from Calcium Humate or Humus. N. F. Bourgeois de Mercey. Fr. Pat. 353,550, May 1, 1905.

Moist peat is treated with a suitable quantity of lime to obtain a brown product similar to natural humus. This is either dried by exposure to the air until fit for use, or is filter-pressed and ground. —A. S.

*Chlorine and Citrate-soluble [Calcium] Phosphate; Simultaneous [Electrical] Production of* — A. Clemm. Fr. Pat. 354,109, May 8, 1905. VII., page 1067.

## XVI.—SUGAR, STARCH, GUM, Etc.

*Sugar; Diffusion Process for the Manufacture of Beet* — A. Herzfeld. Z. Ver. Deutsch Zucker-Ind., 1905, 5 835—868.

THE conditions were examined under which diffusion and pressing gave pulp containing the highest percentage of dry solids, the results having an incidental bearing on the recent maceration process of Steffen. Instead of the short maceration at 80° C. adopted by him, it was found that richer products which would press equally well could be obtained, if the temperature of the juice were raised only to the coagulation point of albumin, and, consequently to that of the agglomeration of the protoplasmic contents of the cells, that is, not higher than 75° C. provided the duration of the maceration were correspondingly prolonged. The general conditions to be observed when the whole of the press water is returned to the battery are as follows:—(1) The preparation of sharp-cut chips, which give as little fine pulp as possible in pressing and which have a good firm consistency; overheating in the battery must be avoided. (2) The exhaustion should be as slight as agricultural conditions will allow, having regard to the relative values of sugar produced at the factory as compared with the value of the pulp fodder. (3) The pressing should be as slight as possible without materially increasing the cost of the subsequent drying process, since with stronger pressure more pectous and albuminous substances find their way into the press water, and these are only partially precipitated by defecation with lime, the metapectic acid of Scheibler forming a soluble lime salt. When these conditions are observed, it is possible, with a shortened battery, to obtain pulp with as high a percentage of dry solids, and a juice as rich in sugar, as by the use of special maceration trough. One point worthy of notice was remarked during the investigation, namely, that when the chips used had partially dried or withered, the swelled and increased in weight more than could be accounted for by the juice and water left adhering to them. Chips from stored beetroots in good condition when treated similarly showed a slight diminution in weight. —L. J. DE W.

*Juices of [Beetroot] Sugar Works; Formation of Jelly* — C. Maassen. Arb. a. d. biolog. Abteil. f. Landw. u. Forstwirtschaft, am Kais. Gesundheits-Amte, 5, 1—3. Chem. Centr. 1905, 2, 908—9.

*Streptococcus (Leuconostoc) mesenteroides* was not found in a filter-press cake in which formation of gum had occurred, but a spore-forming bacterium of the group of bacilli causing a red colour in potatoes, which give in culture media containing sugar a jelly-like consistency. These bacilli consist of various species difficult to separate one from the other. The commonest form, from its pear or spindle shape is named *Semiostridium communis*. During the formation of gum from the cane sugar present hexoses, carbon dioxide, alcohol, formic, acetic, and d-lactic acids are produced, whilst potassium nitrate is denitrified. This organism appears to be the agent bringing about foaming fermentation of sugar juices. As it is not very sensitive to strong solutions of calcium chloride, a broth containing 5 or 6 per cent. of this salt may be used to separate it from other organisms in milk, faeces, or soil, with or without the addition of glycerol at 40°—50° C. —L. J. DE W.

*Defecation and Carbonating [Beetroot Juice]*. Besson and Rosset. Bull. Assoc. Chim. Sucr. et Dist., 1905, 2 80—86.

THE authors endeavoured, by laboratory experiments, to decide on the relative merits of hot and cold defecation. It was found that when the time of contact of lime with the juice is prolonged, the quotient of purity first increases and then diminishes, the maximum being more quickly reached when the temperature is higher; at 50°—55° C. the maximum is attained in half an hour. The quantity of calcium salts dissolved by the juice increases uniformly with rise in temperature, but the amount only becomes appreciable in 8 to 10 hours at 50°—55° C. The colour



If the juice is not affected by prolonged contact in the cold, but becomes darker with rise in temperature. These results show that the conveyance of undecanted juice in the Luard pipe system has no injurious effect since the temperature is not high and the time of exposure is rarely prolonged. The scums of the cold defecation are greasy and voluminous, and the viscosity increases with the time of contact; in hot defecation this does not occur. Cold liming, therefore, means slow filtration and loss of sugar, outweighing any economy of lime. Juices defecated hot show a lower alkalinity than those treated cold; the escape of ammoniacal vapours can scarcely explain this phenomenon since it is equally evident in juices taken immediately after liming. The cold defecation, however, appears to yield stable precipitates of colouring matter and lime, thus giving juices which may be carbonated completely without showing the dark discoloration which juices defecated hot would give under these circumstances. Increasing the amount of lime reduces a better quality of juice but is limited by the cost. Dilution of juice contributes slightly to augmentation of purity. Oxidising the raw juice by passing a current of air or oxygen through it, did not affect the result in the case of the carbonated juice, but it is quite different in the case of the limed juice. There is then a marked diminution of purity and increase in calcium salts.—L. J. DE W. 3

#### ENGLISH PATENTS.

*Milk Sugar and Casein from Milk; Process of Obtaining* — J. R. Hatmaker, Paris, Eng. Pat. 21,865, Oct. 11, 1904.

When separated or ordinary milk is evaporated to dryness, the casein becomes insoluble in water. Dried milk, prepared in any suitable manner, is treated with water as to extract the milk sugar in the form of a concentrated solution, which is purified and evaporated, whilst the washed casein remains behind.—J. F. B.

#### UNITED STATES PATENTS.

*Sugar; Composition [Sulphonated Rosin Oil] for Cleansing* —, and *Process of Making same*. C. A. Spreckels and C. A. Kern, Assignors to Federal Sugar Refining Co., Jersey City. U.S. Pat. 799,876, Sept. 19, 1905.

Compound for cleansing sugar is made by sulphonating resinous or oleaginous substance (e.g., rosin oil) at a low temperature, separating the sulphonated compound from the mixture, and dissolving it in a hydrocarbon (e.g., kerosine). (See also U.S. Pats. 698,150 and 60,099 of 1902; this J., 1902, 715 and 784.)—T. F. B.

*Gum Tragacanth from Locust Beans; Obtaining* — R. Gray, G. Osborn, H. B. Stocks and H. G. White, Assignors to The Gum Tragacanth Supply Co., Ltd., Hooton. U.S. Pat. 800,369, Sept. 26, 1905.

See Eng. Pat. 27,186 of 1903; this J., 1904, 1156.—T. F. B.

#### FRENCH PATENTS.

*Sugar Syrups [Masseccites]; Continuous Apparatus for Boiling*. H. Roy. Fr. Pat. 353,817, April 29, 1905.

The principle described in Fr. Pat. 353,317 (see this J., 1905, 1024) for boiling two layers of masseccite of different consistencies in the same pan, and for withdrawing a portion of the bottom layer without breaking the vacuum, may be extended, so as to make the process really continuous, by increasing the number of separate boiling systems to such an extent that the lowermost layer is always ready for discharging. The diagrams show, in section and in plan, an arrangement containing four superposed boiling systems, each provided with separate circulating apparatus, re-heater and mixer. The pan consists of a wide upper part A and a narrower, elongated lower portion A<sub>1</sub>. Four circulating pumps, P, withdraw masseccite from the pan A<sub>1</sub> at four different levels through the tubes G<sub>1</sub> and deliver it, after the admixture of feed syrups of

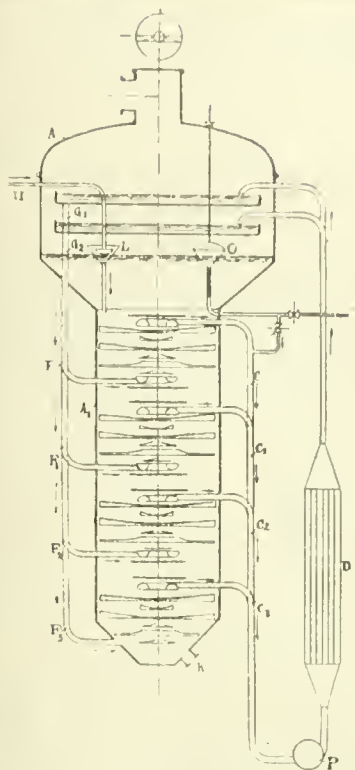


FIG. 1.

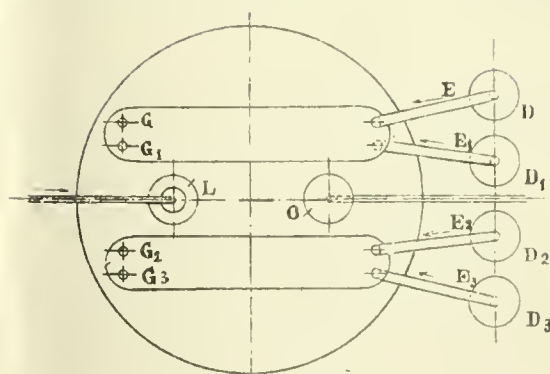


FIG. 2.

suitable concentrations, through the re-heaters D-D<sub>3</sub> on to the tables G-G<sub>3</sub> situated in the evacuated space of the upper portion of the pan. From these tables the masseccites are delivered through the pipes F-F<sub>3</sub> each to a lower point of the pan A<sub>1</sub> than that from which it was withdrawn. The basis of fine grain, on which the masseccite is built up, is prepared in an external evaporator and delivered through a pipe U and overflow L into the top section of the pan A<sub>1</sub>. A perforated metal filter O is adjusted at the surface of the contents of the pan, so as to enable any accumulation of syrup to be removed from the system if necessary. The finished masseccite is withdrawn continuously from K.—J. F. B.

*Inulin and Levulose; Process of Preparing* — The Levulose Co., Ltd. Fr. Pat. 353,670, April 25, 1905.

See Eng. Pats. 16,546 and 16,546A of 1904; this J., 1905, 744.—T. F. B.

*Ligneous "Starch" ("Amidon de lignine"). Amyloid, Dextrose and Alcohol from Wood Wastes; Process of Manufacture of —.* Mlle. M. Holanbek. Fr. Pat. 353,730, April 27, 1905. XVII., page 1079.

#### GERMAN PATENT.

*Sugar Solutions Obtained from Wood Containing Tannin; Process for Rendering — Easily Fermentable.* A. Classen. Ger. Pat. 161,644, Nov. 22, 1904.

Up to the present fir has been the only kind of wood used for the preparation of sugar solutions by inversion. If woods containing a considerable quantity of tannin be used, the sugar solutions obtained are not readily fermentable owing to the presence of gallic acid. According to the present patent, the gallic acid is precipitated by the addition of a suitable salt, for example, ferrous sulphate. The free acid is then neutralised by the addition of calcium carbonate, and calcium hydroxide is added in small portions until the solution has a faintly alkaline reaction.—A. S.

### XVII.—BREWING, WINES, SPIRITS, Etc.

*Barley; Valuation of —.* C. Bleisch and P. Regensburg. Z. ges. Brauw., 1905, 28, 625—631.

The authors have studied in the case of about 80 samples of barley, principally of Bavarian origin, the variations of the different factors which influence the malting value from the economic point of view, and have compared the relative variations amongst each other by means of curves. As the protein-content of the barley increased, the yields of extract both from the barley and the malt prepared from it decreased. The curve for the malt extract was not exactly parallel to that for the barley extract, owing probably to differences in the composition of the substances lost in the malting process. The maximum yield of extract, both with the barley and the malt prepared from it, did not correspond with the minimum protein-content (8 per cent.), but occurred at a protein-content of about 9 per cent. The size of the corns decreased with increase in the protein-content of the barleys, and the maximum size corresponded with the maximum yield of extract. The proportion of hulls, varying in the barleys examined between the limits of 8.0 and 10.1 per cent., increased as the protein-content increased, i.e., with decrease in the extract values. The coarse-hulled barleys contained a larger proportion by weight of hulls than the fine-hulled barleys. The loss of dry weight during the malting process was determined both on the large scale and in the laboratory. It was remarked that determinations of malting loss in the laboratory alone, afforded no measure of the losses occurring on the large scale, owing to the difficulty of maintaining constant temperature and other conditions on the large scale. The loss of substance during malting on the large scale varied very erratically when compared with the protein-content, but there was a general tendency for the loss of weight to increase with the protein-content. This tendency was perfectly well defined in the case of malting experiments in the laboratory, where, owing to perfect control, the variations were more regular.

As a general rule the yield of extract from the malt varied inversely as the loss of weight which had been suffered during malting, but the curves showed great irregularities. The best measure for the valuation of barley from an economic standpoint is the extract yield of the malt referred to the barley dry substance, since it includes both the yield of malt and the extract yield of that malt. The curves showed that with increase of the protein-content of the barley, the yield of malt extract derived from the barley substance decreased, both under practical conditions of malting and in the laboratory. The protein-content of the malt was not proportional to that of the barley, but the loss of protein in malting increased with increase of the protein-content of the barley.—J. F. B.

*Barley; The Degree of Mellowness of — and its Relation to the Protein-Content.* E. Prior. Allgem. Z. Bierbrau und Malzfab., 1905, 33, 345.

STEELINESS in barley may be of two kinds, one of which

has no effect on the proper modification of the malt, whilst the other kind yields steely, badly modified malt. In order to distinguish between real and apparent steeliness, the barley is submitted to the cutting test both in its original form and after steeping and re-drying. The author has worked out a formula for expressing the true condition of the barley endosperm on the basis

of these two tests:— $A = \frac{(M_1 - M)100}{100 - M} + M$ , where A = the

degree of mellowness of the barley and M = the percentage of mealy corns in the original state, whilst  $M_1$  = the percentage of mealy corns after steeping and drying. In this formula the first portion gives the percentage of corns which have become mealy after steeping and drying. The author points out, however, that the mealy corns originally present in the sample, give the best results in practice, and the value represented by A is the percentage of corns which have been made mealy, plus the percentage of originally mealy corns in the sample. The author has endeavoured to correlate the degree of mellowness thus determined with the protein-content of the barley. He found that, although certain individual values and extreme numbers showed no definite relations, yet, when the barleys were divided into classes containing those with equal or nearly equal protein-contents, the average values for mellowness indicated that the percentage of steely corns tends to increase with increase in the protein-content. Thus barleys rich in protein may be, but are not necessarily, badly adapted for malting and brewing; the question is rather one of the nature of the proteid constituents. The author has further remarked that the degree of mellowness of barleys varies in different years.—J. F. B.

*Saccharomyces Thermautonomus.* G. Johnson. J. Inst. Brewing, 1905, 11, 466—480.

*S. Thermautonomus* (see Eng. Pat. 10,033 of 1903; this J., 1904, 499) is a yeast which resists pasteurisation at 180° F. for a certain length of time, and which performs its functions of budding and fermentation most energetically at temperatures between 105° and 112° F. It readily forms spores on gypsum blocks at 25° C., and is therefore a true saccharomyces. It shows certain peculiarities in its demands for nutrition, and all-malt worts, especially those mashed on the English plan, are not suitable media for its industrial application. This yeast possesses an unusually high inverting power, which must be utilised if the best results are to be obtained. Further, the cell structure does not appear to be adequately provided for by malt alone, and in such worts the yeast becomes brown and does not "break." The peculiarity of the carbohydrate nutrition can be accommodated by restricting the malt diastase by high mashing temperatures, but the best results are got by mashing an unusually large proportion (35—40 per cent.) of flaked maize or rice with the malt, or else by the addition of crystallised cane sugar. Worts made from malt alone also appear to be too rich in nitrogen for the proper development of the yeast. These peculiarities, in addition to the very high temperature of fermentation, make this yeast eminently suitable for fermentation industries in tropical climates. In working with this yeast, it is advisable to discard the mash tun and to work with a converter for the raw grain and a filter-press for the mash. Wort-refrigerators are entirely suppressed, and the boiled, hopped wort is run through a cooling coil into the fermentation vessel. Fermentation, dropping and racking vessels should be made of enamelled metal, or some equivalent material, capable of being sterilised by steam. The vessels should be practically closed and only supplied with filtered air. Freedom from infection at all stages is an absolute essential. Fermentation takes place with extraordinary rapidity, and the yeast settles out in remarkably compact clots.—J. F. B.

*Saccharomyces Cerevisiae; Influences regulating the Reproductive Functions of —.* A. J. Brown. Chem. Soc. Trans., 1905, 87, 1395—1412.

PREVIOUS investigations (Chem. Soc. Trans., 61, 369 and 65, 911) had shown that the reproduction of yeast under



normal conditions is limited by the volume of the liquid in which the yeast grows, and is independent of the number of cells originally sown, and, within wide limits, of the quantity of nutrient available. The author has now studied the relative rates of cell reproduction under varying conditions of crowding, by sowing increasing numbers of cells in equal volumes of liquid and counting the number of cells present per unit volume after a constant interval of time. The results showed that reproduction proceeds at a maximum rate when the number of cells present is at a minimum, and that the rate of reproduction falls with a decreasing velocity as the number of cells sown is increased. From this latter observation it would appear that the arresting influence of crowding is not due to the accumulation of injurious products of cell metabolism, but rather to the exhaustion of some influence which originally favours the reproduction. The author disposes of the theory of the specific arresting action of metabolic products (see Delbrück; this J., 1903, 154) by testing the influence of the volatile, non-volatile and gaseous products of fermentation upon the rate of reproduction separately. The only product which caused any appreciable retardation of the reproductive function was the alcohol, and this was without any marked action on the rate of reproduction until the quantity initially added to the liquid exceeded 3 per cent. If the quantity of alcohol produced during the fermentation were taken into account, it seemed probable that the rate of reproduction of yeast was uninfluenced by proportions of alcohol below 5 per cent. The author concludes that the essential factor in cell reproduction is the presence of oxygen in the liquid, and that reproduction comes to an end when the original supply of oxygen dissolved in the liquid is exhausted. Consequently, when the supply of oxygen is constantly renewed by passing a current of air through the liquid, the influence of the volume on the reproductive function is removed and the limit of reproduction is then determined by the quantity of nutrient matter present.

—J. F. B.

*Fermentation in Presence of Rosin.* J. Effront. *Monit. Scient.*, 1905, 19, 721—722.

WHEN a saccharine liquid is fermented by a pitching yeast containing a small infection, say, 5 per cent., of bacteria, a selective sedimentation takes place during fermentation. A layer of very nearly pure yeast will be found at the bottom of the vessel, but in samples taken at higher levels the ratio of bacteria to yeast cells will be found to increase in proportion to the distance from the bottom, until, near the surface, 400—450 bacteria may be counted for every 100 yeast cells. Thus it happens that a small infection of bacteria may have a chance of developing and producing disastrous results, owing to the removal of the deterrent influence of the yeast, which, if it could be maintained in its original proportions, would eventually suppress the bacteria altogether. It is claimed that the rosin process of fermentation (this J., 1903, 223, 876) produces this desired result. The addition of 0.3—0.5 grm. per litre of rosin soap to the wash at the time of pitching produces a uniform milky turbidity which subsequently "breaks" to a flocculent precipitate. The action of the rosin is a physical one; in the first phase it weights the bacteria relatively more than the yeast, so that the specific gravity of the two becomes virtually the same; in the second phase, the coagulation ensures the contiguity of the bacteria with a preponderating number of yeast cells. By this process, which is employed for the manufacture of 90 per cent. of all the molasses spirit now produced in France, sterilisation of the washes can be omitted, whilst only as much sulphuric acid as is necessary to neutralise the molasses is employed.—J. F. B.

*Metals; Corrosion of* — by *Denatured Spirit.* G. Heinzelmann. *Z. Spiritusind.*, 1905, 28, 368—369.

IN continuation of his study on the corrosion of metallic surfaces by denatured spirits (see this J., 1904, 995), the author observes that aluminium is to be added to the list of metals which are somewhat readily attacked. The different denatured wood-spirits of commerce show considerable variations in composition and in the

readiness with which they corrode metals. The corrosive influence of the wood-spirit is ascribed to the esters contained therein, the proportions of which vary between wide limits. Those wood-spirits which contain the lowest proportions of esters are the most suitable for denaturing purposes. The esters and the aldehydes can be destroyed by suitable treatment with caustic soda in the process of rectifying the wood-spirit; the acetone and acetals are unaffected by this treatment.

—J. F. B.

## ENGLISH PATENT.

*Brewers' Wort and the like; Apparatus for Heating or Boiling* —. H. J. Worssam, London. Eng. Pat. 10,198, May 15, 1905.

A SINGLE or multiple steam drum is supported on feet inside the pan, at such a distance from the bottom that free circulation of the liquid can take place beneath it. The drum is fed with steam either through one of its feet suitably extended inside the drum for the purpose or through a central column. The condensed water is withdrawn in a similar way from a recess in the bottom of the drum, or in the central column. The sides of the drum and the circulating tubes are so attached that no sharp corners or pockets are present in which deposits might settle. A composite form of steam drum, made up of a series of superposed cylinders, of continuously reduced diameters, and provided with circulation tubes, is also described.—J. F. B.

## UNITED STATES PATENT.

*Brewing; Art of* —. J. Schneible, Assignor to the J. Schneible Co., Weehawken, N.J. U.S. Pat. 799,407, Sept. 12, 1905.

IN preparing malt for mashing, the hulls only of the malt are moistened, the starchy portion is then ground while dry to a fine powder, and the whole is carried forward by a current of air, through a machine which moistens the mixture, and finally into the mash tub where the mashing is completed.—J. F. B.

## FRENCH PATENTS.

*Ligneous "Starch"* ("Amidon de Lignine"), Amyloid, Dextrose and Alcohol from Wood Wastes; *Process of Manufacture of* —. Mlle. M. Holmbeck. Fr. Pat. 353,730, April 27, 1905.

THE raw material is digested for about 72 hours with a 2—5 per cent. solution of a manganate or permanganate; it is then boiled, filtered and pressed. The solid matter is then mixed with dilute sulphuric acid until it is completely gelatinised. The amyloid or "starch" is then thrown out by a 5 per cent. solution of sodium sulphate and is saccharified by boiling with a suitable quantity of acid; the solution is finally neutralised and fermented. If the oxidation be effected by a manganate in presence of hydrochloric acid, the addition of sodium sulphate is not necessary. If it be desired to obtain the cellulose, the raw material is digested for 70 hours with dilute alkalis, acids or salts, and the amyloid in the extract is saccharified by acids.—J. F. B.

*Phlegms, Wines and Fermented Musts; Continuous Direct Rectification of* —. A. Baudry. Second Addition, dated July 6, 1904, to Fr. Pat. 338,992, Aug. 19, 1903 (see this J., 1904, 1107).

THE volatile impurities in the alcoholic vapours coming from the distillation column are classified and concentrated on the plates of a double separating column, provided with a refrigerating condenser, in two distinct zones, from which they are continuously removed as they accumulate, so that the intermediate alcoholic liquid of the neutral zone is practically freed from volatile impurities, but still retains odours, which are removed by the injection of direct steam at a higher temperature than that in the column on the plates of which the alcoholic liquid is boiling. The liquid thus purified is passed into the rectifying column. Means are provided by which the "tail products" which, having escaped the first

action of the separating column, have passed into the rectifying column are returned to the separating column.—J. F. B.

*Phlegms, Wines and Alcoholic Liquids; Continuous Rectification of* —. A. Baudry. Second Addition, dated July 9, 1904, to Fr. Pat. 339,079, Oct. 2, 1903. (See this J., 1904, 1231.)

MEANS are described for the continuous elimination of the higher boiling impurities which may have found their way into the rectifying column, and which would contaminate the spirit if no exit were provided for them other than the upper part of the rectifying column. The most impure products from the lower plates of the rectifying column are passed in the form of vapours into the separating column for the "tail products," by employing a small special column, which also receives the impure returns from the above separating column, so as to avoid mixing these two very impure returns with the fresh liquid in the distilling column.—J. F. B.

*Phlegms, Wines and Alcoholic Liquids; Continuous Rectification of* —. A. Baudry. Third Addition, dated July 15, 1904, to Fr. Pat. 339,079, Oct. 2, 1903. (See also preceding abstract.)

THE least contaminated alcoholic liquids from the upper plates of the lower part of the rectifying column are purified in the preliminary distillation column in which the fresh wine is first treated. The most impure fractions, highly charged with "tail products," are concentrated in a special column, and the alcoholic vapours derived from this special column are treated in the concentrating column devoted to "head products." The concentration of "tail products" is effected either by a condenser or by alcoholic liquids derived from the neutral zone of the "head products" concentrating column, or from one of the plates of the rectifying column, in regulated proportions.—J. F. B.

*Rectifying Apparatus for Stills.* J. Guillaume. Fr. Pat. 354,074, April 26, 1905.

THE apparatus is intended for the distillation of weak alcoholic liquors. The vapours from the still are first bubbled through a layer of the condensed distillate, and then pass in succession through a perforated plate, a perforated horizontal coil cooled by condensed liquid, a compound seal cup plate, a hollow seal cup plate, the seal cup being cooled by a current of liquid, and finally another perforated plate. No limit is placed on the number of the plates in the apparatus.—W. H. C.

#### GERMAN PATENT.

*Sugar Solutions obtained from Wood containing Tannin; Process for Rendering — Easily Fermentable.* A. Classen. Ger. Pat. 161,644, Nov. 22, 1904. XVI., page 1078.

### XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

#### (1.)—FOODS.

*Fruits; Acidity of* —. W. F. Sutherst. Chem. News, 1905, 92, 163.

THE sour taste frequently acquired by fruits on boiling is shown by the author not to be due to an increase of acidity. It is probably due to the inversion of the sucrose and the extraction of practically the whole of the acid contained in the skins, so that the acid is concentrated in the semi-liquid mass, instead of being more or less uniformly distributed between pulp and skins as in raw fruit.—A. S.

*Sesamé Oils of Different Origins; Characteristics of — [and Detection of Sesamé Oil in Butter].* H. Sprinkmeyer and H. Wagner. XII., page 1074.

*Wheat Oil and Maize Oil.* H. Snyder. XII., page 1074.

*Formaldehyde; Modification of Hekner's Test for* —. A. B. Lyons. XXIII., page 1086.

#### ENGLISH PATENTS.

*Milk Sugar and Casein from Milk; Process of Obtaining* —. J. R. Hatmaker. Eng. Pat. 21,865, Oct. 11, 1904. XVI., page 1077.

*Food Substances and Brine; Preserving Animal* —. L. Fulda, London. Eng. Pat. 23,616, Nov. 1, 1901.

A PREPARATION consisting of a mixture of equal parts of powdered glass-gall (sodium bisulphate), and potassium metasulphite, or bisulphite, is claimed. This is either added to the food to be preserved or a solution of it is made in which the articles of food are immersed for a time and then hung up to dry. The compound may be added to brine to prevent deterioration of the latter by the decomposition of animal matter therein.—W. P. S.

*Proteids; Obtaining* —. G. Mitchell, London. Eng. Pat. 24,430, Nov. 11, 1904.

SEE Fr. Pat. 350,683 of 1905; this J., 1905, 811.—T.F.B.

*Oil or Fat Compounds or Preparations for Edible and other Purposes and Processes for the Preparation thereof.* J. E. Bloom, New York. Eng. Pat. 1655, Jan. 27, 1905.

SEE U.S. Pats. 782,820 and 782,821 of 1905; this J., 1905, 341.—T. F. B.

#### FRENCH PATENT.

*Blood Albumin Preparations; Process for Producing* —. Soc. Roburin-Werke. G.m.b.H. Fr. Pat. 353,785, April 28, 1905.

SEE Eng. Pat. 7830, 1905; this J., 1905, 1027.—W. P. S.

#### (B.)—SANITATION; WATER PURIFICATION.

#### ENGLISH PATENT.

*Sewage and other similar Sludges; Treatment of* —. [Recovery of Fatty Substances]. F. M. Spence, H. Spence, and P. Spence and Sons, Ltd., Manchester, and R. Ockel, Lower Walton. Eng. Pat. 23,640, Nov. 2, 1904.

THE solid press-cake yielded by the process described in Eng. Pat. 12,124, 1900 (this J. 1901, 830, and 1904, 334) is treated with sufficient mineral acid, preferably sulphuric acid, to decompose the soapy matters present. The cake is then re-dried and the fatty matters extracted by means of a suitable solvent. The quantity of acid added depends on the nature of the sludge, and the mixing may be carried out in a mortar mill.—W. P. S.

#### FRENCH PATENTS.

*Water; Process for the Purification of* —. J. D. Delavierre. Fr. Pat. 353,910, May 3, 1905.

THE process more particularly applies to the purification of dirty river water. After a preliminary straining and settling, the water is allowed to flow through a number of cylindrical vessels placed in series so that each stands at a slightly lower level than the preceding one. The water as it enters each of these vessels passes down a side partition and then rises up the centre of the vessel where it is subjected to the action of a current of electricity. On leaving the last electrolytic vessel the water is conducted into a settling chamber provided with baffle plates, &c. Means are supplied for drawing off the sediment from all parts of the apparatus. Chalk or other substances may be added to the water before treatment.—W. P. S.

*Water; Process for Dissolving Ozone in* — [for Sterilisation]. Comp. Franç. de l'Ozone. Fr. Pat. 354,298, May 15, 1905.

THE water is pumped in at the top of a tall vertical pipe



into which the ozone is also forced. A short distance below the inlet for the ozone, is an "emulsifier" for the purpose of effecting an intimate mixture of the water and ozone. This "emulsifier" may consist of a constriction in the pipe, or of two superposed cones opening into a conical enlargement in the pipe. The water, after admixture with ozone, is discharged from the bottom of the pipe into an outer concentric pipe filled with water, and the sterilised water overflows from the top of this outer pipe, and passes to the delivery pipe.—A. S.

## (C.)—DISINFECTANTS.

## ENGLISH PATENT.

*Deodorisation of Rooms, or other Places or Materials which have been Disinfected with Formaldehyde or the like; Effecting the —.* E. Fournier, Paris. Eng. Pat. 4455, March 3, 1905.

SEE Fr. Pat. 351,518 of 1905; this J., 1905, 901.—T.F.B.

## UNITED STATES PATENT.

*Gaseous Mixtures [Sulphur Dioxide, &c.] for Extinguishing Fire, Killing Insects, &c.; Apparatus for the Production of —.* R. Marot, Paris. U.S. Pat. 799,348, Sept. 12, 1905.

SEE Eng. Pat. 14,372 of 1904; this J., 1904, 879.—T.F.B.

## XIX.—PAPER, PASTEBOARD, Etc.

## ENGLISH PATENT

*Cellulose; Manufacture of Acetylated —.* J. Y. Johnson. London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 24,083, Nov. 7, 1904.

SEE Fr. Pat. 347,906 of 1904; this J., 1905, 454.—T.F.B.

## FRENCH PATENTS.

*Paper; Process for Manufacture of —.* H., L., and A. H. Von Donnersmarck-Beutel. Fr. Pat. 353,997, May 5, 1905.

Logs of wood, either whole or split into quarters, are boiled under pressure with a caustic soda lye, or even with the waste lyes derived from the manufacture of wood cellulose. The boiled logs are then ground in the ordinary wood-pulp grinders to produce a brown pulp suitable for paper or mill-board. It is stated that a saving of 50 per cent. of grinding power is effected with logs boiled in this manner as compared with the plain steamed logs usually employed in making brown mechanical pulp.—J. F. B.

*Alfa [Esparto] and other similar Plants; Conversion of — into Paper Pulp or Textile Fibres.* Mmc. M. Kuess, nee Solley. Fr. Pat. 354,092, May 8, 1905.

ESPARTO is boiled under pressure with a solution of petroleum soap for several hours, the soap solution is run off and the charge is boiled again for a short time with pure water, to which gelose may be added with advantage. The esparto fibres so obtained are very silky and of a pale yellow colour, and can be carded like cotton for textile purposes. For preparing paper pulp the esparto is boiled twice with petroleum soap. The soap is recovered by allowing the used liquors to stand until the soap can be skimmed off the surface.—J. F. B.

*Ligneous "Starch" ("Amidon de lignine"), Amyloid, Dextrose and Alcohol from Wood Wastes; Process of Manufacture of —.* Mlle. M. Holanbek. Fr. Pat. 353,730, April 27, 1905. XVII., page 1079.

*Celluloid, Horn, Ebonite, and similar Substances; Process for Making a Substitute for —.* W. H. Story. Fr. Pat. 353,995, May 5, 1905.

COMMERCIAL phenol (50 parts) or an equivalent quantity of another phenol, is boiled with 40 per cent. formalde-

hyde solution (30 parts), for about eight hours in a vessel provided with a reflux condenser. The product is then rapidly concentrated at a temperature somewhat above 100° C., and poured into moulds, when it hardens on cooling, and forms a transparent mass. If an opaque product is desired, a small quantity of a metallic salt or a fatty oil may be added; the product may also be coloured by the addition of a suitable dyestuff. When the substance is still viscous, it may be dissolved in an organic solvent, the solutions serving as varnishes. When it has hardened, it is stated to be insoluble in every solvent, and not attacked by alkalis or acids, excepting fuming nitric acid. (See Fr. Pat. 345,398 of 1904; this J., 1904, 1233.)

—T. F. B.

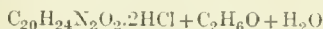
*Celluloid and Similar Substances; Process and Apparatus for Treating Waste —.* E. Garbin, and G. and C. Gérard. Fr. Pat. 354,389, May 17, 1905. Under Int. Conv., Dec. 1, 1904.

SEE Eng. Pat. 10,319 of 1905; this J., 1905, 1028.—T.F.B.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Quinine Hydrochloride; Neutral —.* H. Carotte. J. Pharm. Chim., 1905, 22, 299—303.

THE author has previously stated (this J., 1904, 1041) that neutral quinine hydrochloride, when crystallised from alcohol, contains 1½ mols. of alcohol of crystallisation. C. Erba, having examined the same salt, came to the conclusion that the true formula is



(this J., 1905, 208). The analytical figures obtained by the two investigators were identical, but were differently interpreted. It is now found that when the salt is crystallised from perfectly absolute alcohol, it forms white opaque cauliflower aggregations of needles containing 1 mol. of alcohol; this new salt has therefore the formula  $C_{20}H_{24}N_2O_2 \cdot 2HCl + C_2H_6O$ . When exposed to the air, these crystals rapidly part with their alcohol, and absorb 2½ mols. of water. When the salt is crystallised from ordinary absolute alcohol, containing traces of water, the crystals obtained contain 1 mol. each of alcohol and water, of which the whole of the alcohol and ½ mol. of water are lost on drying in dry air at 37° C. From a mother liquor consisting of absolute alcohol to which a trace of water was added, crystals having the formula  $C_{20}H_{24}N_2O_2 \cdot 2HCl + C_2H_6O + H_2O$  were obtained; these occur as large transparent crystals, unstable in the air, losing 1 mol. of alcohol, and forming the salt with 2½ mols. of water, similar to the salt obtained by crystallisation from an aqueous medium.—J. O. B.

*Quinine Salts and Salts of Ammonium.* P. Guignes. J. Pharm. Chim., 1905, 22, 303.

It has previously been recorded that the presence of ammonium arsenate in the mother liquor facilitates the crystallisation of quinine arsenate. The phenomenon is found to be general. With quinine sulphate, dissolved by means of a small amount of sulphuric acid, and neutralised with ammonia, a dense crystalline precipitate is obtained on adding any ammonium salt in sufficient quantity to destroy the fluorescence of the solution. The crystals formed consist of a mixture of quinine sulphate and the quinine salt corresponding to the ammonium salt added. When ammonium oxalate or tartrate are used, however, the resulting crystals consist of pure quinine tartrate or oxalate. If instead of the sulphate of quinine, hydrated quinine freshly precipitated by ammonia and dissolved in the acid corresponding to the salt it is desired to produce, be employed, and the ammonium salt of the same acid be added to the solution, the pure quinine salt readily crystallises out. This method of salting out a given salt of quinine with the corresponding salt of ammonium, affords a ready means of preparing it in a pure state.—J. O. B.

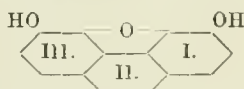
*Coniine Alkaloids; Separation of the* — J. v. Braun. Ber., 1905, 38, 3108—3112.

THE bases to be separated are contained in the hemlock, and consist of coniine, methyl-coniine,  $\gamma$ -coniceine and conhydrine. By fractionation, it is possible to separate the bulk of the coniine from the other substances. The mixture of four bases is then distilled until the temperature of 190° C. is reached. The small quantity of residue left is the *conhydrine*. The distillate is treated with benzoyl chloride and sodium hydroxide, which gives benzoylconiine and benzoyl-4-aminobutylpropylketone with the coniine and coniceine respectively. These form a reddish oil, which is taken up by ether, and from which the *methylconiine* is separated by shaking with dilute acid. The ethereal solution is dried, concentrated, and treated with ligroin (light petroleum spirit), which precipitates the bulk of the benzoylaminobutylpropylketone. The solution is evaporated, and distilled *in vacuo* up to 220° C. The residue is taken up with ether, and precipitated with ligroin. The precipitate is added to the rest of the benzoylaminobutylpropylketone, from which the *coniceine* is obtained. The distillate contains the benzoylconiine which gives the *coniine*. The methylconiine obtained in this separation gives a smaller rotation (positive) than d-methylconiine, and yet it does not appear to be a mixture of d- and l-methylconiine.—C. E. F.

*Thebaine; Decomposition Products of* — [Constitution of Opium Alkaloids.] L. Knorr and R. Pschorr. Ber., 1905, 38, 3172—3181.

AN account is given of the decomposition products of thebaine, and then the more important results obtained by the decomposition of the opium alkaloids and their derivatives, together with references to the literature on the subject, are collected in a table.

At the present time the following facts in respect to the constitution of the opium alkaloids may be regarded as proved. (1) The three alkaloids are derivatives of 3,6-dihydroxyphenanthrylene oxide.



In codeine one, and in thebaine both of the hydroxyl groups are methylated. (2) The divalent complex— $C_2H_4.N.CH_3$  is attached to the phenanthrene nucleus as a side chain. (3) In thebaine, four, and in morphine and codeine, six of the CH groups of the phenanthrene nucleus are reduced to  $CH_2$ . The six additional hydrogen atoms of morphine are divided among the rings II. and III., whilst the ring I. is a true benzene nucleus. The group  $C_2H_4.N.CH_3$  is attached to the reduced portion of the phenanthrene nucleus.—A. S.

*Chelidonium; Chemistry of* — J. O. Schlotterbeck and B. S. Knapp. Amer. Pharm. Assoc., Sept., 1905. Pharm. J., 1905, 95, 443.

THE authors have made a further study of chelidonium (see this J., 1902, 273), and find that it contains one hydroxyl group. When saturated with hydrochloric acid gas at -20° C., and then allowed to stand in a sealed tube for six days at the ordinary temperature, it is apparently converted into amorphous trichelidonium. By treatment with cold phosphorus pentachloride, a mixture of white amorphous monochlorchelidonium,  $C_{20}H_{18}ClNO_4$ , and an amorphous lence compound containing one atom of hydrogen less are produced. On heating with phosphorus pentachloride, the two compounds mentioned above are produced, and also a colourless crystalline chloro-base. This latter yields bright red crystalline salts with acids; the hydrochloride has the composition  $C_{20}H_{15}ClNO_4 \cdot 5H_2O$ . On oxidation with a mixture of nitric and glacial acetic acids, chelidonium yields a crystalline acid melting above 300° C.—A. S.

*Myrtle Oil; New Terpene Alcohol in* — H. von. Soden and Fr. Elze. Chem.-Zeit., 1905, 29, 1031.

THE characteristic smell of myrtle oil is chiefly due to the

acetic ester of an alcohol having the formula  $C_{10}H_{18}O$ , which is contained in the higher-boiling fractions of the oil. To prepare the alcohol, the portion of myrtle oil boiling above 160°—180° C. is fractionated repeatedly by vacuum distillation, and a middle fraction of 0.975 sp. gr. is collected. This is hydrolysed with alcoholic potash, and then distilled, first with steam, and afterwards in a vacuum. The crude alcohol is further purified by making the phthalic acid ester (m. pt. 116°), and then hydrolysing. The alcohol is an oil boiling at 220° C. (751 mm.).—C. E. F.

*Formaldehyde; Modification of Hekner's Test for* — A. B. Lyons. XXIII., page 1086.

#### ENGLISH PATENTS.

*Ortho-oxycarboxylic Acid Esters [Esters] of the Phenyl or Naphthyl Series; Manufacture of* — C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 23,974, Nov. 5, 1904.

SEE Fr. Pat. 347,734 of 1904; this J., 1905, 346.—T. F. B.

*Camphenes; Manufacture of* — A. Béhal, Paris. Eng. Pat. 10,758, May 23, 1905.

SEE Fr. Pat. 349,896 of 1904; this J., 1905, 857.—T. F. B.

*Bornyl Acetates; Manufacture of* — A. Béhal, Paris. Eng. Pat. 10,758A, May 23, 1905.

SEE Addition of May 16, 1905, to Fr. Pat. 349,886 of 1904; this J., 1905, 985.—T. F. B.

*Camphors; Manufacture of — from Bornyl Acetates* — A. Béhal, Paris. Eng. Pat. 10,758B, May 23, 1905.

SEE Addition of May 16, 1905, to Fr. Pat. 349,886 of 1904; this J., 1905, 985.—T. F. B.

#### UNITED STATES PATENTS.

*Benzoylsalicylic Acid and Process of Making same*. E. Bloch, Basel, Switzerland. U.S. Pat. 799,706, Sept. 19 1905.

BENZOYLSALICYLIC acid is obtained in the form of its sodium salt by the interaction of equal molecules of benzoyl chloride and disodium salicylate in a suitable solvent (e.g., ether); the free acid is prepared by treating the sodium salt with acetic acid. It is sparingly soluble in water, easily in ether, alcohol or chloroform; after recrystallisation from alcohol its m. pt. is 132° C.; it is resolved into salicylic acid and benzoic acid by boiling with alkali.—T. F. B.

*Theobromine Sodium Formate and Process of Making same*. F. H. Tritschler, Assignor to F. Hoffmann-L. Roche, and Co., Basel, Switzerland. U.S. Pat. 799,764 Sept. 19, 1905.

AN addition product of the composition  $NaC_7H_7N_4O_2 + HCOONa + H_2O$  is produced by the action of anhydrous sodium formate on monosodium theobromine in aqueous solution. It contains approximately 62.5 per cent. of theobromine, and dissolves in water, giving an alkaline solution, from which theobromine is precipitated by acetic acid. It is applicable as a diuretic.—T. F. B.

*Guanin; Process of Making* — L. Weber, Darmstadt, Germany. U.S. Pat. 799,955, Sept. 19, 1905.

SEE Eng. Pat. 10,976 of 1905; this J., 1905, 813.—T. F. B.

*Salicylglycollate and Process of Making same; Alkyl* — P. Holzach and E. Preiswerk, Assignors to Soc. Chem. Industry in Basle, Basel, Switzerland. U.S. Pat. 800,442, Sept. 26, 1905.

SEE Eng. Pat. 24,672 of 1904; this J., 1905, 902.—T. F. B.

#### FRENCH PATENTS.

*Ether Vapours; Recovery of* — Soc. J. Jean et Cie and G. Raverat. Fr. Pat. 350,057, July 13, 1904.

THE process for the recovery of ether, either pure or mixed with other gases or alcohol, air or moisture, is based



on the retention of the ether vapour by concentrated sulphuric acid of about 53° to 66° B. The ether is liberated by the addition of water to the acid, and recovered by decantation or distillation.—F. S.

*Dialkylbarbituric Acids; Process of Preparing* — Farbentfabr. vorm. F. Bayer und Co. First Addition, dated Feb. 7, 1905, to Fr. Pat. 353,278, Feb. 7, 1905. Under Int. Conv., July 6, 1904.

SEE U.S. Pat. 789,902 of 1905; this J., 1905, 749.—T. F. B.

*Dialkylmalonylurea [Dialkylbarbituric Acid]; Process for Producing* — C. E. Merck. Fr. Pat. 354,355, March 20, 1905. Under Int. Conv., June 17, 1904.

UNDER all conditions of reaction, the condensation of biuret with a dialkylmalonylchloride gives rise only to a dialkylmalonylurea (dialkylbarbituric acid), and not to an eight-membered ring compound as might have been anticipated. This method for the production of dialkylmalonylureas is claimed.—T. F. B.

*Ichthylsulphonic Acids, obtained by the Action of Sulphuric Acid on Mineral Oils Containing Chemically-combined Sulphur; Process of Preparing* —, and *Separating them from the Sulphuric and Hydrochloric Acids and Organic Salts.* Soc. Anon. de la Thyolécine. Fr. Pat. 353,708, April 26, 1905. Under Int. Conv., April 28, 1904.

"ICHTHYOL oil" is sulphonated in the usual manner, washed with a solution of salt, and then extracted with petroleum spirit to remove the unsulphonated oil. The residue is then dissolved in ether, benzene, or other suitable solvent, and allowed to stand. After a time the solution separates into two layers, which are separated, and the upper (ethereal) layer evaporated, when the ichthylsulphonic acids are obtained in a pure condition. Or, if desired, the ichthyl solution may be neutralised with ammonia previous to distillation.

—T. F. B.

*Chloroform; Prevention of Decomposition of — by Air and Light; and Indication of the Decomposition.* P. J. Breteau. Fr. Pat. 353,858, May 2, 1905.

THE chloroform is preserved from the action of air and light by the addition of one or more of the following:—Jeder pith, cork, wood-pulp, guaiacol, ionone, spermaceti, craniole, metamethylprotocatechuic aldehyde or acid, penthol, methylphenyl ether, safrol, methylene-protocatechuic aldehyde, camphor, terebenthene, stonellol alcohol, terpineol, cholesterol. The pith, cork, or wood-pulp may be soaked in a solution of a dyestuff insoluble in chloroform and dried before putting into the chloroform. Any decomposition changes the colour of the dye. (See this J., 1904, 725).—F. S.

*Chloroform and Iodoform; Process and Apparatus for Making* —. H. S. Elworthy and D. Lance. Fr. Pat. 354,291, May 15, 1905.

CHLOROFORM is prepared by subjecting a mixture of the necessary proportions of methane and chlorine, diluted with some inert gas, such as nitrogen or carbon dioxide, to the action of strong light. The methane is preferably prepared by passing a mixture of water-gas and hydrogen over heated nickel. The mixture is passed through a series of thick-walled glass tubes exposed to sunlight, or other suitable light. By diluting the gases, it is stated that there is no risk of explosion or of too rapid a reaction. The chloroform is converted into iodoform by mixing it with an alcoholic solution of sodium or potassium iodide."

—T. F. B.

*Camphor from Isoborneol or Borneol; Process of Preparing* —. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 353,919, May 3, 1905.

SEE Eng. Pat. 9550 of 1905; this J., 1905, 902.—T. F. B.

*Substances [Cyclocitral Derivatives] Possessing the Odour of Violets; Manufacture of* —. A. J. H. Maschmeijer. Fr. Pat. 354,050, May 6, 1905. Under Int. Conv., July 22, 1904.

SEE Eng. Pat. 13,347 of 1905; this J., 1905, 1030.—T. F. B.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*Silver Chloride and Bromide; Colour-sensitive* —. L. Günther, Phot. Chronik, 1905, 361. Chem.-Zeit., 1905, 29, Rep., 287—288.

THE various coloured "photochlorides" were prepared by the author from colloidal silver. The rose-red variety could only be obtained by the use of freshly prepared silver and chlorine solutions, or from silver chloride prepared by precipitating very dilute silver nitrate solution with very dilute hydrochloric acid. The plate prepared from the red-violet and purple-red photochlorides, obtained from colloidal silver, were the most sensitive to colour. Photobromides were prepared in a similar manner, but are not so sensitive to colour; when emulsified in the colloidal state in gelatin and ripened, their sensitiveness to light is increased without increase in colour sensitiveness. The red photochloride gives plates which are most highly colour sensitive, the blue and violet of a spectrum being best rendered, followed by the yellow and red; green is only rendered as bluish-green. A feeble spectrum image on a photochloride plate can be improved by immersion in mercuric chloride solution. A mixture of photochloride and photobromide is not more sensitive than the photochloride; the colour sensitiveness is not improved by the addition of Erythrosin or a cyanine. The author considers, with Wiener, that the colours produced are "body colours," since, on printing a spectrum on to one already printed, the colours of the original spectrum are destroyed, and those of the second one take their places. (See this J., 1888, 230.)

—T. F. B.

*Latent Image; So-Called Destruction of the* —. Lüppo-Cramer. Phot. Corr., 1905, 42, 319. Chem.-Zeit., 1905, 29, Rep., 288.

THE author finds that by treating the latent image with certain reagents, e.g., nitric acid, bromine water, chromic acid, and halides of heavy metals, it is not destroyed, as has been previously contended, but that the subsequent development is very greatly retarded.—T. F. B.

*Negatives; Composition of* —. Lüppo-Cramer. Phot. Corr., 1905, 42, 319. Chem.-Zeit., 1905, 29, Rep., 288.

NEGATIVES which have been immersed for a short time in a 2 per cent. solution of chrome alum and dried, can be treated with reagents which would otherwise destroy the gelatin; thus the silver can be entirely removed from a hardened negative by treatment with nitric acid, ammonium bromide or ammonium thiocyanate; it is also removed without hardening the plate by a solution of chromic acid in two minutes, the gelatin remaining uninjured for some hours; the residue, after this treatment, is of a yellowish-brown colour, and contains no silver chromate; the original image has lost only the feeblest details. When a hardened negative has been treated with ammonium bromide or potassium cyanide, no visible residue is left, but when ammonia and ammonium thiocyanate are used, a distinctly visible image remains. Negatives fixed with thiosulphate are unaltered if immersed for a short while in potassium cyanide or ammonium bromide solution. The residue left after removing the silver from a negative has the following properties: It is unaltered by thiosulphate; bleached by iodine vapour and bromine water; permanently destroyed by Farmer's reducer; is slightly sensitive to light, no metallic silver being produced.—T. F. B.

### ENGLISH PATENTS.

*Films for Photographic and other Purposes; Manufacture of* —. J. H. Smith, Zurich, Switzerland. Eng. Pat. 10,372, May 17, 1905. Under Int. Conv., May 18, 1904.

A GELATIN film, protected on either side by a film of nitrocellulose, and which is said to show no tendency to curl up, is produced by preparing two component films by

first coating a suitable support (e.g., glass) with a solution of gelatin, and allowing this to dry, and then coating the gelatin with a nitrocellulose solution, allowing it to dry, and stripping from the support. If the resulting film is to be used for photographic purposes, the gelatin side of one of the component films is damped and coated with a sensitive emulsion, and the other is moistened and pressed with its gelatin surface to the emulsion of the other component. If the film is intended for other purposes, the two components are moistened, and their gelatin surfaces pressed together. The process may be slightly simplified by preparing only one film, moistening the gelatin surface, and then doubling it upon itself, so that the nitrocellulose surface forms a protective coating to the gelatin.—T. F. B.

*Pigment Process [of Photography] and New Copying Materials for use therein*; The ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 26,456, Dec. 5, 1904.

SEE Fr. Pat. 349,120 of 1904; this J., 1905, 655.—T. F. B.

#### FRENCH PATENTS.

*Sensitising Films of Gelatin, Gum, and similar Products employed for Photographic Purposes; Chromium Preparation for ——*. Act.-Ges. f. Anilinfabr. Fr. Pat. 354,220, May 11, 1905.

A SOLUTION of an alkali bichromate in acetone and water is employed for sensitising gelatin and similar substances for photographic purposes. The solution may consist of ammonium bichromate, 8 parts; water, 100 parts; acetone, 120 parts. The use of such a solution enables the papers, &c., to be dried in five or ten minutes; it is also stated that prepared papers can be kept much longer without deterioration than those prepared with aqueous solutions.—T. F. B.

*Films for Photographic and other Purposes; Process of Making ——*. J. H. Smith. Fr. Pat. 354,330, May 16, 1905. Under Int. Conv., May 18, 1904.

SEE Eng. Pat. 10,372 of 1905; preceding these.—T. F. B.

*Development; Process of Photographic — in which the Gelatin is Hardened at the same Time*. Act.-Ges. f. Anilinfabr. Fr. Pat. 354,005, May 5, 1905.

PHOTOGRAPHIC plates, papers, &c., may be developed and hardened at the same time by adding to the developer a chromium salt; the developer should be composed of a reducing agent which works in presence of an alkali sulphite only, e.g., diaminiophenol or diaminoresorcinol. For example, 2 grms. of 2,4-diaminiophenol and 3 grms. of chromic chloride are dissolved in 300 to 400 c.c. of water, and 6 grms. of anhydrous sodium sulphite are dissolved in the solution. Development of a negative occupies about six minutes; the washing and fixing are performed as usual, when the plate can be washed with water at a temperature of 80–90° C. (which takes about 10 minutes), and dried at the same temperature.—T. F. B.

## XXII.—EXPLOSIVES, MATCHES, Etc.

#### ENGLISH PATENTS.

*Percussion Caps, Detonators, Igniters and the like for the Ignition and Detonation of Explosives; Impts. in or Additions to the Materials Employed in the Manufacture of ——*. King's Norton Metal Co., Ltd., London. T. A. Bayliss and H. W. Brownsdon. Eng. Pat. 23,366, Oct. 29, 1904.

IN order to obtain greater efficiency and certainty of action in the igniting materials of percussion caps, &c., a metal (preferably aluminium) or metals in fine powder, are intimately admixed with the igniting substances. Shellac varnish of a sp. gr. of 0.84–0.86 containing 10 per cent. of aluminium in suspension is added to the cap composition in such a manner that the surface of the explosive is completely covered with the aluminium powder when the

varnish is dry. A sufficient excess of potassium chlorate must be present in the cap composition to produce complete combustion of the aluminium. The addition of shellac varnish serves to protect the metallic powder from actual contact with the composition so that any chemical reaction is impossible.—G. W. McD.

*Explosive Compounds; Impts. in ——*. Curtis's and Harvey, Ltd., London, and A. F. Hargreaves, Rosli N.B. Eng. Pat. 26,146, Dec. 1, 1904.

AN explosive for use in blasting and for shells is made by blending a non-detonating granular explosive (gunpowder), with a granular detonating explosive composed of barium or potassium nitrate, mixed with a nitro derivative of benzene, toluene, naphthalene or phenol. The invention consists essentially in making each explosive separately in a granular form, and then blending the two together in a mechanical mixture in such a way that each explosive retains its individuality, and is capable of performing its own special function, without being impeded by the other, as would be the case when the two are incorporated into one intimate mixture.

The gunpowder constituent may consist of potassium nitrate (78 parts), charcoal (17 parts), and sulphur (3 parts); the detonating constituent of potassium nitrate (75 parts) and dinitrotoluene (25 parts), and they are mixed in approximately equal proportions. The explosive produces shattering effects similar to the detonating class of explosives, but does not require the use of a detonator.—G. W. McD.

*Priming or Detonating Compositions suitable for Percussion Caps*. J. Wetter, London, From Westfälische Anhalt. Sprengstoff-Akt.-Ges., Berlin. Eng. Pat. 27,005, Dec. 10, 1904.

SEE Fr. Pat. 348,721 of 1904; this J., 1905, 636.—T. F. B.

*Nitrocellulose, Nitroglycerin and like Explosives; Manufacture of ——*. E. Hesketh, London and F. A. Willcox, Sunderland. Eng. Pat. 1416, Jan. 24, 1905.

IN the operations of mixing acids and in those of nitration and separation in the manufacture of nitrocellulose and nitroglycerin, it is proposed to employ compressed air which has been cooled and deprived of moisture by means of refrigeration. The development of heat by the combination of the atmospheric aqueous vapour with the sulphuric acid is thus avoided, and the acid is more easily maintained at the requisite temperature.—G. W. McD.

*Explosives; Impts. in High ——*. R. Imperiali, Napoli. Eng. Pat. 14,545, July 14, 1905.

AMMONIUM nitrate (74 parts), antimony sulphide (6 parts) and dinitrobenzene (20 parts) are incorporated together and the mixture kept at a temperature of 100° C. until melted dinitrobenzene covers every particle of the explosive with an impermeable layer which affords protection against the action of moisture. The whole mass is then subjected to pressure until a sp. gr. of 1.7 is attained. The dinitro compounds of toluene and naphthalene are also claimed.—G. W. McD.

#### UNITED STATES PATENTS.

*Explosive*. E. Steele, Berlin. U.S. Pat. 799,687, Sept. 19, 1905.

THE explosive consists of a nitrated mixture of resin and starch-meal, together with potassium chlorate and from 0.5 to 5 per cent. of powdered aluminium.—A. S.

*Explosive; Nitroglycerin [Nitromonochlorhydrin] ——*. M. Bielfeldt, Berlin. U.S. Pat. 799,705, Sept. 19, 1905.

SEE Fr. Pat. 352,750 of 1905; this J., 1905, 987.—T. F. B.

#### FRENCH PATENTS.

*Explosives containing Aluminium; Process of Improving the Quality of ——*. Soc. G. Roth. Fr. Pat. 353,864, May 2, 1905.

SEE Eng. Pat. 6651 of 1905; this J., 1905, 814.—T. F. B.



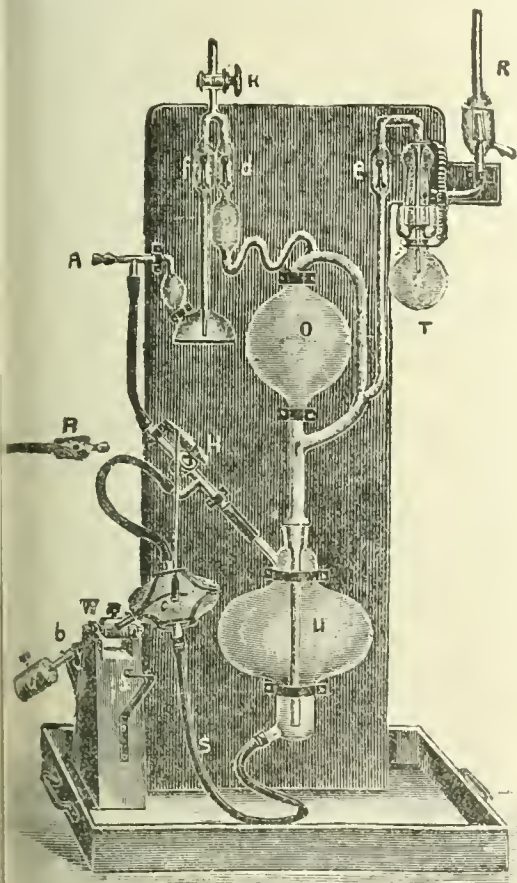
Matches; Paste, free from White Phosphorus, for the Manufacture of —. D. L. Barbé. Fr. Pat. 350,052, July 11, 1904.

According to the present invention the tips of the matches are coated with a mixture of two pastes of suitable composition, for example, a mixture of the pastes used for the boxes and heads respectively of ordinary safety matches.—A. S.

### XXIII.—ANALYTICAL CHEMISTRY.

#### APPARATUS, Etc.

Mercury Pump; Automatic — with Shortened Column of Mercury. L. Ubbelohde. Ber., 1905, 38, 2657—2659.



HE pump is similar in construction to the one described by Stock (this J., 1905, 814), except that it is provided with a device whereby it works automatically. To fill the pump, the rubber tubing connected to the upper part of the small glass vessel *c* is detached from the main part of the pump, and mercury is introduced through it until the vessel *U* is filled up to a mark on its upper narrowed portion. The rubber tube is then again fastened to the pump, and mercury is now introduced through *A* until a tube below the valve *f* is immersed to a depth of 3 mm. in mercury in the hemispherical vessel below. A water-pump is then connected to *A*, and the apparatus together with the vessel in which a vacuum is to be produced, and which is attached at *R*, is exhausted, the screw device *W* being fixed in the position shown in the ure by the clamp *b*, whilst the three-way cock *H* is open *A* and *U*. After the desired degree of vacuum is gained, the clamp *b* is loosened, and the pump will now work automatically. The weight of the mercury in *c*

causes the device *W* to move in such a manner that cock *H* is closed against *U*, whilst the latter is put into communication with the air. The mercury, forcing any air before it, rises through the tube *r*, between *U* and *O*, and the vessel *O* itself, until stopped by the valves *d* and *e*. When the level of mercury in *U* has sunk below a certain level, that contained in *c* begins to flow into *U* through the tube *s*, and after a time, the counter-weight *G* causes the device *W* to swing, whereby the cock *H* is turned and *U* is again put in communication with the water pump. The mercury then begins to fall again into *U* producing a Torricellian vacuum in *O*, and after a time *c* fills again and the whole process is repeated. When *U* is in communication with the air, the screw-clamp on the piece of tubing attached to *U* is so arranged that the air enters with great velocity at the beginning; towards the end the velocity is reduced automatically as the mercury rises in *r*, the tube connecting *U* and *O*. —A. S.

Mercury Pump; A Rotating —. W. Kaufmann. Z. Instrumentenk., 1905, 25, 129—133. Science Abstracts, 1905, 8, A, 537.

THE pump consists essentially of a glass cylinder partially filled with mercury, and provided with two branch tubes, which are coiled around it in the form of spirals. The cylinder is mounted in a position inclined to the vertical, and, when rotated round its axis, acts in a somewhat similar manner to a fall-pump, owing to the alternate rise and fall of the mercury in the two spirals. From 200 to 250 c.c. of mercury are required to charge the pump, and it is stated that, by its aid, a bulb of 12 cm. diameter can be exhausted in about 12 minutes from 20 mm. pressure to that at which Röntgen rays begin to appear. —A. S.

#### ENGLISH PATENT.

Gas; Impts. in the Testing of — [Argand Burner]. C. C. Carpenter, London. Eng. Pat. 13,553, July 1, 1905.

A "WANDSWORTH" argand burner is modified by attaching to its socket a vertical threaded pin, on which is mounted a horizontal disc, which may be screwed up or down on the pin, the disc being of diameter sufficient to cover the air inlet to both the inner and outer surfaces of the annular flame. The proportion of air admitted to the burner may thus be regulated. The modified burner is designed for use in the photometric testing, at a standard rate of consumption, of gases of various compositions. —H. B.

#### INORGANIC—QUALITATIVE.

Vanadium Compounds; Some — [and the Detection of Hydrochloric Acid]. C. Matignon. VII., page 1035.

#### INORGANIC—QUANTITATIVE.

Manganese; Determination of —, in Presence of Chromium. M. Gröger. Chem.-Zeit., 1905, 29, 987—988.

THE author has adapted Volhard's permanganate method to the determination of manganese in presence of chromium. Zinc hydroxide precipitates some manganese with the chromium from a chromic solution containing manganese. A basic zinc sulphate is, however, satisfactory. It may be prepared by dissolving 288 grms. of pure crystallised zinc sulphate and 28 grms. of pure caustic potash, each in 500 c.c. of water, and shaking them well together in a closed flask. To a measured volume of the sample solution, containing about 0.1 grm. of chromium, contained in a 250 c.c. flask on a boiling water-bath, the zinc "solution" (well shaken) is added, until the precipitate appears no longer green, but violet. The whole is then cooled, water added up to the mark, and the solution filtered through a dry filter. Fifty c.c. of the filtrate are treated with 20 grms. of crystallised zinc sulphate in 150 c.c. of water, the mixture heated to boiling and titrated with N/10 permanganate solution, shaking vigorously. If

chromium be present as a chromate, the solution is first reduced with sulphur dioxide, and the excess of this boiled off after addition of sulphuric acid.—F. SDN.

*Arsenic ; Determination of —, in presence of Vanadium and Molybdenum.* C. Friedheim, O. Decker and E. Diem. Z. anal. Chem., 1905, 44, 665—686.

To every 1 grm. of the substance are added 1-1½ grm. of potassium iodide and 70 c.c. of hydrochloric acid (sp. gr. 1.19) and the mixture is distilled at once, without waiting for solution. A 100 c.c. distillation flask with a well-fitting ground-in delivery tube is employed, and in order to avoid liquid being thrown over, the neck of the flask is enlarged at two points. The receiver is cooled by water to prevent loss of arsenic. Much iodine separates at first, and until all this is over, the flames should be carefully regulated to prevent stoppage of the delivery tube. All the arsenic is distilled over in 20 minutes. The distillate is evaporated to a syrup, chlorine-water being added at intervals as an oxidiser. The arsenic pentoxide may then be weighed as such, over phosphorus pentoxide, after evaporation in a platinum dish and heating to dull redness (435°—450° C.), or be precipitated by magnesia mixture. The vanadium and molybdenum in the residue are separated, as usual, by sulphuretted hydrogen, the former being determined volumetrically by permanganate and the latter as trioxide, according to the known methods.—F. SDN.

*Phosphoric Acid ; Determination of — as Ammonium Phosphomolybdate.* G. P. Baxter and R. C. Griffin. Amer. Chem. J., 1905, 34, 204—217.

It has already been shown (this J., 1902, 1351) that the precipitate formed by adding a solution of phosphoric acid to an ammonium molybdate solution containing an excess of molybdic acid, and heating to 300° C., has approximately the formula  $(\text{NH}_4)_3\text{PO}_4 \cdot 12\text{MoO}_3$ , but that there is always some excess of  $\text{MoO}_3$  above what is given by this formula. The amount of this excess of  $\text{MoO}_3$  is found to depend on the conditions of precipitation, but under given conditions is constant. Under the following conditions the number 12.143 represents the number of molecules of  $\text{MoO}_3$  in the precipitate. The phosphate solution is poured into the molybdate solution with constant stirring, and the solution allowed to stand for 18 hours at the ordinary temperature. The precipitate is filtered through a weighed Gooch crucible, and is washed with a 10 per cent. solution of ammonium nitrate; it is then heated in an air bath to 300° C. for two hours and weighed. If this method be followed, the precipitate, which is obtained at first, is a diammonium phosphomolybdate, but this is converted after heating (in presence of the ammonium nitrate) into  $(\text{NH}_4)_3\text{PO}_4 \cdot 12.143\text{MoO}_3$ . In carrying out this precipitation the phosphate solution must be poured into the molybdate solution, and not the reverse; it is also important that the precipitation should be carried out in the cold, if constant results are to be obtained.—C. E. F.

#### ORGANIC—QUALITATIVE.

*Formaldehyde ; Modification of Hekner's Test for —.* A. B. Lyons. Amer. Pharm. Assoc., Sept. 1905. Pharm. J., 1905, 75, 443.

THE Hekner test for formaldehyde can only be applied to milk or a mixture of the solution under examination with milk, as the presence of proteids is essential to the production of the colour reaction. The author recommends the substitution of beef peptone for the milk. Two duplicate tests are made in the following manner: Two c.c. of the solution under examination are mixed with 20 mgrms. of beef peptone in a test-tube, and 2 c.c. of a mixture of 1 vol. of the official (U.S.P.) tincture of ferric chloride with 20 or 25 vols. of concentrated sulphuric acid are introduced, so as to form a distinct layer at the bottom. One tube is then allowed to stand till the colour-zone develops, whilst the other one is shaken in order to mix the contents. The test is stated to be capable of detecting 1 of formaldehyde in 4,000,000.—A. S.

*Sesamé Oils of Different Origin ; Characteristics of — [and Detection of Sesamé Oil in Butter].* H. Sprinkmeyer and H. Wagner. XIL, page 1074.

#### ORGANIC—QUANTITATIVE.

*Coal ; Determination of Sulphur in —.* O. Bruck. Z. angew. Chem. 1905, 18, 1560—1562.

COBALT oxide, free from sulphur, is prepared by ignition of the pure nitrate at as low a temperature as possible (heating to redness lowers the efficiency of the oxide; small amounts of nitrate left through imperfect decomposition are not harmful). The finely-powdered coal (1 grm.) is intimately mixed in a glass or glazed porcelain mortar with 2 grms. of a mixture of 2 parts of cobalt oxide and 1 part of anhydrous sodium carbonate, and the mixture transferred to a roamy platinum or porcelain boat. This is placed in a wide glass tube, 30 cm. long, through which a stream of oxygen can be led. Experience shows that the far end of the tube may be left open; but, if desired, absorption vessels may be connected there, containing brominated hydrochloric acid, and sodium carbonate solution with a little hypobromite, to catch any sulphur in the escaping gases. Whilst a gentle stream of oxygen passes, the near end of the boat is heated by a very small flame till the coal ignites, when the flame is removed and the combustion is regulated entirely by the stream of oxygen. Near the end, the whole length of the boat is heated gently till combustion is complete—15 minutes is enough for the whole operation. After cooling, the contents of the boat are extracted with water and filtered through a close filter, using a few drops of sodium carbonate with the wash-water to prevent the cobalt oxide from passing through the filter. The filtrate is warmed with a few c.c. of hydrogen peroxide acidified, and precipitated by barium chloride in the ordinary way. With certain coals the cobalt oxide retains sulphur probably as basic sulphate; if this be suspected, the residue on the filter is dried, the filter incinerated, the whole dissolved in a little hydrochloric acid, filtered, and the filtrate treated with barium chloride, any precipitate being added to the main portion. Comparison of this method with Eschka's and the bomb methods show that usually all give concordant results, but that differences sometimes occur between Eschka's method and the others, seldom between the other two. The method is much quicker than Eschka's, excludes the possibility of error from sulphur from the products of combustion of the gas, and allows of any sulphur escaping in the gaseous products being caught and determined.—J. T. D.

*Petroleum and Liquid Fuels ; Determination of Sulphur in —.* A. Goetzl. Z. angew. Chem., 1905, 18, 1528—1531.

To determine the sulphur in liquid fuel, 2—3 grms. of the oil are weighed into a large platinum crucible, and treated with 4 c.c. of fuming nitric acid. The crucible is covered with a watch-glass, and the two layers of liquid allowed to mix gradually, violent action being avoided. The crucible is allowed to stand over night, and is then gently heated of the water-bath. When all action appears to have ceased the watch-glass is removed, and heating on the water-bath continued until the contents are dry. 6—8 grms. of a mixture of pure sodium carbonate and potassium nitrate (5:1) are stirred in, and a layer of this mixture placed on the top. The crucible is then heated with a free flame until the contents are quite white, a little nitre being added if necessary. The resulting mass is dissolved in warm water, hydrochloric acid and barium chloride added, and the sulphur calculated from the barium sulphate obtained.

In the case of a light oil (petroleum) the same method is applicable; 10 grms. of the petroleum are taken, and 12 grms. of the sodium carbonate and nitre mixture are required. The method also gives good results with lignite coals, and animal oils.

For the determination of water in liquid fuel, the method recommended, is the ultimate analysis of the oil before and after drying it with calcium chloride.

—C. E. F.



*Gambier or Yellow Catechu; Determination of the Value of —.* M. Greshoff. Pharm. Weekblad, 1905, 42, 669—676. Chem. Centr., 1905, 2, 993.

**Solubility.**—Five grms. of the sample are shaken with one litre of water, heated nearly to boiling, the mixture is allowed to stand in the dark for 24 hours, and the amount of soluble matter in 100 c.c. of the filtered solution determined, the evaporation residue being dried for three hours at 105° C. **Tannin.**—125 grms. of the aqueous extract are shaken vigorously with 2.5 grms. of "voluminous" aluminium chloride, the mixture is allowed to stand for 24 hours, and the evaporation residue of 100 c.c. of the filtered solution determined as described above. The difference between this and the total soluble matter represents the amount of tannin. **Crude Catechin.**—Two grms. of the sample are finely ground up with an equal weight of pumice, and the mixture is shaken vigorously with 50 c.c. of ethyl acetate. After allowing to stand for 24 hours the solution is filtered, the residue washed twice with 5 c.c. of ethyl acetate, and the evaporation residue of the filtrate determined. The difference between this and the weight of tannin represents the amount of crude catechin. **Crystallised Catechin.**—The mixture of crude catechin and tannin is dissolved in 10 c.c. of warm water, the solution filtered and the residue washed with 5 c.c. of warm water. The filtrate is set aside to crystallise, but if no catechin separate, 0.1 gm. of the pure substance is added, and is subsequently deducted from the total quantity obtained. It is stated that cutch or brown catechu does not yield crystallised catechin by this method. **Water.**—2 grms. of the sample are finely ground with 2 grms. of pumice, and the mixture dried at 105° C.

A sample of unadulterated gambier gave the following results on analysis:—Insoluble matter, 7.6; tannin, 24; crude catechin, 46; crystallised catechin, 30—35; water, about 15; and ash, at the most, 5 per cent.—A. S.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

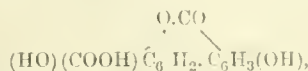
*Grignard's Reaction.* A. Baeyer. Ber., 1905, 38, 2759—2765.

GRIGNARD found that magnesium acts on the bromine and iodine derivatives of fatty hydrocarbons in ethereal solution; also that it acts on the halogen derivatives of the aromatic hydrocarbons if a small quantity of iodine be added. Baeyer and Villiger (this J., 1903, 1124) were unable to obtain a similar reaction with halogen derivatives of aniline and dimethylaniline, but Sachs and Ehrlich (this J., 1904, 56) found that the reaction takes place if a little ethyl bromide be used to start the reaction. This last method has, however, some disadvantages. The author has found that finely divided magnesium acts on the halogen derivatives of aniline, if it receive a thin coating of magnesium iodide before being introduced into the ether. To prepare magnesium in the "active" condition, magnesium filings are heated in a round-bottomed flask, and half the weight of iodine added in small quantities at a time; each portion of iodine is allowed to disappear before the next is added, and the temperature is not allowed to rise above the melting-point. The product turns brown if kept, and moisture must be carefully excluded. Such magnesium acts energetically on methyl alcohol, and somewhat less so on ethyl alcohol and water. In ethereal solution, it is without action on chlorobenzene, but acts violently on bromobenzene. It acts on all the iodo-substitution products from aniline and dimethylaniline; the action is most violent with the ortho-derivatives, and weakest with the para-compounds. The reaction is carried out as follows: One part of the iodine derivative of aniline or dimethylaniline is dissolved in two parts of ether, and one-fifth part of magnesium added in small quantities at a time. The solution remains colourless in the case of the ortho-derivatives, but becomes dark brown with the meta- and para-derivatives; the solubility of the magnesium compounds varies greatly.

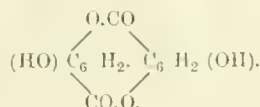
The magnesium compound of the iodo-derivatives of dimethylaniline react with ketones (e.g., benzophenone) in ethereal solution giving derivatives of triphenylcarbinol —C. E. F.

*Hydroxybenzoic Acids; Some Oxidation Products of the —, and the Constitution of Ellagic Acid.* A. G. Perkin and M. Nierenstein. Chem. Soc. Trans., 1905, 87, 1412—1430.

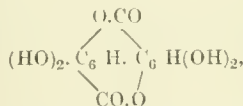
By treating gallic acid in acetic acid solution with potassium persulphate and sulphuric acid, ellagic acid,  $C_{14}H_6O_8$  is produced. It melts above 360° C., and gives a tetracetyl compound melting at 313—346° C. Protocatechuic acid when oxidised in a similar manner, but without using any acetic acid, gives *catellagic acid*  $C_{14}H_6O_6$ , probably identical with the compound isolated by Schiff (Ber., 1882, 15, 2590). It melts above 360° C., and gives a diacetyl compound melting at 322°—324° C. Both ellagic acid and catellagic acid yield fluorene on distillation with zinc dust. *p*-Hydroxybenzoic acid, when treated in a similar manner, yields catellagic acid and a compound  $C_{14}H_8O_6$ , which melts above 360° C., and gives a diacetyl compound melting at 267—268° C. This compound appears to result from the interaction of protocatechuic acid and *p*-hydroxybenzoic acid, and probably has the constitution



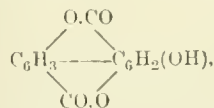
from which it follows that catellagic acid has the formula



In a similar manner ellagic acid would have the formula



identical with that proposed by Graebe (compare this J., 1905, 899). *m*-Hydroxybenzoic acid on oxidation with potassium persulphate and sulphuric acid, gives *metellagic acid*,



m. pt. 273°—276° C., which forms a monoacetyl compound melting at 269—271° C.

The authors find that the compound obtained by Barth and Goldschmidt (Ber., 1879, 12, 1237) by the action of caustic potash on ellagic acid, and considered by them to be hexahydroxydiphenyleneketone, is really the pentahydroxy derivative of the lactone of 2-hydroxydiphenyl-2'-carboxylic acid (diphenylmethylolide) as suggested by Graebe, and this fact agrees with the formula given above for ellagic acid. The dyeing properties of ellagic acid are somewhat anomalous, since the carboxyl group, when present as a portion of a lactone complex, is not usually associated with this characteristic. It is probable, however, that the diphenyl linkage has the effect of rendering these groups less susceptible to hydrolysis, so that a quinonoid form becomes possible. The pentahydroxydiphenylmethylolide mentioned above gives no precipitate with gelatin in warm aqueous solution, and it is doubtful, therefore, whether ellagic acid can be regarded as a tannin matter in the true sense of the word. (Compare this J., 1905, 899.)—A. S.

*Ellagic Acid.* G. Goldschmidt. Monatsh f. Chem., 1905, 26, 1139—1148.

THE author describes an addition compound of ellagic acid and phenylhydrazine and also the tetramethyl ether of ellagic acid, prepared with the aid of an ethereal solution of diazomethane. In a discussion of recent work on the constitution of ellagic acid, he supports the conclusion of Perkin and Nierenstein (see preceding abstract) that Graebe's formula for this compound is correct.—A. S.

*Sulphur in Albuminoid Substances* [Wool]; *Condition of* —. P. N. Raikow. Chem.-Zeit., 1905, 29, 900—901.

Of the elements present in albuminoids, sulphur is the one generally present in smallest quantity, but the sulphur content varies within much wider limits than the amounts of the other elements in different albuminoids. The sulphur compounds which have been isolated, up to the present, from the decomposition products of albuminoids, can all be regarded as derivatives of hydrogen sulphide, and this has given rise to the opinion that the albumin molecule does not contain any sulphur directly united to oxygen. The author has now found that if wool (or human hair) be allowed to stand for some time at the ordinary temperature, in contact with syrupy phosphoric acid (sp. gr. 1.7) in a closed flask, considerable quantities of sulphur dioxide are produced.—A. S.

## New Books.

**SELECT METHODS IN CHEMICAL ANALYSIS** (Chiefly Inorganic). By Sir WILLIAM CROOKES, D.Sc., F.R.S., &c. Fourth Edition, Rewritten and Enlarged. Longmans, Green and Co., 39, Paternoster Row, London, New York and Bombay. 1905. Price 21s. nett.

LARGE 8vo volume, containing 703 pages of subject matter, with 68 illustrations, a final chapter of "Useful Tables," and the alphabetical index. In his preface the author states, that he has rigidly adhered to the rule of "omitting methods of which he has no personal experience," and that he believes that he thus "added to the value of the book as a work of reference." The text is classified under the following divisions:—I. Potassium, Sodium and Ammonium compounds. II. Calcium, Strontium, Barium, Glucium and Magnesium. III. Cerium, Lanthanum group, Didymium, Europium, Gadolinium, Samarium and Yttrium. IV. Zinc, Cadmium, Gallium, Radium, Aluminium, Thallium. V. Uranium, Vanadium, Molybdenum, Tungsten. VI. Chromium, Iron, Manganese, Nickel, Cobalt. VII. Silver, Mercury, Copper, Lead and Bismuth. VIII. Antimony, Tin, Arsenic, Tellurium and Selenium. IX. Gold, Platinum, Palladium, Iridium, Osmium, Rhodium, Ruthenium. X. Sulphur, Phosphorus and Nitrogen. XI. Iodine, Bromine, Chlorine, and Fluorine. XII. Carbon, Boron, Silicon. XIII. Electrolytic Analysis. Gas Analysis. XIV. Miscellaneous Processes and General Methods of Manipulation.

**CHEMISTRY FOR ENGINEERS AND MANUFACTURERS. A Practical Text-Book** by BERTRAM BLOUNT and A. G. BLOXAM. VOLUME II.—Chemistry of Manufacturing Processes. Second Edition. Chas. Griffin and Co., Ltd., Exeter Street, Strand, London. 1905. Price 16s. nett.

8vo volume containing 466 pages of subject matter, bibliographic tables filling four pages, and the alphabetical index. There are 46 illustrations. Whilst the scheme of the first edition has been retained, new matter has been added, increasing the pages from 436 to 466; the scheme of the first edition is given in this J., 1896, 926. The work, it is stated, has also undergone complete revision.

**SMOKE ABATEMENT.** A Manual for the Use of Manufacturers, Inspectors, Medical Officers of Health, Engineers and Others. By WILLIAM NICHOLSON. Chas. Griffin and Co., Ltd., Exeter Street, Strand, London. 1905. Price 6s. nett.

8vo volume, containing 349 pages of subject matter with 59 illustrations, and the alphabetical index. The scheme of the work is furnished under the following

heads:—I. Introduction. II. General legislation against the Smoke Nuisance. III. Local legislation against the Smoke Nuisance. IV. Foreign Laws in regard to Smoke Abatement. V. Smoke Abatement. VI. Smoke from Boilers, Furnaces and Kilns. VII. Private Dwelling House Smoke. VIII. Chimneys and their Construction. IX. and X. Smoke Preventers and Fuel Savers. XI. Waste Gases from Metallurgical Furnaces. XII. Summary and Conclusion.

**RESEARCHES ON THE AFFINITIES OF THE ELEMENTS AND ON THE CAUSES OF THE CHEMICAL SIMILARITY OR DIS-SIMILARITY OF ELEMENTS AND COMPOUNDS.** By GEOFFREY MARTIN. J. and A. Churchill, 7, Great Marlborough Street, London. 1905. Price 16s. nett.

LARGE 8vo volume, containing 264 pages of subject matter with five woodcuts, and the alphabetical index. There is also one large plate, 14 tables, and three Appendices.

**SUBJECT LIST OF WORKS ON AGRICULTURE, RURAL ECONOMY, AND ALLIED SCIENCES IN THE LIBRARY OF THE PATENT OFFICE.** Darling and Son, Ltd., 34-40, Bacon Street, London. E. The Patent Office, 25, Southampton Buildings, Chancery Lane, London, W.C. 1905. Price 6d.

**RADIUM AND RADIO-ACTIVE SUBSTANCES. THEIR APPLICATION ESPECIALLY TO MEDICINE.** By CHAS. BASKERVILLE, Ph.D. Professor of Chemistry and Director of the Laboratory, College of the City of New York. Williams, Brown and Earle, 918, Chestnut Street, Philadelphia, Pa., U.S.A. 1905.

8vo volume, containing 152 pages of subject matter, with 67 illustrations, and the alphabetical index. The subject matter is classified in the following groups:—I. Phenomenon of Radio-Activity. II. Extraction of Radium Salts and their properties. III. Other Radio-Active Substances. IV. Emanations of Radium and Induced Radio-Activity, Ex-Radio. V. Theories of Radio-Activity. VI. Physiological Properties and Therapeutic Applications of Radio-Active Substances. VII. Other Therapeutic Radiations.

**CEMENTS, LIMES AND PLASTERS: THEIR MATERIALS, MANUFACTURE AND PROPERTIES.** By EDWIN C. ECKEL, C.E. John Wiley and Sons, New York. Chapman and Hall, Limited, London. 1905. Price 25s. 6d. nett.

8vo volume, containing 710 pages of subject matter with 165 illustrations and 254 tables, followed by an alphabetical index. The subject matter is classified by arrangement in the following groups:—I. INTRODUCTION. Growth of Cement Industries. Classification and Relationships of Cementing Materials. PART I. PLASTERS. (i) Composition: Distribution and Excavation of Gypsum. (ii) Chemistry of Gypsum-Burning. Manufacture of Plasters. (iii) Composition, Properties, and Tests of Plasters. (iv) Flooring-Plasters and Hard-Finish Plasters. (v) Statistics of the Gypsum and Plaster Industries. PART II. LIMES. (vi) Composition, Origin and General Characters of Limestones. (vii) Lime Burning. (viii) Composition and Properties of Lime. (ix) Hydrated Lime; Preparation and Properties. (x) Manufacture and Properties of Lime-Sand Bricks. PART III. MAGNESIA AND OXYCHLORIDE CEMENTS. (xi) Sources and Preparation of Magnesia. (xii) Magnesia Bricks and Oxychloride Cements. PART IV. HYDRAULIC LIMES, SELENITIC LIMES, AND GRAPPIER CEMENTS (xiii, xiv, and xv). PART V. NATURAL CEMENTS. (xvi and xvii) Raw Material and Natural-Cement Rock. (xviii) Manufacture of Natural Cements. (xix, xx, and xxi) Composition and Properties of Natural Cements, &c. PART VI. PORTLAND CEMENT (xxii—xli). PART VII. POZZOLAN CEMENTS. (xli, xlii, xliii and xliiv) Slag Cement. Composition and Properties. (xlv) Slag Bricks and Slag Blocks.



**SELECT METHODS IN FOOD ANALYSIS.** By H. LEFFMANN, Ph.D., M.D., and WILLIAM BEAM, M.D. Second Edition. Revised and Enlarged. Reiman, Limited, 129, Shaftesbury Avenue, London, W.C. 1905. Price 11s. nett.

8vo volume, containing 388 pages of subject matter, with 54 illustrations and an alphabetical index. The analytical methods described, are classified thus:—  
I. ANALYTICAL METHODS. Physical Data. Chemical Data. II. APPLIED ANALYSIS. General Methods. Special Methods. The latter are sub-classified under (i) Starch, Flours, Meals and Bread, Sugars, &c.; (ii) Fats and Oils; (iii) Milk and Milk Products; (iv) Non-alcoholic Beverages; (v) Condiments and Spices; (vi) Alcoholic Beverages; (vii) Flesh Foods.

## Trade Report.

### I.—GENERAL.

*Bd. of Trade, Oct. 4, 1905.*

#### INFORMATION ON TRADE MATTERS.

The Board of Trade desires to point out to British manufacturers and merchants who wish to obtain information in regard to trade matters in foreign countries, that it is advisable that applications should first be made to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C., before communications are addressed to His Majesty's Consular officers abroad. By the adoption of this course much delay would be avoided by the inquirer in cases in which the Intelligence Branch is already in possession of the required information.

#### FACTORY ACT: REGULATIONS FOR LOCOMOTIVES AND WAGGONS ON LINES AND SIDINGS.

*Home Office, Oct. 23rd, 1905.*

The Secretary of State for the Home Department, in pursuance of section 81 of the Factory and Workshop Act, 1901, has appointed Mr. Chester Jones, Barrister-at-Law, of 1, Paper Buildings, Temple, E.C., to hold an inquiry with regard to the draft regulations for the use of locomotives and waggons on lines and sidings under the Factory Act, published in pursuance of section 80 of that Act.

The inquiry, which is a public one, will be opened at the Caxton Hall, Westminster, London, on Wednesday, November 22nd, 1905, at 10 a.m., and any person who has objected to the draft regulations and any other person who, in the opinion of Mr. Chester Jones, is affected by them, may appear either in person or by counsel, solicitor, or agent.

#### SWISS CHEMICAL TRADE.

*Chem. Trade J., Oct. 7, 1905. \**

The Bâle Chamber of Commerce, in its report on the Swiss chemical and colour trades for 1904, states that the tanning material for the Bâle trade comes chiefly from the Levant and China, and it was kept moderate in price. In the course of the year dyewood extracts to the value of 392,000 frs. were exported, against corresponding imports to the value of 341,000 frs. The export of fluid tanning extracts were valued at 337,000 frs., the imports thereof were 470,000 frs.; whereas the export and import figures for solid tanning extracts were 352,000 frs. and 155,000 frs. respectively. The report further shows that in the pharmaceutical-chemical branches good business was done, resulting in a rise in values. The exports under this head, including drugs, alkalis and pharmaceutical preparations, valued 8,400,000 frs., against 7,270,000 frs. in the preceding year. The total value of the exports for 1904 was 17,888,269 frs., the principal customers having been the United States of America, 4,338,734 frs.; Ger-

many, 3,733,309 frs.; England, 2,724,398 frs.; Italy, 1,331,926 frs.; Austria-Hungary, 1,064,809 frs.; and British Indies, 909,167 frs. The imports, amounting in value to 1,657,875 frs., were almost entirely from Germany.

#### TRANSVAAL; TRADE OF THE —

*Bd. of Trade J., Oct. 12, 1905*

The following tables, showing the value of certain articles imported into and exported from the Transvaal during the six months ended 30th June, 1905, as compared with the corresponding period of the preceding year, have been compiled from official figures published in the *Transvaal Government Gazette*:—

#### Imports.

Articles.	Six Months ended 30th June.	
	1904.	1905.
	£	£
Metals and manufactures thereof .....	1,387,000	1,353,000
Drugs and chemicals .....	212,000	321,000
Leather and manufactures .....	238,000	279,000
Beverages (includes ale, spirits, wine and mineral waters) .....	207,000	200,000
Arms and ammunition (includes dynamite and other explosives) .....	137,000	191,000
Groceries and oilmen's stores (includes oils, paints, turpentine and varnish) ..	142,000	147,000
Soap and candles .....	115,000	146,000
Glass and glassware .....	37,000	31,000

#### Exports.

Articles.	Six Months ended 30th June.	
	1904.	1905.
	£	£
Gold .....	7,711,000	10,076,000
Diamonds .....	341,000	628,000
Coal .....	67,000	46,000
Wool .....	35,000	37,000
Skins, hides and horns .....	13,000	24,000

### III.—ACIDS, ALKALIS, Etc.

#### GASES; CARRIAGE OF COMPRESSED — IN INDIA.

*Chem. and Drug., Oct. 14, 1905.*

The Railway Board of India have issued the following new rules regarding the carriage of compressed oxygen, compressed or liquefied carbonic acid gas, compressed coal-gas, compressed hydrogen, liquefied anhydrous ammonia or compressed ammonia gas, liquefied or compressed nitrous oxide, liquefied or compressed sulphur dioxide:—

1. These gases must be packed in cylinders.  
2. Cylinders must be made of wrought iron or mild steel of the best quality, containing not more than 0.25 per cent. of carbon, thoroughly annealed after manufacture, of sufficient strength and efficiently tested, and must not exceed 8 ft. in length and 10 ins. in diameter.

3. Cylinders must be separately and securely packed in a strong wooden case, or in a covering made of closely-plaited 1 in. (circumference) hemp or coir; except that several small cylinders not exceeding 18 ins. in length and 4 ins. in diameter may be packed in one box, provided each cylinder is contained in a separate compartment or is separately incased in closely-plaited 1 in. (circumference) hemp or coir. Each box must not contain more than 25 cylinders, and the gross weight of each box and contents must not exceed 3½ maunds (86.4 lb.).

4. Cylinders containing atmospheric air, coal-gas, hydrogen or oxygen must not be charged to a greater pressure than 1800 lb. per square inch.

5. No cylinder may contain, per pound of water capacity, more than ¾ lb. of carbon dioxide; ½ lb. of anhydrous ammonia; ¾ lb. of nitrous oxide; or 1¼ lb. of sulphur dioxide respectively.

6. Cylinders must be carefully handled, and must not be exposed to the rays of the sun, nor to the heat of a fire, stove, or other source of heat.

#### GRAPHITE PRODUCTION OF THE UNITED STATES.

*U.S. Geological Survey, 1905.*

The U.S. Geological Survey reports that the value of Acheson graphite produced in 1904 was 217,790 dols., while the total graphite mined amounted to 341,372 dols., of which amount New York State produced 119,509 dols. worth. The International Acheson Graphite Co. has recently doubled the capacity of its graphite plant, and has contracted with the Niagara Falls Power Co. for another 1000 h.p. of electrical energy, in addition to the 1000 h.p. previously used.

#### X.—METALLURGY.

##### IRON TRADE STATISTICS AND COAL OUTPUT OF SWEDEN FOR 1904.

*Ed. of Trade J., Oct. 12, 1905.*

The following table, showing the production of iron ore, pig iron, &c., in Sweden in 1904, with comparative figures for 1903, is based on official statistics recently published:—

	1903.	1904.
	Metric tons.	Metric tons.
Iron ore .....	3,677,841	4,084,647
Pig iron .....	506,825	528,525
Blooms from pig iron in charcoal hearths .....	192,342	189,246
Bessemer ingots and castings .....	84,229	78,577
Open-hearth ingots and castings .....	232,878	252,832
Crucible .....	1,105	1,162
Iron and steel bars .....	178,538	181,775
Wire rods, iron and steel bands and rods .....	106,628	102,976

The output of coal in 1904 was 320,984 metric tons, as compared with 320,390 tons in 1903.

#### XIV.—TANNING; LEATHER; GLUE, Etc.

##### TANNERIES IN JAPAN.

*Cham. of Com. J., Oct. 1905.*

In the great Japanese industrial centre, Osaka, there are nearly 50 tanneries, almost all of small importance, employing 1150 workmen and 360 women. These tanneries deal annually with hides to the value of about 766,000 yen,\* of which 727,000 yen represent large ox-hides. The hides are almost exclusively of Japanese origin, chiefly from the slaughter-houses of Osaka and Kobe. The price of the hides has risen recently to 12 to 13 yen each. For the tannage oak bark from the islands of Shikoku and Hokkaido is employed, but tanning materials from America are also imported. Osaka also possesses a large manufactory of machine belting, which has existed for twenty years and uses European machinery. The raw material comes principally from Germany, for the Japanese hides are not suitable for this manufacture. This factory has produced during one year about 600,000 yen of merchandise, of which 60,000 yen were exported to China and Corea. About 150 hands, working 10 hours a day, are employed all the year round.

#### XVII.—BREWING, WINES, SPIRITS, Etc.

##### SPIRIT TAXATION LAW IN ITALY.

*Ed. of Trade J., Oct. 12, 1905.*

The Italian "Bollettino di Legislazione e Statistica Doganale e Commerciale" for July, contains the text of an

\* Ten yen equals approximately 1*l*.

Italian Law, dated the 29th June, 1905, modifying various provisions of the Spirit Taxation Law of 30th January, 1896.

Article 7 of the present Law abolishes the special tax of 15 centesimi per degree and per hectol. imposed, by the Law of 22nd March, 1903, on spirit derived from non-vinuous products, denatured and intended for lighting, heating, motive, or other industrial purposes.

By Article 8 of the Law the manufacturing tax on spirits, other than adulterated spirits destined exclusively for industrial purposes, is increased by 10 centesimi per degree and per hectol. The countervailing surtaxes on imported spirits, and on products containing spirits or prepared therewith, are consequently increased in proportion, and are now as follows:—

	Rate of Surtax.
	Lire. Cts.
Spirits, other than adulterated—spirits intended exclusively for industrial purposes	
Per degree, per hectol.	2 00
Ether and chloroform .....	4 66½
Spirituous essences of rum or cognac; and other essences containing spirit .....	1 13½
Alcoholic perfumery .....	1 60
Spirit varnish .....	1 33½
Medicinal preparations, compound medicines, and chemical products not specially mentioned, containing spirit or in the manufacture of which spirit has been used .....	Surtax, at above rate, on spirits contained or used in their manufacture.

\* Without deduction of weight for the immediate recipient.

#### Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

#### I.—PLANT, APPARATUS, AND MACHINERY.

- [A.] 20,144. Schumacher. Device for mixing liquids.\* Oct. 5.  
 „ 20,318. Brown. Regenerative furnaces.\* Oct. 7  
 „ 20,431. Snell. Apparatus for compressing gas or air. Oct. 10.  
 „ 20,697. Kestner. Machine for atomizing liquids Oct. 12.  
 „ 20,752. Ostertag. Drying furnaces.\* Oct. 13.  
 „ 20,808. Pickering (Dixon). See under XVI.  
 „ 20,865. Trent. Agitating or mixing apparatus.\* Oct. 14.  
 „ 20,866. Trent. Filters.\* Oct. 15.  
 [C.S.] 20,938 (1904). Shiels. Apparatus for heating, condensing, evaporating, &c. Oct. 15.  
 „ 23,983 (1904). Ray. Process of and apparatus for continuous distillation. Oct. 18.  
 „ 25,832 (1904). Eldred. Reverberating furnaces. Oct. 11.  
 „ 1304 (1905). Ter Meer. Centrifugal separating machine. Oct. 11.



- [C.S.] 2795 (1905). Mitchell. Apparatus for generating steam from hot slag. Oct. 11.
- " 5458 (1905). Hurrell and Hounzo. *See under VIII.*
- " 10,538 (1905). Seitz. Filters. Oct. 18.
- " 11,875 (1905). Hawkes and Klepetko. Water jackets for cupola, blast, and similar furnaces. Oct. 11.
- " 17,946 (1905). Clamond. Method of and apparatus for separating mixed gases. Oct. 18.

## II.—FUEL, GAS, AND LIGHT.

- [A.] 19,995. Hutmaecher. Carburation of gases.\* Oct. 3.
- " 20,175. Just, Hanaman, Landesberger, Salzmann, and Verein. Electricitäts A.-G. Manufacture of incandescing bodies for electric incandescence lamps.\* Oct. 5.
- " 20,330. British Thomson-Houston Co., Ltd. (Allgem. Elektrizitäts-Ges.). Arc lamp electrodes. Oct. 9.
- " 20,360. O'Sullivan-Beare. Process for preparing peat for use as fuel, peat moss, &c. Oct. 9.
- " 20,445. Wesselsky. Gas generators.\* Oct. 10.
- " 20,783. Bickerton, Bradley and Clerk. Gas producers. Oct. 13.
- [C.S.] 21,408 (1904). Perrier. Production of gas by the combination of compressed air with petroleum. Oct. 11.
- " 21,755 (1904). Márton. Manufacture of fuel and other briquettes. Oct. 18.
- " 25,578 (1904). Armstrong, Whitworth and Co., Orde and Sodeau. Combustion of liquid fuel. Oct. 18.
- " 25,879 (1904). Wilton. *See under III.*
- " 27,571 (1904). Hall Brown. Gas producers. Oct. 11.
- " 28,295 (1904). Thorneycroft, and J. I. Thorneycroft and Co. Purifying the gas from gas producers, blast furnaces, &c. Oct. 11.
- " 28,811 (1904). Koppers. Gas furnaces or coke ovens. Oct. 11.
- " 347 (1905). Middleton. Agglutinants for use in solidifying pressed fuel. Oct. 18.
- " 10,706 (1905). Fichet and Heurtey. Gas producers. Oct. 18.
- " 16,993 (1905). Towns. Purifier for gases. Oct. 18.
- " 11,751 (1905). Moores and Bailey. Material for use in manufacturing air gas. Oct. 11.
- " 14,090 (1905). Towns. Gas producers. Oct. 11.

## III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [A.] 19,988. Dreyman. Conversion of unsaturated into saturated compounds.\* Oct. 3.
- " 20,448. Daum und Co., and Thyarks. Process for the incorporation of petroleum or mineral oil in soaps. Oct. 10.
- [C.S.] 23,727 (1904). Kuess. Process for transforming into soap mineral oils in general and petroleum in particular. Oct. 11.

- [C.S.] 25,879 (1904). Wilton. Distillation especially of tars or tarry products and for use in the manufacture of carburetted water gas and like processes. Oct. 18.

## IV.—COLOURING MATTERS AND DYESTUFFS.

- [A.] 20,359. Newton (Bayer und Co.). Manufacture of a new dyestuff of the anthraquinone series and of intermediate products. Oct. 9.
- " 20,780. Abel (Akt.-Ges. f. Anilinfabr.). Manufacture of amidosulphonic acids of phenyl-1,2-naphthimidazole and intermediate products. Oct. 13.
- [C.S.] 26,345 (1904). Holliday and Sons, Turner and Dean. Black colouring matters containing sulphur. Oct. 11.
- " 26,361 (1904). Ransford (Cassella und Co.). Manufacture of benzene derivatives and dyestuffs therefrom. Oct. 11.
- " 26,477 (1904). Abel (Akt.-Ges. f. Anilinfabr.). Manufacture of a yellow sulphurised dyestuff. Oct. 11.
- " 27,091 (1904). Abel (Akt.-Ges. f. Anilinfabr.). Manufacture of new sulphurised dyestuffs. Oct. 18.
- " 27,092 (1904). Abel (Akt.-Ges. f. Anilinfabr.). *See under XIII.A.*
- " 27,093 (1904). Abel (Akt.-Ges. f. Anilinfabr.). *See under XIII.A.*
- " 27,094 (1904). Abel (Akt.-Ges. f. Anilinfabr.). *See under XIII.A.*
- " 27,292 (1904). Abel (Akt.-Ges. f. Anilinfabr.). Manufacture of sulphurised dyestuffs and of a parent material therefor. Oct. 18.
- " 28,593 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of new colouring matters of the anthracene series. Oct. 18.
- " 28,734 (1904). Newton (Bayer und Co.). Manufacture of a dyestuff of the anthracene series. Oct. 11.
- " 1062 (1905). Newton (Bayer und Co.). Manufacture of oxyanthraquinones. Oct. 11.
- " 5572 (1905). Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of yellow sulphur dyes. Oct. 18.

## V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 20,011. Waidmann. Machines for dyeing yarns in hanks. Oct. 3.
- " 20,218. Textile Fibres, Ltd., and Tiekel. Treating rhea, ramie, or china grass, flax and similar fibres. Oct. 6.
- " 20,220. Hamitzsch. Production of effects or designs on paper, textile fabrics or the like.\* Oct. 6.
- " 20,268. Ainley. Machine for drying, tentering and steam blowing fabrics. Oct. 7.
- [C.S.] 27,871 (1904). Imray (Meister, Lucius und Brüning). Method of and apparatus for distributing dyestuffs on fabrics, warps or the like. Oct. 18.

- [C.S.] 29,130 (1904). Adam (Erste Triester-Reisschäl-Fabriks A.-G.). Manufacture of sizing or finishing media. Oct. 11.
- „ 1281 (1905). Bloxam (Verein. Glanzstoff-Fabrik A.-G.). Manufacture of threads and films of cellulose. Oct. 11.

#### VI.—COLOURING WOOD, LEATHER, PAPER, Etc.

- [A.] 20,220. Hanitzsch. *See under V.*

#### VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 19,839. Worsey and Hoal. *See under XIII A.*
- „ 19,986. Johnson (Chem. Fabr. Griesheim-Elektron). Concentration of dilute nitric acid. Oct. 3.
- „ 20,312. Mobarrem. Preparation of carboneum from the carbonic acid of all carbonates. Oct. 7.
- „ 20,454. Reaney. Process for hydrating lime.\* Oct. 10.
- „ 20,837. Grossmann. Method of manufacturing sulphate of ammonia. Oct. 14.
- [C.S.] 21,393 (1904). Souheur. Preparation of briquettes of arsenious acid. Oct. 11.
- „ 6759 (1905). Westhauser. Manufacture of hydrochloric and hydrobromic acid. Oct. 11.

#### VIII.—GLASS, POTTERY, AND ENAMELS.

- [C.S.] 5458 (1905). Hurre and Houze. Regenerative furnaces for the manufacture of glass and for other purposes where a high temperature is required. Oct. 11.

#### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 20,070. Thom. Artificial stone. Oct. 4.
- „ 20,296. Baur. Machinery for preparing or treating loam clay and the like. [Swiss Appl., Dec. 3, 1904.]\* Oct. 7.
- „ 20,868. Ford. Manufacture of artificial stone. Oct. 14.
- [C.S.] 25,837 (1904). Eldred. Method and means for burning cement. Oct. 11.
- „ 26,286 (1904). Constable and Hart. Manufacture of tarred paving, macadam and the like. Oct. 11.

#### X.—METALLURGY.

- [A.] 19,860. Blackmore and Howard. Treatment of complex ores containing lead, zinc and other sulphides. Oct. 2.
- „ 19,892. Siemens und Halske A.-G. Process for hardening tantalum metal. [Ger. Appl., Oct. 13, 1904.]\* Oct. 2.
- „ 19,941. Blood. Method of utilising iron ore waste in the manufacture of iron and steel. Oct. 3.
- „ 20,004. Goldschmidt and Weil. Method of manufacturing metals according to the aluminothermic process. Oct. 3.

- [A.] 20,322. Wolf. Separation of metals from their ores. Oct. 7.
- „ 20,380. Bousfield (Mackay and Beckwith). Treatment of sulphide ores.\* Oct. 9.
- „ 20,884. Kühne. Process for the production or isolation of metals, metalloids, or their alloys.\* Oct. 14.

- [C.S.] 22,422 (1904). Auchinachie. Process of obtaining metallic vanadium from its ores or other vanadium compounds. Oct. 18.
- „ 26,881 (1904). Perret. Method of treating ores of vanadium. Oct. 18.

#### XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- [A.] 20,024. Harris. Electro-deposition apparatus. Oct. 4.
- „ 20,107. Swan and Hyde. Coating metals with metals. Oct. 5.
- „ 20,217. Varelle. Apparatus for the electrolysis of water.\* Oct. 6.
- „ 20,500. Hatfield, and The Reason Manufacturing Co., Ltd. Mercury electrolytes. Oct. 10.
- „ 20,737. Markus, and The Barnwell Machine Co., Ltd. Insulating materials for covering electric cables. Oct. 13.
- „ 20,770. Hatfield, and The Reason Manufacturing Co., Ltd. Cathodes. Oct. 13.
- [C.S.] 21,562 (1904). Koopman (Townsend). Electrolytic method and apparatus for the production of white lead. Oct. 18.
- „ 23,765 (1904). Rudenick. Insulating material for electro-technical purposes. Oct. 18.
- „ 26,602 (1904). Johnson (Badische Anilin und Soda Fabrik). Apparatus for producing reactions in gases by means of electric arcs. Oct. 11.

#### XII.—FATTY OILS, FATS, WAXES, AND SOAP.

- [A.] 19,988. Dreymann. *See under III.*
- „ 20,103. Hine. Soap. Oct. 5.
- „ 20,448. Daum and Co., and Thyarks. *See under III.*
- [C.S.] 21,596 (1904). Bedford, Bedford and Crowther. Process and apparatus for the preparation of soap. Oct. 11.
- „ 23,737 (1904). Kuess. *See under III.*
- „ 29,081 (1904). Holmblad. Candles. Oct. 18.

#### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

##### (A.)—PIGMENTS, PAINTS.

- [A.] 15,398a. Bennett and Mastin. Manufacture of permanent pigments from glass.\* Oct. 14.
- „ 16,490a. Brunet. Manufacture of white antimony pigment. Oct. 13.
- „ 19,839. Worsey and Hoal. Manufacture of zinc white from substances or compounds containing zinc. Oct. 2.
- [C.S.] 21,562 (1904). Koopman (Townsend). *See under XI.*



- [C.S.] 27,092 (1902). Abel (Act.-Ges. f. Anilinfabr.)  
Manufacture of orange colour lakes. Oct. 18.
- „ 27,093 (1904). Abel (Act.-Ges. f. Anilinfabr.)  
Manufacture of new colour lakes. Oct. 18.
- „ 27,094 (1904). Abel (Act.-Ges. f. Anilinfabr.)  
Manufacture of red colour lakes. Oct. 18.

## (B.)—RESINS, VARNISHES.

- [A.] 20,888. Godfrey, and The Linoleum Manufacturing  
Co., Ltd. Manufacture of linoleum. Oct. 14.
- [C.S.] 27,037 (1904). Shaw. Machinery for printing the  
pattern on linoleum, oilcloth, and like materials.  
Oct. 18.

## (C.)—INDIA-RUBBER.

- [A.] 20,606. Wilderman. Technical separation of red  
rubber into its important and unimportant  
parts. Oct. 11.
- „ 20,610. Munby. Treatment of india-rubber.  
Oct. 11.
- „ 20,709. Scott, Dagnall and Thomas. Substance  
similar to india-rubber and process for manu-  
facturing the same. Oct. 13.
- [C.S.] 24,966 (1904). Jacobs, Jacobs and Brockwell.  
India-rubber substitute. Oct. 18.

## XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

- [C.S.] 26,778 (1904). Payne. Tanning and the treat-  
ment of waste tanning materials and liquors.  
Oct. 18.
- „ 27,425 (1904). Hilbert. Process of and apparatus  
for manufacturing glue and gelatin. Oct. 18.
- „ 29,130 (1904.) Adam (Erste Triester-Reisschäl-  
Fabriks A.-G.). *See under V.*

## XV.—MANURES, Etc.

- [A.] 20,228. Norman. Manures for horticultural and  
agricultural purposes. Oct. 6.

## XVI.—SUGAR, STARCH, GUM, Etc.

- [A.] 20,808. Pickering (Dixon). Centrifugal separator  
for the treatment of sugar and other materials.  
Oct. 14.

## XVII.—BREWING, WINES, SPIRITS, Etc.

- [A.] 20,246. Chew, and H. J. West and Co., Ltd. Pro-  
duction of non-deposit beer and apparatus  
therefor. Oct. 6.
- „ 20,876. Hunt. Treatment of fusel oil or malt or  
other spirits for maturing the same, and rendering  
them more commercially valuable. Oct. 14.
- [C.S.] 26,698 (1904). Board and Board. Process of  
fermentation. Oct. 11.
- „ 11,147 (1905). Barker (Ronnberg und Co.). Manu-  
facture of a product which enables beer to be  
hopped in a rational and economical manner.  
Oct. 18.

XVIII.—FOODS; SANITATION, WATER  
PURIFICATION; & DISINFECTANTS.

## (A.)—FOODS.

- [A.] 20,306. Gractz. Process for aerating and cleaning  
flour and the like.\* Oct. 7.
- „ 20,488. Müller. Method of bleaching flour and  
the like. Oct. 10.
- „ 20,755. Héritte. Alimentary extracts of blood.  
Oct. 13.
- [C.S.] 9457 (1905). James (Organose Co.). Manufacture  
of a food product. Oct. 11.

## (B.)—SANITATION; WATER PURIFICATION.

- [A.] 20,080. West. Water softening or purifying  
apparatus. Oct. 4.
- „ 20,234. Cameron and Commis. Treatment of  
sewage. Oct. 6.
- „ 20,750. Kestner. Process for the purification of  
water, sewage effluent and the like, and apparatus  
therefor. Oct. 13.
- [C.S.] 5537 (1905). Stephenson. Apparatus for purifying  
water or other liquids. Oct. 11.

## (C.)—DISINFECTANTS.

- [C.S.] 23,463 (1904). Hawliczek. Disinfectant and  
detergent compounds. Oct. 18.
- „ 25,308 (1904). Gauthier. Manufacture of a gas  
for disinfecting purposes. Oct. 18.
- „ 5278 (1905). Illingworth. Means for disinfecting.  
Oct. 18.

## XIX.—PAPER, PASTEBOARD, Etc.

- [A.] 20,802. Baker and Lockett. Paper making  
machines. Oct. 14.
- [C.S.] 9698 (1905). Kuess. Transformation of alfa and  
similar plants into paper pulp or textile fibres.  
Oct. 11.
- „ 12,523 (1905). Erkens. Paper making machines.  
Oct. 18.

XX.—FINE CHEMICALS, ALKALOIDS,  
ESSENCES AND EXTRACTS.

- [A.] 19,988. Dreyman. *See under III.*
- [C.S.] 26,779 (1904). Zimmermann (Schering). Manu-  
facture of camphor. Oct. 11.
- „ 4564 (1905). Abel (Act.-Ges. f. Anilinfabr.).  
Manufacture of dialkyl-derivatives of malonyl-*p*-  
phenetide. Oct. 18.
- „ 4959 (1905). Abel (Act.-Ges. f. Anilinfabr.) Manu-  
facture of soluble compounds of theobromine.  
Oct. 11.
- „ 14,316 (1905). Mettler. Manufacture of alcohols  
and ethers by the reduction of aromatic esters.  
Oct. 11.
- „ 18,674 (1905). Mettler. Manufacture of aromatic  
alcohols. Oct. 11.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 19,850. Poulsen. Self-toning photographic paper.\* Oct. 2.
- „ 19,885. Kelly and Bentham. Developing and fixing photographic negatives or positives. Oct. 2.
- „ 20,372. Neue Photographische Ges., A.-G. Reproduction of pictures, &c., with the aid of catalysis. [Ger. Appl., Oct. 13, 1904.]\* Oct. 9.
- „ 20,662. Powrie. Colour photography.\* Oct. 12.
- [C.S.] 21,210 (1904). Brasseur. Polychrome photographs. Oct. 11.
- „ 24,290 (1904). Koppmann. Process for producing coloured photographs. Oct. 11.
- „ 9036 (1905). Mertens. Photographically copying designs for the production of printing surfaces. Oct. 11.

[C.S.] 17,303 (1905). Hoffsummer. Manufacture of photographic papers. Oct. 11.

## XXII.—EXPLOSIVES, MATCHES, Etc.

- [A.] 20,310. Reese. Process of making nitroglycerine.\* Oct. 7.
- „ 20,353. Bokmayer and Swoboda. Match compositions.\* Oct. 9.
- „ 20,706. Arnold, Scott and Fox. Recovery of acetone or other volatile substance used in the manufacture of cordite or other material containing nitrocellulose or rubber. Oct. 12.

## XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[C.S.] 15,160 (1905). König. Titration apparatus. Oct. 11.



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### SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

The Sixth International Congress of Applied Chemistry will be held in Rome in April, 1906, during Easter week. All communications should be addressed to the President, Prof. E. Paternò, Via Panisperna, 89 Rome.

Foreign and Colonial members are reminded that the subscription of 25s. for 1906, payable on January 1st next, should be sent in good time to the Hon. Treasurer (Mr. Samuel Hall) in order to ensure continuity in the receipt of the Society's Journal. Any changes of address for the new List of Members now in course of preparation should reach the General Secretary not later than January 31st, 1906.

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 Taubman, Robt., 12, Eton Road, Haverstock Hill, N.W. Oct. 27.

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Meeting held at Nottingham, on Friday, October 20, 1905.

MR. J. M. C. PATON IN THE CHAIR.

### STRYCHNINE TANNATE AND ITS USE IN THE ANALYSIS OF TANNING MATERIALS.

BY S. R. TROTMAN, M.A., F.I.C., AND J. E. HACKFORD.

Although the hide powder method of analysing tanning materials has held the field so long, and has served so well as an illustration of the way in which difficulties of analysis can be overcome, yet it has never been pretended that it is perfect as an analytical method. In that it has enabled chemists to agree approximately in their results it has been exceedingly useful, but as is well-known to those who have to use the process, this agree-



ment can only be obtained by rigidly following out the prescribed conditions. Moreover, when one has taken the utmost care in the analysis, one is still at the mercy of the hide power, and whenever disagreement occurs between two chemists it can often be traced to this cause. The increasing and, at times, almost unsurmountable difficulty of obtaining a satisfactory supply of hide power is so great, that a method which eliminates this substance would be welcomed by everyone, and for a long time chemists have been trying to arrive at some such method.

We have ourselves made experiments with at least twelve different methods, but which have had to be thrown aside.

The method suggested by Parker and Payne, namely, precipitation of tannic acid by means of collin, was in many ways a considerable advance, but was not ideal because it was an indirect process, and, moreover, as shown by Wood and Trotman\* the precipitating reagent has not a constant composition, and the constitution of the precipitated products is practically unknown. The chief claim which the collin method has is that, unlike hide powder, it does not co-estimate gallic acid.

An ideal method must be one in which a known compound of tannic acid is produced and weighed, and with this end in view we have for a long time been making experiments which, we venture to think, will go some way towards solving the problem. During the course of these experiments it became accidentally known to one of us that Drs. Parker and Casaburi were also working at the same subject, and a notification of this fact has since appeared in the "Collegium." We feel that the field is so wide and the subject so important that there is room for all, and trust that our joint efforts will assist in placing the analysis of tanning compounds above the reproach of being merely empirical. A brief account may be given of the experiments that have led up to the method which we now suggest.

(1) Experiments with collin solution show that there are objections to its adoption as a standard method, for the following, among other reasons:—

(a) It is not constant in composition.

(b) It possesses no advantage over commercial peptone, or even over a dilute solution of albumoses or pure gelatine (except in keeping properties) and very little advantage over the collagens.

The following experiments prove this point, and are enumerated in the table given below:—

Reagent employed.	Quantity used, c.c.	Strength, per cent.	Nature of ppt. on adding 0.0001 grm. tannic acid.	Effect on adding 1 c.c. 50 per cent. acetic acid	Effect on adding excess of acid.
(1) Collagen .....	10	1	slight precipitate	dissolves	dissolves
(2) Albumoses .....	10	1	slightly heavier than (1)	no action	ditto
(3) Commercial peptones ..	10	1	heavy	no action	dissolves with difficulty
(4) Collin .....	10	1	not so heavy as (3)	little action, if any	dissolves more easily than (3)
(1) Collagen .....	10	5	no ppt.	no action	no action
(2) Albumoses .....	10	5	no ppt.	ditto	ditto
(3) Commercial peptones ..	10	5	marked ppt.	ditto	dissolves
(4) Collin .....	10	5	ditto, and of same bulk	ditto	dissolves more easily than (3)

From this it is seen that so far as sensitiveness is concerned, collin is not equal to commercial peptones, while it is very little superior to collagen and albumoses, if the latter be in a weak solution (1 per cent.). It is superior to the latter two if the strength of the solutions be greater than that mentioned.

Messrs. Parker and Payne also state the sensitivity of the collin solution to be increased by the addition of acetic acid. We point out, however, that with or without acid it is not equivalent to commercial peptones, while, if a slight excess of acid be added, the precipitate redissolves, as it also does in the case of collagens, albumoses and peptones. Without the addition of more acetic acid, we would point out that the difference between collin solution and commercial peptones is that collin = peptones + sodium acetate - calcium salts, and the difference in results given by collin is evidently due to the presence of sodium acetate.

(2) Many experiments were tried with metallic salts, but it appeared to be almost impossible to obtain complete precipitation, since the precipitate is soluble in the acid liberated. Thus  $\text{CuSO}_4$  gives a ppt. with tannic acid which is soluble in sulphuric acid and that given by lead acetate is soluble in acetic acid. It was found difficult to make alkaline and so neutralise the acid liberated, for the alkali decomposes a tannic acid solution, causing it to turn brown, since tannic acid is very readily oxidised.

In passing we noted that tannic in solution may be estimated by means of Fehling's solution, but that gallic acid is also simultaneously decomposed.

(3) *Experiments with Organic Bases.*—As a result of the experiments with metallic salts we tried bases, for here there is no acid to be liberated, while if an acid other than tannic be present it will be neutralised if the base be present in excess. By this means foreign acids which might affect the insolubility of the precipitate are removed.

A great many bases were tried, including phenyl hydrazine and several primary and secondary amines with more or less satisfactory results, and to which we hope to return in a later paper.

Passing from these to the more complicated bases, namely, alkaloids which are tertiary amines, we arrived at what appeared to be a solution of the difficulty. It is known that the alkaloids combine with tannic acid, giving more or less insoluble tannates, but little attention appears to have been paid to these compounds. The tannate is produced by precipitation with free alkaloid, the excess of which neutralises any other free acid present forming soluble compounds.

Several alkaloids were tried, but strychnine finally made use of, since it is cheap, does not precipitate gallic acid, and its tannate is highly insoluble in water and fairly easily manipulated.

*Experiments with Strychnine and pure Tannic Acid.*—When strychnine or its salts are added to a solution containing tannic acid, a white flocculent precipitate is produced. Its insolubility is so great that one part in 10,000 of tannic acid may be readily detected, when the base itself is employed.

As we were unable to find any full description of this compound, it seemed advisable to us to make a careful study of it, and determine its composition. A considerable quantity of the compound was prepared and

purified by decantation. It was then filtered through a porous plate and thoroughly washed with water, alcohol and chloroform, and dried in a vacuum. The compound cannot be crystallised and is decomposed when heated, so that its m. pt. cannot be determined. When dry it is a white amorphous powder which contains no water. Upon combustion, it gave the following figures:—

C, 63.80 : H, 4.80 : N, 4.25:

theory for  $\text{C}_{21}\text{H}_{22}\text{N}_2\text{O}_2$ ,  $\text{C}_{14}\text{H}_{10}\text{O}_9$ :—

C, 64.02: H, 4.87: N, 4.27.

These figures leave little room for doubt: but further confirmatory evidence was obtained in the following way:—

The weight of the precipitate produced from a known quantity of pure tannic acid with excess of strychnine was determined with great care. Twelve separate experiments gave practically identical results, and proved conclusively that the acid and base combine in the proportion of 1 mol. of each, and, further, that the compound has

\* Notes on collin. This J., 1904, pp. 1071-1072.

a constant composition when thrown down in the presence of excess of the base.

A known quantity of strychnine having been used, the unused portion was estimated, and again found to agree.

The following are details of the method employed in obtaining the precipitate, and since this is that which is used in the case of tanning materials a short description may be of service:—0.125 grms. of pure tannic acid were dissolved in 50 c.c. of water in a 250 c.c. flask, and cooled. 0.25 grms. of strychnine are now dissolved in 50 c.c. of alcohol and diluted with water until its volume is nearly 200 c.c., cooled and added to the tannic acid solution. The mixture is now made up to 250 c.c., thoroughly shaken, and filtered through a Gooch crucible, dried in a vacuum and weighed.

Using 0.125 grms. of tannic acid the theoretical weight of the precipitate is 0.2546 grms., while the mean result of 12 experiments gives 0.2540 grms., the variation being very small. The residual alkaloid was, in each case, estimated as a check. These results conclusively prove that the formula of the precipitate is  $C_{21}H_{22}N_2O_2 \cdot C_{14}H_{10}O_9$ , when dry.

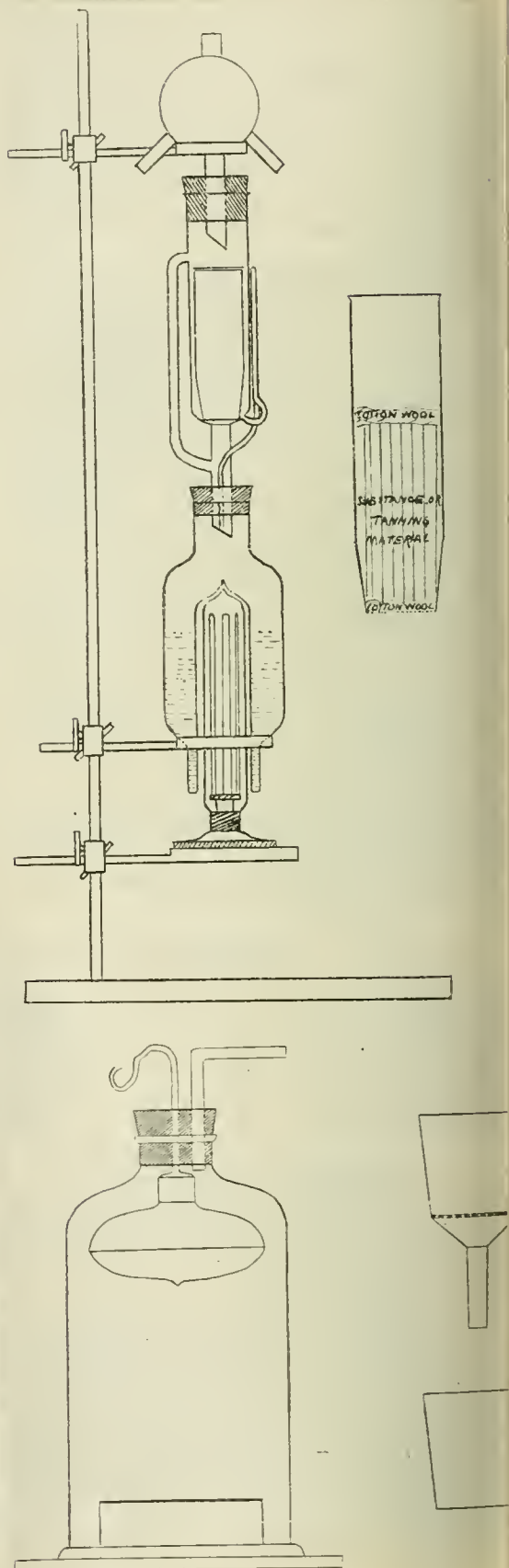
*Analysis of Tanning Material.*—These may be extracted in the ordinary way, but as the result of many experiments, we find the process of extraction shortened and made more complete by using alcohol and a Soxhlet extractor.

F. P. Veitch \* records the real and imaginary objections to the extraction of tanning materials by the different methods, using water as the extracting liquid. By the use of alcohol all possible objections are overcome, such as hydrolysis of tannic acid, &c. This is conclusively proved in the case of a sample of lentisco, which, upon immediate analysis when extracted by alcohol, gave a result of 5.08 per cent. tanning matters. After boiling for a fortnight 5.00 per cent. tannins were found, thus showing that no hydrolysis had taken place.

To avoid the use of a water bath, or a direct flame, a modification of the electrical heaters (proposed by us at a previous meeting, this J., 1904, 1137) is used. The alcohol is placed in a flask with a re-entering bottom, in which is fitted a cylindrical electric lamp, the filaments of which are similar to those employed in electric radiators. The lamp is raised or lowered as may be necessary. The extraction will be complete when the spirit comes from the Soxhlet extractor colourless, and generally does not require more than half an hour, the advantage being that the alcohol may be made to boil at whatever rate one pleases, without running the risk of the dissolved matter being left above the surface of the alcohol in a dried and possibly burnt condition. The quantity of material extracted should contain about 0.5 gm. tanning material. This is placed in the tube having a perforated bottom, and is prevented from falling through by a small plug of cotton wool, while another small plug is placed above, to prevent particles flowing over the top. (See diagram.)

The solvent is now evaporated to about 50 c.c., then poured into a 100 c.c. flask, and made up to the mark with water. This will cause the precipitation of resins and similar bodies which have been extracted by the alcohol. These are filtered through a dry Gooch crucible, and the tannic acid is estimated in 25 of the filtrate. A further 25 or 50 c.c. is evaporated to dryness, and the residue weighed to determine the non-soluble tannins. The tannic acid in the filtrate is estimated as follows:—25 c.c. of the extract are placed in a 250 c.c. flask and diluted with water. 0.25 gm. of strychnine are then weighed out and dissolved in about 50 c.c. of alcohol. To this an equal volume of water is added, the mixture cooled and added to the tannic acid, the contents of the flask being diluted to the mark, and thoroughly mixed. If the precipitation be not carried out in the above manner, it is found that the strychnine tannate will not come down in a sufficiently flocculent form, and will be difficult to filter.

The contents of the flask are now filtered through a weighed Gooch crucible. The crucible used has a diameter of from 1 to 2 ins. at the bottom, and may be made of platinum or porcelain. Having fixed it to the filter pump, a thin mat of asbestos pulp is prepared in the usual way,





dried over the blowpipe flame and weighed. The tannates, after filtration, are partly dried by means of a current of air, the dehydration being completed in a vacuum oven, by which decomposition is avoided, this occasionally taking place if dried in an air or water oven.

A very simple form of laboratory vacuum oven may be made as follows:—A bell-jar fitted with a rubber bung stands on a ground-glass plate. Through the bung passes an electric wire from the main supply, and which is internally connected with a lamp, by which the temperature of the bell-jar is raised to about 60° C.

The results attained by this method of estimation are quite consistent. The same sumach was analysed on three separate days, the results being shown in the following table:—

Weight of sumach used.	Percentage of tanning matter estimated.	Percentage of soluble non-tannins estimated.
(1) 2.5 grms. ....	23.44	17.84
(2) 2.5 „ ....	23.56	17.52
(3) 5.0 „ ....	23.752	17.92

The following table shows a few results obtained from the commoner tanning materials, and proves that the figures obtained by this method do not necessarily agree with those from the hide powder method, showing that the latter absorbs many substances other than tannic acid. This has already been pointed out by Parker and Payne, but apparently even collin, although incapable of precipitating gallic acid, still combines with organic substances which are unaffected by strychnine. These results are embodied in the following table. It will be seen that they are, as might be expected, much lower than those obtained by the bell filter, while the soluble non-tannins are, as a rule, higher than those obtained by either Procter or Parker, the difference being probably due to colouring matter which is not estimated at all by strychnine.

It is, of course, obvious that there remains much to be done in connection with the various tannic acids which occur in the different tanning materials, more information being required as to their power of combining with alkalis and their actual value in the tan-yard. This investigation is already in hand.

	Percentage of tanning matter by Procter.	Soluble non-tannia by Procter.	Total solids by Procter.	Tanning matter by Trotman and Hackford.	Soluble non-tannin by Trotman and Hackford.	Total solids by Trotman and Hackford.
Sumach .....	25.48	15.2	30.68	23.56	17.84	31.40
Lentisco .....	11.30	18.70	30.00	5.086	24.928	30.014
Larch .....	8.60	6.86	15.46	6.648	9.752	16.400
Birch .....	7.22	6.55	13.77	5.50	7.55	13.05
Gambier .....	59.68	21.76	81.44	8.40	71.80	79.20
Cutch .....	40.10	2.38	42.48	26.32	20.50	46.82
Divi Divi .....	28.32	22.40	50.72	23.22	35.20	58.42
Myrobalans .....	29.80	20.92	50.72	18.15	16.21	34.36
Tamarix .....	—	—	—	11.63	14.61	26.24

# DISCUSSION.

Mr. J. T. WOOD mentioned as a singular coincidence that Messrs. Trotman and Hackford and Dr. Parker and Mr. Payne hit upon the idea of using alkalis for the precipitation of tannin independently of each other. The figures quoted required digesting before one could criticise them properly. The extraction by alcohol did not take out the same amount of matter as extraction by water, as one would naturally expect. He noticed that in the case of sumach the difference in total solids as determined by Procter's method, and the total solids as determined by Trotman and Hackford's method, was 0.72 in favour of alcohol.

In the case of gambier the difference was 2.24 less by alcohol than by water, but in myrobalans 16.36 less. He concluded that the tannin in sumach was nearly pure gallo-tannic acid. Myrobalans tannin appeared to be a mixture of gallo-tannic acid and another tannic acid. Had Mr. Trotman tried pure tannins other than gallo-

tannic acid? If so, it would be interesting to know how they behaved. The resemblance between the values given by collin precipitation and the strychnine precipitate was remarkable. He suggested that figures should be given showing results from other tannins which had been isolated in a pure state.

Prof. F. STANLEY KIPPING said it appeared to him that, from a chemical point of view, Messrs. Trotman and Hackford had made a distinct step in advance as this was the first time that the matter had been worked out on a strictly scientific basis. Instead of using as reagent a mixture of unknown compounds they had used a pure and definite base, whose purity could be guaranteed. He would like to know if, instead of using strychnine, the authors had made experiments with amido acids, or with compounds that approximated closely to those which absorbed tannic acid in the hide powder. What was the difference between the constituents taken out by the strychnine and by the hide powder? Had they tried the effect of adding hide powder after the gallo-tannic acid had been removed by strychnine, and, if so, what sort of a product had they got? If not had they added any other bases to the filtrate after precipitating the gallo-tannic acid?

Dr. A. TURNBULL said that Messrs. Trotman and Hackford appeared to be working on correct lines using a pure chemical substance as precipitant and estimating the tanning matters from the weight of the precipitate. From the results it was clear that only certain tannins were precipitated by strychnine. This was interesting from a chemical point of view, but for purposes of trade it would be necessary to get at the full added weight which went to make leather. He also would be glad to be free from having to use hide powder in tannin analysis, but, at the same time, he felt that hide powder was not altogether to blame for want of concordance amongst the various chemists, as some of this was undoubtedly due to minute differences in manipulation. There seemed to be no advantage, but rather many disadvantages, in extracting tannin materials by means of alcohol in place of water.

Dr. J. GORDON PARKER said the paper could not be digested in one night without a careful consideration of the figures. It was true that he had been working on similar lines to Messrs. Trotman and Hackford, but, unfortunately, he had not been able to complete his

experiments. He and his colleague, Mr. Payne, had discarded strychnine because it could not be titrated. They got better results with quimidine acetate, brucine and other materials, but were not yet ready with their results. He did not like the idea of extracting tanning materials with alcohol. So little was known as to how tannin existed whether in combination or in a free state. They could not get an equal extraction with alcohol and water. When they got it with alcohol they threw out some tannins which existed in combination with soluble compounds.

Mr. E. M. PAYNE objected to the use of any method which could not be used in an acid solution, since, in the tan-yard, liquors were almost invariably strongly acid. He further objected to the statement that the collin method would not estimate gallic acid. He claimed that it did, and that its estimation was of as much importance as that of the gallo-tannic acid. Tannate of strychnine had been found by Dr. Parker and himself to be soluble in acetic acid, and he thought this would be an objection.

Mr. S. R. TROTMAN, in reply, said that they were quite well aware of the solubility of the tannates of strychnine and other alkaloids in acetic acid, and for this reason they preferred to use the alkaloid itself as recommended in the paper. The previous neutralisation of the tannic acid before precipitation was practically very difficult although theoretically possible, since the tannins were so readily oxidised. He disagreed with Mr. Payne when he said that the collin method was capable of estimating gallic acid. On the contrary he thought that great claim was made for this method largely because it did not estimate gallic acid except by inference, which could also be done by means of strychnine. It appeared to him that a method of this sort must be an advance towards the discovery of a perfect method, since it was an attempt to place the estimation of tannin upon a purely scientific basis, and one could not too strictly emphasise the importance of a direct method. They had also tried titration, but found volumetric methods unsuitable to strychnine. With reference to the delicacy of the reaction they had never failed to be able to detect tannic acid by means of strychnine in a solution which gave a positive reaction

with collin. They did not, of course, at this stage, put the method forward as one to replace the hide powder. They had tried certain amido compounds but hitherto unsuccessfully. If hide-powder were added after the gallo-tannic acid had been removed by strychnine, gallic acid would, at any rate, be removed. They had used collin for this purpose and found that strychnine removed practically the same constituent.

With reference to the extraction of tanning materials by means of alcohol they agreed that it was unsuitable for some materials, but there seemed to be no reason why it should not be used for others. Most of the figures given in their table had been obtained from alcoholic extracts, and they agreed in most cases fairly well with those from the aqueous extract. In some cases the enormous shortening of time would be of considerable advantage. It should be noted that so far as they had gone at present they had only dealt with gallo-tannic acid, which was readily soluble in alcohol. Experiments with other forms of tannic acid were already in progress, the results of which they hoped to bring before the Society at a future meeting.

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### I.—PLANT, APPARATUS & MACHINERY.

#### ENGLISH PATENTS.

*Separating Machines; Centrifugal*. — G. Ter Meer, Hanover, Germany. Eng. Pat. 1304, Jan. 23, 1905. Under Int. Conv., Feb. 16, 1904.

SEE Fr. Pat. 351,143 of 1905; this J., 1905, 835.—T. F. B.

*Straining, or Separating Solids from Fluids, more especially intended for Use with Apparatus operated by Water, or other Fluid; Apparatus for*. — P. Evans, Philadelphia. Eng. Pat. 11,780, June 5, 1905. Under Int. Conv., June 4, 1904.

THE invention relates to methods of straining the water supplied to automatic alarm devices used with sprinklers or other fire-extinguishing apparatus. The water entering the apparatus is caused to impinge at an acute angle or tangentially on to the surface of a wire gauze screen. The water passes through the screen, and any solid matter

that has been stopped by the gauze, is washed off by the inflowing water, and either settles to the bottom of the chamber, or is carried forward into a trap, formed by prolonging the screen beyond the opening through which the strained water passes.—W. H. C.

#### UNITED STATES PATENT.

*Coal, Ores and other Minerals; Method of and Apparatus for Treating — for Draining them of Water*. F. Baum, Herne, Germany. U.S. Pat. 801,204, Oct. 10, 1905.

SEE Eng. Pat. 2485 of 1904; this J., 1904, 539.—T. F. B.

#### FRENCH PATENTS.

*High Vacua and the Separation of Gases; Method of Absorbing Gases and Vapours and its Application for the Production of*. — J. Dewar. Fr. Pat. 334,794, April 23, 1905.

SEE Eng. Pat. 13,638 of 1904; this J., 1905, 793.—T. F. B.



*Motive Agents (Alcohol, Hydrocarbons or Mixtures of the two); Method of Increasing the Efficiency of —, by the Addition of Bodies rich in Oxygen.* C. H. J. Roth. Fr. Pat. 354,285, May 15, 1905.

THE claim is for the addition of ammonium nitrate to the alcohol, hydrocarbons or mixtures of both used in explosion engines, with the object of increasing the efficiency. An alcoholic solution of ammonium nitrate may be added to the alcohol, &c., before use, or an aqueous solution may be injected into the explosion chamber along with the combustible. Several suitable mixtures are given as examples.—W. H. C.

*Condensers, Coolers, &c., employed in Distilling and other Industries; Impts. in —.* E. Guillaume. Fr. Pat. 354,402, May 18, 1905.

A WOODEN rod or a metal tube, closed at both ends, is suspended concentrically in each of the tubes of a tubular condenser. The inner rod or tube is of slightly smaller diameter than the condenser tube, thus the cross-sectional area of the space through which the liquid flows is decreased and, if the same volume of liquid is used as in ordinary cases, the rate of flow through the annular space is largely increased, with the result that the condenser or cooler is much more efficient.—W. H. C.

*Evaporating in Vacuo; Apparatus for —, with Separate Compartments for Heating and Vaporising.* R. Sauerbrey. Fr. Pat. 354,711, May 27, 1905.

SEE Eng. Pat. 10,947 of 1905; this J., 1905, 958.—T. F. B.

## II.—FUEL, GAS, AND LIGHT.

*Gas; Utilisation of Natural —.* Naphtha, 1905, 12, 264. Chem. Rev. Fett- u. Harz-Ind., 1905, 12, 251.

IN Austria, a patent has been taken out by Wolski for the liquefaction of natural gas, and Linde's apparatus has been used for the purpose by Dabrowski in the oil fields of the Carpathian Co. For the liquefaction of this gas, it is sufficient to reduce the pressure from 50 to 5 atmos. The liquefied gas begins to distil at  $-106^{\circ}\text{C}.$ , and has thus a higher b.pt. than methane ( $-160^{\circ}\text{C}.$ ), and a lower one than ethane ( $-89^{\circ}\text{C}.$ ). The first fraction probably consists, in the main, of methane, the higher b. pt. being due to the presence of other substances. It also contains heavy benzene constituents, which separate in the gas pipes, and form the residue left on the evaporation of the more volatile portions of the liquefied gas. A further advantage of its use is that the vapours of the liquefied product have only a relatively small tension, so that the liquid can be kept and transported in ordinary soda-water siphons. It is particularly suitable for small gas engines, for lighting isolated houses, and as fuel for motor cars, &c. Some notion as to its cost may be formed from the fact that a firm in Augsburg was able to manufacture liquefied coal-gas at a cost of 1.2 mark. per kilo., or 4.5 to 6.5 pf. for 100 Hefner candles per hour. Since the natural mineral gas is a by-product, its cost in the condensed form must be much less than this.—C. A. M.

*Iron Oxide as a [Gas] Purifying Agent, and its Valuation as a Raw Material and in a Spent Condition.* H. L. Greville. J. Gas Lighting, 1905, 91, 750–751.

AFTER discussing the regulations with regard to the removal of sulphur compounds from gas, and describing the usual methods of analysing the raw bog ore (iron oxide) used for this purpose, the author states that there is considerable doubt as to the real composition of hydrated oxide of iron. In a recent commercial case, the seller put forward the formula  $\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$ , whilst the buyer insisted on the formula  $\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$  for the substance. The author found that the precipitate produced by ammonia in a solution of ferric chloride, had the composition  $2\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$  after being dried at  $100^{\circ}\text{C}.$  Some experiments on natural bog ores dried over sulphuric acid in a desiccator and afterwards exposed to a temperature of  $100^{\circ}\text{C}.$ , showed that the substance contained a

hydrate which was decomposed, at least partially, at a lower temperature than  $100^{\circ}\text{C}.$  Results of quantitative tests showed that natural bog ores contained hydrated ferric oxides which have a higher percentage of combined water than is represented by the formula  $2\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$ .

For the determination of sulphur in spent oxide, the author introduces 250 grs. of the sample into carbon bisulphide contained in a 250 c.c. flask, having a fairly long neck. After shaking for a short time, the solution is filtered, and 100 c.c. of the filtrate (— 100 grains of sample) are evaporated to dryness, and the residue of sulphur weighed. This method is much quicker than the usual exhaustion with carbon bisulphide, and is stated to give equally accurate results.—A. S.

*Gas; [Cost of] Purification of — from Sulphuretted Hydrogen.* T. Holgate. J. Gas Lighting, 1905, 92, 174.

As the result of a complete year's working at the Halifax gas works, using only oxide purification, after the gas had been passed through purified ammoniacal liquor, a net profit of 0.04d. per 1000 cb. ft. of gas sold was realised; as the average of the six lowest costs of purification at other works was 0.23d., this represented, on the quantity of gas sold, a saving of over £900. In six of the last eight years, a profit was made on the oxide section of the purification. The following statement shows the cost of purifying 1000 cb. ft. of gas by oxide, and by lime, and also the net cost of purification during the last eight years:—

Year ended March 31.	Percentage of carburetted Water Gas.	Oxide Purific. cost.	Lime Purific. cost.	Net cost.
		d.	d.	d.
1898	—	0.030	0.360	0.353
1899	—	0.005	0.346	0.363
1900	—	0.025	0.296	0.318
1901	9.79	0.007	0.389	0.466
1902	13.63	0.047	0.425	0.554
1903	6.37	0.019	0.394	0.476
1904	1.83	0.150	0.119	0.331
1905	0.64	0.048	0.007	0.040

—T. F. B.

*Acetylene; Dissolved —.* Kuchel and E. Bournonville. Engineer, 1905, 100, 381–382.

“DISSOLVED acetylene” consists of acetylene dissolved in acetone under a pressure of several atmospheres, the liquid being absorbed completely by porous material contained in steel cylinders. The maximum pressure employed is 10–12 atmospheres. One volume of acetone holds, at 10 atmospheres, 250 volumes (as measured at the ordinary atmospheric pressure) of acetylene gas, and 300 volumes at 12 atmospheres. The solubility is seriously reduced by impurities in the acetone, especially water; and since a cylinder containing the porous substance is used repeatedly in practice, the capacity in terms of gas gradually decreases. The porous materials at present in use are made either from asbestos and sodium silicate, or from charcoal and a cementing substance, and their porosity is fixed, as accurately as possible, at 80 per cent., i.e., 80 per cent. of their apparent volume consists of interstitial spaces. On being fully saturated with acetylene at 12 atmospheres pressure, 1 volume of acetone expands to about 1.5 volumes; hence, in charging a cylinder, filled with the porous substance, a quantity of acetone little more than one-half the volume of the interstitial space is introduced, the remaining space being available for expansion, and for some free compressed gas. It is found that, as required by theory, the gas from a 12-atmosphere cylinder carries off, per 1000 litres, the vapour of 60 c.c. (48 grms.) of liquid acetone. In the process of manufacture, washed dried acetylene is passed through a meter, a water-cooled compressor, and a separator (for removing oil carried over from the pump), into the cylinder, which has previously been filled with the porous substance, evacuated, and charged with the necessary quantity of acetone.

From experiments made by Kuchel it appears that a cylinder charged to 12 atmospheres pressure at  $20^{\circ}\text{C}.$ ,

could only develop a pressure of about 24 atmospheres if exposed to the hottest rays of the sun (55° C.); and as the heat-conductivity of the porous material is very low, the actual pressure is not likely to reach even this figure.

On charging the cylinders, complete saturation of the acetone does not occur immediately; thus, in a cylinder freshly charged with gas, the pressure rose to 12 atmospheres, but gradually sank in six hours to 7.2 atmospheres. Similarly, time is required for the acetone to give up the whole of the gas during discharge. Tests were made with a cylinder which in each experiment was charged with the same quantity of gas; 96.5 per cent. of the theoretically available volume of gas was utilisable when the discharge occupied 17 hours, and only 65 per cent. when the discharge took place in 1 hour, 22 minutes—the test consisting in supplying the gas to various numbers of burners at their normal rate of consumption, and noting the quantity of gas which had been consumed when the pressure failed.

Kuchel has compared the relative merits, for the illumination of trains, of dissolved acetylene, oil-gas, oil-gas enriched with 25 per cent. by volume of acetylene, and electricity from accumulators, and from his figures the following table has been constructed, the data referring to the output, weight, and measurements of the apparatus required per flame of 14 English candle-power:

Illuminant.	Hours of Light.	Weight in lb.	Space occupied in cb. ft.
German oil-gas, 4.77 c.p. per cb. ft.	96.15	12.0	0.47
British oil-gas, 8 c.p. per cb. ft. . .	161.7	7.1	0.28
Electricity from accumulators . . . .	144.0	6.1	0.06
Acetylene oil-gas, 11.8 c.p. per cb. ft.	238.1	4.8	0.19
Dissolved acetylene, 35.5 c.p. per cb. ft.	357.14	0.53	0.005

Kuchel calculates the cost of dissolved acetylene to be 1.552 pf. per hour per flame of 14 English candles, the figures for the other illuminants, on the same basis, being: oil-gas, 2.548 pf.; acetylene oil-gas, 1.798 pf.; accumulators, 8.976 pf.—H. B.

*Oxide [Gas-Purifying Material]; Analysis of Spent* — H. L. Greville. XXIII., page 1127.

*Lime; Analysis of Raw and Spent* — H. L. Greville. XXIII., page 1126.

#### ENGLISH PATENTS.

*Gas Furnaces or Coke Ovens.* H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 28,811. Dec. 29, 1904.

SEE Fr. Pat. 351,962 of 1905; this J., 1905, 884.—T.F.B.

*Gas obtained by the Combination of Compressed Air with Petroleum; Process and Apparatus for the Production of a Combustible* — A. Perrier, Paris. Eng. Pat. 21,408, Oct. 5, 1904.

SEE Addition of Aug. 23, 1904, to Fr. Pat. 327,461 of 1902; this J., 1905, 270.—T. F. B.

*Gases; Washing — and Apparatus therefor.* G. M. Capell, Stony Stratford. Eng. Pat. 24,903, Nov. 16, 1904.

THE gas to be washed is drawn or forced through a horizontal chamber which is of smaller cross-section at the inlet than at the outlet end. The chamber is partially filled with water, which may be circulated by means of pipes, connecting the lower portion of the washer with an adjacent water vessel. A series of vertical or inclined shutters depend from the top of the washing chamber and dip to a successively decreasing distance into the water. The gas is thus forced to bubble through a series of water seals and may afterwards be dried by being caused to pass through perforated plates covered with coarse asbestos cloth or similar material, and placed at the outlet end of the washer.—W. H. C.

*Electrodes for Electric Arc Lamps; [Flaming Arc]* — The British Thomson-Houston Co., Ltd., London. From the General Electric Co. of Schenectady, Schenectady, U.S.A. Eng. Pat. 13,381, June 29, 1905.

Boric oxide, 2 parts, and aluminium, 1 part, are heated slowly together in a Hessian crucible or the like; the mixture is next heated in a refractory crucible, not attacked by boron (e.g. one made of magnesite), to about 2300° C.; and the mass is then allowed to cool slowly, to allow the elementary boron produced to crystallise. After removal of the unaltered boric anhydride and aluminium, and the alumina which has been formed during the heating, the boron is powdered, mixed with carbon, and heated in a carbon crucible in an electric furnace. The product, which appears to consist of boron carbide, B<sub>4</sub>C, is powdered, and mixed in the proportion of 2 to 6 parts, with from 6 to 2 parts of titanium carbide and 2 parts of carbon; the mixture is formed into electrodes with the aid of tar or other suitable binder, and the baked electrodes are plated with copper, to prevent oxidation when in use.—H. B.

#### UNITED STATES PATENT.

*Plaster or Mortar [from Spent Gas Lime]; Process of Making* — J. B. N. Berry. U.S. Pat. 800,606, Sept. 26, 1905. IX., page 1110.

#### FRENCH PATENTS.

*Coke Briquettes; Process of Making* — L. L. D. Zuiderhoek. Fr. Pat. 350,118, Aug. 16, 1904.

SEE Eng. Pat. 17,906 of 1904; this J., 1905, 836.—T.F.B.

*Fuel; Improving the Combustion of Carbonaceous* — J. Harris. Fr. Pat. 554,598. May 24, 1905. Under Int. Conv., Sept. 23, 1904.

OZONE or ozonised air is admitted into the firebox or furnace, to improve the combustion of the fuel.—C. S.

*Alcohol; Preparing a New Product for Industrial Purposes, by the simultaneous Concentration and Carburization of* — F. Sallé. Fr. Pat. 353,030, June 7, 1905.

COMMERCIAL alcohol is mixed with acetone or other solvent of acetylene and then treated with sufficient calcium carbide to absorb the contained water. The liquid is then separated from the resulting calcium hydroxide by distillation, and the distillate is saturated with the acetylene liberated in the first operation.—C. S.

*Stoves; Slow-Combustion* —, with Channels for the Escape of the Gaseous Products of Combustion. H. Freise. Fr. Pat. 354,131, May 9, 1905. Under Int. Conv., May 21, 1904.

THE vertical gas channels formed on the interior surface of the walls of slow-combustion stoves are connected together at intervals by a series of horizontal channels. The latter are further connected by grooves or channels formed in the brick lining of the stove. The object of the invention is to facilitate the escape of the gases when the vertical channels are partially or completely blocked by small particles of the fuel.—W. H. C.

*Gases from Lime, Brick, Cement, Pottery and Porcelain Kilns; Utilisation of Waste* — E. Genz. Fr. Pat. 354,796, April 29, 1905. IX., page 1110.

*Producer; Suction* — Soc. L. Boutillier et Cie. Fr. Pat. 354,479, May 20, 1905.

At the lower part of the producer, and situated above the fire-grate, is provided a recessed, annular reservoir of cast-iron, heated directly by the incandescent fuel, but not attacked by it. The reservoir is kept full of water, and generates steam in quantities proportional to the requirements of the motor which is fed with the gas produced. The steam, issuing from an annular space round the hottest zone of the producer, passes up in contact with the refractory walls of the latter, preventing overheating and the adhesion of clinker. The air supply



enters in a dry state beneath the fire-grate. The producer, and the connected washer, are built up of readily detachable parts, having joints similar to those of gas- or water-mains.—H. B.

*Generator for Gas mixed with Steam.* E. Schmidt. Fr. Pat. 354,724, May 27, 1905.

A COMBUSTIBLE liquid, such as petroleum, is introduced under pressure, through an atomising jet, into the lower part of a closed boiler-like chamber, where it burns along with a supply of compressed air. Water is injected, through an atomising jet or jets, into the hot products of combustion, soot being thus eliminated from the mixed gas, which is led off at high pressure from the dome of the boiler, to be used directly for motive purposes. A curved plate, extending over the hydrocarbon jet, prevents the water from mingling with the hydrocarbon before the latter is fully inflamed. By means of a thermo-regulator, the temperature of the generator is regulated automatically by the increase or decrease of the water supply. In a second form of the apparatus, the combustion of the hydrocarbon and air takes place in a chamber enclosed within the boiler-like chamber, steam being generated by directing the water spray on to the top of the combustion chamber; and the steam produced mingles with the hot gases issuing from the combustion chamber.—H. B.

*Gas under Pressure for Motive Purposes; Process of Preparation of a —.* O. Assmann. Fr. Pat. 354,837, May 31, 1905. Under Int. Conv., June 1, 1904.

A GASEOUS mixture at high pressure, suitable for driving a motor, is produced by the sudden combustion of a combustible within a chamber (which may be the cylinder of the motor itself), the heat necessary for causing the ignition being produced either by (1) heating the air and combustible, separately, to the ignition point; or (2) heating the combustible to a temperature short of the ignition point, and the air to a point sufficiently above it to bring about the ignition of the mixture; or (3) heating the air, or air and combustible, beforehand, and then compressing the mixture sufficiently to raise it to the igniting point.—H. B.

*Gas Washers.* T. Redman. Fr. Pat. 354,570, May 22, 1905. Under Int. Conv., June 4, 1904.

See Eng. Pat. 12,659 of 1904; this J., 1905, 611.—T.F.B.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

#### ENGLISH PATENTS.

*By-Products; Process and Apparatus for Obtaining — in the Dry Distillation or Gasification of Fuel.* H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 20,870, Sept. 28, 1904.

See Fr. Pat. 351,268 of 1905; this J., 1905, 839.—T.F.B.

*Volatile Compounds, Separation of — by Distillation, and Apparatus therefor.* A. G. Green, Leeds. Eng. Pat. 24,363, Nov. 10, 1904.

THE ordinary fractionating column and constant temperature still-head are replaced by the following apparatus. A simple, unobstructed column, coated on its outside with a non-conducting material, is mounted on a still, and connected at the top to a condenser. The liquid to be fractionated is forced by pressure through a heater into a spraying nozzle, which is placed near the upper end of the column, and which may deliver the spray either downwards or upwards as desired. In the latter case, a deflecting plate is placed above the nozzle. The heated spray falls down the column and meets the hot vapours ascending from the still. The less volatile bodies are condensed and returned to the still, whilst the more volatile portions pass on to the condenser. It is

stated that great economy of heat, greater efficiency, and a much more simple method of construction, and consequent lower cost are thus obtained.—W. H. C.

*Dust; Improved Compound which forms an Emulsion with Water to be applied to the Surfaces of Roads or other Places for the Purpose of Preventing the Formation of —.* E. Hardestale and Kay Bros., Ltd. Eng. Pat. 14,239, July 11, 1905. IX., page 1110.

#### FRENCH PATENTS.

*Petroleum Oils Especially Redistilled Oils; Refining —.* H. P. J. B. Gollart. Fr. Pat. 350,091, Aug. 1, 1904.

THE oil may be decolorised and decodurised by agitation for 10–15 minutes with about 2½ per cent. of a solution of ferric chloride and about ½ per cent. of hydrochloric acid, after which it is left to settle, separated from the sediment and filtered. Any black particles of iron salts still remaining, can be eliminated by agitation with ammonia or an alkali. Any other soluble ferric salt may be used.—C. S.

*Asphaltum and Sulphur or Mixtures of Asphaltum with Pitch, Tar, Resin, Petroleum, Fats, Oils and Analogous Substances; Process for Rendering — Miscible with Water.* K. Mann. Fr. Pat. 354,648, May 25, 1905. Under Int. Conv., June 2, 1904.

THE substances, in a state of solution, fine division or suspension, are intimately mixed with soap and some colloidal substance like starch paste, gum, pectins, mucilages, or colloidal oxides or silicates. The soap may be replaced by aqueous solutions or emulsions of fats, resins, lac, oils, waxes, balsams, paraffins, saponin, &c., &c.—C. S.

*Petroleum Associated with Ammonia; Emulsifying by Saponification —.* E. Charbonneaux. Fr. Pat. 354,884, June 5, 1905.

HALF a grm. of saponin is dissolved in 5 grms. of commercial ammonia and 15 grms. of water, and to this solution 100 grms. of petroleum are stirred in 10 grms. at a time. The oil should have been treated with 5 grms. of amyl acetate, to remove smell and facilitate saponification. The thick, creamy emulsion may be scented with a saponifiable essential oil.—C. S.

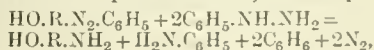
*Turpentine Substitute; Preparation of a —.* A. Pollet. Fr. Pat. 354,425, May 20, 1905. XIII.B., page 1118.

*Fats, Oils, Resins and Hydrocarbons; Purification of —.* C. Fresenius. Fr. Pat. 354,810, May 17, 1905. XII., page 1117.

### VI.—COLOURING MATTERS AND DYESTUFFS.

*Hydroxyazo Compounds; Reduction of — to Amino-phenols by means of Phenylhydrazine.* G. Oddo and E. Puxeddu. Ber., 1905, 38, 2752–2755.

THE reaction takes place according to the equation:—



where R represents an aromatic radical. Either an *o*- or a *p*-hydroxyazo compound may be used. One mol. of the hydroxyazo compound is heated with 2 mols., or rather more, of phenylhydrazine. The hydroxyazo-compound dissolves in the base as the temperature is raised. At about 110° C. an energetic reaction occurs with sudden evolution of gas and steam, and rapid rise of temperature. The flame is at once removed, but the reaction continues for about five minutes, the temperature finally rising to 180°–200° C. The temperature then falls, and the gas-evolution becomes less, ceasing altogether on cooling. The aminophenol then often crystallises out, or can be isolated by crystallisation from benzene, followed by recrystallisation from benzene, ligotin or water. In other cases it is better to treat the

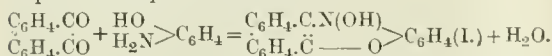
product of the reaction with a dilute alkali hydroxide solution, extract the undissolved bases with ether, and precipitate the aminophenol by means of carbon dioxide. The yields are often quite, or almost theoretical. The preparation of 5-amino-eugenol, o-amino-*p*-cresol, *p*-amino-carvacrol ( $\text{CH}_3\text{:OH:C}_6\text{H}_7\text{:NH}_2=1:2:4:5$ ) and *p*-aminophenol by this method are described in detail.

—E. F.

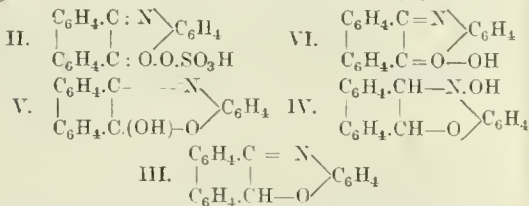
#### Azoxonium Compounds. F. Kehrman.

Ber., 1905, 38, 2952—2962.

THE authors have studied the condensation of phenanthraquinone with o-aminophenol in benzene solution, and show that the product obtained is not phenanthrophenazoxine, as they previously thought (see Ber., 1901, 34, 1626; this J., 1901, 799), but a colourless pseudo-base of phenanthrophenazoxonium.



This colourless pseudobase (I.) is converted into the violet coloured salts of phenanthrophenazoxonium (II.) by concentrated sulphuric and other mineral acids. These salts are decomposed by water, first, probably, into the hypothetical violet-coloured true phenanthrophenazoxonium hydroxide (VI.); thence by intramolecular change into a very unstable isomeric yellow pseudo base (V.); which, in the presence of much water, rapidly goes over again into the stable colourless modification (I.).



Thus azoxonium salts may be derived from not only one but two or more different but isomeric pseudo bases. The substances with no quinonoid carbon-nitrogen double bonds are colourless; those with one or more are coloured. The intramolecular changes that take place are due to the disappearance and re-appearance of the double bond. The colourless pseudobase (I.) crystallises in snow-white needles, m. pt. 206° C., and may be dried at 110° C. without decomposition; the yellow modification could not be obtained in a pure state, but its constitution is said to be clearly shown by the behaviour of certain higher homologues, stable in both the white and yellow modifications. By reduction of the colourless pseudo-phenanthrophenazoxonium (I.) with phenylhydrazine, dihydro-oxy-phenanthrophenazoxine (IV.) is obtained. This crystallises when pure in white, glistening needles, and is practically stable in dry air. On heating to 100° C., it is converted into the original pseudo base (I.). When a few drops of dilute hydrochloric acid are added to the alcoholic solution, a molecule of water is split off, and it immediately goes over into pseudo-phenanthrophenazoxine (III.). The latter substance crystallises in yellowish-green fluorescent needles, which are fairly stable in dry air, but are rapidly oxidised to the original pseudo base (I.) when heated to 80° C. It may be also prepared by reducing the latter base with stannous chloride.—H. L.

#### Terephthalaldehyde Green; Thiele's Xylene-Oxidation and —. P. Claussner. Ber., 1905, 38, 2860—2862.

OCTOMETHYL-TETRAMINOTETRAPHENYL-*p*-XYLENE, the leucobase of Terephthalaldehyde Green, was prepared by condensing terephthalaldehyde tetra-acetate with dimethylaniline by means of zinc chloride; and was converted into the dyestuff, in the usual way, by oxidation with lead peroxide and acetic acid. The dyestuff is very similar to Malachite Green both in shade and, so far as determined, in dyeing properties. Terephthalaldehyde-tetra-acetate was prepared from *p*-xylene by Thiele's method (Annalen., 311, 358), and can be converted into the leucobase without previous hydrolysis into the alde-

hyde. The author found that a mixture of *p*-toluylaldehyde-di-acetate  $\text{CH}_3\text{:C}_6\text{H}_4\text{:CH(OC}_2\text{H}_5\text{O)}_2$  m. pt. 69° C., with the tetra-acetate is produced by carrying out the preparation at 5°—10° C., the temperature recommended by Thiele. At —2° to —10° C., the diacetate is almost exclusively obtained, whilst at 10°—18° C., the tetra-acetate is practically the sole reaction product. The separation of the mixtures produced at intermediate temperatures is readily effected by means of alcohol, in which the tetra-acetate is insoluble.—H. L.

#### Hydroxyquinol; Condensation of — with Aldehydes. E. Heintschel, Ber., 1905, 38, 2878—2883.

LIEBERMANN and Lindenbaum obtained mordant dyestuffs of the fluorone group by combining 2 mols. of hydroxyquinol with 1 mol. of an aldehyde (see Ber., 1904, 1175, 2728; this J., 1904, 485). The author has submitted *m*-nitro- and *m*-bromo-benzaldehyde, and 5-nitro-, 5-bromo-, and 3,5-dibromosalicylic aldehyde to the same reaction, and obtained analogous results. Using terephthalaldehyde, it was found that each of the two aldehyde groups reacted with 2 mols. of hydroxyquinol, with the formation of *p*-phenylene-bis-2,3,7-trihydroxyfluoronone. This dyestuff, in consequence of its greater molecular weight, is distinguished by its very great insolubility, and by the different composition of its sulphate. The shades produced in dyeing are, however, similar to those obtained with the other fluorones.—H. L.

#### Pyrrol Blue; The Group of —. C. Liebermann and G. Häse. Ber., 1905, 38, 2847—2853.

THE authors describe as "Pyrrol Blues" the dyestuffs obtained by combining isatin (1 mol.) with pyrrol (1 mol.) (see V. Meyer, Ber., 1883, 16, 2974; Camician and Silber, Ber., 1884, 17, 142; this J., 1884, 236), 1 mol. of water being eliminated. Two different products are obtained, both of which are said to resemble indigo.

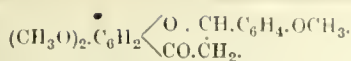
Pyrrol Blue A (13 grms.) is prepared by adding at 5° C., 5 grms. of pyrrol to a dilute solution of 10 grms. of isatin and 50 grms. of sulphuric acid. The dry powder is of a pure indigo blue colour, and contains a small amount of Pyrrol Blue B. Pyrrol Blue A is only slowly soluble in concentrated sulphuric acid with a dull violet colour, which turns to blue-black after standing for some time.

Pyrrol Blue B may be obtained in considerable quantity together with Pyrrol Blue A, by carrying out the reaction under certain specified conditions. It has a pronounced metallic lustre, and is much less soluble than Pyrrol Blue A. It dissolves very readily in cold sulphuric acid with a fine violet coloration, soon changing to bright cornflower blue, owing to the formation of a disulphonic acid, which may be easily precipitated and purified. Pyrrol Blue B contains one atom of oxygen less than Pyrrol Blue A. Pyrrol Blue A itself could not be acetylated, but by boiling it with acetic anhydride in pyridine solution, a small amount of a substance was obtained, which was shown to be the acetyl derivative of Pyrrol Blue B. This is obtained in microscopic needles, possessing a golden lustre. It dissolves in sulphuric acid, producing a splendid Magenta coloration, which soon changes to cornflower blue owing to the formation of a disulphonic acid. This acid is very soluble in water, and the solution dyes silk blue. It may be obtained in lumps possessing a very bright coppery lustre, by evaporation of the aqueous solution. The authors consider the above blue substances of great interest, owing to their resemblance to indigo, and will discuss their constitution and describe other members of the same group later on.—H. L.

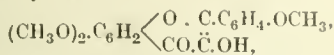
#### Kämpferol (3,4,3'-Trihydroxyflavonol); An Isomeride of —. S. v. Kostanecki and B. Schreiber. Ber., 1905, 38, 2748—2751.

GALLACETOPHENONE dimethylether is combined with anisaldehyde to form 2'-hydroxy-3',4',4'-trimethoxy-chalkone,  $(\text{CH}_3\text{O})_2\text{(OH)C}_6\text{H}_2\text{:CO.CH} \text{---} \text{CH.C}_6\text{H}_4\text{:OCH}_3$ . This is converted in the usual manner, though with some difficulty, into 3,4,4'-trimethoxyflavonone,

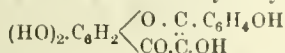




By the action of amyl nitrite and hydrochloric acid this is changed into its  $\alpha$ -isonitroso-derivative, which forms 3,4,4'-trimethoxyflavonol,



on boiling with a mixture of acetic and dilute sulphuric acids. By boiling with hydriodic acid this trimethoxyflavonol is converted into 3,4,4'-trihydroxyflavonol,



which crystallises in light yellow needles. It dyes mordanted fabrics strongly, giving orange-yellow shades on alumina mordant.—E. F.

#### ENGLISH PATENTS.

*Dyestuff; Manufacture of a New Yellow Sulphurised [Sulphide]* —. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 26,477, Dec. 5, 1904.

SEE Fr. Pat. 348,900 of 1904; this J., 1905, 541.—T. F. B.

*Dyestuffs; Manufacture of New Azo —, and of Intermediate Products for Use therein.* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 27,843, Dec. 20, 1904.

SEE Fr. Pat. 353,928 of 1905; this J., 1905, 1061.—T. F. B.

*Dyestuff of the Anthracene Series: Manufacture of a —.* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,734, Dec. 29, 1904.

SEE Fr. Pat. 349,606 of 1904; this J., 1905, 726.—T. F. B.

*Oxyanthraquinones [Anthracene Dyestuffs]; Manufacture of —.* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 1062, Jan. 19, 1905.

SEE addition of Jan. 17, 1905, to Fr. Pat. 336,867 of 1903; this J., 1905, 841.—T. F. B.

#### UNITED STATES PATENTS.

*Diaminodiphenylamine Sulphonic Acid, and Process of Making same.* H. Geldermann, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 800,735, Oct. 3, 1905.

*p-NITROCHLOROBENZENE-O-SULPHONIC* acid is condensed with an aromatic meta-diamine of the benzene series, and the resulting *p*-nitro-*m'*-aminodiphenylamine-*o*-sulphonic acid is reduced in a slightly acid solution.—H. L.

*Amines [Aminoarylsulphomides]; Process of Nitrating Aromatic —.* W. Herzberg and E. Thon, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 800,913, Oct. 3, 1905.

SEE Eng. Pat. 6741 of 1904; this J., 1905, 193.—T. F. B.

#### FRENCH PATENTS.

*Dyestuffs Susceptible to Chroming and "Coppering" on the Fibre; Process of Preparing Nitro-o-Hydroxyazo [Azo] —.* Fabr. de Coul. d'Aniline et d'Extraits ci-dev. J. R. Geigy. Fr. Pat. 350,071, July 21, 1904.

SEE Eng. Pat. 15,982 of 1904; this J., 1905, 724.—T. F. B.

*Dyestuffs Susceptible to Chroming and "Coppering" on the Fibre; Process for Making o-Hydroxymonoazo [Azo] —.* Fabr. de Coul. d'Aniline et d'Extraits ci-dev. J. R. Geigy. Fr. Pat. 350,079, July 23, 1904.

SEE Eng. Pat. 16,566 of 1904; this J., 1905, 724.—T. F. B.

*Indophenols and Sulphide Dyestuffs Derived therefrom; Process of Making New —.* Act.-Ges. f. Anilinfabr. Fr. Pat. 350,077, July 23, 1904.

SEE Eng. Pat. 16,268 of 1904; this J., 1905, 795.—T. F. B.

*Dyestuffs; Production of Yellow Sulphide —.* Act.-Ges. f. Anilinfabr. Fr. Pat. 354,307, May 15, 1905.

A MIXTURE of acetyl-*o*-, *p*-, or *m*-toluidine with benzidine is heated with sulphur to 220–241° C. for some hours. The melt is powdered, dissolved by boiling with aqueous sodium sulphide and filtered. The dyestuff is then precipitated from this solution in the usual way. The process and the dyestuffs are similar, whichever isomeride is employed. The products are easily soluble in sodium sulphide, and dye unmordanted cotton in very bright yellow shades, stated to be very fast to milling, acids and alkalis. None of the isomeric acetyl toluidines yields a dyestuff when fused with sulphur without the addition of benzidine.—H. L.

*Lakes [from Azo Dyestuffs]; Process of Producing Red —.* Act.-Ges. f. Anilinfabr. Fr. Pat. 354,649, May 25, 1905. XIII.A., page 1117.

*Lakes [from Azo Dyestuffs]; Process of Producing Orange or Yellowish-Red —.* Act.-Ges. f. Anilinfabr. Fr. Pat. 354,676, May 26, 1905. XIII.A., page 1117.

*Dyestuffs; Production of Green Sulphide —.* L. Cassella and Co. Fr. Pat. 359,083, July 25, 1904.

GREEN sulphide dyestuffs are prepared by heating the indophenols (or their derivatives) resulting from the condensation of *p*-aminophenol (or its substituted derivatives) with aliphyl- or chloroaliphyl-naphthylamine-sulphonic acids—in particular the aliphyl-1,8-acid—with polysulphides, with or without the addition of copper or other metallic salts. (Compare Sandoz, Fr. Pat. 343,377 of 1904; this J., 1904, 1026.)—H. L.

*Dyestuffs; Process for Producing Blue Sulphine [Sulphide] —.* L. Cassella et Cie. Fr. Pat. 350,096, Aug. 2, 1904.

SEE Eng. Pat. 17,318 of 1904; this J., 1905, 795.—T. F. B.

*Dyestuff; Process for Preparing a Violet Sulphide —.* Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 350,086, July 27, 1904.

SEE U.S. Pat. 778,713 of 1904; this J., 1905, 83.—T. F. B.

*Anthraquinone Derivatives [Anthracene Dyestuffs]; Production of New —.* Soc. Anon. Prod. F. Bayer et Cie. First Addition, dated Aug. 11, 1904, to Fr. Pat. 342,195, April 11, 1904.

SEE Eng. Pat. 17,589 of 1904; this J., 1905, 725.—T. F. B.

*Anthraquinone Derivatives containing Nitrogen; Production of —.* Soc. Farbent. vorm. F. Bayer und Co. Fr. Pat. 351,717, May 27, 1905.

AMINO-, alkylamino- and arylaminoanthraquinones are produced by heating alkyl- or aryl-ethers or aryl-thio ethers of the anthraquinone series with ammonia, with primary or secondary aliphatic amines, or with primary aromatic amines respectively.

*Example I.*—A mixture of 10 parts of 1-nitro-4-methoxy-*o*-anthraquinone (prepared by nitrating the methyl ether of erythrohydroxyanthraquinone) with 50–100 parts of *p*-toluidine is heated to 160–180° C. for three to four hours, until the mass has assumed a deep bluish-green colour. On cooling and diluting the melt with alcohol, 1,4-di-*p*-tolyl-diaminoanthraquinone crystallises out. The same product may be prepared by starting from 1-methoxy-4-phenoxyanthraquinone, from quinzarin dimethyl ether or from 1-methoxy-4-bromoanthraquinone.

*Example II.*—100 parts of a 10 per cent. solution of methylamine in pyridine and five parts of the phenyl ether of erythrohydroxyanthraquinone are heated in an autoclave for five hours, at a temperature of 150° C. By adding water to the cold melt  $\alpha$ -methylaminoanthraquinone is obtained in crystals. The same substance is obtained by starting from methoxyanthraquinone. If the methylamine be replaced by aniline, phenylaminoanthraquinone is obtained, if by  $\beta$ -naphthylamine, then  $\beta$ -naphthylaminoanthraquinone is formed.

Aryl ethers of anthraquinone are prepared by treating anthraquinone derivatives containing negative groups

with phenol and caustic alkalis. Thioethers can be obtained by the action of mercaptans, e.g., thiophenol, on nitroanthraquinones in the presence of caustic alkalis. —H. L.

*Dyestuff; Process for Making a Blue Monoaza [Azo]* — K. Oehler. Fr. Pat. 354,454, April 1, 1905.

SEE Eng. Pat. 7839 of 1905; this J., 1905, 796.—T. F. B.

## V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

### ENGLISH PATENTS.

*Cellulose; Manufacture of Threads and Films of* — A. G. Bloxam, London. From Verein. Glanzstoff-Fabriken A.-G., Elberfeld, Germany. Eng. Pat. 1284, Jan. 23, 1905.

SEE Fr. Pat. 351,206 of 1905; this J., 1905, 855.—T. F. B.

*Silk Threads; Devices for the Manufacture of Artificial* — R. Linkmeyer, Brussels. Eng. Pat. 6356, March 25, 1905.

SEE Fr. Pat. 352,528 of 1905; this J., 1905, 967.—T. F. B.

*Sizing or Finishing Media; Manufacture of* — M. A. Adam, London. From Erste Triester Reisschäl-Fabriks A.-G., Trieste. Eng. Pat. 29,130, Dec. 30, 1904.

SEE Fr. Pat. 349,074 of 1904; this J., 1905, 617.—T. F. B.

*Paper Pulp or Textile Fibres; Process for the Transformation of Alga and other similar Plants into* — M. Kuess. Eng. Pat. 9698, 1905. XIX., page 1122.

### UNITED STATES PATENT.

*Waterproof Coating and Method of Making same. Fabric Coating Insoluble Fabric Coating and Method of Making same.* F. X. Goyers. Assignor to Americus Manufacturing Co. U.S. Pats. 800,144, 800,145, and 800,146, Sept. 26, 1905. XIX., page 1122.

### FRENCH PATENTS.

*Silk; Production of Textile* — Soc. Anon. pour l'Etude Ind. de la Soie Serret. Fr. Pat. 354,336, May 16, 1905.

WASTE silk or other material containing silk may be converted into "silk threads of as good quality if not better than that of the best natural silks," by dissolving it in any solvent which does not instantaneously decompose silk, and forming it into threads before the silk has been altered by the solvent. For instance, silk is dissolved in hydrochloric acid, and as soon as solution is complete, the mass is neutralised or very strongly diluted. A gelatinous and sticky mass is thus obtained which may be formed into threads. The same result is obtained by cooling the solution to below 0° C., and forming the solution into filaments directly without neutralising. In this case neutralisation is effected as the threads make their exit from the apertures.—H. L.

*Silk by the Chardonnet Process; Recovery of the Cotton Wool and Muslin used for Filtering Collodion in the Manufacture of Artificial* — Soc. Anon. pour la Fabrication de la Soie de Chardonnet. Fr. Pat. 354,398, May 17, 1905.

THE filters consist of cotton wool wrapped in muslin, and rapidly become impregnated with pyroxylin, owing to the evaporation of the solvent, and have to be renewed. Filtration is thus a burdensome operation, as the cotton wool and muslin are expensive, and the old caked filters have hitherto been burnt as a useless and possibly dangerous by-product. The process now described is for the recovery of the cotton wool and muslin by treatment of these "filter cakes." Any solvent for pyroxylin, or

denitrating agent may be employed, but the best results are obtained by treatment at 70°–90° C. with a 1–2 per cent. solution of sodium or potassium carbonate, or a 2–5 per cent. solution of an alkali sulphide. In this way the pyroxylin is completely dissolved, and may be removed with the greatest ease by a single washing with water. The cotton wool is left unaltered, and after being dried, and if necessary, recombed, may be directly used again for filtering; or it may be nitrated. The dark brown solution of the pyroxylin is evaporated; and the residue is calcined and converted into cellulose. The net cost of the process is stated to be insignificant, the plant rudimentary, and the labour practically nil. The operation may be carried out in any ordinary bleaching kier, and a particular form of the latter is described and also claimed.—H. L.

*Silk; Method of Making Non-inflammable Artificial* — G. Gorrand. Fr. Pat. 354,424, May 19, 1905.

BY the use of a mixture of amyl alcohol, ethyl acetate and acetone for dissolving the nitrocellulose, it is stated that a non-inflammable artificial silk of great brilliancy is obtained. A few drops of acetic acid are added to the nitrocellulose solution, in order to accelerate the denitrication, which is carried out with ammonium sulphhydrate. —T. F. B.

*Fibres and Fabrics of all Descriptions; Oiling of* — Deutsche Kuehloel Werke Baier and Co. Fr. Pat. 353,947, April 22, 1905.

A PRODUCT for oiling fabrics such as wool, cotton, jute and hemp, in place of the oils and emulsions of oils usually employed, is described. 100 kilos. of castor oil are heated to nearly 99° C. with 50 kilos. of caustic potash of 50° B., to which 50 kilos. of water have previously been added. Forty litres of cooler water are then added slowly, care being taken to keep the temperature of the mixture constant. As soon as the liquor begins to rise, 40 litres of cooler water are again added, with the same precaution to keep the temperature from falling below 99° C. At the same time care must be taken to prevent the liquor boiling, as this would produce too great saponification. By the prolonged action of heat below the boiling point, the oil, it is stated, absorbs water and caustic potash without being changed, and the whole finally forms a perfectly limpid, nearly black liquid. This is diluted with five times its weight of hot or cold water, and is then ready for use without any further preparation. Other vegetable oils may be employed besides castor oil, and the quantity of unsaponified oil present may be increased by stirring the prepared liquid with a fresh quantity of castor or other vegetable oil. The product is slightly alkaline, but wool fibre is not injured, as the oiling may be done in the cold. The solution is clear and limpid, and will not separate out on standing like an emulsion.

It is claimed for this product that:—(1) In spinning it gives a 10 per cent. better utilisation of the raw material owing to the greater evenness and regularity with which the fibres are oiled; (2) In weaving less oiling is required.

The product can be completely removed by water, preferably by cold water, and scouring of the goods subsequently with soap, soda, or fuller's earth can thus be dispensed with.—H. L.

*Silk or other Similar Products on Bobbins or Rollers; Double Continuous Machine for Washing Artificial* — J. Foltzer. Fr. Pat. 353,973, May 4, 1905.

ARTIFICIAL silk threads, after having been wound on to bobbins, have to be thoroughly washed to completely remove the precipitating liquor or other substances with which they are impregnated. This washing has hitherto been carried out by hand on a wooden framework. In the present machine two horizontal shafts (see Figs. 1 and 2 which represent side and front view respectively) are fixed on two supports 1 and 2. The lower shaft is controlled by means of pinions 3 and 4, and an endless screw 5. Each shaft carries one or more pulleys 6 and 7, over which an endless chain 8 travels. On this chain suitable supports 9 are fixed to carry the bobbins 10. In operation the bobbins are first placed in the lowest receptacle, and are



submitted to a continuous stream of water from sprinklers 11 and 12 as they slowly mount upwards. The washed bobbins finally descend on the far side of the machine and

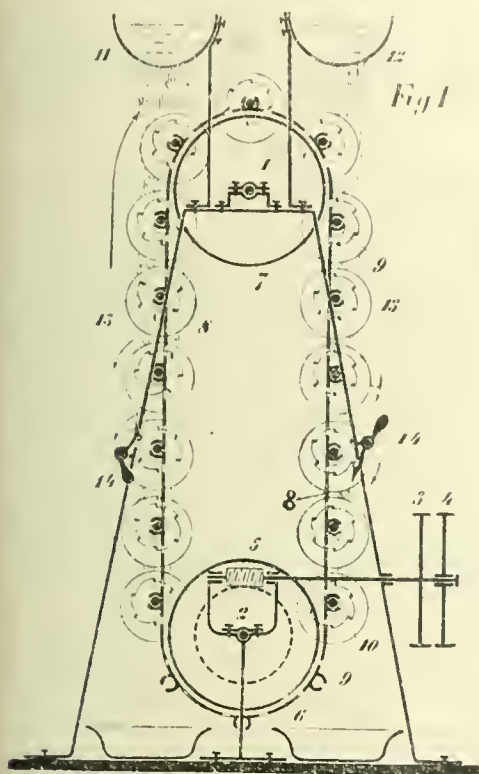


Fig. 1

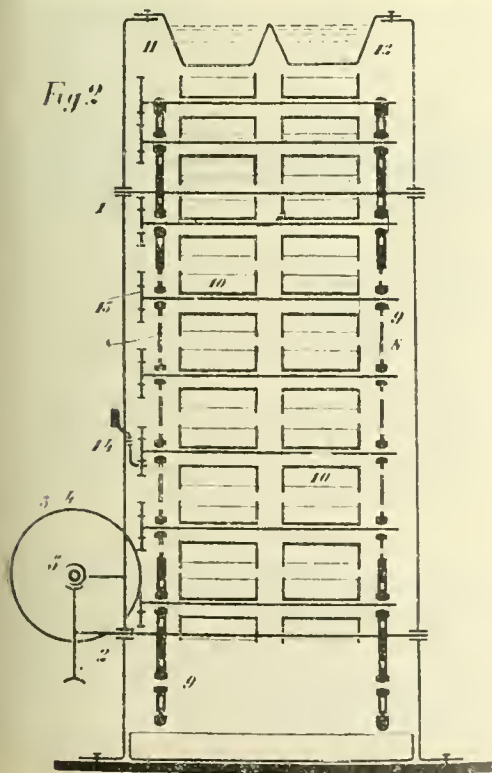


Fig. 2

are then removed and dried. They may be turned during the process by means of ratchet wheels 13 and catches 14.—H. L.

*Silk; Process of Treating [Weighting]* ——. The Jochen Silk Weighting Co. Fr. Pat. 354,927, June 3, 1905.

SEE U.S. Pat. 792,218 of 1905; this J., 1905, 799.—T.F.B.

*Wool; Detergent for Degreasing* ——. S. Wohle. Fr. Pat. 354,702, May 27, 1905. Under Int. Conv., June 3, 1904.

THE wool in its original bales is placed in a cylinder provided with a piston; the cylinder is closed, and a suitable volatile solvent is run on to the top of the bale, in such a manner that all the wool is saturated. By compressing and releasing the bale several times, by means of the piston, all the grease is said to be extracted; the solvent is now run off, and the bale is compressed once more to remove as much of the solvent as possible, and then dried. The apparatus consists of a compression chamber provided with a piston, a filter for the used solvent, a still, a condenser, and drying chambers, together with the necessary pumps.—T. F. B.

*Wool; Detergent for Degreasing* ——. S. Wohle. Fr. Pat. 354,702, May 27, 1905. Under Int. Conv., June 3, 1904.

SEE Eng. Pat. 12,632 of 1904; this J., 1905, 671.—T.F.B.

*Fabrics; Printing on Vegetable or Animal* ——. E. Joly. Fr. Pat. 350,041, July 6, 1904.

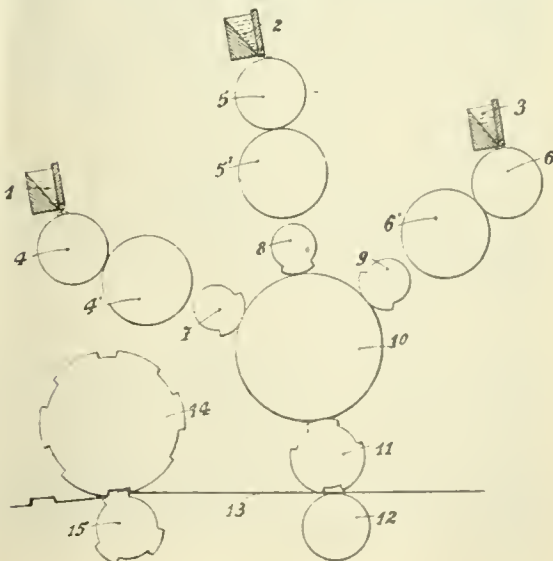
THE process is for producing iridescent or nacreous effects on vegetable, animal or mixed fibres. In principle it consists in printing a ground by means of one roller and then passing the goods over two other rollers engraved with shaded-off designs, the first of which prints horizontal, the latter vertical stripes. The required effects are produced by the superimposition, and by the gradation and shading down of the colours and by the crossing of the multicoloured designs.—H. L.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

### FRENCH PATENTS.

*Printing and Embossing [Paper, &c.]; Machine for* ——. C. H. Jeanson. Fr. Pat. 354,137, May 9, 1905.

A NUMBER of ink-troughs 1, 2, 3, (see fig.) are placed in contact with the inking rollers 4, 4', 5, 5', 6, 6', and



the latter ink the same number of cylindrical clichés, each marking one cliché in the corresponding colour. The clichés are fixed on cylinders 7, 8 and 9, and only partially envelope these cylinders. Cylinders 7, 8 and 9 in their turn carry forward all the colours which they receive to an intermediate cylinder 10, made of smooth and elastic material. By suitable adjustment of the movements of cylinders 7, 8, 9 and 10, the colours are deposited on cylinder 10, at the place required for the design. Cylinder 10 brings all the colour it receives on to a general cliché placed round cylinder 11. The paper or other material 13 for printing and embossing, is passed between cylinder 11 and its counterpart cylinder 12. Immediately after leaving cylinders 11 and 12 the material passes between the embossing calenders 14 and 15. The latter rotate at the same tangential velocity as cylinders 11 and 12, in order to keep the material in shape; and the distance between the printing and embossing cylinders should be cut down to the strict minimum.—H. I.

## VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

*Perchromates.* K. A. Hofmann and H. Hiendlmaier. Ber. 1905, 38, 3059—3066.

WHEN ammonium bichromate is dissolved to saturation in 10 per cent. aqueous ammonia at 0° C., and hydrogen peroxide added, blackish-brown rectangular prisms separate, doubly refracting and strongly dichroic, having the composition  $\text{CrO}_4(\text{NH}_3)_3$ . The substance is stable when dry or in strong aqueous ammonia, but when rubbed, brought into contact with a flame, or touched with strong

### Ordinary.

Bright yellow crystals, fairly permanent in air. Dissolves in 195 parts of carbon bisulphide.

Sp. gr., 2.03.

M. pt., 275°—276° C.  
Mol. wt. in boiling carbon bisulphide 444 (formula  $\text{P}_4\text{S}_{10}$ ).

### New Modification.

Whitish crystals, evolving hydrogen sulphide in air. Dissolves in 30 parts of carbon bisulphide.

Sp. gr., 2.08.

M. pt., 255° C. (small residue melts below 275°). Mol. wt. in boiling carbon bisulphide 360 (between  $\text{P}_2\text{S}_5$  and  $\text{P}_4\text{S}_{10}$ ).

—J. T. D.

*Nitrogen; Action of — on Water Vapour at High Temperatures.* O. F. Tower. J. Amer. Chem. Soc., 1905, 27, 1209—1216.

THE combination of nitrogen and oxygen and the dissociation of water vapour at high temperatures have recently been studied by Nernst and von Wartenberg (Nachr. Kgl. Ges. Wiss., Göttingen, 1904, [4] and 1905, [1]). The results obtained show that at high temperatures, nitrogen will act on water vapour, to a certain extent according to the following equation;  $\text{N}_2 + 2\text{H}_2\text{O} = 2\text{NO} + 2\text{H}_2$ . The author studied the reaction quantitatively by passing nitrogen saturated with water vapour through an iridium tube heated electrically to about 2000° C. The yield varied from 0.5 to nearly 3 c.c. nitric oxide per litre of moist nitrogen. The issuing gas was passed first through a tube (i) containing sulphuric acid, then mixed with oxygen, which converted any nitric oxide into nitrogen peroxide, and finally passed through a second tube (ii) containing sulphuric acid to absorb the nitrogen peroxide. The results obtained are shown in the following table:—

Expt. No.	Temperature.	Duration of experiment.	Nitrogen passed through.	Total volume of gas.		Rate of passage of gas.	Nitric oxide found.			
				$\text{N}_2 + \text{H}_2\text{O}$ passed through.			i.	ii.	i. + ii.	Per hour.
	°C.	Hours.	Litres.	Litres.		Litres per hour.	c.c.	c.c.	c.c.	c.c.
1	2009	1.07	2.00	2.67		2.50	0.00	0.50	0.50	0.47
2	2000	1.02	0.7	0.93		0.91	0.22	0.48	0.70	0.69
3	1978	1.50	0.45	0.60		0.40	1.60	1.32	2.92	1.95
4	1987	1.50	0.40	0.53		0.35	0.72	0.69	1.41	0.94
5	1974	0.97	1.55	2.07		2.13	0.14	1.18	1.32	1.36

sulphuric acid, decomposes explosively. Heated with sodium hydroxide solution, it gives off two "equivalents" [half atoms] of oxygen, and leaves sodium chromate. Heated with dilute acid it evolves three equivalents of oxygen, leaving a violet-red solution apparently containing chromium peroxide. A modification of this substance is obtained if ammonium bichromate be dissolved in 20 per cent. aqueous ammonia, and the solution, before adding the hydrogen peroxide, be saturated with ammonia gas. This  $\beta$ -form differs in many physical characters from the  $\alpha$ -form, but their general chemical behaviour is similar. The addition of hydrogen peroxide to a cooled saturated aqueous solution of ammonium bichromate, to which ammonium nitrate has previously been added, gives the ammonium perchromate  $\text{NH}_4\text{CrO}_5 \cdot \text{H}_2\text{O}_2$  already described by Wiede (this J., 1898, 78 and 348); the substance is much more readily prepared in this way than by Wiede's method.—J. T. D.

*Phosphorus Pentasulphide.* A. Stock and K. Thiel. Ber. 1905, 38, 2719—2730.

BESIDES ordinary phosphorus pentasulphide (advantageously prepared by heating together phosphorus and sulphur dissolved in carbon bisulphide, to which a trace of iodine has been added, in sealed tubes at 120° C., and repeatedly recrystallising from carbon bisulphide), the authors find another modification exists, prepared by suddenly cooling the vapour of the ordinary sulphide, and fractionally treating the product with carbon bisulphide. The following comparative table shows the points of difference yet established between the two:—

The presence of nitric oxide (or rather, nitrogen peroxide in tube (i.) before mixing the reaction products with oxygen, is due to the diffusion of some hydrogen through the hot iridium tube, whereby excess of oxygen was left, which oxidised some of the nitric oxide to nitrogen peroxide. —A. S.

*Chlorates; Determination of —, and Calculation of Yield in the Electrolytic Chlorate Industry.* M. Conlér. *XIA.*, page 1114.

*Fluorspar; Quick Method for the Valuation of —.* A. W. Gregory. *XXIII.*, page 1127.

*Barium Sulphite; Solubility of — in Water and Sugar Solutions.* J. Rogowicz. *XVI.*, page 1119.

*Bromine; Detection of — in presence of large Excess of Iodine.* H. Cormimboeuf. *XXIII.*, page 1126.

### ENGLISH PATENTS.

*Hydrochloric and Hydrobromic Acids; Manufacture of —.* F. Westhauser, Hohenheim, Germany. Eng. Pat. 6759, March 30, 1905.

SEE U.S. Pat. 791,306 of 1905; this J., 1905, 731.—T. F. B.

*Lime or the like; Apparatus for Slaking — to Produce "Efflorescence" therein.* K. Tsnji, Takaoka, Japan. Eng. Pat. 2346, Feb. 6, 1905.

THE lime to be slaked is delivered into a wide pipe entering a revolving cylinder, having internal radial shelves,



which pick up and drop the material, and plates between the shelves, with their faces arranged at an angle to the axis of rotation. The plates act as an interrupted screw, and carry the charge forward to the discharge end, meeting a current of steam carrying water spray mixed with air. The steam, charged with fine dust in suspension, issues from an exit pipe in the entrance end of the drum and passes to a screening apparatus containing a number of cloth-covered filter frames, through which it is drawn by the action of one or more fans.—E. S.

## UNITED STATES PATENT.

*Lime; Process of Treating [Hydrating]* — C. Ellis, Boston, Mass. U.S. Pat. 800,635, Oct. 3, 1905.

A stream of quicklime is caused to meet, at a certain point, sufficient water to form therewith the dry hydrate. The mixture of lime and water is then conducted away from the point of mingling, whilst being subjected to mechanical agitation without further addition of water, until the lime is completely converted into the dry hydrate.—E. S.

## FRENCH PATENTS.

*Sulphuric Acid; Chamber for the Manufacture of* — C. W. Grosse-Legge. Fr. Pat. 354,831, May 31, 1905. Under Int. Conv., June 1, 1904.

Is the chamber process for the manufacture of sulphuric acid, according to this invention, the chambers are constructed with a conical base, merging above into an upright cylinder. The gases are introduced with steam or atomised water at the side, near to the bottom, and, striking the opposite side, are deflected thence, and so repeatedly on their ascent, from side to side, so that they take a helical course, and constantly impinge against the chamber walls, which are kept moist by the dilute acid formed. The gases leave the chamber near the top, thence passing to near the bottom of the next chamber. From a perforated trough fixed round the outside of the upper part of the chamber, water trickles down the sides, with cooling effect.—E. S.

*Sodium Sulphate and Concentrated Hydrochloric Acid Gas; Muffle Furnace for the Manufacture of* — Obviating the Disengagement of Obnoxious Vapours. K. Oehler. Fr. Pat. 354,467, May 4, 1905.

The charge is heated in a closed muffle, from which the acid vapours are conducted away for condensation without access of air, into a receiver in which the gas meets with an excess of moisture. The floor of the muffle is provided, near the working doors, with traps, through which the sodium sulphate is discharged into a channel beneath, from which it is conveyed by an endless chain into a closed receptacle in which cooling is effected. As the discharge takes place, communication is opened to a tuyère leading to a secondary condensing arrangement, and opening into the roof of the muffle, close to the door from which unabsorbed gases are drawn through the action of diminished pressure, thus avoiding escape into the air of acid vapours. The system of pipes, with their connections and means for directing the gases as required, are shown. Reference is made to Fr. Pat. 318,386 of Feb. 4, 1902; this J., 1902, 1454. (Compare also Eng. Pat. 2856 of same date; this J., 1903, 93.)—E. S.

*Barium Carbonate; Manufacture of* — P. Seurre. Fr. Pat. 354,419, May 18, 1905.

EQUIVALENT quantities of native barium sulphate and calcium chloride, with a few per cents. of wood charcoal, all in powder, are mixed and placed in a crucible, which is heated, with agitation, until the contents are fused. The mass, treated with water, gives barium chloride in solution, and a residue of calcium sulphate. The cleared barium chloride solution is treated with ammonium carbonate solution to obtain a precipitate of barium carbonate, and ammonium chloride in solution, from which ammonium carbonate may be re-formed by treatment with chalk.—E. S.

*Carbonates of Potassium, Sodium and Barium; New Process of Making* — A. P. Polunowsky. Fr. Pat. 354,966, June 5, 1905. Under Int. Conv., June 9, 1904.

SEE Eng. Pat. 18,809 of 1904; this J., 1905, 891.—T. F. B.

*Sulphur; New Process for Extracting* — from Sulphur-bearing Earth and Sand. L. J. Roos. Fr. Pat. 354,688, May 27, 1905.

EARTH or sand containing free sulphur is heated in a closed chamber, communicating with a centrifugal apparatus, which is also heated, somewhat above the fusing point of sulphur. As the sulphur-bearing material becomes sufficiently hot to enable the sulphur to flow, it is transferred to the centrifugal apparatus, by the action of which the molten sulphur is expelled, and may then be collected.—E. S.

## VIII.—GLASS, POTTERY, AND ENAMELS.

## ENGLISH PATENTS.

*Arsenious Acid; Preparation of Briquettes of* — [for Glass Manufacture]. L. Souhenr, Bobrek, Germany. Eng. Pat. 21,393, Oct. 5, 1904. Under Int. Conv., Oct. 6, 1903.

SEE Fr. Pat. 335,753 of 1903; this J., 1904, 253.—T. F. B.

*Furnaces for the Manufacture of Glass and for Other Purposes where a High Temperature is Required; Regenerative* — C. J. Hurrie and L. Houze, Stockton, U.S.A. Eng. Pat. 5458, March 15, 1905.

SEE Fr. Pat. 354,544 of 1905; following these.—T. F. B.

*Silica and Analogous Material; Attachment of Metals to Objects of Fused* — J. F. Bottomley, Walsend-on-Tyne, and A. Paget, North Cray, Kent. Eng. Pat. 21,018, Sept. 30, 1905.

METALS may be directly attached to objects of fused silica, either with the object of insulating the metal or of attaching the silica to other pieces of apparatus, by casting the metal around or within the fused silica. In the case of the harder metals, however, which have high coefficients of expansion, it is necessary to protect the silica, which has a very low coefficient of expansion, from the crushing stresses produced by the contraction of the surrounding metal. This is done by leaving hollow spaces between the silica and the metal, which are partly or wholly filled with some suitable material, such as asbestos. Thus, in casting iron around a tube of silica of external diameter 1 in. and walls  $\frac{1}{4}$  in. thick, a wrapping about  $\frac{1}{4}$  in. thick of thin asbestos cord and powdered asbestos may be used. In casting metals inside a mass of silica, the inner surface of the latter may be roughened, so as to give the metal a hold on the silica as it contracts. Metals with high elongation are to be used wherever possible.—A. G. L.

## FRENCH PATENTS.

*Glass-Pot.* R. A. J. Blondel. Fr. Pat. 354,379, May 17, 1905.

THE pot is characterised by being divided into two compartments by a vertical partition, which near the centre of the pot widens out into a vertical pipe, preferably of elliptical cross-section. The flames enter this pipe at the top and pass out through a horizontal passage formed in the base of the pot. The two compartments communicate by means of a round hole in the lower part of the partition: each compartment is provided with a separate mouth, through one of which the raw materials are introduced, whilst the other serves for withdrawing the molten glass.—A. G. L.

[Glass] *Furnace for Continuous Working at High Temperatures.* C. J. Hurrie and L. Houze. Fr. Pat. 354,544, May 23, 1905.

BURNERS are placed in the rear portion of a glass tank furnace on each side in such a way that the flames from

the burners on one side beat against the flames from the burners on the other side. The flames then have to pass across the furnace and escape through a number of longitudinal openings in the sides of the furnace, passing through passages on their way to the chimney, which provide means for preheating the air necessary for combustion.—A. G. L.

*Silica; Method of Working Fused* — J. F. Bottomley and A. Paget. Fr. Pat. 354,842, May 31, 1905. Under Int. Conv., Aug. 25, 1904.

SEE Eng. Pat. 18,434 of 1904; this J., 1905, 846.—T. F. B.

[Ceramic Product]. *Use in the Ceramic Industry of Earth found in Alluvial Deposits, either naturally possessing a Special Composition, or else Mixed Artificially*. J. Dessane. Fr. Pat. 354,201, May 9, 1905.

The earth used, is dried, reduced to powder, and moulded, after moistening it with the smallest quantity of water possible, after which it is burnt at about 900° C., a semi-vitrified red product of great hardness and resistance to abrasion being obtained. By burning at 1000° C. instead of 900° C., a black fully vitrified product of but limited application is obtained. By substituting other metallic oxides for the ferric oxide in the raw material, differently coloured objects may be produced.—A. G. L.

*Gases from Lime, Brick, Cement, Pottery and Porcelain Kilns; Utilisation of Waste* — E. Genz. Fr. Pat. 354,796, April 29, 1905. IX., see below.

*Photographs; Process for Obtaining —, in Relief on Ceramic Objects*. A. and P. Dalpayrat. Fr. Pat. 354,694, May 27, 1905.

FILMS are made of a mixture of 75 grms. of gelatin, 4 of potassium bichromate, 4 of albumin, 30 of alcohol, and 2 of fish-glue, with a quantity of water depending on the amount of relief it is desired to obtain. These films are covered with a negative and exposed in the ordinary way, after which they are placed in water heated to about 45° C., when the portions unaltered by the light swell up. When the development is sufficient, the film is cooled and a mould of plaster of Paris made from it, from which the porcelain object is next made. This is burnt, covered with enamel, and again burnt.—A. G. L.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

### ENGLISH PATENTS.

*Stone; Manufacture of Artificial* — A. H., H., and G. van der Vijgh, all of Amsterdam, Holland. Eng. Pat. 23,364, Oct. 29, 1904.

THIS invention is an improvement on that described in Eng. Pat. 23,159 of 1898 (this J., 1899, 147). Artificial stone is now made from a mixture of pumice stone, 70; Portland cement, 10; hydraulic lime, 10; and water, 10 per cent.—A. G. L.

*Wood; Preservation of* — H. H. Lake, London, from Rütgerswerke Act.-Ges., Berlin. Eng. Pat. 22,990, Oct. 25, 1904.

WOOD is impregnated in the usual manner with a hot solution, saturated at 100° C., of zinc  $\beta$ -naphthalene-sulphonate, which mostly separates out in the pores of the wood on cooling. An addition of 10 per cent. of sodium chloride may be made for the purpose of rendering the zinc salt still more insoluble in cold water. The magnesium  $\beta$ -naphthalenesulphonate may also be used with advantage instead of the zinc salt. In this case the acid mixture obtained by the action of excess of sulphuric acid on naphthalene may be directly neutralised with magnesium oxide or carbonate; whereas, if the zinc salt is to be made, the acid mixture must first be neutralised with lime, after which the zinc salt is obtained by double decomposition of the calcium sulphonate with zinc chloride.

—A. G. L.

*Dust; Improved Compound which forms an Emulsion with Water to be applied to the Surfaces of Roads or other Places for the purpose of Preventing the Formation of* — E. Harcastle and Kay Bros., Ltd., both of Stockport, Cheshire. Eng. Pat. 14,239, July 11, 1905.

A MIXTURE of 50 gall. of coal tar creosote, 1 ewt. of coal tar pitch and 2½ ewt. of rosin is heated until solution is effected. A solution of 28 lb. of caustic soda or potash in 18 gall. of water is poured into the first liquid, and the whole is agitated until completely combined, when it is mixed into an emulsion with water and sprinkled on roads.—A. G. L.

*Cement; Method of and Means for Burning* — B. E. Eldred, New York. Eng. Pat. 25,837, Nov. 28, 1904.

SEE U.S. Pat. 797,506 of 1905; this J., 1905, 971.—T. F. B.

### UNITED STATES PATENTS.

*Plaster or Mortar [from Spent Gas Lime]; Process of Making* — J. B. N. Berry, Washington, D.C. U.S. Pat. 800,606, Sept. 26, 1905.

SPENT lime from gas-purifiers, in which the sulphur has been converted into calcium sulphate, by exposure to weather, if necessary, is mixed with clay rich in alumina. The mixture is powdered, formed into balls or blocks with water, and calcined at a temperature below that at which the setting qualities of calcium sulphate are destroyed. Slaked lime, clay and sand are added to the calcined product, and the whole is finely powdered.—A. G. L.

*Structures; Process of Rendering — Impervious against various Agents*. M. Toch. U.S. Pat. 800,956, Oct. 3, 1905. XIII., page 1117.

### FRENCH PATENTS.

*Slag or other Mixture of Silicates to Facilitate Hydration; Preliminary Treatment of Blast-Furnace* — B. Bruhn. Fr. Pat. 354,790, April 18, 1905. Under Int. Conv., April 19, 1904.

A SMALL percentage of alkali or alkali salt is added to the blast-furnace slag or other silicate mixture, either before or during the cooling. The presence of the alkali facilitating the subsequent hydration with water.—A. G. L.

*Gases from Lime, Brick, Cement, Pottery and Porcelain Kilns; Utilization of Waste* — E. Genz. Fr. Pat. 354,796, April 29, 1905.

THE waste gases from kilns are mixed with producer- and water-gas in such proportions that the final mixture of gas contains about 16 per cent. of carbon monoxide, 2 per cent. of heavy hydrocarbons, 2 per cent. of hydrogen, and 11 per cent. of carbon dioxide. This mixed gas may be utilised for heating or power purposes.—A. G. L.

*Cement, Lime, &c.; Kiln for Burning* — N. Perpignani and E. Candlot. Addition dated May 17, 1905, to Fr. Pat. 335,377, Sept. 18, 1903. (This J., 1904, 188.)

To allow the kiln to be charged continuously, the upper part is left uncovered, and the gas is drawn off through a short central tube which dips into the charge.—C. S.

*Cement-Kiln with Continuous Charging and Discharging*. N. Perpignani and E. Candlot. Fr. Pat. 354,595, May 24, 1905.

THE materials to be burnt are charged into the annular space between the kiln-walls and a central tube, which serves as a chimney for the burnt gases. This tube extends some way into the kiln; the space around it is always open, so as to allow of continuous charging. Between the upper and lower part of the interior of the kiln is inserted a horizontal grating resting on a cast iron cylinder, below which is placed a vertical cylindrical grating through which the burnt material passes on its way to the exit openings in the base of the kiln. The air needed for combustion passes between the walls of the kiln and the above mentioned internal cylinders and through the horizontal grating, and becomes heated in so doing.

—A. G. L.



# X.—METALLURGY.

*Ore; Use of High Percentages of Fine — in a Charcoal Blast-Furnace.* H. R. Hall. Bull. Amer. Inst. Mining Eng., 1905, 1107—1110.

THE author describes the conditions under which successful results were obtained in the manufacture of pig-iron from magnetic concentrates and "cobbed" ore with charcoal fuel, weighing from 12 to 20 lb. per bushel. The charcoal was made from hemlock, pine, spruce, balsam, maple, beech and birch woods. The concentrates contained 62—65 per cent. of iron, and would all pass an  $\frac{1}{8}$ -in. screen, whilst 34 per cent. would pass an 80-mesh sieve. The cobbed ore contained from 32 to 47 per cent. of iron, and from 23—32 per cent. of silica; it would all pass through a 1-in. ring, and about 25 per cent. would pass an  $\frac{1}{8}$ -in. screen. During one period of working the smallest day's output was 66 tons, and the largest 113 tons of pig-iron, the total output for one month being 2777 tons, with a fuel consumption of 114 bushels (average weight, 17 lb. per bushel) of charcoal per ton of pig-iron. The ore charge consisted of about 15 per cent. of cobbed ore, and 85 per cent. of concentrates. Later, in a period of five months, an ore charge of concentrates only was employed, the furnace-charge consisting of 1.6 tons of concentrates, 89 bushels of charcoal (average weight, 20 lb. per bushel), and 200 lb. of limestone per ton of pig-iron produced. During this period, the average daily output was 89 tons of pig-iron, and the loss of ore blown out of the furnace in the form of dust amounted to 6 per cent. of the quantity charged. The volume of air used was about 5625 cb. ft. per minute. In the same furnace with coke fuel, 60 tons of pig-iron per day were produced for a month with a fuel-consumption of 2220 lb. of coke, whilst the loss of ore-dust was 25 per cent. when the same volume of air was used as with charcoal. Coke is generally regarded as the ideal fuel for making pig-iron, but the author points out that charcoal is more advantageous, on account of its low content of ash and its freedom from sulphur. Moreover, it is estimated that a charcoal furnace of the same size as a coke-furnace will produce, in the same time, from 25 to 33 per cent. more pig-iron. The following table shows the general relation between hearth-area and daily output of a charcoal furnace:—

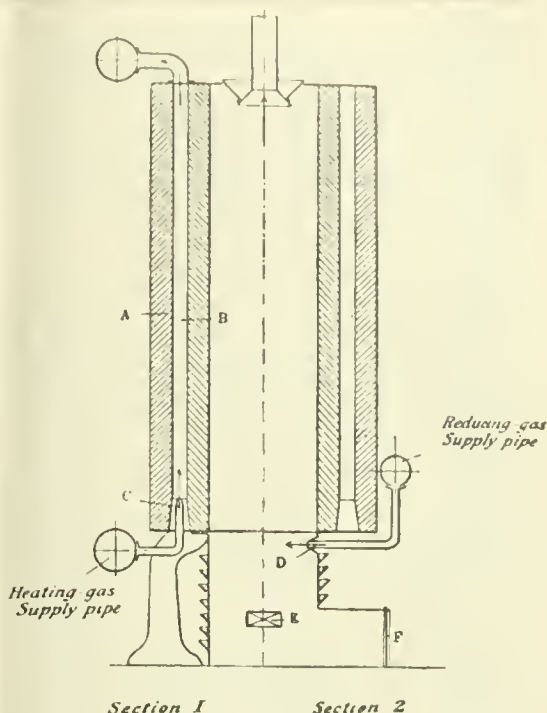
Diameter of hearth, in feet...	7	7.5	8	8.5	9
Output of furnace, in tons....	110	133	161	192	225

—A. S.

*Blast-Furnace Gases; Application of —, to the Reduction of Iron Ore for the more recent Open-Hearth Steel Processes.* O. Simmersbach. Stahl u. Eisen, 1905, 25, 1187—1189.

IS the recent modifications of the open-hearth process in which the molten pig-iron is run direct into the hearth, the addition to the charge of as large a proportion of ore as possible presents itself as desirable, for the cost of iron as ore is much lower than that of iron as metal. But the amount of ore that can be added is limited by the amount of reducing impurities permissible in the metal, and reduction of the ore by the furnace-gases increases the duration of the charge and lessens the daily output of the furnace. The author proposes, therefore, to reduce the ore (beyond that needed for the oxidation of the impurities in the metal) in a separate furnace, and to utilise blast-furnace gases for that purpose; basing his proposal on the facts (1) that the reduction of ferric oxide by carbon monoxide, the materials having been heated up to the temperature needed for it, requires no thermal assistance from without, but gives out a small amount of heat, and (2) that the composition of the gases at the mouth of the blast-furnace is practically the same as at the level at which they actually reduce the ore, 30 ft. below.

The diagram shows the principle on which his furnace is constructed. It is heated by blast-furnace gas, burning at the burners C (section I.) at the bottom of the vertical channels in the brickwork casing, to the necessary tempera-



ture (800° C.), and the reduction of the ore is effected by the same blast-furnace gas introduced without air at D (section II). The furnace below D is cooled by water, so that the spongy iron can be withdrawn by the side opening E and the door F without re-oxidising on its way to the steel-furnace. Clearly the inner portion of the double casing must not be too thick: and producer-gas or similar gas may be substituted for blast-furnace gas.—J. T. D.

*Bessemer-Martin Process at Witkowitz; Chemical Processes in the Combined —.* C. Canaris. Stahl u. Eisen, 1905, 25, 1125—1127.

THE process in use at Witkowitz, Germany, consists essentially in blowing the pig-iron in an acid-lined Bessemer converter till the greater part of the silicon, manganese and carbon is removed, and then treating the metal in a basic Martin furnace to de-phosphorise it. The author investigated the chemical reactions which take place in the process. Two charges were worked. In the first, 22,280 kilos. of molten pig-iron from the converter were further treated in the Martin furnace with 1100 kilos. of burnt lime, 400 kilos. of Gellivera ore (Swedish magnetite), 500 kilos. of Martin pig-iron, 1000 kilos. of steel cuttings, and 200 kilos. of 77 per cent. ferro-manganese. In the second case the charge for the Martin furnaces was the same as before with the exception that the amount of molten pig-iron from the converter was 21,790 kilos., whilst 210 kilos. of ferro-manganese were added. It was found that in the converter, silicon and manganese were oxidised first, then the oxidation of the carbon began slowly, but became more rapid as the temperature rose, and the amount of manganese decreased. The beginning of the "boiling" period could be recognised distinctly by the sudden fall in the carbon content of the metal (from over 2 to less than 0.7 per cent.). Owing to the high temperature attained during the "boiling" period, the silicon and manganese were also oxidised more rapidly than in the earlier stages. The percentage of phosphorus usually became slightly higher, owing to oxidation of the iron. In the Martin furnace, the phosphorus passed rapidly into the slag. The addition of ferro-manganese had little effect on the percentages of manganese and carbon in the final product, as the manganese was, for the most part, utilised in de-oxidising the metal, whilst the carbon was rapidly oxidised.—A. S.

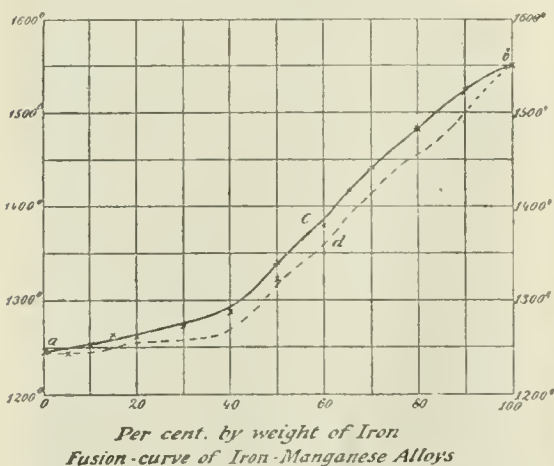
"Temper-Carbon" and Graphite; the two Forms of Carbon in Iron. F. Wüst and C. Geiger. *Stahl u. Eisen*, 1905, 25, 1134—1139, and 1196—1202.

THREE views exist as to the nature of "Temper-carbon" (see also this J., 1904, 985); Ledebur regards it as a carbide, James as a modification of graphite, Wüst and Jüptner as pure amorphous carbon. The authors have endeavoured to elucidate the conditions for its formation and its modification or destruction, by heating cast-iron, white and grey, to various temperatures for various periods, and quenching in a variety of ways. Their results are summarised as follows:—1. Temper-carbon is formed in small amounts at comparatively low temperatures (say 900° C., but the minimum temperature depends on the other constituents of the iron), but the length of time to produce a given quantity is greater as the temperature is lower. 2. As soon as a certain temperature, dependent on the composition of the iron, is reached, the greater part of the possible temper-carbon is formed suddenly: and the higher the temperature the greater the amount thus suddenly formed. 3. Continuance of the heating increases but slightly the amount of temper-carbon. 4. The rate of cooling of the iron influences but slightly the amount of temper-carbon, though rapid cooling greatly modifies the structure and the strength. 5. Frequent reheating of a sample in which temper-carbon has been already formed increases the amount, the more so as the temperature is higher. 6. Quenching from any temperature below the melting point, does not diminish the amount of temper-carbon; hence it is in all probability not a carbide. 7. Heating in pure hydrogen or nitrogen does not, contrary to hitherto received opinion, lessen the amount of temper-carbon; it can only be reduced in amount by the action of oxidising substances (water vapour, carbon dioxide, ferric oxide), so that the presence of such substances is necessary for the tempering process. 8. Graphite is removed by these oxidising substances in the same way as temper-carbon.

The experiments on the conversion of temper-carbon and graphite into the gaseous form and their consequent removal showed that the gaseous substances concerned—water vapour, hydrogen, oxygen, carbon dioxide, carbon monoxide—permeated the whole substance of the iron, the central parts of the sample rods being affected equally with the outer portions; and, as might have been expected, the porous graphite irons showed themselves more readily permeable than those of closer structure.

—J. T. D.

*Manganese-Iron Alloys.* M. Levin and G. Tammann. *Z. anorg. Chem.*, 1905, 47, 136—144.



IN the determination of the heating and cooling curves of manganese-iron alloys, special precautions are necessary owing to the strong action of fused manganese on the porcelain crucible containing the metal and on the porcelain sheath of the thermo-element. To protect the

thermo-element the porcelain sheath was enclosed in a cap of nickel or platinum, and the latter covered with a coating of magnesia. The iron used in the experiments contained only 0.07 per cent. of carbon and very small quantities of lithium, manganese, phosphorus, sulphur and copper. The manganese contained small quantities of iron, copper and silica. The melting point of manganese was found to be 1247° C. In the experiments, the beginning of the crystallisation and the end of the melting period could be readily detected, but the lower breaks in the curves (corresponding to the end of the crystallisation and the beginning of the melting period respectively) were very indistinct, and were only estimated approximately from the rates of cooling and heating, and then corrections made. The results obtained are given in a table and are also shown in the accompanying curve-diagram. The form of the curve shows that no compound of manganese and iron separates from the melts, the two metals forming an uninterrupted series of mixed crystals. The results of the micrographic examination of the alloys did not appear to conform to this view, since in a number of cases, two different structural elements could be recognised distinctly, but this was found to be due to the fact that, owing to relatively rapid cooling, complete equilibrium between the melt and the separated crystals did not occur, so that the solid alloy consisted of primary crystals richer in iron, surrounded by secondary crystals richer in manganese. With slower cooling, the alloys had a practically homogeneous structure.

It was found that the addition of manganese to iron causes a strong diminution in the magnetic permeability of the latter. The temperatures at which the magnetic permeability of the alloys undergoes sudden change are shown in the following table:—

Percentage of Iron.	Magnetic permeability.	
	Disappears.	Re-appears.
	°C.	°C.
100 .....	950	750
90 .....	820	715
80 .....	750	720

—A. S.

*Pickling Solutions; Influence of Arsenic in* — C. F. Burgess. *Amer. Electrochem. Soc. Sept.*, 1905. [Advance Proof.]

It has long been known that the addition of arsenic to a sulphuric acid pickle renders it much less active. The author has made some comparative experiments on the action of 5N sulphuric acid, pure and mixed with less than 1 per cent. of arsenic as trioxide, upon steel springs. The pure acid dissolved in an hour 34 times as much iron as did the impure acid. In the first twenty minutes the ratio of the two rates was 9:1, in the last forty minutes 94:1.

Acid solutions exert a weakening influence on steel apart from the thinning due to solution; they render the metal brittle, an effect supposed to be due to the penetration of hydrogen into the metal. Experiments were made on steels in the manner described above, and the weakening was measured by comparing the angle through which the steel could be sharply bent before breaking, before and after treatment; in all cases the arsenic exerted a marked influence in diminishing the weakening effect of the acid solution—the effect of the arsenical acid was from 1/7 to 1/60 of that of the pure acid. Similar but smaller differences were observed when sulphuric was substituted for hydrochloric acid. Steels pickled in the pure and the arsenical acid and then nickel-plated showed similar differences, a weakening of 7.2 per cent. with the arsenical, of 15.6 per cent. with the pure acid.—J. T. D.

[Lead Smelting] *Process at Friedrichshütte; Huntington-Hoberelein* — A. Biernbaum. *Z. Berg-Hütten. u. Salinenwesen im Preuss. Staate*, 1905, 53, 219—230. *Eng. and Mining J.*, 1905, 80, 535—538.

At the present time at the Friedrichshütte in Upper Silesia, all kinds of lead ore, with the exception of a low-



grade concentrate containing from 25–35 per cent. of lead, are treated by the Huntington-Heberlein process (see Eng. Pats. 8064 of 1896, 3795 of 1897, and 13,454 of 1903; this J., 1897, 543, 683; 1904, 791). The author discusses in detail the cost and advantages of this process as compared with the older methods of lead smelting. Among the advantages of the process are stated to be—decreased cost of labour and fuel, smaller production of lead fume, non-interference of the zinc contained in the ores, and increase of the yield of lead and silver by 6–8 per cent.—A. S.

*Gold Bullion; Notes on the Assay of* —. T. Kirke Rose. XXIII., page 1127.

*Lumpblack and Graphite from Acetylene and Metallic Carbides.* A. Frank. XIII A., page 1117.

#### ENGLISH PATENTS.

*Iron; Manufacture of* —. O. Thiel, Landstuhl, Germany. Eng. Pat. 9199, May 2, 1905.

SEE Fr. Pat. 351,104 of 1905; this J., 1905, 1070.—T. F. B.

*[Gold] Ores; Combined Apparatus for Grinding or Crushing, Washing and Separating* —. R. Stanley, Nuneaton, Warwickshire. Eng. Pat. 24,386, Nov. 10, 1904.

The mineral is reduced to a fine powder by several sets of rolls and then falls on to a travelling belt of gauze which dips into a trough of water and then passes beneath a water-spray. The finer portion of the material is forced by the water-spray through the gauze belt and falls into the trough, whilst the coarser portion remaining on the belt is returned to the finishing rolls. Separators and elevators of various kinds may be used with or without mercury in their respective sumps.—J. H. C.

*Zinc; Impts. in Furnaces or Apparatus for* —. J. Armstrong. Eng. Pat. 20,543, Sept. 23, 1904.

The furnace consists of a number of narrow, tall reducing chambers formed with relatively thin walls and surrounded by heating flues. The flues are heated by compressed gaseous fuel burned with the aid of compressed air in injector burners arranged at the bottom of the flues. A supply of secondary heated air from flues disposed in the brickwork of the furnace is also introduced into the heating flues, being drawn in by the partial vacuum produced by the burning gaseous fuel. The zinc ore together with the carbon necessary for reduction is fed in continuously at the top of the reducing chambers, and the residue is withdrawn continuously from the bottom. The zinc fumes pass through gills or ducts into condensing chambers alongside the reducing chambers, the latter being sealed against admission of air by the charge of ore and carbon at the top and by the residual ore at the bottom.—A. S.

*Furnaces; Roasting* —. H. E. Newton, London. From F. J. Falding, Brooklyn, U.S.A. Eng. Pat. 6931, April 1, 1905.

SEE U.S. Pat. 788,098 of 1905; this J., 1905, 549.—T. F. B.

*Copper Mattes; Conversion of* —. C. M. Allen, Butte, Montana, U.S.A. Eng. Pat. 8387, April 19, 1905.

The walls of the converters in which copper matte is Bessemerised are constructed of heavy metal pieces or blocks, the heat conductivity and capacity of which are sufficient to maintain the inner surface of the converter at a temperature below that of the molten bath, but above that at which any considerable chilling of the bath will occur.—A. S.

*Nickel Ores, or other Material Containing Nickel; Treating with Carbonic Oxide* —, and Apparatus therefor. C. Langer, Ynyspenllwch, Glamorgan. Eng. Pat. 13,351, June 28, 1905.

In the extraction of nickel, according to the process described in Eng. Pat. 12,626 of 1890 (this J., 1891, 774), it is stated that the treatment with carbon monoxide may be carried out at temperatures ranging from 0° to 150° C.

It is now found that in order to obtain good results the temperature must be kept between 40–50° C. To effect this purpose a modified form of the apparatus described in Eng. Pat. 23,665 of 1895 (this J., 1897, 47) is used. It consists of superimposed chambers, each having a partition and a bottom. A fluid is caused to pass through passages within the apparatus for the purpose of keeping the temperature of the material between 40° C. and 50° C. —J. H. C.

#### UNITED STATES PATENTS.

*Iron Oxide for Use in Furnaces; Preparing Fine Particles of* —. U. Wedge, Ardmore, Pa. U. S. Pat. 860,698, Oct. 3, 1905.

The fine particles of iron oxide are moistened with sulphuric acid and heated until iron sulphate is formed. The mass is then agitated and heated sufficiently to decompose the sulphate and expel the sulphur.—A. S.

*Ores; Process of Reducing* —. H. Arden, San Francisco, Cal., Assignor to J. Treadwell, Oakland, Cal. U. S. Pat. 801,129, Oct. 3, 1905.

FINELY-DIVIDED ores are mixed with carbonaceous matter, a hydrocarbon, such as the less volatile fractions of crude petroleum, and water-glass; the mass is formed into coherent briquettes, and the latter are coked and then reduced.—A. S.

*Ores for Blast-Furnaces; Process of Preparing Dust* —. H. E. Esch, Giessen, Germany, Assignor to the Firm of Fellner and Ziegler, Frankfurt-on-the-Maine, Germany. U. S. Pat. 801,143, Oct. 3, 1905.

ORE-DUST of "high fusibility" is prepared for the blast-furnace by passing it, by a rotating advancing action, first through a region of gradually increasing heat, and then into a region where it is subjected to a stream of ignited coal-dust mixed with an easily fusible ore-dust. The ore-dust thus becomes agglomerated into coherent masses.—A. S.

*Ores for Blast-Furnaces; Preparing Dust* —. J. C. Fellner, Assignor to the Firm of Fellner and Ziegler, Frankfurt on the Maine, Germany. U. S. Pat. 801,144, Oct. 3, 1905.

In the process of roasting disintegrated materials in a kiln with the aid of a mixture of air and a combustible, any sintered material which adheres to the internal wall of the kiln is removed by cooling it for a short time, whereby it is caused to spring off or become loose. The cooling may be effected either by shutting off, for a moment, the supply of combustible and allowing only the air to strike against the sintered material, or by shutting off the supply of the mixture of air and combustible, and projecting a current of cold air against the sintered material.—A. S.

*Iron or Steel; Compound for Hardening or Case-hardening* —. G. Reininger, Assignor to Cyanid-Ges. m. b. H., Berlin. U. S. Pat. 801,339, Oct. 10, 1905.

SEE Fr. Pat. 345,642 of 1901; this J., 1905, 32.—T. F. B.

*Tin from Tin Slag; Process of Extracting* —. C. A. L. W. Witte, Hamburg, Assignors to The Straits Trading Co., Ltd., Singapore. U. S. Pats. 801,290 and 801,820, Oct. 10, 1905.

SEE Eng. Pat. 24,445 of 1904; this J., 1905, 1019.—T. F. B.

#### FRENCH PATENTS.

*Slag or other Mixture of Silicates; Preliminary Treatment of Blast-Furnace* —, to Facilitate Hydration. B. Bruhm. Fr. Pat. 354,790, April 18, 1905. IX., page 1110.

*Furnace; Crucible* —. W. H. Cook. Fr. Pat. 354,547, May 23, 1905.

THE furnace is heated by a combustible liquid which is contained and burnt in one or more open receivers placed in a current of air, by means of which the flame is directed into a chamber where it becomes mixed with an additional air-supply, and from which it passes to the chamber

containing the crucibles, and, finally, after heating a "thermo-siphon" containing water which is subsequently employed to heat the air supply, to a chimney.—J. H. C.

*Ore Concentration; Apparatus for* —. E. Deister.  
Fr. Pat. 354,589, May 24, 1905.

THE pulp is fed into a peculiarly-shaped trough, which is placed within another trough filled with water and made to vibrate by appropriate mechanism. The outer trough is divided into a series of valved compartments by inclined partitions or diversion plates; the various grades of concentrate pass each into its own compartment.  
—J. H. C.

*Ore Concentration; Apparatus for* —. G. F. Wynne.  
Fr. Pat. 354,740, May 29, 1905.

THE finely-divided ore is made to advance gradually in a thin sheet upon inclined tables of steel, wood, slate, or other material by means of scrapers or other analogous appliances as described, while streams of water flow over the ore transversely.—J. H. C.

*Crucibles for the Alumino-thermal Process; Process for Preparing a Refractory Lining for* —. Th. Goldschmidt. Fr. Pat. 354,597, May 24, 1905.

THE crucibles are lined with a mixture of soluble glass (alkali silicate solution) with magnesia or corundum, or both. Old used crucibles may also be restored by the aid of this mixture, after removing adherent slag.—A. S.

*Metallic Deposits on Metals or Metallic Objects; Process for Obtaining* —. The Sherardizing Syndicate, Ltd., and S. Cowper-Coles. Fr. Pat. 354,987, May 26, 1905.

SEE Eng. Pat. 13,579 of 1904; this J., 1905, 804.—T. F. B.

*Aluminium; Process for the Oxidation and Coloration* —. A. Lang. Fr. Pat. 354,713, May 27, 1905.

THE article of aluminium is immersed in a solution of a mercury salt, for instance, mercurous chloride, whereby, it is stated, a coating of amalgam is formed on the aluminium. On removing the amalgam, the aluminium begins to oxidise rapidly, and on the film of alumina thus obtained, coloured coatings are produced by means of easily reducible compounds, e.g., chromium compounds, such coloured coatings being afterwards protected if desired by a covering of enamel.—A. S.

*Copper and its Alloys; Process of Hardening and Tempering* —. C. R. Plumer. Fr. Pat. 355,026, June 7, 1905.

SEE U.S. Pat. 792,070 of 1905; this J., 1905, 737.—T. F. B.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

### (A.)—ELECTRO-CHEMISTRY.

*Chlorates; Determination of* —, and *Calculation of Yield in the Electrolytic Chlorate Industry*. M. Couléru. Chem.-Zeit., 1905, 29, 1072–1074.

WHILE a few years ago the yield of chlorate by electrolytic processes on the industrial scale was about 60 per cent. of the theoretical, and represented about 30 per cent. of the energy furnished, the corresponding figures now are about 90 and 65 respectively. Chlorate in the liquors is determined either by direct chemical or by indirect chemical or physical methods. The usual chemical method consists in boiling a measured volume of the solution with acidified solution of ferrous sulphate, and determining the excess of ferrous sulphate by permanganate; the ferrous sulphate is standardised upon a solution of pure potassium chlorate of known strength. The indirect methods are based on determination of the composition of the evolved gases; if the whole current is producing chlorate, hydrogen only is evolved; if no chlorate is produced, the gas contains 33·3 per cent. of oxygen, and from the actual percentage of oxygen in the gas the proportion of the total current yielding chlorate

is easily calculated. The oxygen may be determined by the usual eudiometric methods, or calculated from the specific gravity of the dried gas. The latter is the more accurate method, for by weighing a litre a difference in weight of 1 mgrm., easily within the power of an ordinary balance, is produced by a variation of 0·2 per cent. of oxygen. The Lux gas-balance can even be arranged so as to register continuously the specific gravity, and hence the percentage current yield. Assuming 2·5 volts to be the minimum or theoretical potential difference between the electrodes, the "current-yield" and "energy-yield" are given by the following formulæ:—

$$\text{Current-yield} = \frac{100y}{ax} \quad \text{Energy-yield} = \frac{100y}{evx}$$

where  $x$  is the number of ampère-hours,  $y$  the amount of chlorate produced in grms.,  $v$  the potential difference at the electrodes, and  $a$  and  $e$  are coefficients per ampère-hour and per watt-hour respectively, having the following values:—

	$a$ .	$e$ .
	GRMS.	GRMS.
Potassium chlorate .....	0·7635	0·3054
Sodium chlorate .....	0·6640	0·2556
Barium chlorate .....	0·9485	0·3794

The determination of the chlorate by weighing the gas affords a ready and very useful control of the process, but it must be remembered that the composition of the gas is influenced by various circumstances, such as temperature, alkaline reaction of the electrolyte, reduction of the chloride-content below a certain point by addition of chromate, calcium or magnesium salts, &c., and consequent variations in the production of hypochlorite. These factors must be considered in interpreting the results of the tests.

A table in the paper gives, for current-yields rising from 60 to 100 per cent. by steps of 2½ per cent., the percentage of oxygen in the gases, the weight of a litre at N.T.P., and the amounts of sodium and of potassium chlorate furnished per H.P. day for each 0·1 volt between 3·0 and 4·0 volts, with the corresponding theoretical energy-yields.—J. T. D.

*Platinum; Electrolytic Solution of* —. R. Ruer. Z. Elektrochem., 1905, 11, 661–681.

A CONTINUATION of the author's earlier researches on the behaviour of platinum in solutions of sulphuric acid, when subjected to the action of an ordinary alternating current. Under these conditions, the platinum electrode does not dissolve, but undergoes a change of the metal surface to the spongy state, the thickness of this sponge being dependent upon the current density used. In order that solution of the platinum may occur, it is necessary, either that the anodic component of the alternating current should preponderate, or that oxidising agents should be present to complete the reaction before the cathodic component of the alternating current have time to become active. The present research was carried out to prove the correctness of this theory, and to show that the anodic component of the alternating currents could be replaced by a suitable oxidising agent, and the cathodic component by a suitable reducing agent, without producing any change in the results observed. The method of observation adopted was to allow a relatively long period to elapse between each electrical current impulse at the anode and cathode respectively, during which time the various oxidising and reducing chemicals employed were allowed to act upon the anode and cathode. The electrolyte used was a 50 to 66 per cent. solution of sulphuric acid, and this was contained in a U-tube having an anode of 30 sq. cm., and a cathode of 1 sq. cm. superficial area respectively, both made from absolutely pure platinum. The electrical circuit was completed by an ampère-meter, a resistance box, a primary battery, and a rotary circuit breaker, provided with two points of contact. The results obtained



by the author in this research are summarised at the conclusion of his paper. These prove that his theory of the action of alternating current upon platinum in sulphuric acid solutions is correct. The potential at the anode must be over 1.20 volts before solution can occur.

—J. B. C. K.

*Electrolytic Analysis; Use of the Rotating Anode and Mercury Cathode in —.* L. G. Kollock and E. F. Smith. XXIII., page 1127.

*Cadmium; Electrolytic Determination of — with the aid of a Rotating Cathode.* C. P. Flora. XXIII., page 1128.

*Lampblack and Graphite from Acetylene and Metallic Carbides.* A. Frank. XIII.A., page 1117.

#### ENGLISH PATENTS.

*Battery Plates; Impts. in Secondary —.* H. C. Hubbell, East Orange, New Jersey. Eng. Pat. 11,861, June 6, 1905.

This invention relates to the preparation of a secondary battery cathode, which is composed of hair-like fibres of nickel intertwined and embedded in a mass of nickel oxide, thus forming a plastic mat or cake which is finally inserted in a wire-gauze pocket.—B. N.

*Electrodes for Electric Arc Lamps; [Flaming Arc] —.* The British Thomson-Houston Co., Ltd. From the General Electric Co. Eng. Pat. 13,381, June 29, 1905. II., page 1102.

*Ozonising Atmospheric Air; Apparatus for —.* Ozonair, Ltd., and E. L. Joseph, London. Eng. Pat. 16,392, Aug. 11, 1905.

CLAIM is made for a portable self-contained ozoniser consisting of an outer and an inner casing, with a fan mounted in the space between them. The current is led to a "step-up" transformer arranged within the inner casing and thence to pairs of electrodes mounted in the annular space between the two casings. Each pair of electrodes consists of two sheets of metallic gauze separated by a sheet of mica or other insulating material. The air drawn in by the fan passes first through a filter and then over the electrodes.—A. S.

*Silica and Analogous Material; Attachment of Metals to Objects of Fused —.* J. F. Bottomley and A. Paget. Eng. Pat. 21,018, Sept. 30, 1905. VIII., page 1109.

#### UNITED STATES PATENTS.

*Plumbago; Manufacture of Stratified Blocks of — [for Electrical Purposes].* C. W. Spiers, Assignor to The Morgan Crucible Co., Ltd., Battersea. U.S. Pat. 800,838, Oct. 3, 1905.

SEE Eng. Pat. 9875 of 1905; this J., 1905, 805.—T. F. B.

*Silicon Carbide; Process for the Production of Moulded Blocks of —.* F. Bölling, Assignor to Chem. Elekt. Fabrik Prometheus, G.m.b.H., Frankfort on Maine, Germany. U.S. Pat. 801,296, Oct. 10, 1905.

SEE Eng. Pat. 6693 of 1905; this J., 1905, 976.—T. F. B.

#### FRENCH PATENTS.

*Gas Battery.* P. G. L. Noel. Fr. Pat. 350,100, Aug. 4, 1904.

THE battery consists essentially of a series of hydrogen electrodes and oxygen electrodes, formed of hollow plates of palladium-asbestos, hydrogen gas and oxygen gas being supplied to the interiors of the alternate hollow plates, the whole being immersed in an electrolyte consisting of a 15–20 per cent. solution of caustic potash. The hydrogen (or oxygen) gas is occluded on the inner face of the palladium, diffuses through to the outer face, and there combines with the oxygen (or hydrogen) from the adjacent electrode, with formation of water and generation of an electric current. Each electrode is constructed of two

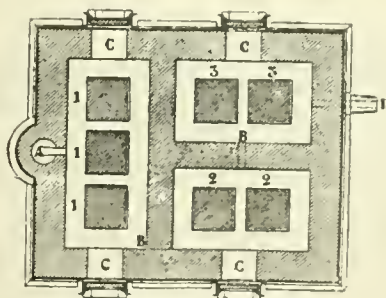
parallel grids, spaced apart by a frame, and having the openings in the grids covered by shallow perforated boxes containing sheets of palladium-asbestos; the gas is admitted into the space between the two grids. The alternate electrodes are separated by means of corrugated sheets of perforated ebonite. A number of electrodes and separators, having communicating passages for the gases and electrolyte, are bolted together to form the battery.—H. B.

*Battery; Electric —, with Liquid Chlorine [Depolariser].* E. Bnhot. Fr. Pat. 351,551, May 23, 1905.

THIS invention relates to a rotating electric battery, in which chlorine, stored in the liquid form, acts as the depolariser. The battery consists essentially of two vessels, joined together on the axis of rotation by a tube provided with a stop-cock. One vessel contains the liquid chlorine, and the other is partially filled with the electrolyte of dilute hydrochloric acid, into which dip the electrodes consisting of discs placed perpendicularly to the axis of rotation. The negative electrode of iron or zinc divides the electrolytic cell into two parts, which are in communication by openings in the electrode near to its outer edge. On each side of the negative electrode are arranged the positive electrodes of platinised silver, or carbon, bound together, and furnished with slits, one edge of each slit being turned towards the front of the plate and the other towards the back, this arrangement facilitating the renewal of the liquid between the electrodes. During the rotation, the different parts of the electrodes pass successively into the electrolyte and into the gas, and at the same time chlorine is slowly admitted, this gas combining with the liberated hydrogen and preventing polarisation. The current is conveyed away in any suitable manner, as, for instance, by means of mercury cups.—B. N.

#### (B.)—ELECTRO-METALLURGY.

*Steel; New Gin Process for the Electrical Manufacture of —.* G. Gin. Amer. Electrochem. Soc., Sept., 1905. [Advance Proof.]



IN the process described, the formation of arcs in the slag above the bath of metal serves as the chief source of heat.

As shown in the figure, the furnace is divided into three compartments. In compartment 1, the crude metal is refined by being heated in contact with iron ore and, if phosphoric, lime is also employed. The dissolved oxide is removed in compartment 2, in which also the metal is re-carburised. The third compartment serves to finally adjust the carburisation or to incorporate any special constituents of the steel.

The chambers communicate through the passages B which are below the slag line. The electric current passes into the furnace through carbon electrodes, which dip into the slag in chamber 1, and passing through the metal, leaves the furnace by the electrodes in 2 and 3, which are electrically in parallel. The passage of metal from one chamber to another, as also the tapping from the furnace by the outlet D, is effected by immersion of the electrodes and the consequent raising of the level of the metal.

—R. S. H.

*Bullion; Electrolytic versus Sulphuric Parting of* ——. F. D. Easterbrooks. Amer. Electrochem. Soc., Sept., 1905. [Advance Proof.]

By the sulphuric acid method of parting, gold can be produced ready for shipment in 24 to 30 hours, whilst the electrolytic method requires several days for production of refined gold. This gain in time is advantageous when interest charges have to be considered. The acid process, however, entails a loss of acid in the parting kettles, and the non-elimination of the tellurium present in the bullion. The author gives photographs of silver alloys, to show the effects of the presence of this metal in rolling and minting operations with the silver-copper alloy used for coins. The electrolytic process entirely removes this impurity from the silver. The Balbach and Moebius vats for electrolytic refining are described in detail. The former is stated to be the simpler of the two in construction and operation. An electrolytic parting plant is to be preferred, on the grounds of neatness and cleanliness of operation for refining silver bullion, but as regards gold bullion, the author considers the electrolytic processes, such as the Wohlwill process, too expensive and slow in operation to come into general use, excepting when platinum is present in paying quantities in the metal alloy which is to be refined.

—J. B. C. K.

*Silver; Electrolytic Process for Refining* ——. A. G. Betts. Amer. Electrochem. Soc., Sept., 1905. [Advance Proof.]

THE Moebius and Balbach processes for refining silver by electrolysis, according to the author, are open to objection, since they require the enclosure of the anodes in cloth bags, the collection of the deposited silver in a loose condition and also demand a high E.M.F. and the use of ungainly apparatus. The presence of lead and bismuth in the bullion also causes loss, since these metals are not recovered in a marketable form. The author, after many experimental trials with various acids, has found that methyl-sulphuric acid prepared at a temperature of about 100° C., gives excellent results as solvent for the anodes, and that the quality of the deposit of silver obtained from this solution can be improved by use of carbon bisulphide in the bath. The deposits of silver obtained with this acid, were hard and solid, and free from any tendency to form trees. Lead, copper and bismuth go into solution with the silver at the anode, while gold, selenium and tellurium remain undissolved.

The three first-named metals can be separated and recovered from the solution by chemical substitution—and the silver salt of methyl-sulphuric acid can be re-formed for further use in the bath.—J. B. C. K.

*Antimony; Notes on the Electro-Metallurgy of* ——. A. G. Betts. Amer. Electrochem. Soc., Sept., 1905. [Advance Proof.]

CRUDE antimony can be purified by treatment with ferric chloride solution to form ferrous chloride and antimonious chloride, and subsequent electrolysis with carbon anodes and lead cathodes. On electrolysis, the ferric chloride formed at the anode flows down to the bottom of the cell, and is drawn off, whilst fresh antimony solution is introduced at the top. With a cathode area of 65 sq. in. and anode area of 60 sq. in., 3 to 4 ampères at about 1.2 volts give a current efficiency of 90 per cent.

Antimony fluoride solutions are preferable to those of the chloride for the refining of the metal, and yield a very good cathode deposit.—R. S. H.

*Aluminium; Use of* ——. as a Reducing Agent. O. P. Watts. Amer. Electrochem. Soc., Sept., 1905. [Advance Proof.]

SOME metals, like titanium and tungsten, cannot be obtained in the pure state by reduction of their oxides with aluminium powder, as the reaction does not evolve sufficient heat. Addition of ferric oxide to the charge supplies the heat necessary for the reduction, but the metals are then obtained as alloys ferro-titanium or ferro-tungsten. The author finds that Goldschmidt charges can be fired with safety in an electric arc furnace, by adding fluorspar or cryolite to lessen the violence of the reaction in the case of more easily reducible oxides; in

this way titanium or tungsten can be reduced. The charge was put into a furnace lined with magnesite, the cover put on, and an arc started just above the charge; for five minutes 300 ampères at 80 volts were used, then for five minutes 600 ampères at 80 volts. Quantities up to 350 grms. of aluminium were used. Probably the heat of the arc can be used as a supplementary supply in all cases where hitherto an easily reducible oxide has been added for that purpose.—J. T. D.

*Metals from Solutions of their Sulphates; Cathode Potentials necessary for the Electrolytic Separation of* ——. G. Coffetti and F. Foerster. Ber. 1905, 38, 2934—2944.

PREVIOUS determinations of the equilibrium potential of metals of the iron group against solutions of their simple salts differ widely in the results obtained. The authors have carefully measured the potential required to effect separation of a number of metals—including iron, cobalt and nickel—from solutions of their sulphates. The apparatus consisted of an electrolytic cell containing a  $N/1$  solution of the sulphate, with an anode of the pure metal under examination, and a cathode of platinum, 0.5 mm. thick, the edges and one face of which were covered with shellac. In the case of cadmium the electrolyte also contained 10 per cent. of hydrofluosilicic acid to prevent the uneven deposition of the metal. The E.M.F. of the cathode was measured by means of Ostwald's capillary electrometer, at various current densities, which were in each case maintained constant for some time.

From the results obtained it appears that the potential required for separation of iron, nickel, and cobalt is intermediate in value between the potentials required for separation of cadmium and zinc respectively. In view of the high "back E.M.F." of hydrogen against the latter the authors consider the above an explanation for the fact that iron is not deposited quantitatively from a weak acid solution.—B. J. S.

#### ENGLISH PATENTS.

*Separators; Impts. in Magnetic* ——. A. Goodwin and W. J. Hollidge, Southwark. Eng. Pat. 20,877, Sept. 28, 1904.

SEGMENTAL or flat-surfaced electro-magnets are provided, each having a magnetising coil or coils and a number of polar projections of gradually decreasing cross-sectional area towards their free ends, the object of the arrangement being that when the machine is in action the polar projections shall be magnetised in a high degree so that powerful magnetic fields may be set up between them.

—J. H. C.

*Solutions and the like used in Electro Deposition of Metals; Apparatus for the Agitation of* ——. W. C. Wood and B. Oaksford, London. Eng. Pat. 2001, Feb. 1, 1905.

INSIDE the tank containing the electrolyte is fixed a trough (or troughs) extending longitudinally or transversely across the same. Within the trough is a bar or plunger provided with a number of holes, through which the liquid can pass into and out of the trough as the plunger is moved up and down.—A. S.

#### UNITED STATES PATENTS.

*Furnace; Electric* ——. F. A. Kjellin, Saltsjöbaden, Sweden. U.S. Pat. 800,857, Oct. 3, 1905. SEE Eng. Pat. 14,214 of 1905; this J., 1905, 976.—T.F.B.

*Metals; [Electrolytic] Process of Purifying* ——. U.S. Pat. 800,984, Oct. 3, 1905.

THE fused metal is kept in contact with a fused electrolyte, from which a reagent is disengaged by the action of the current, which, at the temperature used, has a greater affinity for the impurities contained in the metal than for the metal itself.—A. S.

*Metals of the Alkali Group; Process for the Production of* ——by Electrolysis. E. A. Ashcroft, Weston. U.S. Pat. 801,199, Oct. 10, 1905.

SEE Eng. Pat. 17,640 of 1903; this J., 1904, 904.—T.F.B.



*Separation of Substances of Diverse Electric Susceptibilities; Apparatus for Electrostatic* —. C. H. Huff, Brockton, Mass. U.S. Pat. 801,380, Oct. 10, 1905.

SEE Eng. Pat. 27,449 of 1904; this J., 1905, 282.—T. F. B.

*Metal Surfaces; Protecting* —. F. Uehmann, Langfuhr, Germany. U.S. Pat. 810,189, Oct. 10, 1905.

SEE Eng. Pat. 9202 of 1904; this J., 1905, 623.—T. F. B.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

*Para Rubber Seed Oil.* L. Wray, Malay Mail; through Chem. Rev. Fett.-u. Harz-Ind., 1905, 12, 250.

THE average weight of 1000 decorticated and sun-dried seeds of the Para rubber plant is 2.043 kilos. They contain about 40 per cent. of oil, and 1000 kilos. of the dried seeds yield about 437 litres of oil. A single tree usually bears more than 1000 seeds, but there is a small-leaved variety, which produces no fruit at all. The seeds must be expressed immediately after drying and crushing, since otherwise the oil becomes dark and turbid.—C. A. M.

*Glycerol; Determination of* — in Soap Lyes. H. Strauss. XXIII., page 1128.

*Glycerol; Determination of* — by the Extraction Method. Dynamitfabrik Schlobusch. XXIII., page 1129.

### FRENCH PATENTS.

*Oil from Oleaginous Matters; Process for the Continuous Extraction of* —. A. Smits. Fr. Pat. 354,229, May 13, 1905.

THE substance to be extracted is placed in a series of vessels in connection with one another. The solvent is conducted from a tank to the bottom of the first vessel, and, after percolating through the material, is drawn off from the top and passed down a pipe to the bottom of the second vessel, and so on. From the last vessel the solvent and oil are drawn off from the bottom, led through cooling pipes, then into a chamber where any water is allowed to settle, and finally pumped up to a distilling apparatus. The solvent evaporated from the latter is condensed and allowed to flow back into the solvent tank. When a charge of material is almost completely extracted, the connection between the last chamber and the cooling apparatus may be closed and the solvent, which will now contain but little oil, is run off from the bottom of the vessels and pumped into a second tank for use in extracting a further charge of material.—W. P. S.

*Fats, Oils, Resins and Hydrocarbons; Purification of* —. C. Fresenius. Fr. Pat. 354,810, May 17, 1905.

THE formation of an emulsion during the treatment of oils, &c., with alkalis or alkaline-earths may be prevented by keeping the temperature of the mixture at about 55° C. and performing the operation under pressure in an atmosphere of an inert gas. The high temperature unavoidably produced by steam pressure is thus done away with.—W. P. S.

*Food Product [from Oil Cakes]; Manufacture of a* —. The Organose Co. Fr. Pat. 354,326, May 16, 1905. XVIII A., page 1122.

## XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

### (A.)—PIGMENTS, PAINTS.

*Lampblack and Graphite from Acetylene and Metallic Carbides.* A. Frank. Versamm. Ges. deutscher Naturforscher u. Aerzte, Sept., 1905. Chem.-Zeit., 1905, 29, 1044.

If acetylene mixed with carbon monoxide or carbon dioxide be decomposed by explosion, the carbon of both gases is

deposited in a pure form, free from tarry condensation products,  $C_2H_2 + CO = 3C + H_2O$ . The lampblack so obtained is superior to the best American varieties in blackness and covering power. If carbon monoxide or carbon dioxide be allowed to act on carbides of the alkalis or alkaline-earths at a high temperature, the carbon separates in the graphite form,  $CaC_2 + CO = 3C + CaO$ . After the removal of the oxide a graphite remains almost free from ash, and suitable for electro-chemical and chemical purposes. It is similar in properties to Acheson graphite. Other elements which will combine with the metal of the carbide can be used in place of carbon monoxide. It has been shown that at the moment when the carbon is liberated, it is readily taken up by metals. Iron, for instance, when packed with carbide in a muffle and treated with carbon monoxide or dioxide, undergoes hardening and cementation. Silver dissolves carbon under these circumstances and becomes blackened.—F. S.

### ENGLISH PATENT.

*Lakes [from Azo Dyestuffs]; Manufacture of New Colour* —. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,150, Dec. 22, 1904.

SEE Fr. Pat. 349,587 of 1904; this J., 1905, 742.—T. F. B.

### UNITED STATES PATENTS.

*Structures; Process of Rendering Exposed* — *Impervious against Various Agents.* M. Toch, New York. U.S. Pat. 800,956, Oct. 3, 1905.

THE process consists in applying to the structures sheets which have had one side treated with several coats of a solution of pyroxylin in an organic solvent, with or without shellac, and the other side repeatedly coated with a solution of a partially oxidised mixture of Chinese wood-oil and linseed oil in an organic solvent, to which carbon-black or a similar pigment may be added.—M. J. S.

*White Lead Colour; Process for Manufacturing* —. A. Wultze, Charlottenburg, Germany. U.S. Pat. 801,430, Oct. 10, 1905.

SEE Fr. Pat. 347,311 of 1904; this J., 1905, 338.—T. F. B.

### FRENCH PATENTS.

*Paint; Simultaneous Employment of Cupric Thiocyanate [Sulphocyanide] and Arsenious Acid in Submarine* —. C. Dubois. Fr. Pat. 354,618, March 1, 1905.

IT is claimed that the simultaneous addition of cupric thiocyanate and arsenious acid to paints, intended for the hulls of ships, confers on these a far higher degree of preservative efficacy than the use of either of these substances alone.—M. J. S.

*Lakes [from Azo Dyestuffs]; Process of Producing Red* —. Act.-Ges. f. Anilinabr. Fr. Pat. 354,649, May 25, 1905.

THE barium, aluminium, or other salts of the dyestuff obtained by combining diazotised *o*-chloro-*p*-anisidine or *o*-chloro-*p*-phenetidine with  $\beta$ -naphtholdisulphonic acid R, when precipitated on a substratum, produce brilliant bluish-red lakes, very fast to light.—T. F. B.

*Lakes [from Azo Dyestuffs]; Process of Producing Orange or Yellowish-Red* —. Act.-Ges. f. Anilinabr. Fr. Pat. 354,676, May 26, 1905.

THE diazo derivative of *m*-chloroaniline sulphonic acid ( $NH_2 : Cl : SO_3H = 1 : 3 : 6$ ) is combined with  $\beta$ -naphthol. By precipitating this dyestuff on a suitable substratum in the usual manner, orange or yellowish-red lakes are obtained, which are very fast to light, and quite insoluble in water and oil.—T. F. B.

### (B.)—RESINS, VARNISHES.

*Copal (Java Copal); A New Fossil* —. K. Dieterich. Versamm. Ges. Deutscher Naturforscher u. Aerzte, Sept. 1905. Chem.-Zeit., 1905, 29, 1047–1048.

THIS fossil copal is found in Java associated with lignites

and pyrites. It is more or less transparent, with a yellow to greenish-brown colour. It melts completely at 178° C., and its sp. gr. varies between 1.033—1.041. It contains sulphur derived from minute fragments of the pyrites, but no nitrogen. The amount of ash is 2.44 per cent., and water 0.265 per cent. It contains no bitter substances, essential oils or volatile acids. The acid value was 4.55—5.07; saponification value, 14.54—18.03; iodine value, 50.36—54.66. It is very slightly soluble in alcohol, easily soluble in chloroform, benzene and carbon bisulphide. It is only slightly soluble in chloral hydrate, thus proving to be a true copal. On destructive distillation, it yielded the following fractions:—I., 120° C. had a refractive index of 1.4803—1.4812. Fraction II. at 280° C. was a brownish-yellow oil, amounting to 15.67 per cent. of the copal, with refractive index 1.5116; sp. gr. 0.921; iodine value 87.24—96.53. Fraction III., 280°—300° C., amounted to 22.61 per cent., with sp. gr. 0.923, and iodine value 113.48 to 120.74. Fraction IV., 300°—360° C., was a dark oil, amounting to 19.03 per cent.; sp. gr. 0.920; iodine value 98.10—120.68. Fraction V., 12.93 per cent., was a viscous greenish-brown oil, sp. gr. 0.9805; iodine value 42.68. The Java copal, being a true fossil copal, appears to be quite distinct from the Manila copal.—F.S.

#### ENGLISH PATENTS.

*Varnish and Paint; Processes of Removing [and Recovering] Old* —. A. Gottschalk, Höchst on Maine, Germany. Eng. Pat. 8617, April 22, 1905.

SEE Ger. Pat. 158,310 of 1904; this J., 1905, 681.—T.F.B.

*Oilcloth and Linoleum; Substitute for* — [from Paper Pulp]. W. Melville, W. V. Rees, and P. L. Rees, Manchester. Eng. Pat. 22,114, Oct. 14, 1904.

AN emulsion consisting of oil, water, size, sodium carbonate and calcium oxide (the latter in some cases being omitted) is mixed with fibrous paper pulp, when the latter is in a state of pulp or semi-pulp. The mixture may be heated to assist the operation. (See also this J., 1904, 829.)—W. P. S.

*Covering for Floors, Walls and other Surfaces.* H. J. Haddan, London. From Lactoleum Werke Ges. m. b. H., Berlin. Eng. Pat. 6601, Mar. 28, 1905.

CASEIN rendered soluble in water by treatment of the casein precipitated from milk by an alkali, followed by precipitation from the alkaline solution by means of hydrochloric acid, is mixed with vegetable fibre, e.g., sawdust or powdered cork, and water. After adding a colouring matter, the mass is stirred in the cold until it forms a paste, with which oily substances, crude glycerin and a solution of resin in turpentine are incorporated. The whole is again well stirred and applied directly to the surface to be covered. After being applied the mass is dressed and polished.—A. G. L.

#### UNITED STATES PATENT.

*Terpenes and Resinous Substances [from Wood]; Process of Producing* —. G. P. Craighill and G. A. Kerr, Assignors to N. C. Manson, jun., Lynchburg, Va. U.S. Pat. 800,905, Oct. 3, 1905.

WOOD is saturated with an alkaline solution to "fix" the volatile acids and oils, and to liberate the terpenes, which are then removed by passing steam through the wood; water is added to the contents of the still, which are drawn off, and the resinous substances are recovered.—T. F. B.

#### FRENCH PATENTS.

*Fats, Oils, Resins and Hydrocarbons; Purification of* —. C. Fresenius. Fr. Pat. 354,810, May 17, 1905. XII., page 1117.

*Turpentine Substitute; Preparation of a* —. A. Pollet. Fr. Pat. 354,425, May 20, 1905.

It is stated that the turpentine substitutes prepared by mixing heavy petroleum oils with genuine oil of turpentine have the defect of containing fatty substances, which

exert a prejudicial action. The patentee claims to avoid this defect by rectifying the petroleum with a fractionating column, and rejecting both the first and last fractions.—M. J. S.

*Drier for Oils, Oil Colours, Varnishes, &c.* J. Menge. Fr. Pat. 354,548, May 23, 1905.

SEE Eng. Pat. 11,063 of 1905; this J., 1905, 1075.—T.F.B.

*Varnishes and their Manufacture; "Matt"* —. F. Wachendorf. Fr. Pat. 354,955, June 5, 1905. Under Int. Conv., April 3, 1905.

SEE Eng. Pat. 12,460 of 1905; this J., 1905, 934.—T.F.B.

*Oilcloth or Linoleum; Product suitable for Replacing* —. W. Melville. Fr. Pat. 354,736, May 29, 1905. Under Int. Conv., June 4, 1904.

SEE Eng. Pat. 12,663 of 1904; this J., 1904, 829.—T.F.B.

#### (C.)—INDIA-RUBBER, &c.

*Para Rubber-Seed Oil.* L. Wray. XII., page 1117.

#### UNITED STATES PATENT.

*Rubber; Process of Devulcanising* —. A. P. Eves. U.S. Pat. 801,066, Oct. 3, 1905.

THE rubber is heated and treated with sodium sulphate "or its equivalent," and then barium chloride "or its equivalent" is worked into the heated mass.—A. S.

#### FRENCH PATENT.

*Vulcanised Binding Medium for Fibrous Compositions.* C. A. C. de Caudenberg. Fr. Pat. 354,801, May 10, 1905.

THE fibrous composition after being formed into the desired shape, is impregnated with a 2—5 per cent. solution of bitumen and caoutchouc in petroleum spirit. The superfluous liquid having been expelled by gentle pressure, the mass is immersed in carbon bisulphide containing 5—10 per cent. of sulphur monochloride. Absorption may be facilitated by conducting the operation *in vacuo*. Finally, the articles are hardened, this being facilitated by heat. The product is light, hard, proof against acids and oxidising agents, impermeable and uninflamable.—C. S.

### XIV.—TANNING, LEATHER, GLUE, SIZE.

*Tanning Materials; Analysis of* —. B. Weiss. XXIII., page 1129.

*Gelatin Impregnated with Potassium Bichromate and Rendered Insoluble by Light; Composition of* —, and the Theory of the Process. A. L. Lumière and A. Seyewetz. XXI., page 1125.

*Gelatin Rendered Insoluble by Light in presence of Chromic Acid and certain Metallic Bichromates; Composition of* —. A. L. Lumière and A. Seyewetz. XXI., page 1126.

### XV.—MANURES, Etc.

*Sodium Nitrate; Transformations of* — in the Soil of Sugar-Beet Plantations. J. Stoklasa. Z. Zuckerind. in Böhmen, 1905, 30, 1—8.

PRACTICAL observations have shown that, in fertilising sugar-beet crops with sodium nitrate, very little of the fertiliser is washed away in normal weather, but that the nitrogen remains available in the humus of the top soil. This result is due not only to the ease with which nitrate nitrogen is directly assimilated by the growing beet-root, but also to various biological processes which go on side by side in the humus of the soil. These changes, brought about by the lower organisms of the



soil, are mainly:—(1) Reduction of the nitric acid to ammonia, and (2) oxidation of the ammonia to nitrous and nitric acids. In the course of all these processes nitrogen is fixed in the organic form, i.e., in the living protoplasm of the multiplying bacteria. (3) The nitric acid of the sodium nitrate is assimilated directly by algae and fungi, and is converted into organic form. (4) The organic nitrogen of the lower organisms and the root-residues of the beets and various weeds is converted into ammonia or nitric acid. There is thus a cycle of changes and a continuous conversion of the nitrogen of the nitrate in the soil under the action of the lower organisms. Not only is the nitrogen of the nitrate directly assimilated by the higher plants and the lower organisms, but it considerably intensifies the vital processes of the cells and takes part in the oxidation of the carbohydrates. The activity of the organisms which enrich the soil in nitrogen is stimulated, and an increase of the nitrogen in the top layer of humus which contains the micro-organisms is observed, whilst the under soil never contains more than half the proportion of nitrogen which is found in the humus.—J. F. B.

*Fertilisers: Availability of Mixed* — W. F. Sutherst. Chem. News, 1905, 92, 185.

From experiments carried out by the author, it seems that by mixing certain fertilisers the availability increases in some cases and decreases in others. Equal quantities of the materials mentioned below were mixed, and, after moistening with water, were allowed to stand for three weeks, when the citric acid soluble phosphoric acid was determined. The results obtained, expressed as calcium phosphate ( $\text{Ca}_3(\text{PO}_4)_2$ ), were:—

Bone-meal alone	29.06 per cent.
" + potassium chloride	"
" ("muriate of potash")	26.54 "
" + kainite	23.99 "
" + salt	25.85 "
Bone-flour alone	43.45 "
" + ammonium sulphate	44.51 "
" + potassium chloride	"
" ("muriate of potash")	49.06 "
" + kainite	47.97 "
" + common salt	45.30 "
" + sodium nitrate	67.70 "
" + salt + sodium nitrate	44.77 "

—W. P. S.

*Cyanamide: Determination of* —, and *Applications of the Method.* R. Perotti. XXIII., page 1129.

## XVI.—SUGAR, STARCH, GUM, Etc

*Barium Sulphite; Solubility of* — in Water and Sugar Solutions. J. Rogowicz. Z. Ver. dent. Zuckerind., Sept., 1905, 938—940.

THE solubility of barium sulphite was determined at 20° C. and at 80° C. in pure water and in solutions of pure saccharose. The results are given in the following table:—

Solvent.	BaSO <sub>3</sub> Grms. per 100 c.c. in the saturated solution.	
	At 20° C.	At 80° C.
Pure water	0.01974	0.00177
10 per cent. sugar solution	0.01040	0.00335
20 "	0.00968	0.00289
30 "	0.00782	0.00223
40 "	0.00484	0.00158
50 "	0.00298	0.00149
56 "	0.00223	0.00112

—J. F. B.

*Sugars, Polyhydric Alcohols and Hydroxy-Acids; Influence of Lead and Bismuth Salts on the Rotatory Powers of* —. H. H. Grossmann. Z. Ver. dent. Zuckerind., 1905, 55, 911—976.

SALTS of the heavy metals, especially lead and bismuth, react with hydroxylated compounds in presence of alkali, causing the replacement of the hydrogen of one or more of the alcoholic hydroxyl groups by PbO or BiO. In the case of optically active compounds, this reaction is accompanied by very profound modification of the specific rotatory power, the change being further complicated by the influence of the excess of alkali which is necessary to redissolve the precipitate of heavy metal compound at first produced. In the case of lead salts the change is frequently associated with an actual inversion of the sign of the optical rotation, e.g., in the well-known case of levulose, in which levo-rotation may be changed to the dextro-rotation which increases up to a maximum point and then changes back again as the proportion of lead is increased. The author has studied the action of lead acetate and nitrate in varying proportions in presence of more or less excess of caustic soda upon the rotatory powers of a large number of sugars and other compounds of the above type. The alkali-lead compounds of the hexoses are not very stable, since the free alkali tends to produce after a short time the isomeric redistributions studied by L. de Bruyn.

The action of bismuth was investigated in the form of a solution of bismuth nitrate in aqueous glycerol. The alkali-bismuth tartrates are particularly interesting; there appear to exist two series of these compounds—one, stable only in acid solutions, very strongly levo-rotatory, and the other very powerfully dextro-rotatory. Of the sugars, only levulose appears to be profoundly modified in its optical properties by the bismuth salt; the smaller depressions of the rotatory powers observed with the other sugars are attributable rather to the influence of the excess of alkali than to that of the bismuth.—J. F. B.

*Sodium Nitrate; Transformations of* — in the Soil of Sugar-Beet Plantations. J. Stoklasa. XV., page 1118.

*Fucose Phenyllosazone.* W. Mayer and B. Tollens. XXIV., page 1131.

### ENGLISH PATENT.

*Levulose; Manufacture of* —. S. Stein and M. Loewenthal, Liverpool. Eng. Pat. 8898, April 27, 1905.

AN aqueous solution of inulin is boiled in a closed vessel under a pressure of 8—10 lb. per sq. in., which is sufficient to determine the conversion of the inulin into levulose without the use of any hydrolysing agent. The solution of inulin prepared according to Eng. Pat. 16,546A of 1904 (this J., 1905, 744) is most suitable for the purpose.

—J. F. B.

### UNITED STATES PATENTS.

*Sugar Crystallising Apparatus.* R. Fölsche, Halle a/Saale, Germany. U.S. Pat. 801,312, Oct. 10, 1905.

SEE Eng. Pat. 23,692 of 1903; this J., 1904, 72.—T. F. B.

*Viscin; Process of Purifying* —. W. Loebell, Klein-Zschachwitz, Germany. U.S. Pat. 800,925, Oct. 3, 1905.

SEE Eng. Pat. 26,383 of 1904; this J., 1905, 852.—T. F. B.

*Sugar Diffusion; Employment of Aluminium Salts, principally Aluminium Bisulphite, in* —. R. Broquet, C. Dethier and E. Savc. Fr. Pat. 354,483, May 20, 1905.

ALUMINIUM bisulphite, or other aluminium salt, is introduced into the diffusion battery in the proportion of about 0.1 to 0.2 per cent. on the weight of the beet-roots. The salt is introduced into the system preferably at a point about the middle of the battery. The effect of the salt is to precipitate albuminoid matters and prevent oxidation and fermentative changes; the quantity of lime required for defecation is considerably reduced.—J. F. B.

## XVII.—BREWING, WINES, SPIRITS, Etc.

Barley; Extract Determinations in — [Season 1904—5].  
A. Reichard and G. Furucker. Z. ges. Branw., 1905,  
28, 677—682.

THE authors summarise their general conclusions from the analysis of a large number of samples of barley and the malt prepared therefrom. In the analyses of the past

solid media with agar-agar, to which dextrose and mineral salts had been added, and streaks were made on plates by means of a brush of each of the yeasts and fungi studied, each culture occupying the same relative position on the different plates. In this manner, 15 yeasts were tested on 15 plates, and the assimilability of the various nitrogenous products by the different species was judged by the vigour of the colonies developed. The following table shows the results obtained from nine of the more important species tested:—

No. in Berlin collection.	Species of Yeast or Fungus.	Tyrosine.	Leucine.	Adenine.	Hypoxanthine.	Histidine (chloride).	Uracil.	Asparagine.	Aspartic Acid.	Arginine.	Guanidine (hydrochloride).	Lysine.	Choline.	Thymine.	Potassium nitrate.	Ammonium sulphate.
788	<i>S. cerevisiae</i> (bottom) .....	12	12	1	1	2	1	2	1	2	—	1	12	1	2	1
755	Dist. yeast Race xii. (top) .....	1	12	1	1	2	2	1	1	1	—	2	2	1	2	1
785	Logos yeast .....	1	1	1	1	2	2	1	1	1	—	2	—	1	2	1
173	<i>Schizosacch. Pombe</i> .....	1	2	—	2	2	1	2	2	1	2	—	—	1	2	—
273	<i>S. Ludwigii</i> (also <i>apiculatus</i> ) .....	2	2	—	2	2	2	2	2	2	2	2	—	2	2	2
693	<i>Mycoderma</i> .....	12	12	12	1	1	1	3	12	3	3	3	12	1	2	3
126	<i>Wella belgica</i> ( <i>anomalous</i> ) .....	12	12	12	1	1	12	3	12	3	3	3	12	1	2	12
557	<i>Oidium lactis</i> .....	12	12	1	3	12	12	3	1	3	3	12	3	1	2	12
119	<i>S. turbidans</i> ( <i>ellipsoideus</i> II.) .....	12	12	12	1	2	1	2	12	12	—	1	2	1	2	12

season, the values obtained for the barley extracts were compared with those for the malt extracts by taking into account the loss of weight sustained in malting. The quantity of malt extract, calculated on 100 parts of the barley extract, thus becomes an important factor in the valuation of barley, provided the conditions of malting be known and standardised.

The percentage of extract in barley decreases as the percentage of protein increases; the percentage of extract in malt is, as a rule, proportional to the percentage of extract in the barley. From the percentage of protein in the barley a conclusion may be drawn as to the relative percentage of extract in the malt. Under determined conditions of malting, the yield of malt extract can be calculated from the percentage of extract in the barley. The quantity of malt extract obtainable from 100 parts of barley extract decreases, as a rule, as the loss of weight in malting increases. The percentage of sinker corns in the malt, is, to a certain extent, a measure of the degree of modification of the endosperm, and has, therefore, an influence on the availability of the extract in the malt. A very low proportion of sinkers indicates high availability but low proportion of extract, i.e., "forcing." The most advantageous proportion of sinkers appears to be 15—22 per cent. The ratio of the price per unit of barley extract to the price per unit of wort extract obtained, becomes more unfavourable the higher the loss of weight in malting. If this ratio be worked out for each percentage of malting loss, the cost of the malt extract of the wort can be calculated at the time of buying the barley.—J. F. B.

Beer Yeast; Assimilability of the Autodigestion Products of — by Different Species of Yeast and Fungi. I. P. Lindner, Rülke and H. Hoffmann. Woch. f. Brau., 1905, 22, 528—530.

In the case of yeast, the aggressive nourishment of stronger cells at the expense of the substance of their weaker neighbours has not been observed, but the utilisation of the autodigestion products of aged or dead cells by the vigorous survivors in old droplet cultures, fully exhausted of sugar, is a well-known fact. The authors have taken advantage of the isolation and purification of the various nitrogenous products of the autodigestion of beer yeast by Schenck (this J., 1905, 555) to study the availability of each of these substances separately for the nutrition of cultures of various species of yeast and allied organisms. This question has a practical bearing on the employment of yeast products as nutrients for the yeast in distillery fermentations, &c. The study also shows that the metabolic products are not to be regarded as yeast poisons, but in most cases as actual foods.

The various purified substances were incorporated in

It would appear that the autodigestion products are most readily assimilated by the aërophilic fungi with little or no fermentative capacity, also by the culture yeasts and most of the wild after-fermentation yeasts, but not by *S. exiguus*, Logos yeast, fission yeasts, *S. apiculatus* and *Ludwigii*.—J. F. B.

Yeast; Nitrogenous Nutrition of—. A. Fernbach. Ann. de la Brasserie; through Brewers' J., 1905, 41, 620

THE author emphasises the fact, first mentioned by Duclaux 40 years ago, that yeast cells may have a dual existence, viz., (1) as simply vegetative organisms, and (2) as ferments the special function of which is the decomposition of sugar into alcohol and carbon dioxide. In a study of the nutrition of yeast, these two functions must be examined separately, in order to ascertain whether any particular food stimulates chiefly the vegetative or the fermentative function. The author discusses the results which have been obtained by various workers, and points out the need of investigating the alterations sustained by the nitrogenous constituents of barley and malt. For if these transformations can be brought under control, so that any given character of wort can be produced at will, it should be possible to impart predetermined characteristics to the fermentation process and to the resulting yeast crop. —A. S.

Aromas, Specific; Production of — in Fermentation. T. Bokorny. Zentralbl. f. Bakt.; through Brewers' J., 1905, 41, 629.

In the fermentation of concentrated sugar solutions pitched with large proportions of beer yeast, different aromas can be produced by varying the conditions. In one instance, the flavour and aroma of Malaga wine were produced, whilst in another the odour strongly resembled that of toast. The production of aroma is attributed to the formation of ethers during fermentation. The odour and flavour of Malaga developed only after a considerable time, and are probably due to a special reaction of moribund zymase. The production of the toast odour is observed chiefly in the case of strong solutions of sugar, pitched with a large quantity of yeast, and exposed to a temperature of 30°—40° C. It is due to the action of zymase, since it is not observed when there is no fermentation—for example, when fermentation is rendered impossible by the use of excessively concentrated solutions of sugar, or when sugar is absent. The odour is produced to a greater degree when the zymase is in an encephal condition, than when it is in a normal state.—A. S.



*Enzymes; Behaviour of — towards Colloidal Solutions.* Reiss. *Beiträge Chem. Physiol.*; through *Brewers' J.*, 1905, 41, 624.

THE author finds that rennet and trypsin when shaken with a solution of lecithin in chloroform are dissolved to some extent by the latter. These enzymes mentioned are not dissolved by other solvents, and it is therefore concluded that the chloroform-lecithin solution is colloidal, and that the enzymes pass from their aqueous solution or suspension into this colloidal liquid. The catalase present in milk behaves in an exactly opposite manner. It adheres to the milk globules, being found more abundantly in cream than in skimmed milk, but if the globules are separated, and then suffused with water or "physiological" salt solution, the enzyme passes into the liquid almost completely. In this case, therefore, the colloids of milk plasma precipitate the enzyme, which is readily soluble in non-colloidal liquids.—A. S.

*Malt Analysis.* Ehrlich. XXIII., page 1129.

*Methyl Alcohol in Spirit Preparations; Detection of —.* G. Fendler and C. Mannich. XXIII., page 1128.

*Methyl Alcohol; Detection of — in Liquids containing Ethyl Alcohol.* [Official Test of New U.S.P.] S. P. Sadler. XXIII., page 1128.

#### ENGLISH PATENT.

*Brewing [Hopping Beer]; Impts. in —.* H. W. Gates, Sheffield. Eng. Pat. 25,774, Nov. 26, 1904.

THE beer is charged with hops during the process of fermentation by lowering a vessel with perforated walls, filled with raw hops, into the fermentation vessel and pumping the beer from the bottom of the fermentation vessel into the top part of the hop cylinder, so that it percolates through the hops back into the fermentation vessel. In cases where it is not desirable to pump the fermenting beer, the hops may be packed in a perforated cylinder fitted up so as to serve as a rouser, which is stirred about in the beer during fermentation. The used hops are suitable for employment in the wort copper for extraction by boiling wort.—J. F. B.

#### FRENCH PATENTS.

*Beer; Preparation of a Product for Hopping —.* G. Ronnberg and Co. Fr. Pat. 354,160, May 10, 1905. Under Int. Conv., April 25, 1905.

THE lupulin of hops is collected in the pure state and is mixed with a saccharine substance, e.g., cane sugar, invert sugar or glucose, but preferably with dextro-levulose. This mixture is incorporated with the beer and is intended to supersede the addition of raw hops to the beer in cask, which is liable to introduce micro-organisms and other undesirable matters.—J. F. B.

*Condensers, Coolers, &c., employed in Distilling and other Industries; Impts. in —.* E. Guillaume. Fr. Pat. 354,402, May 18, 1902. I., page 1101.

*Wines and Spirits; Artificial Ageing of —. Process and Apparatus for the Oxidation and Esterification of Oleaginous and Alcoholic Liquids.* M. E. Pozzi-Escot. Fr. Pat. 354,747, May 29, 1905.

THE apparatus consists of a catalytic-oxidising vessel ["oxydateur-catalysateur"] and an esterifying-pasteurising vessel. The liquid contained in a reservoir is fed under pressure through a jet, which aspirates air during the passage of the liquid, into the top of the oxidising column. This column contains a number of metallic baskets filled with catalytic materials, one of the most suitable being platinised asbestos. The temperature of oxidation is regulated by a water-jacket surrounding the column. The bottom of the column is connected with the esterifying vessel which consists of a worm of small diameter surrounded by a steam chamber. The liquid and vapour issuing from the esterifying worm are cooled and condensed by passing through a worm condenser, and the gases which escape condensation in this are further

cooled by a worm surrounded by a freezing mixture. For the treatment of oils, the esterifying-pasteurising vessel is omitted.—J. F. B.

*Amyl Alcohol; Manufacture of —.* E. A. Mislin and L. Lewin. Fr. Pat. 354,807, May 16, 1905.

CERTAIN bacteria exist which are capable of transforming sugar or maltose into amyl alcohol. Cultures of these bacteria are prepared, for example, from the must of prunes, and introduced into a wort prepared from potato or grains, and containing 1—2 per cent. of alkali. After fermenting for 120—150 hours, the liquor is distilled at 136°—140° C. (See this J., 1904, 124, 876 and 1107; and 1905, 683.)—E. S.

*Alcohol; Preparing a New Product for Industrial Purposes by the simultaneous Concentration and Carburation of —.* F. Sallé. Fr. Pat. 355,030, June 7, 1905. II., page 1102.

### XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

#### (A).—FOODS.

*Yeast; Determination of Dough-Raising Power of Bakers' —.* M. Silberberg. Z. Spiritusind. 1905, 28, 388—389.

THE author bases his argument on the principle that the value of a yeast for bakers' purposes is inversely proportional to the specific gravity of the bread made with it, and contends that none of the methods hitherto proposed for the valuation of bakers' yeast yield results in accordance with this principle. These methods deal only with the rate of evolution of gas from a dough or sugar solution at a temperature of 30° C., and relate, therefore, only to the dough stage of the manufacture of bread. They take no account of the subsequent activity of the yeast in the oven, at a stage which is of the greatest importance in determining the volume, shape and structure of the loaf. The fermentation at this stage depends on the fermentative power of the yeast at high temperatures and under the pressure occasioned by the formation of the crust, also upon the temperature at which the yeast ceases to be active. The author has examined, comparatively, a beer yeast and a pressed yeast by the method described by Pollack (this J., 1901, 452). He found that the beer yeast was the more active in the dough fermentation stage and raised the dough to a larger volume in the first half-hour than the pressed yeast. After two hours, when the diastatic enzymes of the yeast had exerted their activity, the volumes of the dough with the two yeasts were practically the same. Incidentally it was observed that in this process, at 30° C., the dough continued to rise for about four hours, after which it slowly subsided. But in the practical bread-making experiments, the beer yeast was found to give a very inferior product on account of its feeble fermentative activity in the oven. The loaves with the beer yeast had a flattened shape, poor appearance and small volume, whilst the loaves with the pressed yeast were in every way satisfactory, and had a volume from 9 to 23 per cent. greater than the others. Similar results were obtained by other methods in use for the determination of dough-raising power, all indicating the superiority of beer yeasts which gave poor results in practice; consequently the author concludes that the only reliable test for bakers' yeast is an experimental baking, combined with a determination of the volume of the loaves.—J. F. B.

*Arsenic and Antimony in presence of Organic Matter; Detection and Determination of —.* F. A. Norton and A. E. Koch. XXIII., page 1129.

*Cocoa Preparations; Determination of Sugar and Fat in —.* A. Steinmann. XXIII., page 1130.

## ENGLISH PATENTS.

*Blood and Fluid Extracts and Preparations of Animal Tissue; Process for Drying* —, with or without the Addition of other Substances. J. R. Hatmaker, Paris. Eng. Pat. 25,077, Nov. 18, 1904.

BLOOD or extracts of animal tissue may be obtained in a dry flaky form by the use of the hot roller apparatus previously described for drying milk. (Eng. Pat. 8743 of 1903; this J., 1903, 815.) The fibrin may be removed from or retained in the blood, as desired.—W. P. S.

*Proteid; Process for the Production of* —. G. Mitchell, London. Eng. Pat. 26,654, Dec. 7, 1904.

SEE Fr. Pat. 350,683 of 1905; this J., 1905, 811.—T.F.B.

*Food Product; Manufacture of a* —. R. W. James, London. From The Organose Co., Crawfordsville, U.S.A. Eng. Pat. 9457, May 4, 1905.

SEE Fr. Pat. 354,326 of 1905; following these.—T.F.B.

## UNITED STATES PATENTS.

*Food Preparations [Resembling Human Fat]; Manufacture of* —. J. E. Bloom, U.S. Army. U.S. Pat. 800,201, Sept. 26, 1905.

FOOD materials are deprived of fat and then mixed with a "jellifying" ingredient, free oleic acid, myristin and an oil or fat consisting of olein, palmitin and stearin in the proportions in which they exist in human fat. (See this J., 1905, 341.)—W. P. S.

*Cocoa Paste; Manufacture of* —. F. E. F. Neumann, Waudsbek, Germany. U.S. Pat. 801,259, Oct. 10, 1905.

SEE Fr. Pat. 330,616 of 1903; this J., 1903, 1099.—T.F.B.

*Milk; Process of Refining* —. G. Daseking, Assignor to J. Berliner, Hanover, Germany. U.S. Pat. 801,773, Oct. 10, 1905.

SEE Eng. Pat. 12,045 of 1903; this J., 1904, 381.—T.F.B.

## FRENCH PATENTS.

*Food Product [from Oil Cakes]; Manufacture of a* —. The Organose Co. Fr. Pat. 354,326, May 16, 1905.

THE proteid matter is extracted from pressed feeding cakes (such as those of sesame, linseed, cottonseed, &c.) by steeping the powdered cake in a strong brine bath at a temperature not exceeding 37° C. After filtering, the solution is slightly acidified with hydrochloric acid, and the precipitated proteid collected, dried and powdered.

—W. P. S.

*Meat; Process for Preserving Fresh* —. G. Craveri. Fr. Pat. 354,682, May 26, 1905.

SEE Eng. Pat. 13,266 of 1904; this J., 1905, 452.—T. F. B.

*Butter Substitutes and Process of Making same.* K. Mann. Fr. Pat. 354,903, June 3, 1905. Under Int. Conv., Nov. 30, 1904.

SEE Eng. Pat. 15,311 of 1905; this J., 1905, 1027.—T. F. B.

## (B.)—SANITATION; WATER PURIFICATION.

## UNITED STATES PATENT.

*Water; Apparatus for Softening* —. H. S. Flynt, Sale, England. U.S. Pat. 800,287, Sept. 26, 1905.

THE apparatus consists of a hollow drum adapted to contain the softening solution, and provided on its outside with a number of semi-circular buckets. The water to be treated is fed into these buckets, thus causing the drum to rotate, an adjustable detaining gear making the rotation intermittent. Inside the drum is placed a tube, one end of which projects through the side of the drum, whilst the other end carries a measuring vessel which takes up a certain volume of the solution and discharges it into the water at each revolution.—W. P. S.

## FRENCH PATENTS.

*Air; Purification of* —. J. Harris. First Addition, dated May 24, 1905, to Fr. Pat. 320,661, April 25, 1902. Under Int. Conv., Aug. 22, 1904.

SEE Eng. Pat. 18,144 of 1904; this J., 1905, 281.—T. F. B.

*Water; Automatic Apparatus for Purifying* —. H. S. Flynt. Fr. Pat. 354,914, June 5, 1905. Under Int. Conv., Oct. 3, 1904.

SEE U.S. Pat. 800,287 of 1905; preceding these.—T. F. B.

## (C.)—DISINFECTANTS.

## UNITED STATES PATENT.

*Aluminium Acetate [Disinfectant]; Process of Making Insoluble* —. R. Reiss, Charlottenburg, and O. Schmatolla, Berlin. U.S. Pat. 801,158, Oct. 3, 1905.

SEE Ger. Pat. 160,348 of 1904; this J., 1905, 1027.—T.F.B.

## XIX.—PAPER, PASTEBOARD, Etc.

*Cellulose [Copper Compound].* H. Riesenfeld and F. Taurke. Ber., 1905, 38, 2798—2800.

A SAMPLE of wood-cellulose which was insoluble in a solution of copper oxide in ammonia, as prepared by the authors, was soluble, after some time, in a solution of copper carbonate in ammonia. The solution obtained contained 1.3 per cent. of cellulose and 4 per cent. of copper. This solution deposited, on heating, a brownish-black precipitate containing the whole of the cellulose. The precipitate contained 69.7—71 per cent. of cupric oxide and 22.9—26.6 per cent. of cellulose. It is regarded as a definite compound having the approximate formula  $11\text{CuO}$ ,  $2\text{C}_6\text{H}_{10}\text{O}_5$ ,  $2\text{H}_2\text{O}$ . It resists washing and drying at 100° C., but is decomposed by acids, which extract all the copper, it is soluble in ammonia. A similar precipitate is also formed when the cellulose solution is diluted with an equal volume of fresh copper carbonate-ammonia solution.—J. F. B.

## ENGLISH PATENTS.

*Paper Pulp or Textile Fibres; Process for the Transformation of Alfa and Other Similar Plants into* —. M. Kuess, Tunis. Eng. Pat. 9698, May 8, 1905. Under Int. Conv., May 9, 1904.

SEE Fr. Pat. 354,092 of 1905; this J., 1905, 1081.—T. F. B.

*Oilcloth and Linoleum; Substitute for* — [from Paper Pulp]. W. Melville, W. V. Rees and P. L. Rees. Eng. Pat. 22,114, Oct. 14, 1904. XII(B.), page 1118.

## UNITED STATES PATENTS.

*Waterproof Coating [for Paper] and Method of Making same.* F. X. Govers, Owego, N.Y. Assignor to Americus Manufacturing Co., New York. U.S. Pat. 800,144, Sept. 26, 1905.

FOR coating paper, a composition made of a calcium salt, e.g., calcium sulphate, wax, and a solution of casein in ammonia, is applied to the paper, and the solvent is evaporated by heating to a temperature of 110° F. or higher.—J. F. B.

*Fabric [Paper] Coating.* F. X. Govers, Owego, N.Y., Assignor to Americus Manufacturing Co., New York. U.S. Pat. 800,145, Sept. 26, 1905.

A COATING for paper is claimed, composed of "sulphuric acid casein," sodium phosphate, sodium "hyposulphite," a base or filler and wax incorporated with water.—J. F. B.

*Fabric [Paper] Coating; Insoluble* — and Method of Making same. F. X. Govers, Owego, N.Y., Assignor to Americus Manufacturing Co., New York. U.S. Pat. 800,146, Sept. 26, 1905.

CASEIN is dissolved in a solution containing an alkali



phosphate and "hyposulphite," and a suitable filler, such as china clay and satin white, is incorporated in the solution, to which formaldehyde is then added.—J. F. B.

#### FRENCH PATENTS.

*Paper and Millboard; Manufacture [Sizing] of* — F. Dobler. Fr. Pat. 350,107, Aug. 8, 1904.

PAPER is made from unsized or very lightly sized pulp containing a small excess of an acid or alum. The web of paper is then treated on the machine with a solution of rosin soap or any other sizing material which is capable of being precipitated by acid. The sizing solution is first absorbed by the paper and then precipitated by the acid contained therein, with the result that the paper emerges from the machine in a fully-sized condition. The paper may be passed through baths of acid and water before drying, if it is found necessary to do so.—J. F. B.

*Paper of High Mechanical Resistance; Manufacture of* — Rheinsche Akt.-Ges. f. Papierfab. Fr. Pat. 354,732, May 29, 1905.

PAPER, manufactured and sized in the usual way, is passed, after drying, through a bath of parchmentsing acid, e.g., through a bath of sulphuric acid of 54° B., at a speed of about 40 metres a minute. The excess of acid is removed mechanically, and the paper is washed and dried.—J. F. B.

*Explosives; Cartridge Wrappers for* — Soc. Gén. pour la Fabr. de la Dynamite. Fr. Pat. 350,099, Aug. 4, 1904. XXII., page 1126.

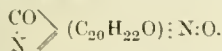
*Silk by the Chardonnet Process; Recovery of the Cotton Wool and Muslin Used for Filtering Collodion in the Manufacture of Artificial* — Soc. Anon. pour la Fabr. de la Soie de Chardonnet. Fr. Pat. 354,398, May 17, 1905. V., page 1106.

*Silk; Method of Making Non-inflammable Artificial* — G. Gorrand. Fr. Pat. 354,424, May 19, 1905. V., page 1106.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*Strychnine Oxide.* A. Pietet and M. Mattisson. Ber., 1905, 38, 2782—2787.

WHEN strychnine is gently heated with 10 times its weight of a 3 per cent. solution of hydrogen peroxide, it gradually dissolves, and large colourless prismatic needles of strychnine oxide separate out on cooling. This body melts with decomposition at 199° C.; it is readily soluble in hot water, and crystallises with 3 mols. of water of crystallisation; the aqueous solutions have a neutral reaction. It is readily soluble in alcohol, acetic acid and chloroform, less soluble in benzene and insoluble in ether and light petroleum spirit. Its specific rotatory power  $[\alpha]_D = -1.75^\circ$ . Strychnine oxide contains one atom of oxygen more than strychnine, and its general properties indicate that it belongs to the class of amino-oxides, characterised by the presence of the group: N:O. On the basis of Tafel's formula for strychnine, the oxide would have the constitution



It readily parts with its extra oxygen when heated in presence of glycerol above 100° C., and it liberates iodine from potassium iodide; it oxidises sulphur dioxide with the production of strychnine sulphate. It reacts as a mono-acidic base and its salts possess an acid reaction; they are not decomposed by ammonia.—J. F. B.

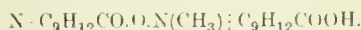
*Isostrychnine.* A. Baeovescu and A. Pietet. Ber., 1905, 38, 2787—2792.

ISOSTRYCHNINE is obtained when strychnine is heated with water in sealed tubes at 160°—180° C.; the strychnine is gradually dissolved and the isostrychnine separates out on cooling in the form of long needles. The same body

is also formed when strychnine acid is heated under similar conditions at a temperature of 205° C. Isostrychnine behaves as a mono-acidic base, and is the inner anhydride of isostrychnine acid, into which it is converted by boiling with an alcoholic solution of sodium ethylate. Isostrychnine crystallises with 3 mols. of water and melts without decomposition at 214.5° C. It is soluble in hot water, but only sparingly soluble in cold; the aqueous solutions have an alkaline reaction. It is readily soluble in alcohol, acetic acid and dilute mineral acids, but insoluble in alkalis. The alcoholic solution of isostrychnine is optically inactive. This body differs from strychnine in some of its colour reactions, and resembles curare rather than strychnine in its physiological effects.—J. F. B.

*Yohimbine; The Methylation of Yohimboic Acid.* L. Spiegel. Ber., 1905, 38, 2825—2833.

By the action of dimethyl sulphate or of methyl iodide and sodium hydroxide upon yohimboic acid (see this J., 1904, 621), a new substance is obtained which melts at 293°—294° C., and which has a composition corresponding to the formula  $\text{C}_{21}\text{H}_{28}\text{N}_2\text{O}_4$ . This body contains no methoxy group, and the methyl group is therefore united to one of the nitrogen atoms. The author regards this body as methyl-yohimboic acid; it possesses only feebly acid properties, and the free acid can be readily crystallised from aqueous solutions of its sodium salt. Cryoscopic determinations of the molecular weights of yohimbine and yohimboic acid in acetic acid solutions indicated the formulae  $\text{C}_{22}\text{H}_{28}\text{N}_2\text{O}_3$  for yohimbine, but only  $\text{C}_{10}\text{H}_{13}\text{NO}_2$  for yohimboic acid. This result was apparently at variance with the analysis of the salts of yohimboic acid, which behaves as a monobasic acid with a  $\text{C}_{20}$  molecule. The author therefore considers that yohimboic acid, under the influence of acids and bases, very readily doubles its molecule, yielding the complex  $\text{N:C}_9\text{H}_{12}\text{CO.OH} \cdot \text{C}_9\text{H}_{12}\text{COOH}$ , and that methyl-yohimboic acid possesses the constitution,



The yohimbine, which was originally obtained from the plant, was probably the methyl ester of this acid, and the body now termed yohimbine, which is anhydro-yohimbine, according to the original nomenclature, is probably produced therefrom by the elimination of the elements of water, derived from the N-methyl group, and one of the adjacent oxygen atoms.—J. F. B.

*Sambunigrin, a New Cyanogenetic Glucoside from the Leaves of the Black Elder.* E. Bourquelot and E. Danjou. Comptes rend., 1905, 141, 598—600.

THE leaves of the black elder (*Sambucus nigra*, L.) were extracted with alcohol, the alcohol distilled off, and the residue taken up with ethyl acetate. The purified sambunigrin crystallises from ethyl acetate and toluene in long, colourless needles, with a sweetish, then bitter, taste. It dissolves in 3.5 parts of water at 20° C., is very soluble in cold alcohol, moderately soluble in wet ethyl acetate, and almost insoluble in dry ether. It has  $[\alpha]_D = -7.6^\circ$ , and melts at 151°—152° C. It does not lose weight at 100° C., and does not reduce Fehling's solution. It is hydrolysed by emulsin to glucose, hydrocyanic acid and benzaldehyde. It yielded 61.28 per cent. of glucose and 8.61 per cent. of hydrocyanic acid. The molecular weight by cryoscopy was 298.8. These figures agree with the formula  $\text{C}_{14}\text{H}_{17}\text{NO}_6$ . Fischer's mandelic nitrile glucoside, with which sambunigrin is isomeric, has  $[\alpha]_D = -26.1^\circ$ .—F. S.

*Gentiopierin.* G. Tanret. Comptes rend., 1905, 141, 207—209.

To isolate the glucoside, first discovered by Kromayer in 1862, a 17 per cent. aqueous solution of the alcoholic extract of fresh gentian root was extracted with 25 to 30 times its weight of ethyl acetate, saturated by distillation, a syrupy deposit was obtained, which, when exposed to the air, formed a crystalline mass. This was dissolved in an equal weight of boiling absolute alcohol, from which, on cooling, crystals of impure gentiopierin were obtained, still containing about 1 per cent. of gentiin, and giving a

colour reaction with ferric chloride. These crystals were, therefore, purified by repeated recrystallisation from ethyl acetate, containing 2 per cent. of water, by which means the more soluble gentiin was eliminated. The yield of pure gentiopicroin, thus obtained was from 7 to 14 per cent., calculated on the dry extract. Gentiopicroin crystallises in two forms: anhydrous,  $C_{10}H_{20}O_9$  and hydrated  $(C_{10}H_{20}O_9 + \frac{1}{2}H_2O)$ . The former, m. pt.  $191^\circ$  C. is obtained from absolute alcohol or from anhydrous ethyl acetate. The latter, m. pt.  $122^\circ$  C. is obtained from water or hydrated ethyl acetate; after brief agitation, it becomes dehydrated and then has the m. pt.  $191^\circ$  C., but it does not lose weight appreciably when exposed over sulphuric acid, and is only completely dehydrated at  $105^\circ$  C. Gentiopicroin is a lactone; its solutions are neutral to litmus, and form gentiopicroinates with alkalis; the gentiopicroic acid liberated from these is gradually converted into gentiopicroin. Gentiopicroin forms a crystalline pentacetyl derivative  $C_{16}H_{15}O_4(C_2H_3O_2)_5$ , m. pt.  $139^\circ$  C.;  $[\alpha]_D = -164^\circ$ . Hydrated gentiopicroin has the  $[\alpha]_D = -198.75$ . Although it has less therapeutic activity than quinine, gentiopicroin is found to possess distinct action as an antiperiodic.—J. O. B.

*Gentiamarin.* G. Tanret. Bull. Soc. Chim., 1905, 32, 1071–1073.

BESIDES crystalline gentiopicroin, fresh gentian root contains notable quantities of another glucoside, *gentiamarin*,  $C_{16}H_{20}O_{10}$  or  $C_{16}H_{22}O_{10}$ . It is obtained from the alcoholic mother liquors after crystallising out gentiopicroin; these are evaporated to a syrup, the residue extracted with ether and chloroform, then dissolved in water and precipitated with a 20 per cent. solution of tannin. The precipitate formed is removed, a large excess of tannin is added to the filtrate, and the glucosidal tannate salted out, in the cold, with magnesium sulphate. The precipitate is collected, pressed, washed with saturated magnesium sulphate solution, and then extracted with 80 per cent. alcohol. The alcoholic solution is treated with excess of hydrated lead oxide, filtered, excess of lead removed with sulphuric acid, and the filtered alcoholic solution distilled *in vacuo*. The residue is gentiamarin. It is amorphous and more unpleasant in taste than gentiopicroin;  $[\alpha]_D$  between  $-80^\circ$  and  $-90^\circ$ , the higher rotation being due to a trace of gentiopicroin. ( $[\alpha]_D = -198.75$ ). When hydrolysed with sulphuric acid it gives an amorphous brown substance which is not gentiagenin, and does not give a blue colour reaction with sulphuric acid. Gentiamarin has no lactone function, and does not combine with alkalis, nor does it afford an acetyl derivative.—J. O. B.

*Gentiin.* G. Tanret. Bull. Soc. Chim. 1905, 33, 1073.

GENTIIN,  $C_{23}H_{25}O_{14}$ , is the glucoside, sparingly soluble in water, which accompanies gentiopicroin in gentian root. It accumulates in the ethyl acetate mother liquors in the preparation of the latter, and is isolated by evaporating these and precipitating the gentiin by the addition of water. It crystallises from 60 per cent. alcohol in pale yellowish, microscopic, anhydrous needles, m. pt.  $274^\circ$  C. It is practically insoluble in water, small amounts being dissolved in the presence of gentiopicroin. It has no lactone function. It gives a blackish-green colour reaction with ferric chloride. Nitric acid dissolves it with the production of a fine green colour, which passes to orange in presence of excess of alkali. When hydrolysed in a sealed tube with dilute sulphuric acid, the reduction products give evidence of the presence of a pentose. Glucose and xylose were found to be present therein, also a yellow body, crystallising in fine needles, m. pt.  $225^\circ$  C. and subliming at about  $195^\circ$  C. This has the formula  $C_4H_8O_5$ , and is, therefore, isomeric with gentisin. It has been named gentienin. Gentiin is remarkable as being the first glucoside known to yield xylose on hydrolysis.

—J. O. B.

*Adrenalin; Physiological Activity of Substances Related to —.* H. D. Dakin. Roy. Soc. Proc., B, 1905, 76, 498–503.

It appears that the catechol nucleus is essential for the

production of physiologically active substances of the type of adrenalin; the hydrogen atoms of both phenolic hydroxyl groups must be unsubstituted. When an alkyl group of low molecular weight is attached to the nitrogen atom, the substance is more active than similar derivatives of piperidine, heptylamine and benzylamine, which, in their turn, are more active than those in which an aromatic radical is attached. The reduction of ketonic bases of the type  $C_6H_4(OH)_2COCH_2R$ . ( $OH:OH:COCH_2R = 1:2:4$ ), where R is a simple aliphatic radical, results in the production of bases of greatly increased physiological activity.—T. F. B.

*Grindelia; Chemical Examination of —.* F. B. Power and F. Tutin. Amer. Pharm. Assoc., Sept., 1905. [Advance Proof.]

THE material examined was *Grindelia robusta* or a closely allied species. The chief constituents are amorphous resins, the amount of these representing 21.6 per cent. of the official drug. These resins were extracted successively with different solvents. The petroleum extract was a greenish, sticky solid. On boiling with potassium hydroxide, ammonia was evolved. Subsequent to this treatment, hentriacontane,  $C_{31}H_{64}$ , and a crystalline substance melting at  $166^\circ$  C., probably an isomeride of phytosterol,  $C_{26}H_{44}O$ , were obtained, in addition to formic and higher fatty acids. The ether extract, after fusion with caustic potash, yielded fatty acids and the molecular compound of protocatechuic and parahydroxybenzoic acids, melting at  $194^\circ$  C. The drug contains a considerable amount of a laevo-rotatory sugar, apparently *l*-glucose, also proteid substances, colouring matter, tannin, and a very small amount of an essential oil. No indication of the presence of saponin or an alkaloid was obtained.—F. S.

*Sweet Orange [Citrus Aurantium]; Essential Oil of the Leaves and Stems of the —.* G. Litterer. Bull. Soc. Chim. 33, 1079–1081.

THE oil distilled from the twigs and leaves of *Citrus aurantium* had the sp. gr. 0.8603; and  $n_D^{20} = +56.46'$ . It contained 4 per cent. of citral, *d*-camphene, limonene and 20 per cent. of total alcohols, partly free and partly as esters. Geraniol was isolated, and *d*-linalol was probably present also.

—J. O. B.

*Lemon Leaves and Twigs [Citrus Limonum]; Essential Oil of —.* G. Litterer. Bull. Soc. Chim., 1905, 33, 1081.

THE oil distilled from lemon leaves and twigs had the sp. gr. 0.8824;  $n_D^{20} = +21.08'$ ;  $n_D^{20} = 1.1725$ . It yielded 24 per cent. of citral; no citronellal; 19.4 per cent. of total alcohols, consisting of geraniol and probably *d*-linalol; the terpenic portion contained camphene and limonene.—J. O. B.

*Ginger; Essential Oil of Cochin and African —.* Haensel's Report, April, 1905, 9–11.

*Cochin Ginger Oil* had the following characters: sp. gr. 0.8826;  $n_D^{20} = -4.30'$ ; saponification value 17; solubility in 80 per cent. alcohol, 1 part by weight in 65 parts to a not quite clear solution. The yield was only 1.5 per cent. *African ginger oil* had the sp. gr. 0.8795;  $n_D^{20} = -4.14'$ ; saponification value 13.5; solubility similar to Cochin ginger oil.—J. O. B.

*Fir Buds, Scotch [Pinus Sylvestris]; Essential Oil of —.* Haensel's Report, April, 1905, 19–21.

By direct distillation Scotch fir buds yield 1.127 per cent. of essential oil; by cohobation and distillation the yield is increased to 1.47 per cent. The two oils, which differ in characters were collected separately.

*Oil from direct distillation.* Sp. gr. 0.8839  $n_D^{20} = -22'$ ; saponification value 19.5; acetyl value 58; solubility in 80 per cent. alcohol, 1:20; colour, yellow.

*Oil from cohobation.* Sp. gr. 0.9388;  $n_D^{20} = -5.44'$ ; saponification value 33; acetyl value 145; solubility in 80 per cent. alcohol, 1:15 not quite clear. Colour, olive green.—J. O. B.



*Phenylacetylene and Menthone; Action of Potassium Hydroxide on a Mixture of —.* E. Rommow. J. russ. phys.-chem. Ges., 1905, 37, 657–659. Chem. Centr., 1905, 2, 1021.

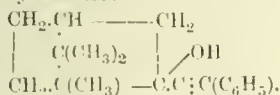
FINELY-POWDERED fused potassium hydroxide (3.6 grms.) is added, in small portions, with frequent agitation, to a mixture of molecular proportions of menthone (10 grms.) and phenylacetylene (6.6 grms.), cooled with ice-water. After allowing to stand for 42 hours at 0° C. and 5–6 days at the ordinary temperature, ether is added, a current of carbon dioxide is passed through the mixture, and the solution filtered. The ether is expelled from the filtrate, and the product is distilled *in vacuo*. A yield, amounting to 59 per cent of the theoretical amount of the alcohol

$\text{CH}_2 < \begin{matrix} \text{CH}_2 \cdot \text{CH}(\text{C}_6\text{H}_5) \\ \text{CH}(\text{C}_6\text{H}_5) \cdot \text{CH}_2 \end{matrix} > \text{C} < \begin{matrix} \text{OH} \\ \text{C}(\text{C}_6\text{H}_5) \end{matrix}$ , is thus obtained.

This compound boils at 196°–198° C., under 14 mm. pressure, and has the sp. gr. 1.0045 at 0°/0° C. and 0.9906 at 20°/20° C. It is a thick yellowish liquid of bitter taste and with an odour resembling that of menthone. It is decomposed into its components, menthone and phenylacetylene, on boiling with a 10 per cent. solution of potassium hydroxide.—A. S.

*Phenylacetylene and Camphor; Action of Potassium Hydroxide on a Mixture of —.* J. Kotkowski. J. russ. phys.-chem. Ges., 1905, 37, 659–661. Chem. Centr., 1905, 2, 1021.

A MIXTURE of molecular proportions of phenylacetylene and camphor, when treated with potassium hydroxide in a manner similar to that described in the preceding abstract, yields a tertiary alcohol:



which is a borneol, in which the hydrogen atom adjacent to the hydroxyl group is replaced by a phenylacetylene residue. The product melts at 33°–34° C., and boils at 205° C., under 14 mm. pressure. On treatment with acetyl chloride, the hydroxyl group is replaced by chlorine; the chloro derivative obtained melts at 71°–72° C., boils at 180°–185° C., under 9 mm. pressure, is easily soluble in ether and ligroin (petroleum spirit) and slightly soluble in alcohol.—A. S.

*Methyl Alcohol in Spirit Preparations; Detection of —.* G. Fendler and C. Mannich. XXIII., page 1128.

*Methyl Alcohol; Detection of — in Liquids containing Ethyl Alcohol.* [Official Test of the New U.S.P.] S. P. Sadler. XXIII., page 1128.

*Hydroxyazo Compounds; Reduction of — to Amino-phenols, by means of Phenylhydrazine.* G. Oddo and E. Puxeddu. IV., page 1103.

#### ENGLISH PATENTS.

*p-Phenetidine; Manufacture of a New Derivative of —.* [Dipropylacet-*p*-phenetidine]. C. D. Abel. London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 4565, March 4, 1905.

DIPROPYLACET-*p*-PHENETIDINE is obtained by boiling parts of dipropylacetic acid with 3 parts of *p*-phenetidine or 15 hours under a reflux condenser. The product is treated with hot water, and the residue dried and recrystallized from benzene. The product thus obtained has a m. pt. of 147° C., and is sparingly soluble in hot water, and easily soluble in alcohol or benzene.—T. F. B.

*Alcohols and Ethers; Manufacture of Aromatic — by the Reduction of Aromatic Esters.* C. Mettler, Munich. Eng. Pat. 14,316, July 11, 1905. Under Int. Conv., July 15, 1904.

SEE Fr. Pat. 348,951 of 1904; this J., 1905, 559.—T. F. B.

#### UNITED STATES PATENTS.

*Terpenes and Resinous Substances [from Wood]; Process of Producing —.* C. P. Craighill and G. A. Kerr, Assignors to N. C. Manson, jun. U.S. Pat. 800,905, Oct. 3, 1905. XIII.B., page 1148.

*Camphor; Process of Making —.* K. Stephan and P. Hunsalz, Assignors to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 801,483, Oct. 10, 1905. SEE Eng. Pat. 8295 of 1905; this J., 1905, 857.—T. F. B.

*Camphor; Process of Making —.* K. Stephan and P. Rehländer, Assignors to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 801,485, Oct. 10, 1905.

SEE Eng. Pat. 9550 of 1905; this J., 1905, 902.—T. F. B.

*Salicylic Acid; Monoglycol Ester of —.* F. Hofmann, Elberfeld, Germany. Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 794,982, July 18, 1905.

SEE Eng. Pat. 4055 of 1905; this J., 1905, 1029.—T. F. B.

#### FRENCH PATENTS.

*p-Phenetidine; Process for Making a Dipropylacetyl Derivative of —.* Act.-Ges. f. Anilinfabr. Fr. Pat. 354,619, March 14, 1905.

SEE Eng. Pat. 4565 of 1905; preceding these.—T. F. B.

*Dialkylbarbituric Acids from Cyanodialkylacetylureas; Process of Producing —.* C. E. Merck. Fr. Pat. 354,452, March 20, 1905. Under Int. Conv., July 18, 1904.

IN Fr. Pat. 350,600 of 1905 (this J., 1905, 750), it is stated that dialkylmalonic amides could be prepared by heating cyanodialkylacetylureas with acids. It is now found that, by heating with more concentrated acid at somewhat higher temperatures, or for a longer time, the malonic amides are converted, with loss of ammonia, into dialkylbarbituric acids.—T. F. B.

*Anhydrides of Organic Acids; Preparation of —.* R. Sommer. Fr. Pat. 354,742, May 29, 1905.

THE anhydrides of organic acids are produced by allowing silicon tetrafluoride to act upon the anhydrous salts of the acids. After distilling off the anhydride, silicon tetrafluoride can be regenerated from the residue by heating with sand and sulphuric acid.—F. S.

#### XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*Gelatin Impregnated with Potassium Bichromate, and Rendered Insoluble by Light; Composition of —, and the Theory of the Process.* A. L. Lumière and A. Seyewitz. Bull. Soc. Chim., 1905, 33, 1032–1040.

THE action of light on bichromated gelatin liberates an amount of alkali, which increases with increasing exposure. Potassium hydroxide is set free in the gelatin, and forms, with the excess of bichromate, a certain amount of normal chromate, but very little chromic chromate is produced. A solution containing at least 0.1 per cent. of potassium bichromate is necessary to render gelatin insoluble. The amount of chromic oxide combining with the gelatin increases, with the concentration of the bichromate, from 0.4 to 10 per cent. of the weight of gelatin; this amount also increases with increasing exposure, but appears always to attain a limit at about 10 per cent., which is about three times the amount combined by treating gelatin with a chromium salt (see this J., 1903, 1358). It is probable that the process takes place in two stages—the first is the combination with the gelatin of about 3.5 per cent. of chromic oxide, which renders the gelatin insoluble; in the second stage, the potassium bichromate is reduced by the gelatin, and further amounts of chromic acid combine with the gelatin (according to the exposure), until sufficient potassium chromate is formed to prevent further reaction.—T. F. B.

*Gelatin Rendered Insoluble by Light in Presence of Chromic Acid and Certain Metallic Bichromates; Composition of —.* A. L. Lumière and A. Seyewetz. *Bull. Soc. Chim.*, 1905, 33, 1040—1042.

THE amounts of chromic oxide contained in gelatin rendered insoluble by light in presence of chromic acid and various metallic chromates, were not widely divergent (except in the case of ferric bichromate, where it was very small), lead bichromate giving the lowest figure, and ammonium bichromate the highest. The alkali metals were not found in the gelatin, but oxides of aluminium, lead, barium, zinc and copper were present in the respective cases, in fairly large amounts, and iron in very large quantity. The amount of chromic chromate present (as indicated by the amount of chromic oxide removed by washing with ammonia) was very small in all cases.

It was further found that chromic acid and ammonium chromate (especially the latter) were more easily reduced by light in presence of gelatin than potassium bichromate, owing to no normal chromate being formed to retard the reaction. Considerably greater amounts of chromic oxide therefore combined with the gelatin (see preceding abstract).—T. F. B.

#### ENGLISH PATENT.

*Photographic Purposes; The Coating or Preparation of Media for —.* J. H. P. Gillard, Kew, and H. H. Molyneux, Hampstead. *Eng. Pat.* 1290, Jan. 23, 1905.

A MUCILAGE of the bassorin class (*i.e.*, a mucilage of bassora, tragacanth, marsh mallow root, linseed, or similar substance), combined with a solution of agar-agar or similar substance, is found to form a suitable agent for emulsifying metallic salts for photographic purposes, it being soft and plastic, though sufficiently insoluble when dry. For example, 30 grains of gum tragacanth and 120 grs. of agar-agar are boiled in 12 oz. of water until dissolved; the sensitising salt is emulsified in any suitable manner.

—T. F. B.

#### FRENCH PATENTS.

*Photography; Process for Preparing Pigmented Albuminous or Colloidal Films for —.* K. Pfanz. *Fr. Pat.* 354,715, May 27, 1905.

SEE *Eng. Pat.* 11,077 of 1905; this J., 1905, 1031.—T. F. B.

*Photographic Prints; Process of Obtaining Pigment—without Transfer.* E. Bühler. *Fr. Pat.* 354,722, May 27, 1905. Under Int. Conv., July 11, 1904.

IN the ordinary pigment process, pigmented bichromated gelatin is used, which necessitates double transfer. In the present process, a mixture of soap and casein is employed; this is mixed with a suitable pigment and sensitised by means of bichromate. It is stated that good results are obtained by simply exposing beneath a negative, a paper coated with such a mixture and developing in water.—T. F. B.

*Photographs; Process for Obtaining — in Relief on Ceramic Objects.* A. and P. Dalpayrat. *Fr. Pat.* 354,694, May 27, 1905. VIII., page 1110.

## XXII.—EXPLOSIVES, MATCHES, Etc.

*Glycerol; Determination of — by the Extraction Method.* Dynamitfabrik Schlegbusch. XXIII., page 1129.

#### ENGLISH PATENT.

*Explosives; Manufacture of Safety —.* N. Ceipek, Vienna. *Eng. Pat.* 28,256, Dec. 23, 1904.

THE invention relates to the manufacture of safety explosives of the ammonium nitrate class by mixing with the other ingredients, picric acid to an amount which falls between the inclusive limits of 7 per cent. and 10 per cent. of the mixtures. Increased safety is said to be thus obtained. (See also this J., 1901, 1240).—G. W. McD.

#### FRENCH PATENT.

*Explosives; Cartridge Wrappers for —.* Soc. Gen. pour la Fabrication de la Dynamite. *Fr. Pat.* 350,099, Aug. 4, 1904.

THE paper used for wrapping mining cartridges is rendered unflammable by impregnating it with ammonium phosphate and boric acid, and the paraffin usually employed between the two sheets of paper is replaced by a non-inflammable material. (See also this J., 1905, 1032.)

—G. W. McD.

## XXIII.—ANALYTICAL CHEMISTRY.

#### APPARATUS, ETC.

#### ENGLISH PATENT.

*Carbonic Acid contained in Combustion Gases; Apparatus for Indicating the Amount of —.* A. Schlatter and L. Deutsch, Budapest, Hungary. *Eng. Pat.* 3089, Feb. 14, 1905.

SEE *Fr. Pat.* 351,442 of 1905; this J., 1905, 904.—T. F. B.

#### INORGANIC—QUALITATIVE.

*Bromine; Detection of — in Presence of Large Excess of Iodine.* H. Cormimboenf. *Ann. Chim. anal. appl.* 1905, 10, 145—146.

*Detection of Bromine in Iodides, Hydriodic Acid, &c.*—Any acid present is neutralised with sodium carbonate and the salts are dissolved in water; the solution must be neutral or very slightly acid. An excess of ferric chloride solution, sp. gr. 1.420 is added, which precipitates the iodine, in a few seconds, in the form of a black powder, which is separated by filtration through glass wool. The traces of iodine remaining in the filtrate are eliminated by boiling until violet vapours cease to be disengaged. The solution is then treated with excess of caustic soda, filtered, and a crystal of potassium chlorate and some chloroform are added to the colourless filtrate; the liquid is made acid with sulphuric acid, and then excess of strong sulphuric acid added. Any bromine present will be liberated, and, on shaking, will impart a more or less intense yellow colour to the chloroform. By this method the presence of 1 mgrm. of bromine may be detected.

*Detection of Bromine in Free Iodine.*—The iodine is combined as ferrous iodide, by treating it with excess of reduced iron in the presence of water. After removing the uncombined iron by filtration, the filtrate is treated as above.—J. O. B.

#### INORGANIC—QUANTITATIVE.

*Lime; Analysis of Raw and Spent —.* H. L. Greville. *J. Gas Lighting*, 1905, 92, 173—174.

A SIMPLE and rapid method for the determination of calcium oxide in lime is based on the solubility of lime in strong solutions of pure cane sugar or glycerol. The results obtained were in close agreement with those obtained by precipitation. 100 grains of the sample were slaked by adding distilled water, a solution of sugar was added, and the mixture was digested for about half an hour. The solution was diluted, and a portion titrated with standard sulphuric acid solution. The following method has been employed for the analysis of spent lime from gas works:—The lime is decomposed with hydrochloric acid, and the evolved gases passed into a cooled solution of ammonia. Excess of barium chloride solution is added to the latter, and the barium carbonate filtered off and weighed; from its weight the amount of calcium carbonate in the lime is calculated. The residue in the flask is used for the determination of the total calcium and the silicious matter. A further portion of the sample is treated with excess of potassium permanganate solution, pure hydrochloric acid is added, and then more per-



manganate if necessary. Oxalic acid is then added and the solution heated. The liquid should contain all the sulphur as sulphate, which is determined by precipitation with barium chloride. For calculating the percentage of free lime in the sample, the ratio 74 : 48 is assumed as approximately correct for the ratio of calcium combined with sulphur acids to sulphur.—T. F. B.

*Oxide [Gas-Purifying Material]; Analysis of Spent* —. H. L. Greville. J. Gas Lighting, 1905, 92, 37.

In the case of spent oxide which has been used for the purification of water-gas, the sulphur cannot be determined accurately by extraction with carbon bisulphide, as this solvent also dissolves heavy hydrocarbons, which are often present in considerable quantities. The following method is recommended by the author:—250 grains of the sample are dried at 100° C., and then washed on a filter with hot distilled water until free from thiocyanates (sulphocyanides) and sulphates. The material, together with the filter-paper, is then digested with a concentrated solution of sodium hydroxide for half an hour, the liquid decanted off, and the residue washed repeatedly with hot distilled water, until the total volume of solution and washings amounts to 500 c.c. The solution is then filtered, and 50 c.c. of the filtrate (=25 grains of sample) are diluted, treated with a slight excess of potassium permanganate, and hydrochloric and oxalic acids added. The solution is now boiled, and the sulphur precipitated as barium sulphate.—A. S.

*Iron Oxide as a [Gas] Purifying Agent, and its Valuation as a Raw Material and in a Spent Condition.* H. L. Greville. *Id.*, page 1101.

*Fluorspar; Quick Method for the Valuation of* —. A. W. Gregory. Chem. News, 1905, 92, 184–185.

The sample is dried at a temperature of 120° C. Two grms. of the sample are then ignited at a red heat until no further loss of carbon dioxide takes place. A second portion of 2 grms. is treated several times in a platinum basin with hydrofluoric acid until a constant weight is obtained. The calcium carbonate present is thus converted into calcium fluoride and any silica is driven off. The difference between the actual weight after the operation and the weight which may be deduced from the loss on ignition, is equal to the amount of silica present. A third portion of 2 grms. of the fluorspar is treated with concentrated sulphuric acid, evaporated to dryness, ignited and weighed. The increase in weight is due to the conversion of calcium carbonate and fluoride into calcium sulphate; there will also be a loss of any silica present. After allowing for the change of weight due to carbonate and silica, the remaining increase corresponds with the conversion of the fluoride into sulphate from which the percentage of calcium fluoride may be calculated.—W. P. S.

*Gold Bullion; Notes on the Assay of* —. T. Kirke Rose. J. Chem. Met. and Min. Soc. of S. Africa, 1905, 6, 36–38.

THIS paper describes briefly the principal changes made in the assay of gold bullion at the London Mint during the past three years.

**Furnace Work.**—The cupels, in batches of seventy-two, six of which are check pieces, are ranged on a plumbago tray, which is lifted in and out of the furnace by means of an iron "peel" or fork with two flat prongs. The tray has a raised edge, and two grooves below for the prongs of the peel to slide in, and can be used from twenty to thirty times. The cupels are arranged on the tray by hand, and cupel tongs have been entirely discarded. The seventy-two assay pieces are charged in simultaneously by means of a nickel charging tray with sliding bottom. Deep cupels are used, the hollows being 0.75 in. in diam. and 0.3 in. deep. The muffle has been so altered that the draught through it has been made independent of the furnace draught, and the first row of assays is 7 in. from the

front of the furnace. Air is admitted only near the top of the mouth of the muffle, and the assays are protected from the direct draught by a fire-brick 2 in. high. The charges with 4 grms. of lead in each assay piece, are worked off in ten or fifteen minutes.

**Parting Alloy.**—For many years 1.375 grms. of silver have been added to 0.5 gm. of gold in making up alloys for parting. This ratio of 2.75 to 1 has now been reduced to 2 to 1 with improved results. Other improvements connected with the balances, weighings, and weights are described, and in the aggregate all these various small modifications have had a considerable effect on the accuracy of the assays. The number of standardised gold pots rejected and remelted at the Mint, on account of incorrect composition, has fallen from 8.55 per cent. in 1904–2 to 2.66 per cent. in 1904–5.—A. N. C.

*Platinum; Determination of* —. Nordenskjöld Oesterr. Zeits. Berg- u. Hüttenw., 1905, 53, 473. Chem.-Zeit., 1905, 29 [Rep.] 293.

PLATINUM is usually determined by precipitation in the metallic form by means of sodium formate, or zinc. The objections to the first method, are that the precipitate readily passes through the filter paper, and that from 12 to 24 hours are required for a determination. As regards the second method, magnesium is a better reducing agent than zinc. The details of these methods as used by the author are as follows:—(1) The solution is treated with 2 grms. of sodium formate and some ammonium acetate, diluted to 200 c.c., warmed until the evolution of carbon dioxide has begun to slacken, and then boiled for 10 to 12 hours. The black precipitate of platinum is collected and washed, a little nitric acid being added to the washing water to prevent the metal passing through the paper. Finally the filter is ignited and weighed. (2) The dilute solution is treated with a large quantity of magnesium ribbon (about 17 cm. to 1 gm. of platinum). The excess of magnesium is removed by treatment with hydrochloric acid, any magnesium oxychloride formed, also going into solution. Concordant results are stated to be given by these two methods. Iridium, ruthenium and rhodium are somewhat soluble in acids when in the precipitated state, and hence are incompletely precipitated from an acid solution. Therefore the precipitation should be made in such a way that there remains only a slight excess of magnesium. On ignition, the precipitated metals are rendered insoluble in acids, whilst the magnesium oxychloride formed, can be dissolved out. If the ignition is not continued too long, no appreciable quantities of gas are absorbed by the metals. In order to determine the platinum in the sum of the precipitated metals, the ignited powder is digested with *aqua regia*, which dissolves only the platinum (and palladium). (See also this J., 1905; 1033.)—C. A. M.

*Electrolytic Analysis; Use of the Rotating Anode and Mercury Cathode in* —. L. G. Kollock and E. F. Smith. J. Amer. Chem. Soc., 1905, 27, 1255–1269.

RESULTS obtained with a rotating anode and with a mercury cathode respectively, have been previously described (this J., 1903, 1150; 1905, 107.) In the present paper the results obtained by the method of using both a rotating anode and a mercury cathode are given. The electrolysis was effected in a tube 3.5 cm. in diameter and 7.5 cm. high, with a platinum wire sealed in at the bottom. The anode was a platinum wire, 7.5 cm. long and 1 mm. in diameter coiled into a flat spiral 1.5 cm. in diameter. It was inserted in a chuck carried by the rotator, which by means of pulleys of different sizes could be rotated at speeds ranging from 100 to 1800 revolutions per minute. The mercury used as cathode was washed with alcohol and ether and dried before weighing; about 40–50 grms. were taken for a determination. In the determination of zinc, the cathode surface was 3.5 sq. cm.; in the other experiments it was about 9 sq. cm. The results obtained are given in a series of curve diagrams and tables, from which the following are selected:—

Metal.	Weight of metal present.	Sulphuric acid present (40 drops = 1 c.c.).	Volume of electrolyte.	Current.	E.M.F.	Speed of anode.	Time.	Weight of metal found.
	Grms.		c.c.	Ampères.	Volts.	Revs. per min.	Mins.	Grms.
Zinc .....	0.4050	0.25 c.c.	10	5	7	640	5	0.4050
Copper .....	0.3945	0.17 c.c.	10	4	6	1080	5	0.3946
Nickel .....	0.4802	0.25 c.c.	7	6	6	1200	7	0.4801
Cobalt .....	0.1762	0.35 c.c.	10	4	8	560	7	0.1762
Chromium .....	0.1180	3 drops	7-15	4-5	8	640	6	0.1175
Iron .....	0.2075	3 drops	5	3-4.5	7-6	920	7	0.2078

—A. S.

*Cadmium; Electrolytic Determination of — with the aid of a Rotating Cathode.* C. P. Flora. Z. anorg. Chem., 1905, 47, 1-22.

THE author has applied the use of the rotating cathode (see this J., 1903, 823; 1904, 952, 1113) to the determination of cadmium by some of the electrolytic methods which have been proposed at different times. It was found that the cadmium in cadmium sulphate could be deposited satisfactorily in this way from solutions containing sulphuric acid, sodium acetate and acetic acid, or potassium cyanide. The results were not quite so good with solutions containing urea, formaldehyde or acetaldehyde, pyrophosphates, phosphates, tartaric acid, or formic acid. In the case of cadmium chloride, the best results were obtained with solutions containing sulphuric acid, potassium cyanide or pyrophosphates. The cadmium in cadmium nitrate could be deposited satisfactorily only from solutions containing potassium cyanide. Cadmium could not be deposited electrolytically from solutions containing 1 per cent. or more of free nitric acid. In the following table the conditions obtaining in some of the experiments in which satisfactory results were obtained are given.—

be decolorised by the addition of a little water and finely powdered sodium thiosulphate. This method depends upon the formation of formaldehyde by oxidation of methyl alcohol and its subsequent reaction with morphine-sulphuric acid.—F. S.

*Methyl Alcohol; Detection of — in Liquids containing Ethyl Alcohol.* [Official Test of the New U.S.P.] S. P. Sadtler. Amer. J. Pharm., 1905, 77, 106-110.

THE following modification of the method of Mulliken and Scudder has been officially adopted in the latest edition of the Pharmacopœia of the United States. If the spirit to be tested be undiluted, 1 c.c. is taken, and enough distilled water added to it to make the volume up to 10 c.c. If it be already diluted, a correspondingly larger volume should be taken, so that when diluted to 10 c.c. the alcoholic strength does not exceed 10 per cent. by volume. This dilute solution is introduced into a test-tube of about 40 c.c. capacity; a copper wire spiral (made by winding 1 m. of clean No. 18 copper wire closely round a glass rod 7 m.m. thick, making a coil about 3 cm. deep, the end of the wire being formed into a handle) is then heated to redness in a soot-free flame,

Salt used.	Weight of cadmium in quantity of salt taken.	Volume of electrolyte	Substances added to the Electrolyte.								Time.	Current strength.	N.D. <sub>100</sub> .	E.M.F.	Weight of cadmium found.
			Sulphuric acid (1:4.)	Sodium acetate.	Sodium hydroxide.	Acetic acid.	Potassium sulphate.	Potassium cyanide.	Sodium pyrophosphate.	Ammonium hydroxide.					
Sulphate	grms. 0.2—0.25	c.c. 45—50	15 drops	grms —	grms —	—	grms —	grms —	c.c. —	mins. 15	ampères 1—4	ampères 3—12	volts. 8—12	grms. —	
„	0.1491	60—65	—	1.5	—	—	0.5	—	—	15	0.9	2.7	8.0	0.1494	
„	0.1491	60—65	—	—	0.2	small excess	0.5	—	—	15	0.8	2.4	8.0	0.1491	
Chloride	0.1491	65—70	—	—	1.0	—	—	0.5	—	30	2.5—4.5	7.5—13.5	8.0	0.1490	
„	0.1059	45	10 drops	—	—	—	—	—	—	15	2—3	6—9	7.8	0.1058	
„	0.1324	65	—	—	1.0	—	—	1.5	—	35	4.0	12.0	7.8	0.1322	
„	0.1324	45	—	—	—	—	—	0.5	1	15	0.5	1.5	7.8	0.1327	
Nitrate	0.1073	60	—	—	0.5	—	—	0.7	—	50	2.5	7.5	7.7	0.1072	

—A. S.

## ORGANIC—QUALITATIVE.

*Methyl Alcohol in Spirit Preparations; Detection of —.* A. Fendler and C. Mannich. Versamm. Ges. deutscher Naturforscher u. Aerzte, Sept., 1905. Chem.-Zeit., 1905, 29, 1047.

THE following method has received official recognition as a means of detecting wood spirit in preparations containing spirits of wine. Ten c.c. of the liquid to be tested are slowly distilled in a 50 c.c. flask fitted with a 75 cm. tube bent twice at right angles, serving as a condenser. When exactly 1 c.c. of distillate has collected, it is mixed with 4 c.c. of 20 per cent. sulphuric acid and 1 gm. of finely powdered potassium permanganate is added, with water-cooling and stirring. The liquid is filtered and gently boiled for half a minute, and, when cold, 1 c.c. is mixed with 5 c.c. of sulphuric acid with careful cooling. To the cooled mixture, 2.5 c.c. of a freshly prepared solution of 0.2 gm. of morphine hydrochloride in 10 c.c. of sulphuric acid are added. If the original preparation contained at least 0.5 per cent. of methyl alcohol, the mixture assumes a strong violet or reddish-violet coloration in about 20 minutes. Spirits of wine and ether can be tested without the distillation. Iodine tinctures must

plunged steadily quite to the bottom of the liquid in the test-tube, held there for a second or two, and then withdrawn. This treatment with the red-hot copper is repeated five or six times, immersing the test-tube in water to keep down the temperature of the liquid. The contents of the test-tube are then filtered into a wider tube and very gently boiled. If the odour of acetaldehyde be perceptible, the boiling is continued until this ceases to be clearly distinguished. The liquid is now cooled, and one drop of a 0.5 per cent. aqueous solution of resorcinol is added. A portion of the liquid is then cautiously floated, so that the liquids do not mix, on the surface of pure sulphuric acid, in another tube. After standing for three minutes, and then slowly rotating, a rose-red ring is developed at the junction of the two liquids if more than 2 per cent. of methyl alcohol were present.—J. O. B.

## ORGANIC—QUANTITATIVE.

*Glycerol; Determination of — in Soap Lyes.* H. Strauss. Chem.-Zeit., 1905, 29, 1099-1100.

THE following method based on the oxidation of the glycerol by means of potassium bichromate and sulphuric



acid has been in use for several years in the State Laboratory at Darmstadt. From 3 to 4 grms. of crude glycerin, or 10 to 15 grms. of concentrated lyes (20 to 30 grms. if the lyes are very weak), are weighed out, either in the unfiltered state after thorough mixing, or after filtration from solid particles, the amount of which is determined and subsequently taken into account in calculating the proportion of glycerol. Chlorides, if present in quantity, are removed by precipitation with silver oxide, but if only traces of chlorine be present, the precipitation can be omitted and the liquid at once treated with a sufficient quantity of lead acetate to precipitate completely soap, carbonates, &c. The filtrate and washings are made up to 100 c.c. and 10 c.c. oxidised with 5 to 6 grms. of finely powdered potassium bichromate, 20 c.c. of water being added, and then, little by little, 20 c.c. of sulphuric acid (1:1). The liquid is gradually raised to the boiling point, and boiling continued for some time. The steam is condensed, and the carbon dioxide is dried and absorbed in weighed potash bulbs. The increase of weight in the potash bulbs multiplied by 0.6976, is said to give the amount of glycerol in the tenth part of the lye weighed out for the determination.—C. A. M.

*Glycerol; Determination of — by the Extraction Method.* Dynamitfabrik Schlebusch. Z. angew. Chem., 1905, 18, 1656—1660.

It is found that with the extraction method of Shukoff and Sehestakoff (this J., 1905, 294) it is in general quite unnecessary in the case of an alkaline liquid to add sulphuric acid in slight excess, and then to filter the solution from any deposit and again render it slightly alkaline with potassium hydroxide. As regards the duration of the extraction, four hours is sometimes insufficient; the time should, therefore, be increased to five or six hours. It is also shown that when the extracted glycerol is dried for four or five hours at 75° to 80° C., the whole of the moisture is not expelled, and that much more reliable results are obtained by drying it for two hours at 90° to 95° C. For instance, parallel determinations of glycerol in glycerin water gave the following results:—Dried at 75° to 80° C., 16.66 per cent.; dried at 90° to 95° C., 15.68 per cent.; Hehner's bichromate method, 15.50 per cent. The results obtained when the glycerol was dried at this higher temperature were invariably slightly higher than those given by the control methods. This is to be attributed to the extraction of substances other than glycerol, which are not dissolved by the treatment with petroleum spirit. The error thus introduced does not, as a rule, exceed 0.1 to 0.2 per cent. in the case of glycerin waters or soap lyes, but is not infrequently as high as 1 per cent. in the case of crude or dynamite glycerins. In the author's opinion the method should be used as an adjunct to the existing methods (bichromate and acetic methods) rather than as a substitute for them. (See this J., 1905, 806.)—C. A. M.

*Tanning Materials; Analysis of —.* B. Weiss. Der Gerber, 1905, 31, 260—261, and 275—278.

THE author has thoroughly tested the method of analysis of tanning materials, which has been recently suggested by H. Wislicenus (this J. 1904, 765) and also criticises Parker-Payne's titration method (this J. 1904, 648). He compares the results with those obtained by working with chromed hide powder and finds Wislicenus' method unsatisfactory. Non-tannins, and especially the coloured non-tannins are absorbed by the porous alumina used as de-tanning agent. The action of various acids upon this material was studied, and curious results were obtained with lactic acid, more N/10 alkali being required for titrating back than corresponded to the added N/10 lactic acid.

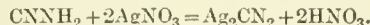
As the Parker-Payne titration method is based upon results obtained with digallic acid only, whereas the tannin materials and extracts which the technical chemist has to deal with, contain mixtures of various unknown tannins in variable proportions, this method was not tested. The author then discusses the candle-filter method (see this J., 1905, 251). It was found that, for example, with an ordinary quebracho liquor, an

entirely clear filtrate could not be obtained in all cases when that filter was used, and, therefore, it seemed preferable to use filter-paper, with which, with some precautions clear filtrates are always attainable.

A full description of the author's method of analysis of tanning materials and extracts, by the use of chromed hide-powder as practised at present at the Vienna Research Institution is given. The powder for this purpose is prepared by digesting 1000 grms. of ordinary hide-powder (free from cellulose) with basic chromium sulphate solution made by neutralising a solution of 150 grms. of chrome alum with 24 grms. of sodium carbonate. The chromed powder is washed repeatedly and freed from wash-water by pressing through cheese-cloth till free from sulphuric acid, when it is dried and reground. 8—10 grms. of dry powder are used for an analysis, and are moistened with 30 c.c. of water and left to soak and swell up for one hour. 120 c.c. of tannin solution are then added, the whole being well shaken and left overnight. Next morning 100 c.c. are filtered off and used for the estimation of non-tannins. A correction for the quantity of added water is made by multiplying the weight of residue by 5/4. 10 grms. of the powder prepared in this way will be found sufficient for decolorising most tanning-liquors, with the exception of some highly coloured mangroves. In such cases solutions of half the prescribed strength are used. This powder is easily prepared and its absorptive properties are more constant than those of various batches of ordinary hide powder. Guided by the results of his elaborate comparative experiments, the author is of the opinion that the chromed hide-powder method is the best, and it is decided to use it at the Vienna Institute.—F. K. K.

*Cyanamide; Determination of —, and Applications of the Method.* R. Perotti. Gaz. chim. Ital. 1905, 35, 228—232.

THE method is based upon the reaction of cyanamide with silver nitrate according to the equation:



A measured quantity of N/100 silver nitrate solution is rendered faintly alkaline with ammonia, and the cyanamide solution is introduced gradually, the solution being warmed and frequently shaken. It is then filtered, the residue washed with faintly ammoniacal water, and the solution titrated with ammonium thiocyanate solution according to Volhard's method. The method can be applied to the determination of calcium cyanamide in the commercial product.—A. S.

*Malt Analysis.* Ehrlich. Allgem. Anzeiger f. Bierbrau.; through Brewers' J., 1905, 41, 623.

THE author investigated the causes of the varying results obtained in malt analyses. He finds that if the mash, after saccharification, be left to rest instead of being stirred, higher yields of extract are obtained. A similar result follows, if the mash be allowed to stand for 10 minutes before filtering, after it has been made up to 450 grms. If the mash be prepared by mixing 50 grms. of grist directly with 200 c.c. of water, a loss of extract frequently ensues owing to starch being left at the bottom of the vessel; better results are obtained by first wetting the grist well with a small quantity of water and then adding the remainder.—A. S.

*Arsenic and Antimony in presence of Organic Matter; Detection and Determination of —.* F. A. Norton and A. E. Koch. J. Amer. Chem. Soc., 1905, 27, 1247—1251.

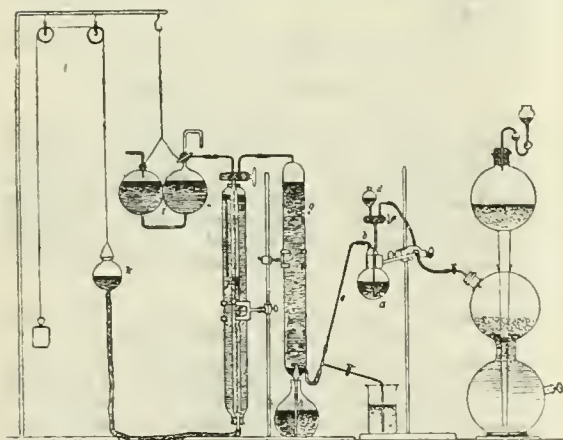
FOR the destruction of organic matter previous to the detection or determination of arsenic and antimony, the authors recommend digestion with concentrated sulphuric acid as in the Kjeldahl process. They have found that compounds of arsenic and of antimony are not volatilised on digestion with sulphuric acid, with the exception of arsenic trichloride, and this is only slightly volatile, if at all, in the presence of much organic matter. After the digestion, the arsenic or antimony can be determined by neutralising, and titrating with iodine solution, or by other known methods.—A. S.

*Cocoa Preparations; Determination of Sugar and Fat in* —. A. Steinmann. Chem.-Zeit. 1905, 29, 1074—1075.

WELMANS' method of determining sugar and fat in cocoa preparations (Z. öfentl. Chem., 1900, 6, 304; this J., 1900, 1151 and 1901, 288) consists in treating the substance simultaneously with known volumes of water saturated with ether and of ether saturated with water. Of the ethereal solution, a definite volume is then evaporated to dryness, the residue weighed, and the result calculated out to the whole quantity of ether, allowing for the increase of volume due to the fat. The sugar in a definite volume of the aqueous solution is determined polarimetrically, and the result similarly calculated out. The specific gravities of fat and sugar are for this purpose taken by Welmans at 1.0 and 1.55 respectively.

The author finds that the changes in composition of the ether-saturated water due to rise of temperature, to solution of the sugar and to loss of ether during filtration, cause very serious errors. These errors are practically all eliminated by substituting petroleum spirit (rectified, and boiling below 60° C.) for the ether; this spirit and water are mutually insoluble, for practical purposes. The author finds the figures 0.95 and 1.60 nearer the specific gravities of cocoa-fat and sugar than Welmans' figures. The increased sugar-concentration due to the lead precipitate in clarifying for the polarimeter is almost exactly balanced by the opposite effect of the other soluble constituents of the-cocoa, so that no correction need be applied for it.—J. T. D.

*Amino-Acids; Determination of Nitrogen in* —. V. Stanek. Z. Zuckerind. in Böhmen, 1905, 30, 9—16.



THE method described is based on the decomposition of nitrosyl chloride by the amino-acids and the measurement of the nitrogen evolved. The nitrosyl chloride is prepared by adding very gradually a 40 per cent. solution of sodium nitrite to five times its volume of concentrated hydrochloric acid. The solution is stable in the cold, and can be diluted with saturated brine without decomposition. The apparatus employed for the determination is illustrated in the accompanying figure. The decomposition flask, *a*, has a capacity of 80 c.c., its stopper carries a gas-evolution tube *b* and a tube which can be connected either with the funnel *d* or with a source of carbon dioxide. The tube, *e*, leading to the absorption apparatus *g*, has a branch with tap leading to a beaker of water in which its end is submerged. Through this branch tube shown in the figure, the air can be expelled from the flask. In the lower part of the absorption cylinder the tube, *h*, dips into a flask containing caustic alkali, whilst the entrance for the gas from the tube, *e*, is trapped by mercury. The absorption cylinder, *g*, is connected by a capillary passage with the adjoining gas burette, *j*, whilst the levelling vessel, *k*, contains water. The vessel, *i*, is a second absorption apparatus containing an alkaline

solution of permanganate. For the determination, 4—5 grms. of common salt are placed in the flask, *a*, with 25 c.c. of the solution, containing 0.05—0.3 grm. of amino-acid. The air is swept out through the branch tap-tube by a stream of carbon dioxide. About 40 c.c. of the nitrosyl chloride solution are then admitted through the funnel, *d*, and the reaction is allowed to continue for 30 minutes. The gas is then expelled from *a* by introducing brine through *d* and is transferred through *g* into the burette. It is then treated in the bulb, *i*, until all the nitrous oxide has been absorbed by the permanganate. Half of the total volume of nitrogen finally measured is derived from the amino-acid. Satisfactory results are recorded for glycol, leucine, tyrosine, glutamic acid, and aspartic acid. Betaine and certain alkaloids have no influence on the results, neither have non-nitrogenous organic substances, but ammonium salts, asparagine, urea, hydrazine, albumin, peptone, and gelatin cause a partial evolution of nitrogen.—J. F. B.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

*Iron Compounds; New Class of* —. O. Hauser. Ber., 1905, 38, 2707—2710.

AMMONIUM carbonate, as is well known, precipitates both ferric and ferrous salts; excess of the reagent, however, dissolves the precipitate in both cases. The ferric precipitate dissolves readily, and the iron can be precipitated from the solution by hydrogen sulphide or by boiling with alkalis, though not by potassium ferrocyanide; on evaporation, ferric hydroxide is gradually deposited. The ferrous precipitate is much less readily dissolved (the precipitate from 10 grms. of ferrous ammonium sulphate requires about 200 grms. of ammonium carbonate in a litre of water); the colourless solution left with a small surface exposed to the air deposits in time practically all its iron as a faintly green precipitate, seen under the microscope to consist of prismatic crystals. It appears to be a basic carbonate containing both ferrous and ferric radicals  $\text{Fe}''_2(\text{NH}_4)(\text{CO}_3)_3\text{Fe}'''0.2\text{H}_2\text{O}$ . Gradual oxidation of this substance yields an olive-green powder, in which the ratio  $\text{Fe}'' : \text{Fe}''' = 1 : 1$ ; when this stage has been reached, further oxidation proceeds much more slowly.—J. T. D.

*Silver Oxide; Autocatalytic Decomposition of* —. G. N. Lewis. Bureau of Govt. Laboratories (Chem. Lab.), Manila, 1905, No. 30, 5—19.

IN an attempt to determine the equilibrium pressure at a given temperature in the system:  $2\text{Ag}_2\text{O} = 4\text{Ag} + \text{O}_2$ , silver oxide was heated at a constant temperature of 335° C. in a stout glass tube connected to a manometer. No sign of decomposition was observed for some hours, but when the reaction once began, it was found to increase in vigour, the rate of increase being greater, the higher the pressure. Quantitative experiments showed that at the beginning the velocity of the reaction is very small, but it increases more and more rapidly to a maximum, and then falls—rapidly at first, later more slowly—until finally the reaction is complete. The decomposition thus appears to be of the character of an explosion, the velocity of which is slow enough to be measured. The acceleration of the rate of decomposition is due to the catalytic action of the metallic silver produced in the reaction; it increases with the quantity of silver present. The curves expressing the reaction-velocity at different temperatures are of the same general character, and if plotted with different units of time, so chosen that each maximum velocity is equal to unity, the curves coincide within the limits of experimental error. The temperature coefficient of the reaction-velocity was determined, and it was found that the velocity increased by about 50 per cent. for a rise of 10° C. In conclusion the author discusses the influence of the purity and the method of preparation of the silver oxide upon its decomposition, and also the nature of the catalytic action.

—A. S.

*Colloidal Salts of the Alkaline-Earths.* C. Neuberg. Versamm. Ges. deutscher Naturforscher u. Aerzte, Sept., 1905. Chem.-Zeit., 1905, 29, 1044—1045.

If dilute sulphuric acid be added to a solution of barium



oxide in methyl alcohol, gelatinous barium sulphate separates out. It retains its gelatinous state after drying over phosphorus pentoxide, and on ignition becomes translucent. If carbon dioxide be passed through methyl alcohol and barium hydroxide, gelatinous barium carbonate,  $\text{BaCO}_3 \cdot \text{H}_2\text{O}$ , is produced. It dissolves in water, but gradually decomposes. It dissolves in methyl alcohol, if carbon dioxide be passed through, forming a true colloidal solution. From an alcoholic solution of potassium hydrosulphide, a gelatinous barium hydroxy-hydrosulphide can be obtained,  $\text{Ba}(\text{SH})(\text{OH})$ . This forms a colloidal solution with methyl alcohol. By the evaporation of the methyl alcohol solution of barium oxide, pearly leaflets of anhydrous barium methylate  $\text{Ba}(\text{OCH}_3)_2$  are produced. This forms an extremely useful saponifying reagent. The toxicity of the colloidal carbonate is only a third of that of other barium salts.—F. S.

*Hydrosols; Formation of — by Ionic Reactions.* A. Lottermoser. Versamm. Ges. deutscher Naturforscher u. Aerzte, Sept., 1905. Chem.-Zeit., 1905, 29, 1042.

ALL amorphous silver salts give rise to hydrosols by ionic reactions, provided certain limits of concentration are not exceeded. One of the reacting ions must be present in excess, and this acts as the "sol" former. If N/10 silver nitrate solution be added slowly to N/10 potassium iodide, the hydrosol of silver iodide is produced, and passes into the jelly-like condition at the end of the reaction. The same phenomena are observed if N/20 potassium iodide be added to N/20 silver nitrate. The bearing of these results on Biltz's theory of the formation of a dielectric layer of hydrosol is discussed.—F. S.

*Fucose Phenylsazone.* W. Mayer and B. Tollens. Ber., 1905, 38, 3021—3022.

WHEN fucose is treated with phenylhydrazine under Fischer's standard conditions for preparing osazones, the product obtained melts at  $155^\circ$ — $158^\circ\text{C}$ . This product is now shown to be a mixture of the osazone and the hydrazone, owing to incomplete conversion. If the conditions of preparation be modified by doubling the proportion of water and prolonging the time of heating from 45 minutes to 75 minutes, the product consists of the pure osazone, which melts at  $177.5^\circ\text{C}$ . after crystallisation from alcohol. Thus it is finally established that fucose yields the same osazone as rhodose and that these two sugars form the true optical antipodes of the same methylpentose.—J. F. B.

## New Books.

**ENGINEERING CHEMISTRY.** A Manual of Quantitative Chemical Analysis for the Use of Students, Chemists, and Engineers. By THOS. B. STILLMAN, Ph.D., Professor of Analytical Chemistry in the Stevens Institute of Technology. Third edition. Chemical Publishing Co., Easton, Pa., U.S. America. 1905. Price \$4.50.

Svo volume, containing 554 pages of subject matter, 25 pages of tables and tabulated matter, and the alphabetical index. There are 139 illustrations. The scheme of the work will be gathered from the classification of the matter, which is as follows:—Determinations of Iron in Iron wire; Alumina in Potash Alum; Copper in Copper Sulphate; Sulphur trioxide in crystallised Magnesium Sulphate; Lead in Galena, &c., &c. Analysis of Limestone. Coal and Coke Analysis. Analytical Methods for a variety of Iron Ores. Analytical scheme for Blast-Furnace Slag. Analysis of Water to determine Scale-forming Ingredients. The Sanitary Analysis of Water. Filtration of Potable Water; also of Boiler Water. Water for Locomotive Use. Feed-water Heaters. Composition of Boiler Scale. Heating Power of Coal and Coke, and its Determination. Calorimetry. Analysis of Chimney Gases with the Elliott, and Orsat-Muencke Apparatus. Gas Analysis. Heating Value of Combustible Gases.

Producer Gas. Oil Gas. Natural Gas. Calorimeters of Hartley, and of Junker. Practical Photometry. Liquid Fuel. Valuation of Coal for the Production of Gas. Determination of Sulphur in Steel and Cast Iron; of Silicon, Carbon, Phosphorus, Aluminium, Nickel and Manganese in Iron and Steel. Carbon Compounds of Iron. Chrome Steel. Classification of Steels. Analysis of Tin Plate; also of Iron Pyrites. Calculation of Blast-Furnace Slag. Chemistry of the Blast Furnace. Charging of Blast Furnaces. Graphic Method of Calculating Blast-Furnace Charges. Blast Furnace as a Power Plant. Chemical and Physical Examination of Portland Cement. Analysis of Clay, Kaolin, Fire Sand, Building Stone, &c. Physical Tests of Building Stones. Saline Efflorescence of Bricks. Asphalt. Chemical and Physical Examination of Paper. Alloys. Determination of Sulphuric Acid and free Sulphur trioxide in Fuming Nordhausen Oil of Vitriol. Sodium Cyanide as a Component of Potassium Cyanide. Soap Analysis. Technical Examination of Petroleum. Examination of Lubricating Oils. Viscosity. Flash and Fire Tests of Oils. Analysis of Lubricating Oils containing Blown Rape-seed and Blown Cotton-seed Oils. Analysis of Cylinder Deposits. Analysis of Pigments and Paints. Pyrometry. Electrical Units. Energy Equivalents.

**FORTSCHRITTE DER FEERFARBENFABRIKATION UND VERWANDTER INDUSTRIEZWEIGE.** An der Hand der systematisch geordneten und mit kritischen Anmerkungen versehenen deutschen Reichs-Patente. Dargestellt von Dr. P. FRIEDLAENDER, Vorstand der chemischen Abteilung des k. technologischen Gewerbemuseums in Wien. Siebenter Teil. 1902—1904. Julius Springer's Verlag, Berlin. 1905. Price M. 40.

QUARTO volume containing 789 pages of subject matter: 27 pages devoted to a classified register of patent numbers in Vols. I.—VII., German, French, British and American, and a further register of German Applications: 4 pages devoted to an alphabetical register of German patents. Finally there is an Alphabetical Index of the subject matter of the patents themselves.

The matter forming the subjects of the patents, the specifications of which are published in this volume, is classified as follows:—I. Intermediate products of the Coal-tar Colour Industry. II. Triphenylmethane Dyestuffs. III. Anthracene Dyestuffs. IV. Indigo. V. Acridine and Quinoline Dyestuffs. Quinone-imide Dyestuffs. VI. Azo Dyestuffs. VII. Sulphur Dyestuffs. VIII. Dyestuffs of Various Composition and Dyeing Qualities. IX. Pharmaceutical Products. X. Odoriferous Substances for Scents, &c.

**DIE ELEKTROCHEMIE DER ORGANISCHEN VERBINDUNGEN.** von Dr. WALTER LÖB. Dritte erweiterte und umgearbeitete Auflage. Wilhelm Knapp's Verlag. Halle a. S. 1905. Price, M. 9.

Svo volume containing 309 pages of subject matter and the alphabetical index. There are 10 illustrations. The matter is classified as follows:—PART I. ELECTROLYTIC PROCESSES. i. Theoretical ii. Methods. iii. Electrolysis of aliphatic compounds. iv. Electrolysis of aromatic compounds. v. Electrolysis by alternating current. vi. Electrical endosmosis. PART II. ELECTROTHERMIC PROCESSES AND THE SILENT ELECTRIC DISCHARGE. i. Theoretical and Methods. ii. Sparking Discharge and Flame Circuit. iii. Utilisation of the Heat of the current in solid Conductors. iv. The Silent Electric Discharge and the action of the Tesla current.

**DIE ELEKTROLYSE GESCHMOLZENER SALZE. ERSTER THEIL.** Verbindungen und Elemente. von RICHARD LORENZ, Ph.D., Professor für Electrochemie und Phys. Chemie, am eidg. Polytechnikum, Zürich. Wilhelm Knapp's Verlag. Halle a. S. 1905. Price, M. 8.

Svo volume, containing 208 pages of subject matter and the indexes of authors and subject matter. The text is illustrated with nine engravings. The subject matter receives the following classification:—I. The Alkali Metals. II. The Metals of the Alkaline Earths. III. Aluminium and the Metals of the Alkaline Earths. IV. Copper and

Silver. V. Zinc, Cadmium and Mercury. VI. Germanium, Tin and Lead. VII. Arsenic, Antimony and Bismuth. VIII. Vanadium, Niobium and Tantalum. IX. Selenium and Tellurium. X. Chromium, Molybdenum, Tungsten and Uranium. XI. Manganese, Iron, Cobalt, Nickel, the Platinum Group and Gold. XII. The Metalloids.

CHEMISCH-TECHNISCHE UNTERSUCHUNGSMETHODEN. Mit Benutzung der früheren von Dr. FRIEDRICH BÖCKMANN bearbeiteten Auflagen. Herausgegeben von Dr. GEORG LUNGE, Professor der tech. Chemie am Eidgenöss. Polytechnikum in Zürich. Dritter Band. 5te. Vollständig umgearbeitete und vermehrte Auflage. Julius Springer's Verlag, Berlin. Price, M. 26. Bound M. 28.

LARGE 8vo. volume, containing 1247 pages of subject matter, with 119 illustrations and 3 tables. There are indexes of authors' names and of subject matter, and an Appendix giving a series of Tables filling 44 pages.

The text is arranged and classified under the following heads, giving besides the subjects, also the names of Prof. Lunge's colleagues who have assisted in the work:— I. Mineral Oils (Prof. Dr. D. Holde). II. Oils, Fats and Waxes. The Candle Industry. Soaps and Glycerin (Dr. J. Lewkowitsch). III. Resins, Balsams and Gum-resins, also IV. Drugs and Galenical Preparations (Dr. K. Dieterich). V. Indiarubber and Vulcanised Rubber, Gutta Percha and Balata (Dr. F. Frank and Dr. E. Marckwald). VI. Ethereal Oils (Dr. E. Gildemeister). VII. Sugar Manufacture. The Raw Materials, Production, &c. (Dr. E. O. von Lippmann). VIII. Starches (Prof. Dr. C. von Eckenbrecher). IX. Spirits (Dr. E. Ebertz). X. Brandy and Liqueurs (Dr. G. Schüle). XI. Vinegar (Dr. G. Schüle). XII. Investigation of Wine (Dr. Karl Windisch). XIII. Beer (Prof. Dr. C. J. Lintner). XIV. Vegetable Tanning Agents (Prof. Dr. C. Cunceler). XV. Leather (Dr. J. Paessler). XVI. Paper (Prof. W. Herzberg). XVII. Ink (O. Schluttig). XVIII. Organic Preparations (Dr. J. Messner). XIX. The Tartaric Acid Industry (Dr. H. Rasch).

XX. The Citric Acid Industry (Dr. H. Rasch). XXI. Organic Dyestuffs (Prof. Dr. R. Gnehm). XXII. Testing Textile Fibres, &c. (Dr. R. Gnehm).

MINES AND QUARRIES: GENERAL REPORT AND STATISTICS FOR 1904. PART III.—OUTPUT. [Cd. 2745.] Price 1s. 6d.

THIS return, which is prepared annually by the Home Office, contains statistics as to the quantity and value of various minerals raised in the United Kingdom. The value, at the mines and quarries, of the mineral output of the United Kingdom in 1904, as shown in the detailed table on page 153, was 97,477,639*l.*, as compared with 101,808,404*l.* in 1903.

IRON AND STEEL, 1904. STATISTICAL TABLES. 296. Price 3d.

THIS memorandum, which has been drawn up in the Commercial, Labour and Statistical Department of the Board of Trade, is in continuation of Parliamentary Paper No. 244 of Session 1904, and deals with the production and consumption during the 14 years 1890-1903 (and where possible to 1904) of iron ore and pig iron, and the production of steel in the United Kingdom, and in the principal foreign producing countries, *viz.*, Russia, Sweden, Germany (including Luxemburg), Belgium, France, Spain, Italy, Austria-Hungary, and the United States of America.

## Trade Report.

### I.—GENERAL.

MINERAL PRODUCTION OF THE UNITED KINGDOM IN 1904; MINES AND QUARRIES, GENERAL REPORT AND STATISTICS, PART III., 1904.

Home Office. [Cd., 2745.]

The following table shows the quantity and value of the minerals produced in the United Kingdom in 1904, as compared with 1903:—

Mineral.	1903.		1904.	
	Quantity.	Value at the Mines and Quarries.	Quantity.	Value at the Mines and Quarries.
	Tons.	£	Tons.	£
Alum shale	3,284	410	6,532	980
Arsenical pyrites	57	57	46	151
Arsenic	902	6,533	976	5,719
Barytes	24,271	22,320	26,327	24,673
Bauxite	6,128	1,516	8,700	2,539
Bog ore	4,090	1,022	4,543	1,136
Chalk	4,469,974	192,527	4,438,728	181,057
Chert and flint	73,181	15,036	65,256	14,697
Clay and shale	16,198,021	1,767,981	15,948,915	1,772,020
Coal	230,334,469	88,227,547	232,428,272	83,851,784
Copper ore	6,428	18,655	5,276	14,172
Copper precipitate	429	3,721	189	3,780
Fluorspar	11,911	8,538	18,160	15,464
Gold ore	28,600	16,995	23,203	68,576
Gravel and sand	2,245,757	171,556	2,239,593	166,189
Gypsum	219,897	69,422	234,005	72,868
Igneous rocks	5,425,538	1,308,054	5,988,821	1,351,139
Iron ore	13,715,645*	3,229,937	13,774,282†	3,125,814
Iron pyrites	9,639	4,816	10,287	5,300
Lead ore	26,587	202,492	26,374	206,238
Limestone (other than chalk)	12,222,971	1,367,733	12,043,135	1,369,610
Manganese ore	818	656	8,756	4,370
Mica	13,197	5,578	7,140	2,996
Natural gas	972,460	194	774,800	155
Ochre, amber, &c.	14,150	17,045	16,050	18,242
Oil shale	2,009,602	477,312	2,333,062	554,346
Phosphate of lime	70	87	58	87
Salt	1,886,992	610,633	1,891,633	596,785
Sandstone	5,409,502	1,795,428	5,306,363	1,717,970
Silver ore	58	1,872	35	1,782
Slate	531,612	1,581,477	563,170	1,678,726
Sulphate of strontia	22,842	22,842	18,169	17,260
Tin ore, dressed	7,382	532,450	6,742	479,633
Uranium ore	6	234	—	—
Wolfram	272	12,864	161	14,369
Zinc ore	24,888	112,864	27,655	137,012
Total values	—	101,808,404	—	97,477,639

\* Exclusive of 193 tons of micaceous iron ore used for paint.

† Exclusive of 322 tons of micaceous iron ore used for paint.



The total value of the minerals raised during the year amounted to 97,477,639*l.*, a decrease of 4,330,765*l.* as compared with 1903. This decrease is to be accounted for by a further fall in the average price of coal from 7*s.* 7*q*3*d.* per ton in 1903 to 7*s.* 2*s.* 5*d.* in 1904.

The total output of coal was the highest hitherto recorded, *viz.*, 232,428,272 tons, but the value was only 83,851,784*l.*, as against 88,227,547*l.* in 1903, when the output was 2,093,803 tons less.

The quantity of coal exported, exclusive of coke and

MINERAL PRODUCTION OF THE UNITED STATES IN 1904.

*Bd. of Trade J., Oct. 26, 1905.*

The following statement, showing the quantity and value of some of the more important of the minerals produced in the United States in 1904, with comparative figures for the preceding year, is taken from a bulletin issued by the Geological Survey :—

		1903.		1904.	
Description of Material.		Quantity.	Value.	Quantity.	Value.
			Dollars.		Dollars.
METALLIC—					
Pig-iron .....	Long tons	(a) 18,009,252	344,350,000	(a) 16,497,033	233,025,000
Silver (b) .....	Troy ozs.	54,300,000	70,206,060	53,603,000	(b) 69,303,319
Gold (c) .....	Troy ozs.	3,560,000	73,591,700	4,090,176	84,551,300
Copper (d) .....	Lbs.	698,044,517	91,506,006	812,537,267	105,629,345
Lead (e) .....	Short tons	282,000	23,520,000	307,000	26,402,000
Zinc .....	"	159,219	16,717,995	186,702	18,670,200
Quicksilver (f) .....	Flasks	35,620	1,544,934	34,570	1,503,795
Aluminium .....	Lbs.	7,500,000	2,284,900	8,600,000	2,477,000
Antimony (g) .....	Short tons	3,128	548,433	3,057	505,524
Other products .....	.....	—	47,980	—	14,000
Total value of metallic products ...		—	624,318,008		542,081,983

(a) Production of iron ore. 1903 : 35,019,308 long tons ; value at mines, 66,328,415 dols. 1904 : 27,643,330 long tons ; value at mines, 43,186,741 dols.  
(b) Coining value, 1-2929 dols. per troy oz. Commercial value, 1903 : 29,322,000. 1904 : 30,982,534 dols.  
(c) Coining value, 20-6718 dols. per troy oz.  
(d) Including copper made from imported pyrites.  
(e) The product from domestic ores only.  
(f) Of 76½ avoirdupois lbs. net ; of 75 avoirdupois lbs. net after June, 1904.  
(g) Includes antimony smelted from imported ores and antimony contained in hard lead.

Description of Material.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
		Dollars.		Dollars.
NON-METALLIC—				
Bituminous coal (h) . . . . . Short tons	282,749,348	351,687,933	279,153,718	305,842,268
Pennsylvania anthracite . . . . . Long tons	66,613,454	152,036,448	65,318,490	138,974,020
Natural gas . . . . .	—	35,815,360	—	38,496,760
Petroleum (i) . . . . . Barrels	100,461,337	94,694,050	117,063,421	101,170,466
Cement (j) . . . . .	29,899,140	31,931,341	31,675,257	26,031,020
Gypsum . . . . . Short tons	1,041,704	3,792,943	940,917	2,784,325
Phosphate rock . . . . . Long tons	1,581,576	5,319,294	1,874,428	6,873,625
Salt (k) . . . . . Barrels	18,968,089	5,286,988	22,030,002	6,021,222
Zinc white . . . . .	62,962	4,801,718	63,363	4,808,482
Other non-metallic products, value . . . . .	—	108,604,034	—	116,175,717
Total value of non-metallic mineral products	—	793,970,109	—	747,178,805
Total value of metallic products . . . . .	—	624,318,008	—	542,081,983
Estimated value of mineral products unspecified . . . . .	—	1,000,000	—	400,000
Grand total . . . . .	—	1,419,288,117	—	1,289,660,788

(h) Including brown coal and lignite and anthracite mined elsewhere than in Pennsylvania. Coke, 1903 : 25,274,281 short tons ; value at ovens, 66,498,664 dols. 1904 : 23,621,520 short tons ; value at ovens, 46,026,183 dols.  
(i) Of 42 galls.  
(j) Of 300 lbs. for natural cement and 400 lbs. for Portland cement.  
(k) Of 280 lbs. net.

patent fuel and of coal shipped for the use of steamers engaged in foreign trade, was 46,255,547 tons, an increase of nearly one and a third million tons on the exports for 1903. Adding the 2,375,588 tons exported in the form of coke and patent fuel, and the 17,190,900 tons shipped for the use of British and foreign steamers engaged in foreign trade, the total quantity of coal which left the country was 35,822,035 tons. The amount of coal remaining for home consumption was 166,606,237 tons, or 3-894 tons per head of the population. 17,535,337 tons were used in the blast furnaces for the manufacture of pig-iron, as against 8,302,240 tons in the previous year.

The output of iron ore shows a further increase of 8,637 tons, but the value is less by 104,123*l.* than in 1903. The ore yielded 4,524,412 tons of iron, or more than one all of the total quantity of pig iron made in the country. 100,756 tons of iron ore were imported during the year, 6 per cent. of which came from Spain.

INDIA ; EXPORT TRADE OF —.

*J. A. Robertson. [Cd. 2750.]*

The following account deals with the exports of certain products from India during the year ended March 31, 1905 :—

The value of manganese ore represents 71·5 per cent. of the total value of all metals and manufactures thereof, other than hardware exported from India, the balance being represented by brass, copper, and iron manufactures. The rapid progress of recent years has been arrested, as the quantity exported 180,945 tons, is very slightly less than in 1903—04, though the value of 24 lakhs is 5 per cent. higher. The exports from Bombay, amounting to 36·8 per cent. of the total, are drawn from the workings in the Central Provinces, and the ore contains a higher percentage of metal than that exported from Madras, which is produced near the coast and thus escapes the heavy transit charge of a long journey by rail. Next to Russia,

India now appears to be the largest producer of manganese, which is exported to America, the United Kingdom, and the Continent for use in steel-making.

The exports of saltpetre which amounted to 348,741 cwt., value 36½ lakhs, were 11 per cent. smaller than in 1903-04, as the abnormally cold winter interfered with its manufacture. The trade is fluctuating and non-progressive, the variation during the last 20 years ranging between 321,033 cwt. in 1893-94 and 528,452 cwt. in 1896-97.

The course of the export trade in indigo in the last 10 years is indicated in the subjoined figures:—

	Quantity.	Value Rs.
	cwt.	
1895-96 .....	187,337	5,35,45,112
1898-99 .....	135,187	2,97,04,781
1900-01 .....	102,491	2,13,59,808
1901-02 .....	89,750	1,85,22,554
1902-03 .....	65,377	1,20,56,819
1903-04 .....	60,410	1,07,62,026
1904-05 .....	49,252	83,46,073

The unremunerative level to which prices have been forced down by the competition of synthetic indigo has reduced the indigo plantations of Bengal to less than half the area they occupied 10 years ago, and over the whole of India the reduction in that period is 66 per cent. Planters in Bengal are strengthening their position by cultivating other crops in addition to indigo, and they can carry on a contest for supremacy with synthetic indigo for many years, but the cultivation of indigo in Madras, where the area fell by 49 per cent. in 1904, appears to be rapidly approaching extinction. The season of 1904 gave a very poor yield, the deficiency compared with the previous year being estimated in the official reports at 31 per cent. in Bengal and 45 per cent. for the whole crop. The slight rise in exports from Calcutta is due to large exports in April, 1904, from the previous year's crop.

Exports to the United Kingdom maintained the level of the previous year, and there was a better demand from the Continent, especially from Russia and France. The largest exports were as usual to Egypt (mainly cheap dry leaf indigo from Madras), but the quantity was 25·1 per cent. less than in 1903-04. Exports to Japan, which for several years had been one of the chief markets for Indian indigo, almost ceased, only 168 cwt., value Rs.27,700 being registered.

Of other dyeing and tanning materials, myrabolams are by far the most important, and the exports were above the average, but of both eutch and turmeric they were very much restricted. The figures of the trade are:—

	1903-04.		1904-05.	
	Cwt.	Rs.	Cwt.	Rs.
Eutch .....	112,938	19,71,896	62,562	0,71,041
Myrabolams .....	1,224,609	42,10,288	1,187,585	42,59,063
Turmeric .....	68,234	4,52,653	44,090	3,04,756

The value of all oils exported, 100½ lakhs, is 2·7 per cent. less than the exceptional trade of the previous year. The decrease was principally in vegetable oils, and owing to short supplies of copra in Madras the exports of coconut oil, valued at 48·8 lakhs in 1903-04, a sum far above all previous records, fell to 29½ lakhs, the level of 1902-03. The exports of castor oil, valued at 16·4 lakhs, fell by 21 per cent., also owing to a poor crop, and the price of all vegetable oil, other than coconut oil, decreased noticeably, the fall in the case of jinjili oil being 26 per cent. Mineral oil from Burma has made remarkable progress, the exports of nearly 4½ million galls., value 20½ lakhs, being four and a half times greater than in 1903-04. Most of it was consigned to China and the Straits Settlements where, as in India, it has to meet the strenuous competition of the amalgamated companies interested in the Eastern oil trade. Exports of paraffin wax, which is classed as an oil, increased in value by 37 per cent. to 11½ lakhs. Another product of petroleum, not included in this class, is candles, in which there is a developing

trade. The quantity exported in 1904-05 was 3,353,000 lb., value 9½ lakhs, the principal markets being China, the Straits Settlements, and Australia.

Though the tanning of hides and skins is an extensive industry throughout India, the export trade is supplied almost entirely by Madras and Bombay, the former in 1904-05 having furnished 91 per cent. of the hides and 73 per cent. of the skins, and Bombay all but an insignificant fraction of the remainder. The exports during the last three years are:—

	Hides.		Skins.	
	Cwt.	Rs.	Cwt.	Rs.
1902-03 .....	107,879	62,84,922	149,299	2,26,96,944
1903-04 .....	102,625	61,45,989	161,869	2,48,42,770
1904-05 .....	123,390	82,52,052	139,214	2,02,65,121

Estimated by weight the export of raw hides was greater by 5·7 per cent. than in 1903-04, and the value increased by 17·1 per cent. Prices have risen steadily during the last four years. Skins on the other hand show a fall in price of 13·1 per cent., which may be partly due to absence of selection, for they were unusually light, and, estimated by weight, the exports were 38·4 per cent. greater than in the previous year and 36 per cent. above the previous record in 1901-02. Altogether 31½ million hides and skins, to the value of 705½ lakhs, was exported. The export figures are:—

	Hides.		Skins.	
	No.	Rs.	No.	Rs.
1902-03 .....	8,210,524	3,01,76,046	18,820,523	2,51,93,622
1903-04 .....	8,261,198	3,16,75,395	19,634,429	2,66,86,740
1904-05 .....	8,722,520	3,70,87,322	22,883,726	3,34,48,263

The demand for hides was good in 1904-05 and prices advanced nearly 14 per cent., the increase in quantity being 20 per cent. and in value 34 per cent. The growing demand for export in the raw state has injuriously affected the trade in tanned skins, of which the exports declined by, 14 per cent. in quantity, and 18½ per cent. in value, the lower price being partly an indication of poor quality. The United Kingdom is the chief market for both tanned skins and hides, taking over 80 per cent. of the former and 90 per cent. of the latter, while most of the raw hides go to the Continent, and of the raw skins to the United States.

Prices of lac have ruled above the high level of the previous year. The exports of stick and seed lac were valued at 9½ lakhs. Of the other two principal varieties, button lac decreased in quantity from 50,500 cwt. to 34,276 cwt., a fall of 32 per cent., while shellac shows an increase from 178,497 cwt. to 193,305 cwt., a rise of 8·3 per cent. The total rise in the average price of these two is 10·3 per cent., the highest price of the year for shellac being Rs.122 per maund in April, 1904, and the lowest Rs.59 per maund in February, 1905. The total quantity is only 258 cwt. smaller, but the value of 298½ lakhs exceeds that of 1903-04 by 11·3 per cent. and of 1902-03, the next highest year, by 65 per cent. Exports to the United Kingdom were valued at 135½ lakhs, to the United States at 107½ lakhs, and to Germany at 25 lakhs.

#### NORWAY; NEW CUSTOMS TARIFF OF —.

The new Norwegian Customs tariff, which came into force on Aug. 8 last, is printed *in extenso* in the Board of Trade Journal for Sept. 28. pp. 590—593, Oct. 5, 21—26; Oct. 12, 71—74; Oct. 19, 113—118; Oct. 26, 165—167.

#### XII.—FATTY OILS, FATS, Etc.

##### NEAT'S FOOT GREASE; U.S. CUSTOMS DECISION. Sept. 23, 1905.

Assessment of duty as an "expressed oil" under paragraph 3 of the tariff was affirmed on neat's foot grease, the crude material from which neat's foot oil is obtained. The claim of the importer that it was free of duty under paragraph 68 as a "grease or oil used only for stuffing leather" was overruled, as other uses for the article were shown by the evidence.—R. W. M.



**XIIIB.—RESINS, VARNISHES, Etc.**ROSIN OIL; U.S. CUSTOMS DECISION. *Sept. 28, 1905.*

Rosin oil is dutiable at 25 per cent. *ad valorem*, as a "distilled oil" under paragraph 3 of the tariff.—R. W. M.

**XIIIC.—INDIA-RUBBER.**BALATA; CRUDE —; U.S. CUSTOMS DECISION. *Sept. 28, 1905.*

The Board of General Appraisers, in overruling a claim for free entry of sheet balata as "india-rubber, crude" under paragraph 579 of the tariff, expressed the view that it was properly dutiable at 10 per cent. *ad valorem* as an "unmanufactured article unenumerated." The board held that india-rubber, gutta percha and balata are distinct articles of commerce. India-rubber and gutta percha are specifically enumerated in the free list, while balata, though equally crude, is not enumerated and hence is subject to duty.—R. W. M.

**XIV.—TANNING, LEATHER, GLUE, Etc.**GALALITH; U.S. CUSTOMS DECISION. *Sept. 22, 1905.*

Articles manufactured from galalith, a substance prepared from casein, were held to be dutiable at 20 per cent. *ad valorem* as "manufactured articles unenumerated," under section 6 of the tariff. The assessment of duty at 30 per cent. *ad valorem*, paragraph 449, by similitude to "manufactures of horn," was overruled.—R. W. M.

**XVI.—SUGAR, STARCH, Etc.**

SUGAR CROP; FRENCH —.

*Times Finan. Supp., Oct. 30, 1905.*

From the recently issued annual report of the French Sugar Manufacturers' Syndicate it appears that France has now 1321 sugar factories in operation, as against 1305 last season. The production of beet will amount to 7,971,300 tons, as against 4,670,000 last year. For all Europe the total crop is 45,269,190 tons, against 31,026,309 tons in 1905, an increase of 45.9 per cent. The French production of raw sugar is 970,200 tons, against 614,800 tons last year (increase of 58 per cent.); and for all Europe 6,181,050 tons (increase of 35.7 per cent.).

TRAGASOL; U.S. CUSTOMS DECISION.

*Sept. 22, 1905.*

Gum tragasol, a natural gum from the locust bean, used to take the place of gum tragacanth and Irish moss for carrying colour and also as a binding agent, was decided not to be free of duty as a "crude drug" under paragraph 548 of the tariff, but subject to a duty of 20 per cent. *ad valorem* under section 6, as a "manufactured article unenumerated."—R. W. M.

STARCH SUGAR [GLUCOSE] AND ITS RELATIONS TO THE FOOD STUFFS INDUSTRIES.

*E. Parrow. Z. Spiritusind., 1905, 28, 396.*

The German starch sugar industry was founded in 1811 at about the same time as the beet sugar industry. The production has increased nearly three times in the last 30 years, and the present annual output is estimated at 12 million cwt. This is only about 1/36th part of the production of beet sugar, so that starch sugar can hardly be regarded as a serious competitor of the latter. For certain purposes starch sugar, especially in the form of starch syrup (liquid glucose), possesses special advantages in the manufacture of confectionery, syrups, preserves and liqueurs, which advantages are not obtainable with beet sugar. Starch sugar is a cheap, wholesome foodstuff of fine quality, and has every right to exist side by side with beet sugar on equal terms. A special plea is made against restrictive legislation and taxation to the detriment of starch sugar.—J. F. B.

**XVII.—BREWING, WINES, SPIRITS, Etc.**

BEER; JAPANESE —.

*H. Keil. Woch. f. Brau., 1905, 22, 555—557.*

The manufacture of saké, the native rice-beer of Japan, is on the decline, and the production of malt and hops beer on the European system is increasing largely. This state of things is favoured by the Excise, the relative duties on saké and malt beers being in the ratio of 12:7. However, saké contains about 13.5 per cent. of alcohol, and in many respects possesses the character of a wine rather than that of a beer. The malt beer is produced in 26 breweries, but the main bulk is manufactured in four large concerns, the chief of which is the Asahi brewery at Osaka. The author has examined samples of Asahi lager beer, labelled "light" and "special light," a pasteurised and unpasteurised sample of each being submitted. The "light" beers were brewed from a wort of 13.4 per cent. strength, and the "special light" from one of 11.9 per cent. They contained 3.9 and 3.5 per cent. of alcohol respectively. The "light" beer was of very good quality and character. The "special light" beer was not quite so good; the flavour of the hop-bitters was rather too strong and dominated that of the beer.—J. F. B.

**XX.—FINE CHEMICALS, Etc.**

QUININE; JAVA —.

*Chem. and Drug., Oct. 28, 1905.*

The Bandoeng Quinine Factory's report for the year 1904 shows that 921,317 kilos. of bark have been worked during the year, containing, according to analysis, a total of 56,210.34 kilos. of cinchona alkaloids, which, after deduction of waste, yielded 54,616.66 kilos. A considerable quantity of sulphate was sold to the Dutch Indian Government at a fair price, and it was the delay in completing this transaction that delayed the report. An agreement had been come to with the Government of the Dutch Indies to deliver from 15,000 to 20,000 kilos. of quinine sulphate this year. In 1904 the Government delivered cinchona containing 27,000 kilos. of quinine, while private planters offered sufficient to keep the factory working during the year. It is hoped that the factory will be in a position this year to produce quite white, flaky quinine, and to find out the cause of the peculiar yellow tint and the defective flakiness of Java quinine. Owing to the extension of the factory, a further issue of capital has been made, to the extent of 300,000 florins (25,000/), the fourth and fifth series having now been called up.

ETHER; SULPHURIO —. U.S. CUSTOMS DECISION.

*Sept. 23, 1905.*

The Board of General Appraisers overruled the assessment of duty at 1 dol per lb. as an "ether, not specially provided for," under paragraph 21 of the tariff, on sulphuric ether which had been purified by distilling over metallic sodium. The claim of the importer that it was dutiable at 40 c per lb. as "sulphuric ether" was sustained, the Board recognising the fact that the article derives its name from the materials used in its manufacture.—R. W. M.

**Patent List.**

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

**I.—PLANT, APPARATUS, AND MACHINERY.**

[A.] 20,941. Constans. Machines for lixiviation processes.\* Oct. 16.

„ 20,961. Kemp. Blast furnaces.\* Oct. 16.

- [A.] 20,973. Walker. Agitation or moving of liquids and apparatus therefor. Oct. 16.
- „ 21,190. Aktiebolaget Separator, and Forsberg. Centrifugal separators for liquids.\* Oct. 18.
- „ 21,639. Adams. Centrifugal concentrators.\* Oct. 24.
- „ 21,775. Stobie. Regenerative gas furnaces. Oct. 26.
- „ 21,830. Horst. Drying apparatus.\* Oct. 26.
- [C.S.] 17,816 (1904). Elmore. Process for separating certain constituents of finely divided material by causing them to rise or float in a liquid. Oct. 25.
- „ 22,878 (1904). Salenius. Method of and means for separating liquids. Oct. 25.
- „ 25,507 (1904). Blundell. Furnaces. Nov. 1.
- „ 27,408 (1904). Hesketh and Brier. Apparatus for removing moisture from air. Nov. 1.
- „ 27,579 (1904). Wertenbruch. Method of concentrating liquids and separating solid matters in such liquid by evaporation of the liquid. Oct. 25.
- „ 3121 (1905). Adams. *See under XVIII B.*
- „ 8256 (1905). Bök. Centrifugal separators. Nov. 1.
- „ 8452 (1905). Soc. Anon. Westinghouse. and Leblanc. Condensing and like apparatus. Nov. 1.

## II.—FUEL, GAS, AND LIGHT.

- [A.] 21,124. Shadbolt and Tully. Gas manufacture. Oct. 18.
- „ 21,135. Klönne. Coke ovens. Oct. 18.
- „ 21,369. Harding. Method of and apparatus for producing a combustible gaseous mixture.\* Oct. 20.
- „ 21,405. Bowmer. Gas producers. Oct. 21.
- „ 21,447. Woodall and Duckham. Vertical retorts for the destructive distillation of coal.\* Oct. 21.
- „ 21,644. Thompson (Engle and Cahill). Artificial fuel. Oct. 24.
- „ 21,715. Williams. Generation of combustible gases. Oct. 25.
- „ 21,732. Mason's Gas Power Co., Ltd., Bentley, Wright and Hollis. Gas producers. Oct. 25.
- „ 21,872. Stokes. *See under XXIII.*
- [C.S.] 23,675 (1904). Blau. Method of treating distillation gases to obtain an illuminating gas in a highly compressed form suitable for transport. Oct. 25.
- „ 27,820 (1904). Creeke. Rotary scrubbers for purifying gases. Oct. 25.
- „ 28,062 (1904). British Thomson-Houston Co. (General Electric Co.). Treating carbon and methods of producing same. Nov. 1.
- „ 241 (1905). Wagner. Apparatus for treating fuel briquettes. Oct. 25.
- „ 4043 (1905). Smith. Suction gas producers. Oct. 25.
- „ 8227 (1905). Heys (Leede Process Co.). Apparatus for making heating or other gases. Oct. 25.
- „ 9885 (1905). Jahns. Production of producer gases. Oct. 25.
- „ 16,018 (1905). Resser. Incandescent bodies and method of making the same. Nov. 1.

## III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [A.] 21,941. Walter. Process for the transformation of organic substances by partial combustion. [Ger. Appl., Oct. 27, 1904.]\* Oct. 27.

- [A.] 21,954. Harrison. Treating inflammable liquids or substances to render them non-inflammable. Oct. 28.

[C.S.] 29,330 (1904). Howorth (Morana Co., A.-G.). *See under XX.*

## IV.—COLOURING MATTERS AND DYESTUFFS

- [A.] 21,361. Flurschein and Flurschein. Manufacture of chloro compounds of *p*-nitraniline. Oct. 20.
- „ 21,746. Johnson (Badische Anilin und Soda Fabrik.). Production of halogenated indigo white.\* Oct. 25.
- „ 22,021. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of a new colouring matter of the triphenyl methane series. Oct. 28.
- [C.S.] 23,193 (1904). Imray (Meister, Lucius und Brüning). *See under V.*
- „ 27,496 (1904). Abel (Act.-Ges. f. Anilinfabr.). *See under XIII A.*
- „ 27,497 (1904). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of *o*-nitro derivatives and *o*-amid derivatives of certain aromatic bases. Nov. 1.
- „ 27,498 (1904). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of *p*-aminophenolsulphonic acid. Oct. 25.
- „ 27,499 (1904). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of indophenols. Nov. 1.
- „ 7002 (1905). Imray (Meister, Lucius und Brüning). Manufacture of a bisulphite compound of a certain dyestuff. Nov. 1.
- „ 7022 (1905). Johnson (Badische Anilin und Soda Fabrik.). Manufacture of compounds of the anthracene series and of colouring matter therefrom. Oct. 25.
- „ 7910 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of 5-nitro-2-amidophenol. Nov. 1.
- „ 7910A (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of azo-dyestuffs derived from 5-nitro-2-amidophenol. Nov. 1.
- „ 9139 (1905). Newton (Bayer und Co.). Manufacture of a new tetrazo dyestuff especially suitable for the preparation of colouring matter lakes. Oct. 25.
- „ 17,242 (1905). Johnson (Badische Anilin und Soda Fabrik.). Manufacture of colouring matter of the anthracene series. Nov. 1.

## V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 21,119. Gillies. Method of and apparatus for bleaching yarns and cloths, applicable also for the decolorisation of coloured yarns and cloths. Oct. 18.
- „ 21,125. Boulton (Bond). Manufacture of waterproof fabrics.\* Oct. 18.
- „ 21,311. Milau. Machines for dyeing or treating with liquids raw cotton, loose wool or silk and like material. Oct. 20.
- „ 21,437. Köther. *See under XI.*
- „ 21,505. Horteloup. Utilisation of furze cellulose and succedanea of furze for manufacturing artificial silk, celluloid, dynamite, &c. [F. Appl., Oct. 24, 1904.]\* Oct. 23.
- „ 21,538. Johnson (Badische Anilin und Soda Fabrik.). Manufacture of formaldehyde sulphoxylate.\* Oct. 23.
- „ 21,702. Young. Treatment of flax and hemp. Oct. 25.
- „ 21,937. Lake (Leontieff). Dyeing vats.\* Oct. 2



- [C.S.] 23,193 (1904). Imray (Meister, Lucius und Brüning). Manufacture of blue and violet to black dyestuffs by oxidation on the fibre. Nov. 1.  
 „ 27,222 (1904). Paterson. Engraving or etching of copper rolls for calico printing. Oct. 25.  
 „ 1283 (1905). Bloxam (Verein. Glanzstoff-Fabr. A.-G.). Manufacture of threads and films of cellulose. Nov. 1.  
 „ 2993 (1905). Mather, Hübner and Pope. Mercerising and apparatus therefor. Oct. 25.  
 „ 4593 (1905). Roberts. Carbonising wool, rags, silk and other fibres. Oct. 25.  
 „ 13,952 (1905). Schmid and Schmid. Process and apparatus for ungumming silk. Nov. 1.

# VII.—COLOURING WOOD, PAPER, LEATHER, Etc.

- [A.] 21,902. Pärre and Kopetz. *See under IX.*

# VIII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 21,280. Ellis (Merck). Manufacture of a new lithium salt. Oct. 19.  
 „ 21,344. Sprengel. Artificial production of diamonds. Oct. 20.  
 „ 21,347. Bloxam (Gebr. Siemens und Co.). Manufacture of forms from silicon carbide.\* Oct. 20.  
 „ 21,538. Johnson. (Badische Anilin und Soda Fabrik). *See under V.*  
 „ 21,949. Digby. *See under XI.*  
 [C.S.] 27,396 (1904). Stead and Palmer. *See under XVII.*

# VIII.—GLASS, POTTERY, AND ENAMELS.

- [C.S.] 2605 (1905). Pilkington's Tile and Pottery Co., Ltd., and Burton. Manufacture of glazed tiles. Nov. 1.

# IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 21,498. Silery. Manufacture of clay products. Oct. 23.  
 „ 21,902. Pärre and Kopetz. Apparatus for impregnating and colouring wood. Oct. 27.  
 [C.S.] 25,884 (1904). De la Roche. Siliceous composition. Nov. 1.  
 „ 27,753 (1904). Gobbe. Rotary kilns for cement making. Oct. 25.

# X.—METALLURGY.

- [A.] 17,844a. Weiss. Method of producing iron briquettes.\* Oct. 18.  
 „ 21,026. Wiswell. Separating metals such as gold and mercury, and means for effecting such separation. Oct. 17.  
 „ 21,060. Bourcoud and Simpson. Manufacture of iron and other metals, and the utilisation of lignite and other fuel therein. Oct. 17.  
 „ 21,160. Leggo. Furnaces for roasting, desulphurising, chloridising, dehydrating or drying ores and other substances.\* Oct. 18.  
 „ 21,206. Thomson. Hardening or treating and carbonising steel, iron, or other metal plates or articles. Oct. 19.  
 „ 21,391. Swinburne. *See under XI.*  
 „ 21,549. Slater. Extraction of gold and silver values from metal bearing matter. Oct. 22.  
 „ 21,634. Peck. Centrifugal ore separators.\* Oct. 24.  
 „ 21,635. Peck. Centrifugal ore separators.\* Oct. 24.  
 „ 21,646. Tyars. Ore concentrating and amalgamating apparatus. Oct. 24.

- [A.] 21,650. Peck. Centrifugal ore separators.\* Oct. 24.  
 „ 21,663. Adams. Centrifugal ore separators.\* Oct. 24.  
 „ 21,721. Atkinson. Treatment of refractory ores containing iron. Oct. 25.  
 „ 21,755. Fawns and Davies. Centrifugal ore and pulp washing and separating machines.\* Oct. 25.  
 „ 21,762. Howard. Roasting or desulphurising furnaces.\* Oct. 26.  
 „ 21,766. Bailey and Lovatt. Case-hardened wrought iron. Oct. 26.  
 „ 21,839. Saunders and The S.O.S. Synd., Ltd. Separation of metals from their ores.\* Oct. 26.  
 „ 21,963. Mackenzie, and Colville and Sons, Ltd. Manufacture of steel. Oct. 28.

- [C.S.] 25,858 (1904). De Bavay. Apparatus for separating by flotation parts of the constituents of ores and other solid bodies from the remainder thereof. Oct. 25.

- „ 25,882 (1904). Jacobsen. Manufacture of bronze. Nov. 1.  
 „ 28,128 (1904). Hirtz. Method of eliminating iron from solutions of nickel and cobalt. Nov. 1.  
 „ 1599 (1905). Goldschmidt. Treating tinned sheet iron to facilitate the removal of the tin. Nov. 1.  
 „ 3032 (1905). Claremont. Annealing copper. Nov. 1.  
 „ 4052 (1905). Deister. Ore concentrators. Nov. 1.  
 „ 17,534 (1905). Jenkins. Plastic composition for binding minerals. Oct. 25.

# XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- [A.] 20,898. Rüber. Electrolytic apparatus. [Appl. in Norway, Oct. 15, 1904.]\* Oct. 16.  
 „ 20,995. Cowper-Coles. Vessels for containing fused salts during electrolysis. Oct. 17.  
 „ 21,391. Swinburne. Electrodeposition of zinc. Oct. 21.  
 „ 21,437. Köther. Electrodes for use in the manufacture of bleaching liquor.\* Oct. 21.  
 „ 21,535. Berglund. Insulation for accumulators with alkaline electrolyte. [Appl. in Sweden, March 15, 1905.]\* Oct. 23.  
 „ 21,548. Quain and Dick. Ozone producer. Oct. 23.  
 „ 21,949. Digby. Manufacture of hypochlorite solution by electrolytic methods. Oct. 28.  
 [C.S.] 25,331 (1904). Hargreaves. Treating the contents of electrolytic cells. Oct. 25.  
 „ 26,849 (1904). Bailey. Apparatus for electrodeposition of metals. Oct. 25.  
 „ 28,129 (1904). Hirtz. Permeable diaphragms for use in electrolytic cells. Nov. 1.  
 „ 29,138 (1904). Day (Empire State Dry Battery Co.). Electric dry batteries. Oct. 25.  
 „ 8631 (1905). Weatherill. Dry battery. Oct. 25.  
 „ 11,862 (1905). Hubbell. Galvanic battery plates. Oct. 25.

# XII.—FATTY OILS, FATS, WAXES, AND SOAP.

- [C.S.] 28,442 (1904). Arledter. Utilisation of waste products in the manufacture of soaps or soap size. Nov. 1.

# XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

## (A.)—PIGMENTS, PAINTS.

- [C.S.] 27,496 (1904). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of colour lakes. Nov. 1.  
 „ 28,259 (1904). Imray (Meister, Lucius und Brüning). Manufacture of yellow and orange pigment colours. Nov. 1.

- [C.S.] 9139 (1905). Newton (Bayer und Co.). *See under* IV.  
 „ 15,398 (1905). Bennett and Mastin. Manufacture of pigments. Nov. 1.

## (C.)—INDIA-RUBBER.

- [C.S.] 19,780 (1904). Owen and Threlfall. *See under* XIV.  
 „ 7129 (1905). Lawrence. Process of cleaning rubber. Oct. 25.  
 „ 14,681 (1905). Alexander. Production of aqueous caoutchouc solution and regeneration of caoutchouc waste. Nov. 1.

## XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

- [A.] 21,154. Lobb. Treatment of leather. Oct. 18.  
 „ 21,267. Soc. Civile d'Etudes de l'Indéchirable Grimson. Manufacture of a material suitable for driving belts, &c. [Fr. Appl., July 13, 1905.]\* Oct. 19.  
 „ 21,443. Schowalter. Preparation for the preservation and waterproofing of leather.\* Oct. 21.  
 [C.S.] 19,779 (1904). Owen and Threlfall. Manufacture of leather. Oct. 25.  
 „ 19,780 (1904). Owen and Threlfall. Manufacture of leather for use as a substitute for rubber, &c. Oct. 25.  
 „ 26,337 (1904). Fawcus and Marr. Process and apparatus for treating animals' skins, hair, &c. Oct. 25.  
 „ 29,002 (1904). Staynes. Manufacture of leather. Nov. 1.

## XV.—MANURES, ETC.

- [A.] 18,990A. Gooding. *See under* XVIII A.

## XVI.—SUGAR, STARCH, GUM, ETC.

- [A.] 21,072. Dorant. Process for refining sugar.\* Oct. 17.

## XVII.—BREWING, WINES, SPIRITS, ETC.

- [A.] 21,376. Hunt. Treating or maturing spirits such as whiskey or brandy. Oct. 20.  
 „ 21,754. Schrottky. Manufacture of fermented material.\* Oct. 25.  
 „ 21,928. Imray (Rach). Brewing apparatus.\* Oct. 27.

- [C.S.] 22,704 (1904). Hornoff. Malt kilns. Oct. 25.  
 „ 27,396 (1904). Stead and Palmer. Means and apparatus for collecting carbonic acid gas from fermentation backs or the like and sterilising same. Oct. 25.

## XVIII.—FOODS; SANITATION, WATER PURIFICATION; &amp; DISINFECTANTS.

## (A.)—FOODS.

- [A.] 18,990A. Gooding. Treatment of kila dirt and the like, and production of a cattle food and a manurial product.\* Oct. 24.  
 „ 21,946. Reis. Preparation of an alimentary substance.\* Oct. 27.  
 [C.S.] 11,131 (1905). Bonnicart (Evangelidi). Process of preserving eatables. Oct. 25.

## (B.)—SANITATION; WATER PURIFICATION.

- [A.] 21,330. Smith and Smith. Boiler compositions. Oct. 20.  
 [C.S.] 3121 (1905). Adams. Filtering apparatus for sewage and other liquids. Oct. 25.

- [C.S.] 17,383 (1905). Vogelsang. Purification or filtering of sewage. Oct. 25.

## (C.)—DISINFECTANTS.

- [C.S.] 1530 (1905). Cooke. *See under* XX.

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- [A.] 21,051. Mallandain. Manufacture of paper. Oct. 17.  
 „ 21,372. West and Co., Ltd., and Webster. Means and apparatus for cleansing and sterilising pulp, &c. Oct. 20.  
 „ 21,505. Horteloup. *See under* V.  
 [C.S.] 29,050 (1904). Sanguinetti. Oscillating cylindrical pulp strainers. Oct. 25.  
 „ 2774 (1905). Couper. Paper making apparatus. Nov. 1.  
 „ 3799 (1905). Imray (Franz). Manufacture of marbled paper. Nov. 1.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 21,172. Jansen (Hendrikszoon). Manufacture of a solution of oxyhaemoglobin.\* Oct. 18.  
 „ 21,175. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of amidooxysulphonic acids of phenyl-naphthimidazole or homologues or derivatives thereof. Oct. 18.  
 „ 21,280. Ellis (Merck). *See under* VII.  
 „ 21,751. Ellis (Chem. Fabr. von Heyden, A.-G.). Manufacture of double salts of antimony lactate.\* Oct. 25.  
 „ 21,757. Zimmermann (Chem. Fabr. auf. Actien, vorm. E. Schering). Manufacture of organic magnesium compounds and of products therefrom. Oct. 25.  
 [C.S.] 28,149 (1904). Newton (Bayer und Co.). Manufacture of pyrimidine derivatives. Nov. 1.  
 „ 29,330 (1904). Howorth (Morana Co., A.-G.). Process for the production of sulphuretted hydrocarbons. Nov. 1.  
 „ 1530 (1905). Cooke. Mercury compounds to be used for medical disinfecting and antiseptic purposes. Nov. 1.  
 „ 14,161 (1905). Traube. Process for producing dialkylmalonylurea. Oct. 25.

## XXI.—EXPLOSIVES, MATCHES, ETC.

- [A.] 21,505. Horteloup. *See under* V.  
 „ 21,529. Abelli. Manufacture of explosives and materials for use therein. Oct. 23.  
 „ 21,779. Cocking, and Kynoch, Ltd. Smokeless powders. Oct. 26.  
 [C.S.] 27,459 (1904). Lheure. Explosives. Oct. 25.  
 „ 27,460 (1904). Lheure. Explosives and the priming of the same. Oct. 25.  
 „ 2875 (1905). Thompson (Saginaw Match Co.). Lucifer matches. Nov. 1.  
 „ 4968 (1905). Gonsalves. Manufacture of explosives. Oct. 25.  
 „ 6045 (1905). Girard. Explosives. Oct. 25.  
 „ 17,741 (1905). Schneider. Explosive coherer-powder. Nov. 1.

## XXIII.—GENERAL ANALYTICAL CHEMISTRY.

- [A.] 21,518. Roth. Instruments for testing benzene or petroleum spirit and other liquid hydrocarbon mixtures. [Ger. Appl., Nov. 24, 1904.]\* Oct. 23.  
 „ 21,872. Stokes. Gas calorimeter. Oct. 27.



# JOURNAL OF THE Society of Chemical Industry.

A RECORD

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Foreign and Colonial members are reminded that the subscription of 25s. for 1906, payable on January 1st next, should be sent in good time to the Hon. Treasurer (Mr. Samuel Hall) in order to ensure continuity in the receipt of the Society's Journal. Any changes of address for the new List of Members now in course of preparation should reach the General Secretary not later than January 31st, 1906.

### DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1881-1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10s. A second volume, embracing the period 1896-1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10s. each copy. A form of application for this purpose will shortly be issued.

## List of Members Elected.

November 23rd, 1905.

Adams, William W., Norwood, Mass., U.S.A., Leather Works Manager.  
 Aleon, Armen P., 372/4 Atlantic Avenue, Boston, Mass., U.S.A., Dyestuff and Chemical Merchant.  
 Barnes, F. V., 4, Annesley Grove, Nottingham, Gas Works Chemist.  
 Biggar, E. B., 471, West Marion Street, Parkdale, Toronto, Canada, Editor.  
 Bixby, Willard G., 194, Hester Street, New York City, U.S.A., Blacking Manufacturer.  
 Brown, Hugh B., c/o James Robertson & Sons, Ltd., Thrusgrove Works, Paisley, Chemist.  
 Cox, Harold N., 730, Jefferson Avenue, Brooklyn, N.Y., U.S.A., Chemist.  
 Evans, Jacob V. R., Ridgway, Pa., U.S.A., Chemist.  
 Felton, H. L., 126, State Street, Boston, Mass., U.S.A.  
 Foregger, Dr. R. von, c/o Roessler & Hasslacher Chem. Co., 100, William Street, New York City, U.S.A., Chemist.  
 Gall, J. B., Knopland, Frith Road, Belvedere, Kent, Chemist, Callender's Cable and Construction Co., Ltd.  
 Glover, Nathan H., 355, River Street, Mattapan, Boston, Mass., U.S.A., Gum Manufacturer.  
 Gray, W. B., Messrs. Lever Bros., Balmain, Sydney, N.S.W., Analytical Chemist.

Keller, Robt. J., c/o Geigy Aniline & Extract Co., 69, Barclay Street, New York City, U.S.A., Dyestuff and Chemical Merchant.  
 Keith, Simeon C., jun., 20, Highland Avenue, Somerville, Mass., U.S.A., Chemist and Bacteriologist.  
 King, Frank E., 75, Gracechurch Street, London, E.C., Analytical Chemist.  
 La Pierre, Elie H., 588, Huron Avenue, Cambridge, Mass., U.S.A., Pharmacist.  
 Lingley, Fredk. W., 9, Mercer Street, New York City, U.S.A., Purchasing Agent (Hard Rubber).  
 Lips, Dr. Carl H., 99, Hart Street, Brooklyn, N.Y., U.S.A., Chemist.  
 McCallum, A. L., c/o Dominion Iron and Steel Co., Sydney, N.S., Canada, Technical Chemist.  
 McSheehy, Edward B., 64, Federal Street, Boston, Mass., U.S.A., Agent (Hemolin Co.).  
 Marx, Dr. Emil, Tar Works, Beckton, E., Research Chemist.  
 Mills, Wm. Henry, 45, Wall Street, New York City, U.S.A., Merchant.  
 Neighorn, Albert, c/o Canada Chemical Manufacturing Co., Toronto, Canada, Agent.  
 Ohliger, Willard, c/o F. Stearns & Co., Detroit, Mich., U.S.A., Chemist.  
 Reed, Herbert W., 153, Milk Street, Boston, Mass., U.S.A., Dye Salesman.  
 Richard, Francis C., Range Quarters, Mount Morgan, Queensland, Assayer, Mount Morgan G. M. Co.  
 Riley, Louis J., 8, Newton Road, London, W., Chemist.  
 Sammet, G. Victor, 73, Sheridan Street, Jamaica Plain, Mass., U.S.A., Chemist.  
 Seaver, Joshua, 212, Milk Street, Boston, Mass., U.S.A., Dealer in Dyestuffs and Chemicals.  
 Sheffstall, Arthur S., Woodbury, N.J., U.S.A., Chemist.  
 Simons, Albert J., Elmhurst, New Barnet, Engineer.  
 Sjöström, Waldemar L., 37, Farnham Street, Lawrence, Mass., U.S.A., Dyeworks Superintendent.  
 Stalmann, Otto, 317, McCormick Building, Salt Lake City, Utah, U.S.A., Metallurgical Engineer.  
 Strunz, Dr. C. E., 1437, Champa Street, Denver, Colo., U.S.A., Chemist.  
 Swenarton, W. Hastings, Broadway Chambers, 277, Broadway, New York City, U.S.A., Patent Lawyer.  
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 Wangemann, H. P., 76-78, York Street, Westminster, S.W., Engineer and Patent Agent.  
 Whetton, John, 23, Church Street, Toronto, Canada, Manager of Canadian Branch of Read Holliday and Sons, Ltd.

## Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

Carhart, Dr. C., 1/o Nicaragua; 7 East and 7 South, Salt Lake City, Utah, U.S.A.  
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- Cotton, W. H., 1/o St. Petersburg; 16 Hauptstrasse, Höchst a/Main, Germany.
- Culmann, Dr. J., 1/o Buffalo; c/o G. Siegle und Co., Stuttgart, Germany.
- Davidson, Thos. A., 1/o Glasgow; c/o Naylor Bros., Varnish Works, Sontball, Middlesex.
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- Gurney, J. C., 1/o La Union; Fundicion de Plomo de D. Miguel Zapata, Portman, Prov. de Murcia, Spain.
- Hanson, A. M., 1/o Abbey Printworks; The Marjorie, Whalley, near Blackburn.
- Harrington, E. M., 1/o New York; c/o W. B. Lewis, 109 Broad Street, Woodbury, N.J., U.S.A.
- Heymann, Dr. Fritz; Journals (temp.) to 53. Dorotheenstrasse, Berlin, N.W.
- Mayer, And., jun., 1/o St. Mark's Avenue; 129, York Street, Brooklyn, N.Y., U.S.A.
- O'Brien, Fredk., 1/o Bedminster; 87, Dongola Road, Horfield, Bristol.
- Palmer, Fred G., 1/o Melling; Athelstan Road, Faversham, Kent.
- Pearson, Frank P., 1/o Pawtucket; 8, Richmond Street, Haverhill, Mass., U.S.A.
- Riederer, Dr. Herman S.; all communications to 251, West 95th Street, New York City, U.S.A.
- Riley, Walter A., 1/o Newmarket Road; Hazeldene, College Road, Norwich.
- Skinner, H. J.; communications to c/o A. D. Little, 93, Broad Street, Boston, Mass., U.S.A.
- Swanson, Jas. F., 1/o Govan; c/o Gildermeister and Co., Iquique, Chili.
- Toyne, Francis D., 1/o Nottingham; c/o Kelsall and Kemp, Ltd., Woodhouse Mills, Norden, near Rochdale.
- Watkins, Willard H., 1/o Boston; c/o Schoellkopf, Hartford and Hanna Co., P. O. Drawer 57, Buffalo, N.Y., U.S.A.

## Birmingham Section.

Meeting held at Birmingham on Thursday, October 26th, 1905.

PROF. P. FRANKLAND, F.R.S., IN THE CHAIR.

### THE PHYSICAL AND CHEMICAL PROPERTIES OF SLAGS.

BY THOMAS TURNER, M.Sc., A.R.S.M., F.I.C.

(Professor of Metallurgy in the University of Birmingham).

When thinking of a suitable subject for the present occasion, that of the physical and chemical properties of slags suggested itself as being on the borderland of chemistry and metallurgy; as embracing products which are met with in exceptional quantities, and of which much yet remains to be understood. Few materials are produced in larger quantities than slags. According to Mr. J. M. Swank the world's production of pig iron in 1904 was 46-368 millions of tons, of which the United States supplied 38.9 per cent., Germany 21.75 per cent., and Great Britain 19.3 per cent. The slag produced per ton of pig iron varies from about 12 cwt., with charcoal furnaces and rich ores, to upwards of 30 cwt., with coke and poorer materials. Assuming the average to be 25 cwt. per ton of pig iron made, which cannot be

very far wrong, it will be seen that the iron blast furnace alone is at present responsible for the output of nearly 60,000,000 tons of slag per annum. To this must be added the slags obtained in the production of wrought iron and steel: the smelting of lead, copper, nickel, and other metals, and the products of various refining and purifying processes. The total weight of slag which is produced every year must, therefore, approach, if it does not exceed, 100,000,000 tons. Materials of such importance have, naturally, received considerable attention from scientific workers, particularly in recent years, but there are certain simple but fundamental principles which do not appear to have received the general recognition they deserve.

The usual definition of a slag is "a fusible combination of gangue and flux" which really only tells us how a slag is usually made, but does not attempt to explain what a slag is. Or, perhaps, slags may be defined as "fusible silicates obtained by the action of the flux on the impurities of the ore," though slags obtained from the basic steel process, or from the purification of gold or silver, are not silicates, and in such cases there is no ore to yield impurities. Lastly, slags are sometimes pithily defined as "smelter's refuse," but, fortunately, the profitable applications of slag in various directions in recent years renders such a definition less and less satisfactory. At present I do not remember to have read a definition of slag which is at once accurate and complete. The true constitution of slags has, however, been very clearly explained by Ledebur and by Hilgenstock (see H. F. V. Jüptner, "Siderology," pp. 289, 312), and to these views further reference will afterwards be made.

**Classification of Slags.**—Viewed from the standpoint of chemical composition, slags may be conveniently divided into two classes according as to whether silicic acid is, or is not, an essential constituent.

1. *Silicate Slags* are the most important commercially, and have received most attention. They include blast furnace slags from the production of iron, copper, and lead; tap cinder, acid Siemens' slag, and similar materials.

2. *Non-Silicate Slags* may be divided into two classes:

- Those containing an acid other than silicic—such as borates, fluorides, phosphates, chlorides, sulphates, and sometimes also titanates, vanadates, &c.
- Those consisting essentially of one or more basic oxides, such as litharge or best tap; and the mixed oxides of calcium, iron, aluminium, &c.

The present paper will deal almost exclusively with the silicate slags, as more information is available in connection with this branch of the subject, and there is great difficulty in dealing, in reasonable time, with the very varied materials included in the second group. Doubtless many of the facts and principles which apply to the former are, with suitable modifications, applicable to the latter.

The usual method of classifying silicate slags is that given in the following table:—

Oxygen Ratio. O in acid. O in base.	Older Chemical Name.	Metallurgical nomenclature.	Molecular Formula.	
			Monoxide bases.	Sesquioxide bases.
1 : 1½	½ silicate	sub-silicate	R'' <sub>2</sub> SiO <sub>5</sub>	R''' <sub>2</sub> SiO <sub>3</sub>
1 : 1	½ "	singulo- "	R'' <sub>2</sub> SiO <sub>4</sub>	R''' <sub>2</sub> SiO <sub>2</sub>
1½ : 1	¾ "	sesqui- "	R'' <sub>3</sub> Si <sub>2</sub> O <sub>10</sub>	R''' <sub>3</sub> Si <sub>2</sub> O <sub>8</sub>
2 : 1	mono- "	bi- "	R''SiO <sub>3</sub>	R'''SiO <sub>2</sub>
3 : 1	1½ "	tri- "	R'' <sub>3</sub> Si <sub>2</sub> O <sub>3</sub>	R''' <sub>3</sub> Si <sub>2</sub> O <sub>24</sub>

**Physical Properties.**—The more obvious physical properties of slags, such as colour, hardness, density, porosity, &c., show marked variations even in slag run from similar ores in the same furnace. The slag from iron smelting may, for example, be white, cream-coloured, olive-green, green, bright blue, brown, or black, each variation in colour corresponding to different working conditions. In fact, there is no more ready and simple method of diagnosing the internal working of a blast furnace than by observing the colour, texture, and appearance of the slag. But for our present purpose the physical properties of slags may be viewed from two aspects, namely (a), when



the slag is at or above its melting point, and (b) when it has solidified. At or above the melting point we have to deal with temperature of formation, fusibility, and fluidity, while at low temperatures, hardness, strength, and the power of resisting disintegration from either internal or external influence are of the first importance if slag has to be utilised for ordinary purposes, such as road metal, railway ballast, the building of walls or embankments, the formation of filter beds, the production of slag wool, or the manufacture of cast-blocks. These applications of slag are, fortunately, now of great commercial importance, but are only indirectly interesting to the metallurgist, who prefers, when possible, to concentrate his energies on his own more legitimate work. It may be stated, however, that experience shows that the slags which are most suitable for the purposes above mentioned, are such as contain in round figures 40 per cent. of silica, 40 per cent. of lime, and 20 per cent. of alumina. Those which contain under about 33 per cent. of silica, or more than about 45 per cent. of lime (or lime and magnesia), or less than 14 per cent. of alumina, are generally weak and apt to disintegrate either on exposure to the air, or if used for filter-beds. The presence of magnesia in moderate quantity is favourable to the resisting power of a slag. On the other hand, slags which are too silicious are apt to become glassy and crack, or even fly to pieces on cooling.

In the iron blast furnace it will be found that under ordinary conditions, when using coke for fuel, there is a close connection between the percentage of silica and the grade or number of the iron. Considerable variations may occur in the proportions of lime, magnesia, or alumina, without very materially affecting the product so long as the proportion of silica is correct. The temperature of working, and the proportion of sulphur in the charge, are, however, of considerable importance. Hence charcoal furnaces may make a very satisfactory product with upwards of 45 per cent. of silica in the slag, while I do not remember to have met with a case in ordinary working with coke furnaces in which a grey iron was produced when the silica in the slag exceeded 40 per cent. The range in the proportion of silica is usually a small one, varying only from about 33 to 38 per cent., though exceptionally, as in the production of basic iron, or where a very open pig is required from sulphurous materials, less than 30 per cent. of silica may be in the slag. Such a slag is, however, useless for any purpose where it is required to resist atmospheric action.

Slags from copper smelting show considerable variations in the proportion of silica. In South Wales about 30 per cent. is satisfactorily used; below this proportion the slag is too basic and usually not clean. In Montana 40 to 50 per cent. of silica is common for the clean slag from the ore furnace, and analyses of slags from the Mansfield district show 48 to 50 per cent. of silica. In the past very satisfactory results have sometimes been obtained by casting copper slags in blocks for walls, channelling, and similar purposes. Examples of this will be found in the neighbourhood of Cheadle, in North Staffordshire, and I remember that the late Mr. A. S. Bolton, of Oakmoor, was unable to tell me how long these blocks had been cast; so it is not at all unlikely that they have stood for considerably more than half a century. Cast slag blocks, probably of similar origin, have stood for many years, to my knowledge, in a wall close to the New University Buildings at Bonnbrook.

*Crystallisation of Slags.*—It is well known that crystals of considerable size, of very definite shape, and of great beauty are sometimes met with in slags. Examples of such slags from various processes, conducted in this country, and in other parts of the world, are upon the table, and will repay careful study. Many mineralogists have contributed to the study of this branch of the subject, and slags are not unfrequently classified according to the mineralogical character of their crystals. C. Rammelsberg (*J. Iron and Steel Inst.*, 1887, Vol. 1, p. 404) divided slags into three groups which belong to the Olivine, the Augite, or the Scapolite series respectively. Probably no other writer has contributed so much to the literature of this subject as J. H. L. Vogt, whose papers have been summarised in the *Journal of the Iron and Steel Institute*

(1885, p. 694; 1886, p. 317; 1887, I., p. 405; 1889, II., p. 412; 1891, I., p. 368), and discussed in detail by Jüptner (*"Siderology,"* pp. 136, 297, &c.). I do not, however, propose to enter, with any detail, into this branch of the subject, as its practical value to the metallurgist is very problematical. When the crystals have formed, and the mass solidified, the slag has done its work, and the metallurgist ceases to be interested in it, except in so far as its structure may indicate its probable composition when molten. It would be unsafe to assume that because certain crystalline aggregations form on cooling that, therefore, of necessity the same constituents exist combined in the same manner in the liquid mass. The size and character of the crystals depend both upon composition and rate of cooling. Slags relatively rich in oxide of iron, and also those containing from about  $\frac{1}{2}$  to  $\frac{1}{3}$  of their weight of silica show the greatest tendency to crystallise. Those rich in lime and alumina, like ordinary blast-furnace slag, show very little tendency to the formation of definite crystals, but are usually micro-crystalline or stony. But slags with upwards of 40 per cent. of lime sometimes give masses of crystals of a subsilicate, in the shape of very long prisms or needles, which, on exposure to the atmosphere, quickly disintegrate, and in a few hours crumble to powder. Slags which are quickly cooled in air are generally glassy, and it is not unusual with copper slags from the ore furnace to see a glassy exterior, a crystallised centre, and a micro-crystalline intermediate portion. In such a case, therefore, we have side by side a supersaturated solution, minute crystals, and definite crystallisation, depending upon the rate of cooling. Though the crystallisation of slags thus affords much interesting information, I am not aware that it is at present practically applied in our smelting works. A blast-furnace manager, for example, does not aim at the production of a slag which will crystallise in the Melilitic-Scapolite group, but one which contains a definite proportion of silica, and perhaps also of lime, alumina, and magnesia, and which will melt freely in his furnace and give the required composition of metal. The reactions and properties of slags at high temperatures are, therefore, those which are of most interest to the metallurgist, and tests conducted upon the solidified material are of interest chiefly in so far as they indicate what have been the actual conditions under which the particular high temperature reactions may have been conducted.

*Properties of Slags at High Temperatures.*—These include, as before mentioned, fusibility, temperature of formation, and fluidity. The question of constitution is also of great importance, but this will be dealt with separately.

The essential property of a slag is, of course, that it shall fuse at a suitable temperature and thus be capable of performing the double object of removing the impurities in the charge, and producing a metal of the desired composition. In the blast furnace, in many instances, the temperature of formation and fusibility of the slag determines the working temperature of the hearth. This is not so much the case in smelting iron ores, where there is always a considerable excess of carbon in the hearth, owing to the fact that reduction is chiefly accomplished by the action of carbon monoxide in the upper parts of the furnace, and the hearth is not merely the melting zone but also a gas producer. In this instance the rate at which carbon can be burned is probably the chief factor in determining the speed of working. But in reducing lead or copper ores the proportion of fuel is smaller, and if a high temperature is desired it can only be obtained in conjunction with a slag of high melting point, and any excess of heat will not give a higher temperature, but only lead to more rapid melting, if the furnace charge is readily fusible.

The temperature of formation of a slag is always higher than that at which the slag itself will melt if reheated after solidification. When the constituents are mixed together in fine powder it is found, as might be expected, that the formation temperature and softening point closely approximate. (Compare Boudouard, *J. Iron and Steel Inst.*, 1905, Vol. 1, pp. 339, 381.) But in practice it is obvious that where lumps of infusible materials are charged into a furnace, there must be considerable local



overheating before substances in such form can mutually combine or dissolve, and even under the most favourable conditions of ordinary practice the temperature of formation must be above the melting point of the resulting slag.

Of more importance than the temperature of formation is the question of fluidity, which is sometimes regarded as equivalent to fusibility. The melting point of a slag is very generally taken as the softening point observed when the slag is gradually heated to a high temperature. It is true that some slags are so viscid that they do not flow out of the furnace, and these have to be laboriously removed by rabbling. But such slags should be avoided whenever possible. They not merely entail the expenditure of much labour of a hot and exhausting nature, but they are usually "dirty" or rich in metal, which has afterwards to be recovered by further treatment. Such slags are also excellent non-conductors and lead to great waste of fuel in reverberatory furnaces. Hence the modern tendency is to use the blast furnace wherever possible not only for iron, but also for lead, copper, and silver ores. In the blast furnace, however, a slag which merely softens would be fatal, as it would lead to scaffolds and all kinds of troubles. Unless, then, a slag is sufficiently fluid to run freely out of the cinder hole in a blast furnace it is quite valueless. The fact that slags pass through a range of temperature during which they have very considerable viscosity renders many observations as to the temperature of softening of slags of little value for metallurgical purposes. So far as I am aware nothing has yet been done in the direction of estimating the relative fluidity or viscosity of slags at various temperatures.

*Melting Points of Slags.*—Jüptner, writing in 1902, pointed out that hitherto no fusing point curves have been compiled for slags, and that the existing reports on the fusing temperatures and temperatures of formation of slags are very defective. ("Siderology," p. 293.) The best known results are those of R. Akerman (*Jernkont. Ann.*, 1886, pp. 1—77), who determined the total heat of fusion of a number of slags by pouring them into a known quantity of water, while Grenet and Gredt have separately made determinations of the softening point of slags of various kinds. Various observers have also, by means of some form of optical pyrometer, recorded the temperature of slag issuing from the blast furnace, or from other sources.

By far the most important recent contribution to our knowledge of the melting points of silicates, is the paper "Experiments on the Fusibility of Blast Furnace Slags," contributed by Dr. O. Boudouard to the Iron and Steel Institute in May last. Like many other papers contributed to that Institute, Dr. Boudouard's communication was taken as read, and not discussed. In these experiments, a complete series of mixtures were made so as to give all the possible combinations of silica, alumina, and lime, so far as this was practicable in a single research. The softening points of these various single and double silicates were determined by comparison with Seger cones, and the results plotted in curves, and represented in the form of solid models. The whole forms a memoir of reference, which will doubtless be consulted by all future workers in this direction. The curves supplied allow of the ready determination of the softening point of any mixture of silica, lime, and alumina which may be desired. The only adverse criticism I feel called upon to make, is that Dr. Boudouard does not appear to have sufficiently realised the difference between fusibility and fluidity. While in the opening sentences of the paper, it is pointed out that a slag which is too viscid may form an emulsion with the metal, and lead to loss, and hence that "a high degree of fluidity is therefore indispensable in order to avoid the retention of suspended globules of metal," the first conclusion drawn from the experiments is that the softening temperatures obtained in those trials "may be regarded as practically their temperatures of fusion."

The softening point in a viscous body is dependent not only upon temperature but also upon time. A piece of pitch, for example, will flow at ordinary temperatures if left undisturbed for some months, and the softening point of a mixture of silicates must in the same manner

depend, at least in part, on the method of observation. In any case, the softening point is below the temperature at which slag and metal separate, and the former flows freely away from the latter. What the metallurgist desires to ascertain if possible is this "minimum working temperature" of the slag, if I may be permitted to introduce such an expression. At present all we know is that the minimum working temperature is higher than the softening point, usually by at least 100° C., and there is good reason to believe that the difference between the two varies considerably with the varying viscosity of the slags. Experiments which have been in progress at the University of Birmingham during the past two years, and which I propose to briefly describe, have led me to the conclusion that, though fusibility is the most characteristic and important of the physical properties of slags, yet silicate slags are also characterised by the fact that they have no melting point.

*Objects of the Research.*—The primary object of the research was to ascertain as far as possible what is the constitution of a typical slag, there being three suggestions worthy of consideration:—

1. That slags consist of one or more definite chemical compounds, which, though mixed together when fluid, preserve their own separate individualities, and on cooling crystallise out in the same state of combination as they exist in the fluid mass. This is apparently the view of earlier writers on the subject, and is the basis of the silicate classification of slags, and of their crystallographic nomenclature.

2. That slags consist either wholly or in great part of eutectics, and may, therefore, be expected to have definite melting points, or to show well marked arrests in their cooling curves.

3. That fluid slags are solutions of certain oxides, or other substances in fusible silicates, the constitution being usually not such as is capable of expression in any simple chemical formulae, the composition depending upon thermal and chemical equilibrium necessary to produce the required character of product.

This last view, though expressed in various ways, is the one now more generally accepted by metallurgists and is in accordance with the ideas advanced by myself in connection with the constitution of puddling cinder (S. Staff. Iron and Steel Inst., Dec., 1891. "Metallurgy of Iron," p. 299) when it was pointed out that puddling cinder may be regarded as a solution of ferrous and ferric oxides in ferrous silicate, and that at the end of the process the puddler should have "transferred the impurities from the pig iron to the cinder, and, as far as possible, saturated the cinder with impurities." We thus conceive the slag to consist of three portions (a) a fusible and relatively inactive solvent; (b) a dissolved active agent, and (c) the product of the action of this agent upon the impurity which it is desired to remove. According to this view, the composition of a slag, and its action upon a metal, is somewhat analogous to that of, say, a solution of hydrochloric acid when employed to remove scale from metallic iron. The solvent is water; the active agent is hydrochloric acid; the product of the desired reaction is ferrous chloride; while the purified metal remains. For the action to be economically and commercially successful, certain conditions of concentration and temperature are necessary, and a known excess of hydrochloric acid must remain in the solution.

Some observations of Ledebur, and also of Hilgenstock, quoted by Jüptner, put this view in clear and simple language. Thus Ledebur says "all the constituents of slags . . . appear in extremely fluctuating mutual proportions, and without reference to stœchiometric ratios. Hence it follows that a slag . . . should be regarded as a solidified solution of various chemical compounds in one another. . . . There is no reason to believe that . . . the formation of a simple mutual solution of the bodies is impossible, and that much closer combination must necessarily occur. Of course, there is no doubt but that certain combinations can occur within a solution, and therefore also within a liquid slag, though, to be sure, these combinations do not come into decided evidence until solidification is proceeding or is complete."



Hilgenstock has adopted for blast furnace slags a view almost identical with that above expressed in reference to puddling cinder, and observes, 'Blast furnace slags contain considerable quantities of "free lime" merely "dissolved" . . . In the solvent capacity for free lime alone have I been able to find an explanation of the behaviour of blast furnace slag in a number of observations.' From the title of the recently published book by Vogt on "Die Silikat Schmelzlösungen," which I have not yet had an opportunity of reading, it may be assumed that the more recent views of this well-known authority are in accordance with those above stated.

In order to throw some further light on the interesting questions which have been thus outlined, it was decided to obtain a considerable quantity of a slag in the molten condition, allow it to cool slowly, and then to ascertain by chemical, microscopic, pyrometric, and other tests how far the mass had separated into various constituents, or into portions possessing different chemical or physical properties.

**Preparation of Samples.**—By the kindness of the blast furnace manager, Mr. W. Moore, the slag was cast on June 6th, 1903, at Sir Alfred Hickman's furnaces, at Spring Vale, Bilston, under the superintendence of Mr. J. H. Colley, who was at that time a Bowen Research Scholar in the University of Birmingham. Mr. Colley almost immediately afterwards obtained an appointment under the Spanish Government at Trubia, and so was unable to take part in the research as was originally intended, but his place was supplied by his successor in the scholarship, Mr T. W. Picken. The furnace chosen was making an "all mine" iron from mixed native ores, and flue cinder, and about 18 cwt. of slag was being made for each ton of pig iron produced. The slag was purposely retained in the furnace for some time before the ladle was filled, so as to obtain a good flush, and hence, as far as possible, to ensure uniformity. The ladle used was clean, of the tipping pattern, and taper, being 5 ft. by 5 ft. 6 in. at the top and 4 ft. 6 in. deep. The slag taken was perfectly hot and fluid, and weighed upwards of 6 tons. It was put on one side at rest, and allowed to slowly cool during four days, at the end of which the ladle was tipped and the still warm contents carefully broken and examined. A vertical section, taken through the centre of the block showed distinct differences in colour and texture, the most noticeable facts being (a) that the outer shell, which cooled most quickly, was lighter in colour, and more glassy in character; (b) that the lower central portion was grey and light blue mottled; (c) that the upper central portion, which doubtless solidified last, was of a uniformly creamy

white appearance. Samples were taken from six positions selected so as to represent the relative order of solidification, so far as this could be gathered from the shape and size of the mass. These samples were preserved in large stoppered bottles for future examination.

The accompanying diagram was prepared to represent the differences in appearance, and to show the positions from which the samples were taken. The probable order of solidification was as follows:—

Order of solidification 1 2 2 4 5 6  
Reference letter E C F D B A

The times of solidification for samples 1 and 2 would be very near together, and 3 would not be very different, but there would probably be some hours interval between each of the others.

The samples were carefully analysed by Mr. T. W. Picken, each result being duly checked. The results are as follows:—

	Samples in order of solidification.					
	Aver. composition.	1.	2.	3.	4.	5. 6.
Silica .....	29.81	30.10	30.24	29.35	29.30	28.74 31.16
Alumina ....	19.94	19.46	19.81	21.60	20.30	21.03 18.91
Lime .....	40.31	40.39	39.89	40.36	39.97	39.57 41.69
Magnesia ....	2.95	2.97	2.94	2.91	2.70	2.82 3.28
Cal. Sulphide	6.92	7.04	7.11	7.32	7.83	7.71 4.56
	99.93	99.96	99.99	100.10	100.19	99.87 99.60

There were also present traces of ferrous and manganous oxides. The total lime, total sulphur, and the oxygen ratio were as follow:—

	Aver.	1.	2.	3.	4.	5.	6.
Total lime...	45.60	45.86	45.42	46.06	46.06	45.56	45.23
Sulphur ....	3.08	3.13	3.16	3.26	3.48	3.43	2.03
Oxygen ratio	0.72	0.73	0.73	0.70	0.70	0.68	0.75

The whole of the samples are such as come between the two types represented by  $2\text{CaO}, \text{SiO}_2$  and  $3\text{CaO}, \text{SiO}_2$  known respectively as the mono- and the sub-silicate.

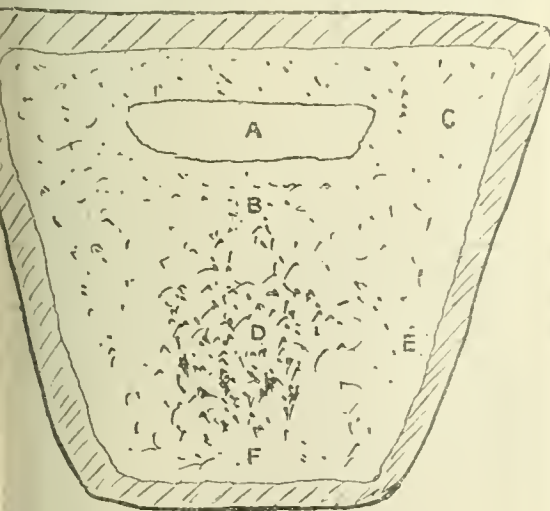
The following tabulated statement has been prepared in order to emphasise the changes which have taken place during slow cooling. The numbers given are obtained by taking the differences between the composition of the samples and the average compositions; these differences have then been multiplied by 100 and divided by the percentage of the respective constituents in the average sample. They represent, in fact, the relative variations in 100 parts by weight of each constituent. Thus in sample No. 6 each 100 parts by weight of silica increased by 4.5 parts, while each 100 parts of alumina decreased by 5.2 parts; and similarly in other cases:—

*Increases per 100 parts of each substance.*

	1.	2.	3.	4.	5.	6.
Silica .....	1.0	1.5	—	—	—	4.5
Alumina .....	—	—	1.1	1.5	5.5	—
Lime .....	0.2	—	0.1	—	—	3.5
Magnesia .....	0.1	—	—	—	—	1.1
Calcium sulphide ..	1.7	2.7	5.7	13.0	11.3	—

*Decreases per 100 parts of each substance.*

	1.	2.	3.	4.	5.	6.
Silica .....	—	—	1.5	1.7	3.6	—
Alumina .....	2.5	0.7	—	—	—	5.2
Lime .....	—	1.1	—	0.9	1.9	—
Magnesia .....	—	0.0	0.1	0.5	0.4	—
Calcium sulphide ..	—	—	—	—	—	33.7



Top centre. Nearly cream white.  
Middle. Blue mottled  
Lower centre. Coarse mottled. Blue and white.  
Bottom. Passing from below upward all stages from nearly glassy to coarse grained blue mottled  
Upper side. Fine close grained to blue mottled.  
Lower side. From close grained to blue mottled.

An examination of the above figures indicates that there has been no important separation of silicates of lime or alumina such as might be expected if the slag were of the nature of an eutectic mixture with an excess of some other constituent. The highest variation is of quite another character, and would perhaps not be so readily anticipated. It will be observed that the last fluid portion contained only 66.3 parts of calcium sulphide for every 100 parts which were present in the original slag. This reduction of sulphur was not due to the loss by volatilisation, or to oxidation by the air, as the creamy white portion was covered with a layer of other slag, at least 6 in. in thickness. Further, it will be noticed that the loss of sulphur in one part is accompanied by a corresponding and gradual increase in sulphur in samples 3, 4, and 5. The proportion of alumina is highest in the parts which contained most sulphur, and these portions were also those which had the most marked blue colour. This appears to give some support to the suggestion that the blue colour of blast furnace slag is due to some form of oxysulphide of alumina. The total lime in sample 6 was only 0.33 per cent. lower than in sample 5, and this could be accounted for by the effect of the removal of 1.30 per cent. of sulphur, as indicated by the analyses. It would, therefore, appear that the action which took place during cooling was merely due to sulphur exchange owing to the alteration in the conditions of equilibrium as the temperature gradually fell.

It is by no means a new observation that sulphur changes in its relation to lime at low as compared with high temperatures. Thus Dr. Percy and Prof. Miller, in their "Report on Crystalline Slags" (B. A. Report, 1846, p. 351), pointed out that sulphur occurs in slags in three forms, *viz.*, free, as sulphide, and as sulphate. I have also recorded some observations on blast furnace slag, which appeared to prove that the sulphur is not always in the same state of combination, it being sometimes more readily eliminated than at others (*Journ. Iron and Steel Inst.*, 1888, Vol. I., p. 28). This part of the subject has been more fully dealt with by Jüptner von Jonstorff (*Journ. Iron and Steel Inst.*, 1902, Vol. I., p. 304), who in summarising Vogt's work, states that it has been shown that slags are capable, when in a molten condition, of dissolving sulphides and holding them in solution; but that on cooling the sulphides are the first to separate out, from which it follows that the solubility of the sulphides in slags at the ordinary temperatures of metallurgical processes is very small. Still more recently Wuest and Welff (*ibid.*, 1905, Vol. I., p. 406), when discussing the reduction of the sulphur which is present in the coke used in the blast furnace, have stated that this sulphur is not merely carried down with the furnace charge and ultimately attacked near the hearth by the fuel and furnace gases, but that it is absorbed from the charge by the oxides of iron, after having been volatilised by the gases in the upper part of the furnace. But when the temperature exceeds 800° C., the position is reversed, and the lime then becomes the chief absorbent of sulphur. It will thus be seen that what has been observed with slowly cooled slag in reference to the separation of calcium sulphide from the longest fluid portion, is in accordance with the observations of other workers under somewhat similar conditions. Further, that apart from this migration of sulphur, there does not appear to be any indication of alteration of composition of any importance owing to the effect of the slow-cooling of a large mass of liquid slag.

In connection with the question of the removal of sulphur by magnesia, it will be observed by a comparison of Nos. 4 and 6, that the former has the highest sulphur and lowest magnesia of the series, while the latter, in which the sulphur is present in smallest proportion, has the maximum percentage of magnesia. This is in accordance with the observation that, though a self-fluxing mixture may be made from Cleveland ores, it is necessary to add lime in order to prevent the resulting pig iron from being rich in sulphur. Uehling has recently observed on this question that though magnesia is efficient as a flux, and weight for weight more effective, in proportion of 1 to 1.4, still as lime is the only flux which under ordinary conditions combines with sulphur and carries it into the

slag, lime must always be used if there is much sulphur in the blast furnace. (*Jour. Frank. Inst.* CLIX, p. 117.) Elbers has also dealt pretty fully with this subject, and concludes partly from thermo-chemical data that the influence of lime, alumina, and magnesia in causing sulphur to pass into the slag is in the order given. (This J., 1895, p. 276.)

**Determination of Free Lime.**—A number of attempts were made to ascertain the proportion of "free lime" in these samples of slag, but no satisfactory results were obtained. The methods employed included extraction with water; treatment with a sugar solution; and digestion with excess of acid and titrating back with alkali. It was found that the order of solubility was affected by the proportion of calcium sulphide, and that the percentage extracted was relatively small. Thus the lime obtained from a hot sugar solution was as follows:—

Samples.	1.	2.	3.	4.	5.	6.
Lime per cent.	1.87	1.67	1.76	1.34	1.43	1.03

It was observed that the slag increased in weight on calcining in a muffle, and the following values were obtained on heating to redness for a few hours, and weighing from time to time till a constant result was obtained.

Samples.	1.	2.	3.	4.	5.	6.
Increase in weight p. cent.	3.75	4.10	3.95	5.10	5.00	2.40

The increase of weight was doubtless due to the absorption of oxygen by the calcium sulphide. The conclusion arrived at was that in the presence of varying proportions of calcium sulphide the ordinary methods of determining "free lime" are inapplicable.

**Cooling Curves of the Slags.**—As it was anticipated that the cooling curves of the different samples might present interesting information, special care and trouble were taken with the preparations for, and the actual taking of, these curves. This work was done by Mr. T. W. Picken, who conducted the experiments under the direction and with the assistance of Mr. O. F. Hudson, the lecturer on metallurgy, who had already had considerable experience of such work at the Royal Mint. The ordinary gas injector furnace was used—originally salamander crucibles were employed—and the thermo-couple of the Le Chatelier type was introduced into the slag when quite fluid. But, as considerable trouble was experienced owing to one of the wires breaking off, just above the surface of the slag, before cooling was complete, the method of procedure was subsequently modified. In all the later tests the slag was melted in a carbon crucible, which was contained by an outer crucible, in order to afford the necessary protection. The thermo-couple was placed inside a thin tube of carbon, obtained by drilling a rod of hard carbon as used for arc lighting. A hot stick of similar carbon was used from time to time, as the temperature gradually rose, in order to ascertain when the slag was thoroughly fluid, at which point the thermo-couple was inserted and the crucible allowed to cool. The lid was kept on the furnace, until solidification was complete, after which the lid was removed so as to hasten the subsequent stages of cooling.

As the literature of the subject teems with figures which are stated to be the melting points of certain slags, and as these figures differ often by only a few degrees from one another, it may be at once acknowledged that we at first expected to get definite results from our observations; considerable disappointment was therefore felt as week after week passed and experiments were again and again repeated, on finding that the cooling curves were all of the same type. They showed no signs of eutectics, and no distinct line could be distinguished between the fluid, plastic, and solid state. They further showed that solidification extends over a relatively wide range of temperature, namely, from about 1345° to 1215° C., and that the plastic condition also extends over a considerable period during cooling. (See Fig. 2.)

Under the circumstances, assistance was sought from the National Physical Laboratory, and by the kindness of Dr. Glazebrook two melting point curves were supplied by Dr. Carpenter, the sample used being that marked D, or the fourth in order of solidification. This is the portion which contained the highest percentage of calcium sulphide. The slag was melted in a salamander crucible, the thermo-junction being enclosed in a carbon tube.



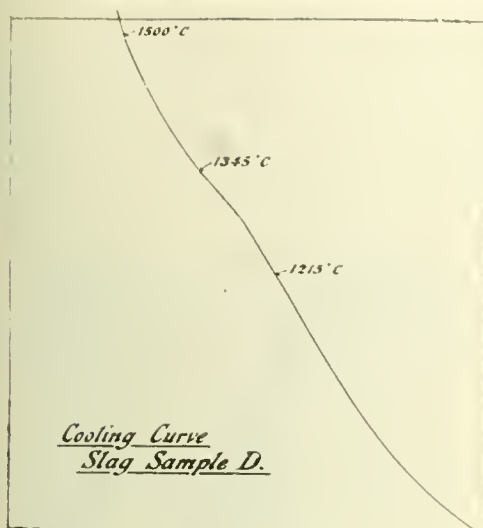


FIG. 2.

The lid was kept on the injector furnace while cooling from 1321° to 980°; from 980° to 690° the lid was off; while from 690° to 476° a gentle current of air was playing on the surface. The range of solidification was found to be upwards of 100° C., namely from 1253°—1140° C., and though the sample was cooled to 476°, no other evolution of heat was observed. In a second experiment the range of solidification appeared to be larger, and was not really complete till 1100°. In this case also no further evolution of heat was observed.

Assistance was also obtained from Dr. T. K. Rose, of the Royal Mint, who kindly supplied a cooling curve taken with the Roberts-Austen automatic recording pyrometer. This curve showed no marked arrest or break at any point, and Dr. Rose was of opinion that the slag was fluid at 1280° C., and that solidification commenced at 1175° C. He added, "the cooling curve appears to be a very unsatisfactory one. The slag must be very heterogeneous, and one constituent after another evidently crystallises out, the mother liquor undergoing a continuous change of composition without ever arriving at a genuine eutectic."

The results may be summarised thus:—

Hudson and Picken began	1345°	ended	1215°
Dr. Carpenter	" 1253°	"	1140°
Dr. Rose	" 1175°	"	?

When trained and competent observers obtain such results as the above, it is obvious that the material under observation has no melting point, but a wide melting range.

As the slags which have been dealt with in these experiments are somewhat basic in character, it may be well to state that Mr. W. Rosenhain has afforded evidence of a similar kind in reference to glass, in a paper read before the Optical Society of London, June 15, 1903. In this communication, Mr. Rosenhain observes that if a crucible of glass be raised to a white heat, and the thermocouple inserted and connected with a recording pyrometer, the cooling curve obtained is quite smooth, proving that no sudden solidification or crystallisation can have taken place. For sake of comparison, Mr. Rosenhain gives on the same diagram the cooling curve of copper with its well-marked freezing point, at about 1050° C., and the perfectly smooth cooling curve given by glass (see Fig. 3). Doubtless the silicate slags and the glasses form a continuous series, and what is true of the one, is, in a great measure, true of the other.

A little reflection on what is commonly known in reference to silicate slags, will confirm the statement that they have no definite melting point. The way in which

### *Cooling Curves of Glass & of Copper Compared (Rosenhain)*

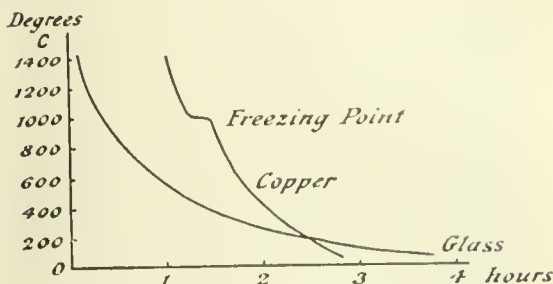


FIG. 3.

a bogie of trap cinder wells up into miniature volcanoes as it cools; the fact that slag can be blown into long filaments of wool, or drawn out in strings at the end of a rod; and the readiness with which the surface of a crucible of steel can be cleaned with a little mop of hot slag, all depend upon the existence of a considerable range of viscosity quite unlike what is usual with a metal or other pure substance. The obvious moral is that all hitherto published "melting points" of slags must be examined with caution, and comparison made only with such as have been made by similar methods. The results of Boudouard, for instance, do not become less valuable, and may be compared with each other; but they must be regarded not as giving the practical working temperatures of the various silicates in question, but as indicating the softening points as determined by a particular method.

It may be added that the samples were not suitable for microscopic examination, on account of their friable and granular structure, and though considerable time was spent on this branch of the work, only small feathery micro-crystallites were observed. There is some reason to believe, however, that there was originally some of the variety of sub-silicate of lime present which forms in long needles, and falls to pieces on exposure to the air, as the lower middle part of the block formed a certain amount of fine powder, spontaneously, when the mass was broken up, though disintegration did not afterwards proceed further. This was particularly noticed in sample 4, which was richest in calcium sulphide.

The following conclusions may be regarded as being justified from what has been before stated.

Silicate slags are heterogeneous mixtures, which, though fusible at a high temperature, have no definite melting point. They usually contain three constituents, viz., (1) A relatively inert solvent or matrix formed of one or more fusible silicates. (2) An active agent dissolved in the solvent, and usually consisting of a metallic oxide, or a mixture of oxides. (3) The product of the action of (2) on some characteristic impurity in the charge, the proportion of which impurity entering into the metal determines its quality. At high temperatures, we thus have a system including four phases, and the results, though complicated, are such as can be determined by the application of the phase rule. Jüptner has already done something in this direction, and his further contributions to the elucidation of the subject will be received with interest.

### DISCUSSION.

The CHAIRMAN congratulated the members of the Section on having had such an instructive address on the occasion of their opening meeting. Personally he had always regarded the subject of slags as dry and unattractive, but in listening to Prof. Turner's paper he had come to look upon it with interest. The subject appeared, however, to be one which must be approached with circumspection owing to the great complexity of the

problems involved. He was particularly interested to hear that these problems must be attacked from the standpoint of the Phase Rule, and that, therefore, this, like so many other fields of investigation, was destined to fall into the domain of the physical chemist. He invited other members, who had a more special knowledge of slags than he had, to discuss the paper.

Mr. A. H. HORN considered that the last part of the paper was the most important, and therefore the most interesting. There were, however, some remarks made at the commencement as to which he would like to say a few words. As to the meaning of the word slag they generally looked on slag as a silicate, and he thought it might be well to confine it to that definition, leaving all other non-silicious products to be known as scoriae and oxides. He had been very much interested to hear that no definite melting point was found for the slag, and thought that was what they might naturally expect from so heterogeneous a subject. Some slags had no doubt a definite melting point, but a slag was, generally speaking, like a rock which might at certain temperatures give out crystallisations. One generally spoke in a very loose way of a body crystallising out by slow cooling, but slow cooling was such a wide expression that it might mean anything, and he did not think that bodies did crystallise by simple cooling, if the temperature fell below a certain point. It was necessary to keep them at a certain range of temperature for a time. That was a very important point in explaining why some slags were crystallised and others were not.

Mr. W. ROSENHAIN said that his only regret was that Professor Turner had confined himself so much to the purely metallurgical standpoint, since slags and slag-like bodies were of interest to many other chemical industries. The author had cited the results of Boudouard, but when these came to be analysed, considerable doubt as to their value must arise. In the current number of the *Iron and Steel Magazine*, the work of Boudouard had been adversely criticised by an eminent American worker, Mr. Clifford Richardson. The chief points of this criticism lay in the fact that while Boudouard's tri-axial diagram included the area representing the composition of pure Portland cement, the known melting points of these pure compounds did not at all agree with Boudouard's figures. Further, Clifford Richardson considers that the grinding of the materials used in the experimental Seger cones was not nearly fine enough. The speaker pointed out how somewhat coarse grinding, or imperfect mixing, might lead to low results when softening temperatures were to be determined; supposing the average composition of a given cone correspond to a maximum in the melting or softening point curve, then any departure from that average composition in either direction would lead to the local formation of more fusible compounds or mixtures, the whole cone softening in the form of an emulsion or suspension. The use of Seger cones for accurate temperature measurements was not advisable, since their softening temperature was admittedly a function of the time during which they were exposed to heat. Accordingly he could not attach much weight to Boudouard's results, especially as the softening temperature was necessarily so very vague. It was quite clear that a definite melting point could not be found in the ordinary way, i.e., by means of cooling curves, unless special means were employed. Two classes of cases were to be distinguished—in one class no definite melting point was found, because, although the solidification produced a crystalline aggregate, this was either a very complicated mixture with a multitude of superposed freezing points, as suggested by Dr. Rose, or because the solids formed varied continuously in composition with the temperature of formation over a very wide range of temperature; in the other class of cases there was no freezing point at all, nor even a long range of solidification, because the slag set as a viscous fluid or "glass" and did not "solidify" in the ordinary sense at all. In these latter cases, the true freezing point could be found by resorting to very slow cooling, possibly aided by "inoculation" of suitable crystals. That ordinary slags, by slow cooling, or even repeated heating and cooling, could undergo changes of

the nature of crystallisation could be well observed in the puddling cinder enclosed in ordinary wrought iron. Usually these slag enclosures appeared practically structureless under the microscope; but recently, while examining a specimen of wrought iron which had been used as a furnace tool and thus repeatedly heated and cooled, Mrs. Rosenhain had found slag enclosures which showed a marked dendritic crystallisation, illustrated in the accompanying photomicrograph, magnified 160 times;



this was undoubtedly a fine example of crystallisation in a slag at temperatures far below its melting temperature. Professor Turner's contention that what was wanted was the knowledge of the temperature required to produce a given degree of fluidity in a slag, recalled some experiments which had been published within the last two years, upon the "melting points" of certain glasses; the glasses were used in the form of rods, and drops were allowed to form and drop off on exposure to known temperatures; this recalled the German definition of a liquid as "tropbar flüssig," and apparently the temperature at which drops could form was a definite function of the substance used, and did not vary with the size of rod, &c. Perhaps some such method might lead to definite results in the case of slags.

Mr. O. F. HUDSON said that although the cooling term was a matter of very great interest, he did not see how they could expect to get any very definite or startling results from slag, because slag consisted of several substances, and a great deal depended on the separation of these constituents. Very much depended on the rate of cooling, and he commended the plan of dropping from a rod described by Mr. Rosenhain.

Mr. F. R. O'SHAUGHNESSY said he was not so much interested in the production of slag as he was in ascertaining its properties and possibilities. Prof. Turner had dealt with the subject almost entirely from the metallurgists' point of view, but the question had a considerable interest to others than metallurgists, and he belonged to that class of people. It was his duty some time ago to inspect practically the whole of the slag heaps of the Black Country, and this forced upon him the very comprehensive meaning of the word slag. The most interesting portion of Prof. Turner's paper to him was that which dealt with the composition of slag, and therefore its particular properties. The properties of slag varied greatly, according to the method of its production, and also according to its subsequent history and manipulation after leaving the furnace, and the paper would be of particular value to him as giving some information on the classification of the subject.



Mr. FRANK NOAKE, as an engineer, expressed regret that Prof. Turner had dealt so exclusively with the subject from the academic standpoint, and had told them comparatively little regarding the practical physical properties of slags. Modern high-speed railway travel was only possible on slag-packed sleepers, and he had hoped to hear the qualities essential in railway ballast slag discussed. Again, locally, a huge plant had been erected to convert slag into tar-macadam with a view to greatly improved roads for motor traffic. Would the author tell them the essential properties for "tar-mac" slag? When in America last autumn, he was greatly interested in seeing, at the Susquehanna furnaces, the molten slag run straight into water from the furnace, and thus be granulated and easily disposed of. The use of slag for bacteria-beds at sewage works was a most important application, and growing. If Prof. Turner would kindly add to their knowledge of the essentials for this use also it would be most helpful.

Mr. CHAMBERS described another method by which the slag was run from the blast furnace through a large tube on which jets of water were constantly playing, and the granulated slag fell through and was led away from the end of the tube.

Mr. HARRY SYLVESTER understood Prof. Turner to say that the use of ordinary limestone was more effective in producing a low sulphur iron than a dolomitic limestone, and under certain conditions this was true. For instance, Mr. Stead had found in smelting Cleveland iron, that when dolomite was substituted for limestone, the iron invariably changed from grey to mottled or white, the sulphur increasing in the pig iron, and the slag changing at the same time from a free flowing to a viscous material. Mr. Fermstone had, however, shown that the prejudice against magnesite was not entirely justified, but that under some conditions, a dolomitic slag removed sulphur better than an ordinary lime slag. For the advantageous substitution of magnesite for some of the lime, the slag must be comparatively low in alumina, as with a high alumina, such as the Cleveland slags contain (19 to 20 per cent.) a viscous cinder was produced, which was not an efficient desulphuriser. Allusion had been made to the composition of blast furnace slags suitable for ballast, and as a filling material for bacteria beds. Locally, slag was being exclusively used for the latter purpose, and with a proper selection—avoiding a limy slag—appeared to be a cheap, suitable material for sewage works, as it did not weather.

Mr. FRANK PLATTEN said that the paper dealt chiefly with iron slag, but he was glad that a small portion of it was devoted to slags produced in copper smelting. Last year when he was in America with the Society, he had the good fortune to visit the copper works at Detroit and Buffalo, and found them doing very excellent practice in cleaning slags produced in copper refining. The object of the metallurgist was to produce a slag low in copper with the minimum expenditure of flux, and he found that they had got a slag containing something under 0.5 per cent., with 17 per cent. lime, 40 per cent. silica, and the balance oxide of iron. When they tried the process in England, they could not obtain such good results, but probably the physical condition of the slag might have had a good deal to do with that. He had no doubt a careful study of the paper would throw some light on the subject, but if Prof. Turner could indicate the reason of the difference in results, it would probably be of great interest to many people who had experienced a similar difficulty.

Dr. ALEX. FINDLAY thanked Prof. Turner specially for the attention he had devoted to Boudouard's curves as to the melting point of slag, which had also been criticised by Richardson; and remarked that the figures of Boudouard could not be compared with those of Richardson, but were comparable only with one another. One point in the communication from Dr. T. Kirke Rose, that in cooling, a continuous curve was obtained, struck him very much, because it was very difficult to understand unless the cooling were carried too far. He supported Mr. Hiorns' view, that if cooling was too rapid,

they could not get a true cooling curve. The unfortunate point in all these questions of curves was that in the case of slags they were dealing with substances which had no true melting point.

Mr. P. L. WHITEHOUSE commended to the notice of Prof. Turner that the most satisfactory method known for determining the softening point of pitch was Kraemer and Sarnow's (this J., 1903, 291) and which might possibly help Prof. Turner to a solution of his present difficulties with regard to the determination of the softening point of slags.

Prof. TURNER, replying, said that many slags were not silicates, one of the most important of these being "basic" slag, and he was afraid it would not do to call such a slag a "scoria" as had been suggested. England was not so far behind in granulating slag as some people imagined, for a large plant had been successfully worked on the process at Bilston for some years. He agreed with Mr. Sylvester that an admixture of dolomite with lime was advantageous, but care must be taken that too much was not used. There must, under ordinary circumstances, be a considerable amount of lime to obtain iron of satisfactory quality. In reference to the crystallisation mentioned by Dr. Findlay, he understood there were several substances which crystallised gradually from the slag, and not at once. They had tried cooling at different rates; they had tried cooling quickly and cooling over a much longer period, but in no case could they obtain marked or definite points of arrest in the cooling curves. He did not see how they could apply Mr. Whitehouse's pitch test to a material held in an opaque vessel, but the subject was worthy of further careful consideration. What they required to determine was the point at which the metal would separate and flow freely from the slag, and when they determined it, they would have a thoroughly reliable metallurgical standpoint.

## London Section.

*Meeting held at Burlington House, on Monday, November 6th, 1905.*

MR. A. GORDON SALAMON IN THE CHAIR.

### EVAPORATION *IN VACUO* OF SOLUTIONS CONTAINING SOLIDS.

BY J. LEWKOWITSCH, PH.D.

Almost a century has elapsed since Howard introduced his great invention—the evaporation of sugar solutions *in vacuo*. This important improvement upon the methods practised before rapidly found favour with the sugar manufacturers, especially in this country. The advantages were obvious. The reduction of temperature effected in the concentration of sugar solutions reduced very considerably the losses which were previously encountered through the high temperature employed in concentrating the juice. Furthermore, the work could be accomplished much more rapidly than previously, as owing to the lowering of the boiling point of the liquid, the temperature-difference between heating steam and boiling liquid became much greater and, consequently, a much greater transmission of heat was obtained for a given heating surface. Not the least advantage was the employment of low pressure steam, such as exhaust steam, for the heating of the sugar pan. It is noteworthy that Howard used mechanical means for producing the vacuum, *viz.*, an air pump. The vacuum obtained by Howard was, adopting the parlance usually employed in practice, 500–550 mm., in other words, the absolute pressure was 260–220 mm. The condensed water had a temperature of 30° C. The disadvantages of Howard's apparatus—which, of course, did not militate against

its introduction at the time the invention was made—will be best considered at once, as I can thus bring out some important points, which will have to be discussed later on. The heating of Howard's apparatus was effected by means of a steam jacket. This is not an economical arrangement, as it is about the worst form of heat transmitter, partly because the air introduced with the steam lodges in the upper part of the jacket, and forms a non-conducting cushion (the remedy against this drawback, *viz.*, the usually applied air tap for intermittent blowing off of steam, can only be looked upon as a palliative) and partly because the steam is, so to speak, short-circuited, the shortest way being taken from the inlet to the outlet. The worst feature of this form of heat transmitter is, however, that the condensed water is not discharged rapidly enough. The low vapour space above the liquid in Howard's pan is bound to cause considerable losses by entrainment, solid particles in the form of a very fine mist being carried away into the condenser. Losses of this kind are not completely avoided by using a high vacuum pan with a large vapour space, such as will be considered later on. In sugar works even nowadays these losses constitute a very appreciable quantity. They have led, as I may mention *anticipando*, to the construction, during the last fifty years, of a large number of entrainment preventers. One of the most efficient of such contrivances, which has been under my personal observation for the last ten years, will be illustrated later on by some lantern slides.

The liquid itself does not circulate briskly enough, being only agitated by the steam bubbles which rise from the heating surface: frequently this is mistaken for violent boiling, whilst it actually only contributes to further loss by entrainment.

The vacuum at the outlet of the Howard pan was, as stated, about 500 mm., *i.e.*, 260 mm. in absolute pressure. To this pressure of the vapour corresponds a temperature of about 72° C. The useful heat, which might have been extracted from this steam, was lost. The loss entailed hereby became increased through the necessity of having to employ sufficient water to condense the vapours effectively. As the water ran away with a temperature of 30° C., it will be easily seen that the quantity of water used must have been considerable. Whilst about a century ago all these drawbacks were far outweighed by the advantages of the new system, they require nowadays very serious consideration.

In France, Howard's system did not find the same favour as in this country, and a retrograde step was made by abandoning the air pump and creating the vacuum by means of injection water only. Roth's apparatus (shown in a lantern slide) illustrates this principle. However, an improvement upon Howard's apparatus was made by substituting a steam coil for the steam jacket. This gives a much better transmission of heat, the air and condensation water being much more rapidly discharged. The vacuum produced here must have been still lower than in Howard's pan, hence the loss of the heat which was carried away by the water must have been greater still. Degrand attempted to evaporate a further quantity of liquor with the help of the vapours leaving the pan, these vapours being condensed in a long cooling worm over which the thin liquor was allowed to trickle, whilst an ascending air current assisted the removal of the vapour rising from the outer surface of the coil. We have in Degrand's arrangement, as it were, the germ of the principle of multiple evaporation, the latent heat of the steam escaping from the vacuum pan being employed for the performance of useful work. (Lantern slide.)

It is evident that the best manner of making use of this latent heat would be to immerse the cooling worm completely in the thin liquor and draw off the vapours by means of a vacuum pump. The exchange of heat would then become much more rapid than in Degrand's apparatus, and consequently more work would be obtained from a given amount of steam sent into the heating coil of the vacuum pan. In such an arrangement the vapours given off by the liquor in the vacuum pan—which we will now term the first vessel—must clearly have a higher temperature than the vapours leaving the second vessel for we can only obtain evaporation when a sufficient

difference of temperature is available. Now, if the temperatures of the two kinds of vapours are different, the pressures under which they stand must also be different. Suppose we are able so to arrange our appliances that we can obtain a practically complete vacuum, say a "vacuum" of about 700 mm. (27 ins.) (*i.e.*, an absolute pressure of 60 mm., or less than 3 ins.), then the vapour passing from the second vessel to the air pump would have a temperature of about 45° C. The temperature of the steam escaping from the first vessel must be higher than 45° C. In order to have useful work performed the difference should be, say, 30° C. Accordingly, the vapours escaping from the vacuum pan—our first pan—must have a temperature of 75° C., corresponding to an absolute pressure of about 288 mm. (11 ins.), or a "vacuum" of 472 mm. (19 ins.). If we allow the same difference—30° C.—between the vapours leaving the first pan and the heating steam, then the latter should have a temperature of 75+30=105° C. We thus see that we use the heat available in the steam of a temperature of 105° C. in two stages. Assuming that the steam is completely condensed, both in the heating coil of the first pan and in the coil of the second pan, then the latent heat of the steam has been used twice over, *i.e.*, we have obtained, with the help of this arrangement, double the effect. An apparatus of this kind has, therefore, been termed double effect, or double effect.

Some such considerations as these must have guided Rillieux when he constructed, about three-quarters of a century ago, his triple effect, *i.e.*, an evaporating apparatus consisting of three vessels in which the latent heat of steam is used three times over. The principle of his apparatus will be readily understood by considering a somewhat ideal case. Suppose we have at our disposal heating steam of what is termed in practice half an atmosphere pressure (or one and a half atmospheres expressed in absolute pressure), such as the exhaust steam from an engine. The temperature of such steam would be about 112° C. Suppose, further, that we have employed the best practical means for producing vacuum at the outlet of the third vessel so that the temperature of the vapours passing into the condenser would be about 46° C. We have, therefore, a temperature-difference of 112°—46°=66° C. available for evaporating purposes. This difference would have to be distributed over the three vacuum vessels or "effets." If we make the heating surface of each vessel the same, it follows that the amount of water evaporated will be the same in each vessel. Consequently, the difference of temperatures in the three vessels must be the same, *viz.*, 66/3=22° C. We have now the following state of affairs:—The steam entering the first effect has a temperature of 112° C. We require 22° C. for raising the liquor in the first vessel to the boiling point; the liquor would then have a temperature of 112°—22° C.=90° C., and the vapours escaping from the outlet the same temperature of 90° C. To this temperature of the vapour corresponds the absolute pressure of 525 mm., or, in technical parlance, a "vacuum" of 235 mm. (say, 9 ins.). A gauge (manometer) fixed to the outlet of the first vessel would, therefore, register this "vacuum." The steam enters the heating system of the second effect with a temperature of 90° C. The liquid in the second vessel requires 22° for raising it to the boiling point, and has, therefore, the temperature of 68° C. If no loss of heat takes place the temperature must be slightly higher, as the flow of liquid (which we shall consider later on) goes in the direction from the first effect to the second effect and the liquid coming from the first vessel has the temperature of 90° C., but this point may be neglected here. The vapour escaping from this second vessel will have the temperature of 68° C., which corresponds to an absolute pressure of 213 mm. (8.5 ins.) or a "vacuum" of 547 mm., say, 21.5 ins. This vapour of 68° C. enters the heating chest of the third vessel, and brings the liquid therein to the temperature of 46° C. The vapours escaping from the third vessel have the temperature of 46° C., corresponding to 75 mm. absolute pressure (3 ins.) or to a "vacuum" of 685 mm. (27 ins.). The water condensed in the heating chest of the first vessel is discharged under more than atmospheric pressure, and can, therefore, be run away without any special con-



trivance being required. The condensed water from the second and third vessels, however, being under a "vacuum" must be drawn off by separate pumps. In large installations the warm water is used for pre-heating the liquor. The flow of liquid usually takes place in the same direction as the steam vapours travel, i.e., the liquor to be evaporated is drawn by the vacuum into the first vessel; the partly concentrated liquor is next drawn into the second vessel to be further concentrated therein and to be then drawn by the still higher vacuum into the third effect, where it is "finished" and discharged after final concentration, either by "breaking the vacuum" and letting the liquor run out under atmospheric pressure or by drawing it off with the help of a special pump.

Regarding the work that is done by the triple effect, it must not be assumed that three times as much liquor is evaporated in it as in a single effect with a heating surface of the size of any of the three vessels (which are made all of the same size). The following consideration will make this clear: With 1 lb. of steam we cannot evaporate in a single effect more than 1 lb. of water. The heat, both the sensible and the latent, inherent in the vapours, leaving the pan at 46° C., passes into the condensing water and is mostly lost unused. If we employ a double effect, then the steam passing from the first vessel into the heating chest of the second vessel gives off its latent heat and part of its sensible heat. We can, however, no longer have 1 lb. of steam escaping from the first vessel with a temperature of 46° C., as was the case in the single effect evaporator. As shown above, the steam will have the higher temperature of 75° C., and at this temperature, in conformance with the higher pressure, we can no longer have 1 lb. of steam removed from the first vessel, but only  $\frac{1}{2}$  lb. of steam. Assuming perfect exchange of heat, we should now only require  $\frac{1}{2}$  lb. of heating steam to enter the heating chest of the first vessel. The steam of 75° C. entering into the chest of the second vessel gives off its latent heat and will evaporate off  $\frac{1}{2}$  lb. of water. We have therefore effected with  $\frac{1}{2}$  lb. of heating steam the evaporation of  $\frac{1}{2}$  lb. of water in the first effect, and of another  $\frac{1}{2}$  lb. in the second effect, i.e., we have evaporated off a total of 1 lb. of water with  $\frac{1}{2}$  lb. of heating steam. We have thus used the latent heat of steam twice over; but it should be repeated, that although we have evaporated with  $\frac{1}{2}$  lb. of steam twice that amount of water, the double effect itself has not evaporated more water than the single effect having the same heating surface as each of the vessels of the double effect. By working out analogous calculations in detail for any multiple effect, we find that we can evaporate off 1 lb. of water with  $\frac{1}{2}$  lb. of steam in a triple effect, or with  $\frac{1}{4}$  lb. of steam in a quadruple effect, with  $\frac{1}{8}$  lb. of steam in a quintuple effect, with  $\frac{1}{16}$  lb. of steam in a sextuple effect, or with  $\frac{1}{32}$  lb. of steam in an octuple effect. Theoretically we can, therefore, evaporate with 1 lb. of steam 2 lb. of water in a double effect, 3 lb. in a triple effect, 4 lb. in a quadruple effect, 5 lb. in a quintuple effect, 6 lb. in a sextuple effect, and 8 lb. in an octuple effect.

We must, of course, make the proviso that there is always at our disposal a useful difference of temperature between, say, the 46° C. of the steam leaving the last vessel of the multiple plant and the temperature of the steam entering the first vessel. It is evident that the larger is the number of effects in a multiple apparatus, the higher must be the temperature of the heating steam. Adopting for a moment a temperature-difference of 20° C. as necessary for each vessel, we should have to add 20° C. for each vessel by which we wish to increase the triple effect. Suppose we employ in a triple effect heating steam of 112° C., then we must have for a quadruple effect 132° C., for a quintuple effect 152° C. for a sextuple effect 172° C., and 212° C. for an octuple effect. The pressures corresponding to steam of the temperatures named would be in the same order, expressed in round numbers,  $1\frac{1}{2}$  atmospheres (=about 22 lb.), 3 atmospheres (=45 lb.), 5 atmospheres (=75 lb.), 8 atmospheres (=120 lb.), 16 atmospheres (=250 lb.). If we work, and it might be possible to do so, with a lower temperature difference than 20° C., say, 10° or even 5° C., the corresponding steam pressures might be reduced. But although the example chosen is a somewhat exaggerated one, it clearly shows the point I wish to bring out, viz., that with a large number of effects the

steam (or boiler) pressure rises unduly and in a very disproportionate manner. This alone proves that in practice a limit must be placed on the number of effects that can be usefully employed. We must also consider that the losses of heat must necessarily increase with each added effect. Furthermore, bearing in mind the increased cost for a larger plant entailing high charges for depreciation, the increased cost for attendance, large space, &c., we find that these increases are not counterbalanced in a proportionate manner by the saving in coal, as theoretically the amounts of coal, in the above considered cases, are only reduced by  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{4}$ ,  $\frac{1}{5}$ ,  $\frac{1}{6}$ , &c. Besides, the fact must not be lost sight of that high pressure steam behaves almost like a gas and does not transfer the heat so economically as low pressure steam. In each special case it must, therefore, become a question of calculation how far the saving of coal is counterbalanced by the increased cost under the heads enumerated. I wish to lay stress on this point, as many a double effect and triple effect have been erected in works, where a single effect would have been the proper installation. It is impossible to lay down general rules, as each case must be considered on its merits, and only a careful calculation and consideration of all points involved can lead to a decision as to what number of vessels should be erected in a given case. It may, however, be said that the higher the price of coal the greater will be the benefit obtained by installing a large number of vessels. Thus it will be readily understood that a sextuple effect for the production of distilled water in the nitrate fields of Chili may prove a profitable installation, whilst similar plant in this country for evaporating brine would be a ruinous proposition.

An example taken from my own practice will perhaps better illustrate the foregoing remarks:—

A dilute caustic soda solution (from a causticising plant) had to be concentrated up to the sp. gr. 1.35. Calculation showed that in a given time 134 tons of water had to be evaporated off. The outlay for coal, having an evaporative power of 7.5, would have amounted for a vacuum evaporating plant consisting of

	S.
Single effect .....	to 496.0
Double effect .....	248.0
Triple effect .....	165.3
Quadruple effect .....	124.0
Quintuple effect .....	99.0

The saving effected by using multiple plant for the above given quantity would therefore be—

	S.	S.	S.
Between single effect and double effect ..	496.0—248.0=	248.0	
.. double and triple ..	248.0—165.3=	82.7	
.. triple and quadruple ..	165.3—124.0=	41.3	
.. quadruple and quintuple ..	124.0—99.0=	25.0	
.. single and triple ..	496.0—165.3=	330.7	
.. single and quadruple ..	496.0—124.0=	372.0	
.. single and quintuple ..	496.0—99.0=	397.0	

The numbers contained in the last table, in conjunction with some other considerations, such as available space, led to the decision that quadruple and quintuple effects would be too dear, whilst a triple effect presented an economical arrangement.

After this theoretical explanation we may now consider the apparatus used in practice. Rillieux, the inventor of the system of multiple evaporation, employed horizontal cylinders, furnished with a number of horizontal tubes arranged in locomotive boiler fashion. Some of the disadvantages of Rillieux's apparatus are the following:—The steam passes through all the heating tubes with a uniform velocity, and especially in the second and third effects with a low rate of velocity. It is, therefore, impossible rapidly to remove the condensed water and thus effect a rapid exchange of heat. As the tubes reach above the centre of the boiler, loss by entrainment is inevitable. The enormous advantages, however, which Rillieux's invention offered led to the fitting up of a number of installations in American factories, which worked very successfully. The introduction of Rillieux's system in Europe, especially in Germany, was not attended with equal success at first. The engineers, who undertook the erection of the apparatus from the drawings brought over, did not understand them and actually degraded Rillieux's

triple effect to a double effect. The troubles experienced with such a triple effect were such that it was jeeringly nicknamed "triste effect."

An important improvement in the apparatus was effected by Roberts (1850), who converted the horizontal effects into vertical vessels with much shorter heating tubes, thus giving to the vacuum vessels that form which is up to now the one most in vogue. In Roberts's vacuum vessels the steam circulates round a number of tubes of small diameter fixed in two tube plates. In an improved form of Roberts's apparatus a tube of larger diameter is fixed in the centre. The purpose of the centre tube was to assist the circulation of the liquid in the pan.

As long as solutions were boiled from which no solid substance separates during the boiling, an evaporator of this type would do fairly good work, as, for instance, when dilute solutions of distilled glycerin are to be freed from water. The only point that has to be considered is whether the heating chest is so designed as to afford, *cæteris paribus*, the best conditions for obtaining the highest efficiency from the heating steam. As soon, however, as solid substances, which are liable to cake on to the heating surface, begin to separate, a difficulty arises which becomes increasingly serious as the quantity of solids that become insoluble increases.

Sugar solutions, to which multiple evaporation was first applied, and for which this system has been worked out in a very thorough manner, present a comparatively easy problem, as the amount of solid matter that may cake on to the heating tubes is not very considerable. Still, the lime salts separating from the sugar solutions encrusted the tubes with the formation of a hard scale, which considerably reduced the coefficient of transmission of heat. In course of time this incrustation became so heavy, and the duty of the evaporation plant fell off so much, that it had to be laid off to be cleaned out. It is evident that an apparatus like Roberts's requires a good deal of manual labour, as each pipe must be cleaned separately. Although various devices were invented for cleaning the tubes they proved unavailing, and in the early days of multiple evaporation the incrustation of the tubes came to be looked upon as a necessary evil. When, therefore, the duty of an evaporation plant became too low, recourse was had to boiling out with acetic acid or hydrochloric acid, followed by caustic soda or caustic potash. The cleaning of horizontal tubes as employed in the old Rillieux apparatus was rendered easier by fixing the tubes in such a manner that they could be taken out singly. This led to the arranging in a bundle or chest of three or more horizontal tubes which could be taken out together and readily replaced.

Guided by the idea that the more rapidly the liquor circulates the quicker the condensed water can be discharged and the more efficiently can the boiling operation be carried on, a large number of inventors patented devices purporting to further these objects. It would be impossible to review here these patents, almost without number, and I must refer the reader to the extensive literature on sugar manufacture. The large central tube in the improved Roberts's apparatus had been credited with the power of creating so strong a current that the liquor rushing up through the narrow tubes and down the central tube would wash away all the solid substances—a pious assumption, which was not confirmed by practice. Great advantages were claimed for heating chests formed by a large number of bundles of tubes arranged as, e.g., in the Wellner-Jelinek apparatus. In order to be able to provide long tubes the circular form of the vacuum vessels was abandoned in this system, and the somewhat unsightly waggon-shape introduced. With a view to further increasing the heating surface, the bundles or chests of tubes were arranged in stages. This plan, which came much into vogue on the Continent and in the United States, permits the ready drawing out of bundles of tubes for cleaning. Another device for increasing the circulation of the liquid, and at the same time for rendering the cleaning of the tubes more easy is represented by the Aspinall drum (Fig. 1). The liquor can here rush round the whole of the heating surface; the drum is easily accessible and can be easily taken out.

A more modern arrangement, shown in Fig. 2, has given

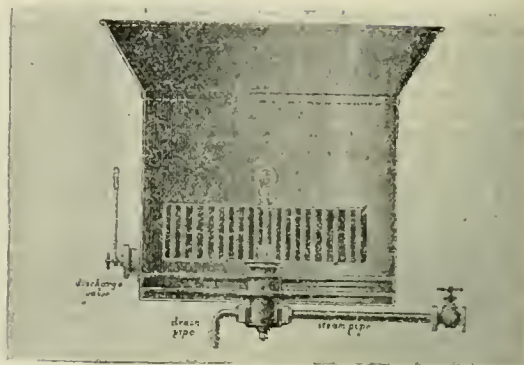


FIG. 1.



FIG. 2.

me very good results as regards rapid circulation and economical use of steam. A similar arrangement has been lately re-patented in a multiple form, two or three of these drums being mounted in stages and furthermore the number of drums being doubled in addition to the fixing of a centre tube in the evaporator.

There is thus a complete ringing of changes in the arrangement of tubes—some of them clumsy devices for tormenting, as it were, the liquid in the hope of avoiding incrustation. Some of these devices seemingly create very rapid boiling, but what is frequently taken for boiling is caused by an eruptive bursting of the steam bubbles, which are generated at the lower portion of the heating chest and rush upwards, scattering the liquid when they burst.

In all the apparatus with horizontal tubes considered hitherto, the steam passes through the heating tubes, whilst the boiling liquid surrounds the tubes. A most important innovation was introduced by Yaryan, who sends the liquor through narrow tubes, whilst the steam circulates around them. The small diameter, in addition to a special feeding device, allowed a small quantity only of liquor to enter the tubes. The liquor is thus quickly heated, and the evolved steam forces it rapidly through the tubes. A much better evaporation was thus obtained, and it was hoped that in the case of sugar solutions, the deposits of salts would be prevented. An illustration of the Yaryan apparatus has been given already in this Journal (1889, p. 32). I show in two lantern slides a more



modern form of one of the effects and a quadruple effect, in which the condensed water is used for pre-heating the liquid. A further evolution of the Yaryan apparatus is represented by the Kestner vacuum evaporator, models of which were shown at the St. Louis Exhibition. It may be tersely described as a Yaryan evaporator placed vertically, though with somewhat longer tubes, so that the principle employed in the well-known Kestner emulsor is developed to the full, the liquid creeping up inside the tubes ("grimpage") whilst leaving an empty core.

Notwithstanding all these improvements, the incrustation of the tubes in sugar solutions still does take place. If the liquors in the succeeding vessels of the multiple plant travel in the same direction as the heating steam, they become, of course, specifically heavier, whilst at the same time, the temperature of the heating steam becomes lower. There is a compensation owing to the "vacuum" becoming increasingly higher, so that a more rapid removal of the vapours is obtained; yet, if the concentration of the liquid becomes too high, boiling would become so sluggish that it would be unremunerative to carry the concentration of sugar solutions too far in a multiple plant. It has therefore become the practice in sugar works to divide the plant for concentrating up to the finishing point into two main parts:—(1) a multiple evaporating plant, and (2) a single effect vacuum pan. When the thin liquors have been brought to a sufficiently high gravity in the first installation, they are pumped into a large single effect—the vacuum pan—which is heated by a row of coils with either exhaust steam or direct steam according to requirements. (Illustrations of installations consisting of a triple effect, having a wet pump, and a vacuum pan fitted with a Torricellian condenser and a so-called dry air pump were shown by means of lantern slides.)

Far more difficult to treat than sugar solutions in vacuum plant—single as well as multiple effect—are those solutions from which salts separate during concentration. The first attempt to apply multiple evaporation to solutions other than those of sugar was made, as far as I am aware, by Reynolds. He endeavoured to concentrate salt solutions in multiple apparatus, similar to one constructed by Derosne, which latter had designed a combination of the Howard pan and the Degrand pan. The apparatus became, however, choked with salt crystals, and we find Pécel referring to this attempt with the somewhat hopeless words:—"Salt solutions can only be boiled down in multiple apparatus until they reach salting point."

A successful effort to apply multiple evaporation to "chemical solutions" was made by Dale in 1859 (Patent specification No. 506: "Improvements in concentrating caustic alkalis and in applying a product therefrom to the purpose of obtaining motive power and to other purposes"). Dale's process is well-known and is being carried out to some extent up to the present day. The boiling, however, did not take place *in vacuo*, as the steam leaving the first vessel was under a sufficiently high pressure to force itself through the heating chests of the succeeding effects; nor was the concentration carried further than to the point when salts would separate out. The liquor was then run into the caustic pot to be "finished" there in the well-known manner.

After a lapse of twenty years, a German potash works was induced by the success attending multiple evaporation plant in sugar works to experiment with their liquors (D.R.P. 14,015). The dilute lyes were concentrated in steam boilers, and the vapours were led into vacuum pans. The evaporation in the boilers over free fire was carried only to the "salting point," as further concentration would have led to separation of salt and burning through of the boiler plates. The vacuum pans were of the vertical type fitted with tubes. The separation of salts in them seems to have caused great trouble, for this system was soon abandoned. According to a later patent (D. R. P. 32,392, 1885), the order of the liquors was reversed, the first stage of the evaporation up to the "salting point" being carried out *in vacuo*, whereupon the concentrated solution was taken out and "finished" over free fire.

Meanwhile, in France, multiple evaporation *in vacuo* was adopted for the concentration of soda solutions. This

process was protected in Great Britain by a patent (E. P. 1527, 1881, J. Buffet: "Improvements in the method of effecting concentration and crystallisation of soda solutions and apparatus for the purpose"). The apparatus, consisting of a quadruple effect, was erected in the Etablissements Malétra at Petit-Queville. The evaporation, however, was not carried beyond the salting point.

The introduction of multiple plant in chemical works, chiefly in Continental ammonia soda works, then became more general. We find that, at the beginning of the last decade, a number of multiple effects of the ordinary vertical type, as also of the Yaryan type (up to sextuple effects), had been installed for concentrating solutions of soda, caustic soda, potassium chloride, potassium carbonate, potassium sulphate, magnesium chloride, mineral water (Vichy), paper makers' waste solutions, and other waste liquors. In all these cases, however, the concentration was only carried on up to the point when salt began to separate. Attempts to go beyond this stage led to great difficulties and, notably in the case of the Yaryan apparatus, to failure.

The first serious attempt to grapple with the difficulty which solutions, if concentrated beyond the salting point offer, seems to have been made by Pick, whose first patent was taken out in the year 1887, under the name G. I. J. Wells, and was supplemented by a further patent (E. P. 3087) in the year 1890. The evaporating vessels, arranged as a triple effect, were of the ordinary vertical tube type. The special feature of the design was that the vessels had conical outlets, to which "salt filters" were fixed, into which the separating salt fell down and was washed and dried by suction. This was an adaptation from the conical pan and salting vessel which had been used successfully in the concentration of soap lyes for the recovery of glycerin. Undoubtedly, the bulk of the salt was thus removed, but equally certain is it that incrustation of the tubes took place. If the scale consisted of salt crystals only, the difficulty could have been mitigated by washing out with boiling water and occasional chipping away of the salt which had set hard. Far more serious was the trouble caused by the deposit of lime and magnesia salts which must be removed by hand. The purification of the brine previous to concentration would naturally suggest itself to the chemical mind, but this appears to be too expensive a process. For this reason, amongst others, evaporating plant for the production of salt from brine has not yet become a generally adopted process.

With the advent of electrolytic soda the question of the removal of salt from caustic soda solutions became more pressing. A liquor of this kind, with which I had to deal, contained about 4 per cent. of caustic soda and 4 per cent. of sodium chloride. Such liquor will throw out salt, when a density of a little over 60° Tw. (measured cold) is reached. It would thus only be possible to evaporate in multiple effect up to 60° Tw., or thereabouts; after that the trouble would commence. If it were intended to carry the evaporation further, the second and third vessels of a triple effect would have to be provided with "salting vessels." In order to prevent incrustation as far as possible, scraping arrangements were fixed in the tubular evaporators below the drum plates—again an adaptation from the method then employed in the recovery of glycerin from soap lyes. Of course, these scrapers could not keep the tubes clean, so that the old difficulty remained in full force. The pans were therefore worked as best as circumstances permitted, and the length of the working run, before the vessels had to be laid off for cleaning, depended entirely on the care with which the operations were conducted. When the duty fell off, the pans were emptied and washed out or, if necessary, cleaned out by hand. Some multiple effect plants were expressly so designed that one vessel could always be thrown out of the series for cleaning purposes. In fact, in the case of a sextuple and a triple effect within my experience, one vessel was always lying idle for cleaning purposes, so that, practically, only a quintuple and a double effect, respectively, were being worked.

It is obvious that working with evaporators under all these difficulties is not an ideal procedure. I was, therefore, led to design an evaporator (Fig. 3) which should

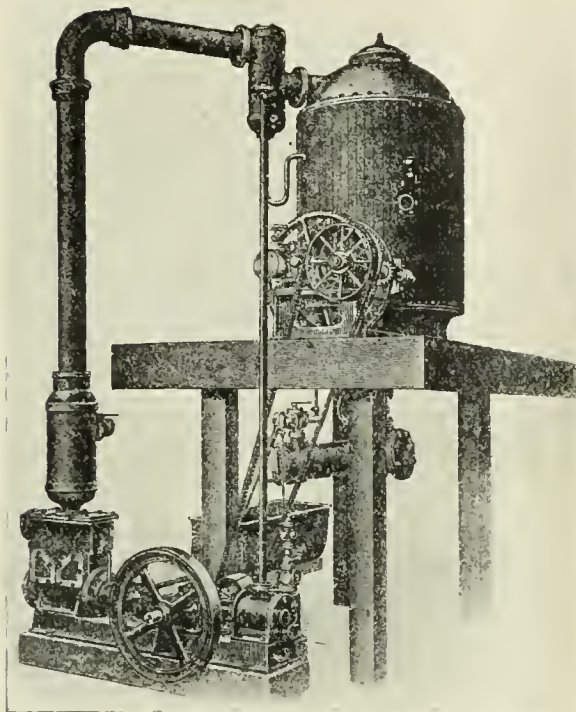


FIG. 3.

allow of continuous working and at the same time unite in itself all the advantages which are to be looked for in a useful vacuum vessel, such as rapid circulation of the liquid, rapid circulation of the steam, low level of liquid, prevention of entrainment, and, above everything, complete prevention of incrustation of the heating surface. The heating surface of my vacuum evaporator consists of a rotating chest, the construction of which varies according to the nature of the liquid which has to be concentrated. The heating chest is actuated by spur gearing, driven from the steam engine, which at the same time works the vacuum pump. The heating surface is kept free from incrustation by mechanical appliances. Thereby the salts are prevented from adhering to the heating surface the very moment they separate out from the solution, and they then drop through a sluice valve into a salting vessel. From this the salts are removed at suitable intervals without the boiling in the vacuum pan being interrupted. At the same time the revolving chest ensures the fullest possible circulation of the liquid, so that a rapid exchange of heat is assured.

The rapid circulation of the heating steam is also ensured by the revolving heater. The condensed water is rapidly thrown out, so that continually fresh contact of the heating steam with the heating surface is obtained. In order to arrive at definite numbers expressing the gain reached thereby, I made a series of experiments on a large working scale with heating surfaces of different types. The amount of water evaporated in a given time was measured carefully and simultaneously the quantity of steam sent through the heater was ascertained by weighing the condensed water. The quantity of water evaporated off, divided by the quantity of condensed water, gives the efficiency.

I experimented with a tubular heating chest of the old type, an Aspinall drum, a drum similar to the one illustrated by Fig. 2, and the rotating heater. I found the efficiency in the old-fashioned tube evaporator to rise hardly above 80 per cent.; with the Aspinall drum and the drum shown in Fig. 2 efficiencies up to 86 per cent. were reached. In the case of the revolving heater the efficiency was never found below 90 per cent. and varied

from over 90 per cent. to 93 per cent.; in some very favourable experiments even 94 per cent. were obtained. The level of the liquor can be easily kept at that height which experience shows to be the most suitable. By keeping the level below the top of the revolving heater, "film evaporation" can be obtained—an experiment which would obviously be very dangerous in the case of tubular heaters. The illustration (Fig. 3) still shows, as an entrainment preventer, the old-fashioned safe, in which the mechanically carried over liquor is trapped and led back into the pan. I have now abandoned this safe and replaced it by an entrainment preventer fixed inside the evaporator. Later on I shall demonstrate the work this entrainment preventer is capable of performing in three lantern slides.

I will now describe briefly a few practical applications of this evaporator to "chemical solutions."

Whereas in the concentration of caustic soda liquors in tube evaporators the sp. gr. of 1.35 cannot be exceeded with safety, I have evaporated caustic soda solutions in my evaporator to above 1.5 sp. gr. (measured hot). The salts which separate are withdrawn, as described already, and washed, whilst the boiling goes on uninterrupted.

An important application of my evaporator is found in the concentration of solutions from which calcium sulphate separates. The glycerin waters ("sweet waters") obtained in the so-called acid saponification processes contain sulphuric acid, which is usually neutralised by lime. A certain proportion of calcium sulphate remains dissolved in the glycerin solution and separates out on the heating surface as a hard scale. Formerly the evaporation of these liquors was carried out under atmospheric pressure, so as to have the heating coils readily accessible for periodical cleaning. In my evaporator the heating surface is kept perfectly clean as the sulphate is removed the moment it separates.

Practically the same problem, although in a more aggravated form, presents itself in the concentration of glucose solutions (as also of invert sugar). When tube evaporators are used in the concentration of glucose liquors, hard crusts of calcium sulphate settle down on the heating surface. A Yaryan evaporator would be practically useless for this kind of liquor as the cleaning of the tubes causes too much expense. Evaporators simulating the Wellner-Jelinek type are being largely used for this purpose, but the manufacturers have to put up with the trouble of pulling out the tube chests and cleaning them singly by boiling off the crusts with hydrochloric acid.

In the process of recovering glycerin from spent soap lyes, evaporation *in vacuo* has found a very important application. For many years the candle makers concentrated their "sweet waters" in the Wetzel pan. When the demand for glycerin brought the hitherto wasted soap lyes into requisition, this pan was also applied to their concentration; but as the surface of a coil does not lend itself readily to cleaning and scraping, Droux substituted for the coil a revolving cylinder. When the recovery of glycerin from soap lyes was introduced in this country, heating by steam was found to be attended by great inconveniences. The glycerin solutions were at first concentrated in open pots over free fire; in fact, the ordinary caustic soda pots, which could be easily scraped down whilst evaporation went on, were used. In order to prevent as far as possible the deposition of the salt on the heating surface, a large saucer was suspended in the liquid so that the bulk of salt could separate out on the saucer. This was lifted out at intervals by means of chain and pulley to clear it from salt. The liquid was not injured by the flue gases, as the concentration was finished at a temperature far below the one at which glycerin is decomposed. Since considerable quantities of glycerol volatilised towards the end of the concentration, the open pans were replaced by closed vessels, consisting of conical cast iron pans to which a salt vessel was fixed. The pans



were covered by a dome through which passed stirring gear, fitted with a set of scrapers by means of which the heating surface was kept clean. This arrangement worked very well and caused no loss nor even serious inconvenience, provided the material from which the pan was made was carefully selected. A large outlet pipe in the dome carried away the vapours. These vapours could now be used for pre-heating thin lyes or for their evaporation in multiple effect fashion. I used for this purpose rotating heaters. There was thus but a step to be made to the application of evaporation *in vacuo*. Vessels of the old tube type would obviously not do, and when they were applied, the inevitable happened. The tubes became rapidly salted up and endless troubles were encountered. Of course, by careful manipulation the trouble can be reduced to some extent, and various means were adopted to hinder incrustation. Thus, in some cases, the evaporators were completely emptied several times a day, and the deposited salt dissolved by charging the evaporator with thin liquors, or if need be with water. It is obvious that everything depended on the care of the manipulator, and I may say that I have seen some evaporators which worked for two days of the week, whilst the remaining days of the week were employed in chipping out the hard salt crust which had settled on the tubes. A more rapid circulation of the liquid, and consequently a washing away from the tubes of a large portion of the separated salt, was obtained by using evaporators fitted with a heating surface of the Aspal drum type or of similar type. But even here very much depends upon the care with which the apparatus is worked. To avoid difficulties in small works, where work is only carried on during the day, the evaporators are emptied in the evening, and boiled out with thin lyes or with water, or where the operations are carried on day and night, the heating surfaces are cleaned by washing out after the

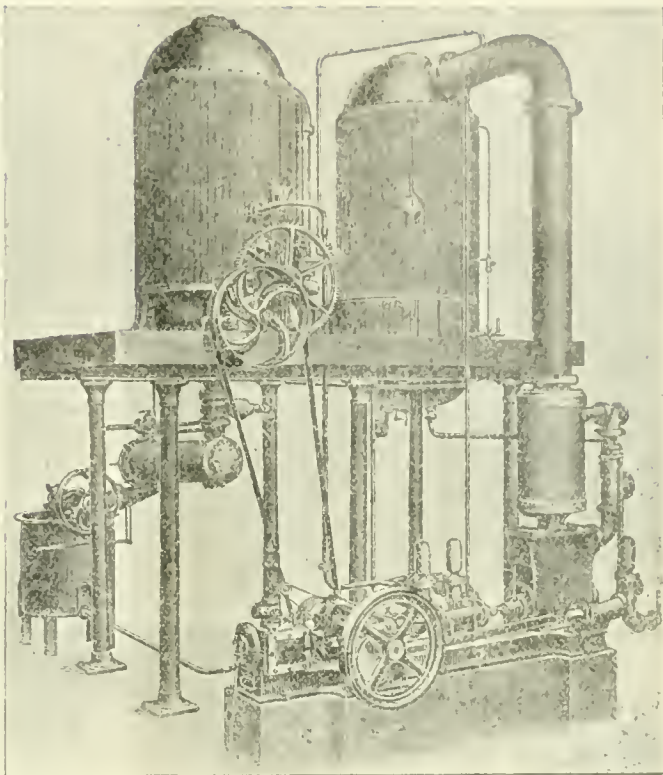


FIG. 5.

effect of this kind in Fig. 4. But I would not care to assert that this evaporating plant can be run for a full week, day and night, without the tubes becoming more or less coated with salt. The difficulty is, however, entirely removed by using my evaporator with the rotating heater. The double effect shown in Fig. 4 has, moreover, another important drawback. The thin liquid containing about 5 per cent. of glycerol enters the first vessel and is therein concentrated with the aid of exhaust steam until it contains about 10 per cent. of glycerol. The further concentration up to a content of 80 per cent. is carried out in the second effect. As the stronger liquid is heated with the steam coming from the first effect, the evaporation, especially during the last hours before finishing, becomes unduly slow. I find it, therefore, advantageous to imitate the sugar works practice, *viz.* to concentrate in the double effect only up to a certain strength, and when the evaporation becomes sluggish to transfer the liquor to a single effect with rotating heater and to finish the batch therein. In the case of plant for smaller works, where a double effect *plus* a single effect would be too large, I reverse the direction of the flow of liquid by using the heating steam for the concentrated liquid, the dilute liquor being heated in the second effect by the vapours coming from the first effect. As no salts separate from the dilute solutions, the cheaper form of evaporating vessel, *viz.* a tubular evaporator, can be used. This combination of a tubular evaporator with the rotating heater evaporator is shown in Fig. 5. Here the concentration of the soap lyes can be carried out throughout a whole week without the heating surface becoming encrusted.

The working of the liquors in the saltpetre making process offers a similar problem.

The nitrate of soda industry presents an example of a more complicated kind. The residue—*ripio*—remaining after the caliche has been boiled out and perhaps washed once contains considerable quantities of sodium nitrate, which can be extracted by further boiling out of the residue. The solutions so obtained contain considerable

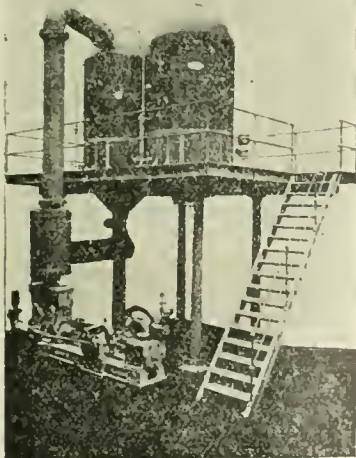


FIG. 4.

finishing of each batch of crude glycerin. I speak from experience as I have myself erected for the evaporation of soap lyes evaporating plant fitted with tubular heating drums of the most advantageous type. I show a double

quantities of common salt and other impurities as the following analysis of a mixture of two successive washes—termed “relavés”—shows:—

	Grms. per litre.
Sodium nitrate .....	64.6
Sodium chloride .....	178.46
Sodium sulphate .....	20.17
Sodium iodate .....	1.95
Aluminium chloride .....	7.79
Calcium chloride .....	4.17
Potassium chloride .....	traces
Magnesium chloride .....	2.36

279.50

By concentrating these “relavés” the impurities are separated out until at last a saturated solution of sodium nitrate is obtained from which a commercially pure nitrate crystallises out.

Under the peculiar conditions of the nitrate fields the concentration can only be carried out economically by multiple evaporating plant, as the main product in this case must be distilled water, whilst the nitrate and the other salts recovered in the process can only be looked upon as by-products. Very soon after the concentration of the liquors commences calcium sulphate and then sodium sulphate separate out, which are bound to encrust the tubular heating surfaces in a very short time. The difficulties which this problem offers are best illustrated by the figures contained in the following table, which gives the composition of the salts as they separate successively on evaporation:—

	Calcium sulphate.	Sodium sulphate.	Sodium chloride.
	Per cent.	Per cent.	Per cent.
First “salts” .....	61.0	0.0	16.0
Second “salts” .....	8.3	0.0	87.8
Third “salts” .....	0.9	1.5	89.2
Fourth “salts” .....	0.85	3.5	83.3
Fifth “salts” .....	—	app. 75	app. 20

It is obvious that in a case of this kind the evaporator with the rotating heating surface is the most advantageous apparatus to employ.

As a last example, I take “distillers’ wash” (*distillers’ residue*). This is usually run from the stills into large ponds, where a certain amount of solid material subsides. The thin supernatant liquors are then run to waste, although they still contain large quantities of valuable food material. The concentration of these liquids in multiple vacuum plant has been attempted repeatedly, but all tubular evaporators have proved a failure. The suspended matter chokes up the tubes rapidly, and evaporation, therefore, falls off to such a serious extent that the boiling must be stopped after a short time. To make things worse the matter froths so incontinently that it is difficult to keep it in the ordinary pans. I have dealt with this material successfully in a double effect like the one shown in Fig. 5. The feeding stuff is recovered as a sludge and then treated similarly to the separated salts mentioned in the preceding examples. The special difficulty which the frothing offered was very effectively overcome by the entrainment preventer I have referred to already.

In this necessarily brief review I have been forced to omit all those processes which aim at the production of dry substances, such as are obtained from milk, blood, &c. Nor have I been able to consider any other heating agent than steam, although it must be obvious that the first effects of a multiple evaporating plant can also be worked with waste flue gases, when a high temperature is not injurious. Such a case is presented by the concentration of caustic soda liquors.

Enough has been said to show that each liquid requires special consideration and that the mere transference of a type of evaporator, which has been found useful in one industry, to another industry must be frequently attended with failure. This requires no further explanation to a chemist. To become more vividly impressed with the truth of this statement, it is only necessary to glance through the following list in which I enumerate, in addition to the substance mentioned already, some “chemical

solutions” to which evaporation *in vacuo* is applicable and has, indeed, been applied:—

Aluminium sulphate, ammonium chloride, borax, calcium chloride, ferrocyanides, lanoline from wool scourers’ wash waters, magnesium sulphate, potassium chlorate, potassium bi-chromate, potassium cyanide, saltpetre, sodium bi-chromate, sodium cyanide, sodium silicate, tartaric acid. Additions to this list will suggest themselves readily.

Before the designing of a suitable evaporator for any of these solutions could be approached, a thorough investigation of the behaviour of the solutions whilst undergoing concentration was indispensable. Nor did the study of the chemical side of the subject alone suffice. The material from which the evaporator, and especially the heating surface, should be constructed, had to be equally carefully considered in each special case. Thus, to take an example, an evaporator in which tartaric acid solutions are concentrated must not be made of iron nor of copper. Lead will suggest itself at once to the chemist. But, as the maker of fine chemicals may raise objections against lead, bronze will be the only comparatively cheap material that can be used in practice.

Here lies a wide field open, in which the chemist must co-operate with the engineer. It is but right to say here that I have worked together in this direction with Messrs. John McNeil and Co., engineers of Glasgow, with whom I have patented conjointly some of the special evaporating plant shown.

Perhaps it was owing to the want of such co-operation that the application of Rillieux’s system in chemical works other than sugar works was so long delayed. Possibly the chemist had not had the necessary engineering knowledge; or, perhaps, the influence of the mechanical engineer predominated in the works. Possibly even the time was not ripe, for this Society was not born until 50 years after Rillieux brought out his first multiple plant. It would be idle to speculate as to the reasons of the apparent neglect, since the enormous number of patents that have been taken out during the past 25 years seems to be making up for past neglect and a considerable number of workers are now busy in this domain, which is peculiarly that of the chemical engineer.

## DISCUSSION.

The PRESIDENT, who was present, congratulated the meeting on having had such a valuable contribution brought before them.

Mr. J. BERNAYS said there were two statements which seemed to him rather to contradict each other. If he understood the author correctly, he said they must not expect a double effect or triple effect apparatus to do double or triple the work of a single one, but he afterwards clearly explained that in using the double apparatus, 1 lb. of steam would evaporate 1 lb. of liquor in the first vessel, and again evaporate 1 lb. in the second vessel, which would mean that in the two there were 2 lb. of liquor evaporated from the original pound of steam and if there was a third, 3 lb. That would, therefore, apparently mean that a triple apparatus should be three times as effective as a single, and a double apparatus twice as effective. With respect to the second point, he was rather surprised to hear Kestner’s evaporating system described as merely a turning over vertically of the horizontal tubes of the Yaryan apparatus. In Kestner’s apparatus, the tubes in which the liquor was contained were never full; the liquor never passed right through; there was no current. The liquor stood only about one-third high and the vapour carried the small particles of liquor right up to the end of the apparatus, and it was, therefore, supposed to be evaporated in a better and more economical way. The system seemed quite different from that involved in Yaryan and other evaporators, although to an outsider the apparatus might appear to be the same as Yaryan’s turned over, and it was surprising to hear it so described.

Dr. SCHACK-SOMMER asked why, when describing the double effect apparatus, did the author first take 30° as the difference of temperature between the liquor entering and leaving each pan; and afterwards, when describing the triple effect, only 22°. Did he mean to imply that the



effective heat was more in the former case than in the latter? One of the slides showed a vacuum pan with a Heizkörper and a central tube, and Dr. Lewkowitsch stated it was a "pious assumption" that the liquor would circulate better or move more rapidly on account of this central tube. Now he knew that a great many sugar chemists assumed that it was very essential that the liquor should circulate freely and move rapidly, and for this reason this centre tube amongst the steam pipes was much thought of, and Freitag patented a central tube that could be lengthened telecopically, following the surface of the liquor in the pan and similar devices had been the subject of various patents. Therefore he should like to ask if the author considered that the usefulness of the central tube was a fallacy or if in his experience it had not proved itself?

Mr. J. F. BRIGGS said a patent had been taken out this year in which it was attempted to obtain the multiple effect in a single pan. The patentee withdrew steam from above the boiling liquid by means of an injector of direct steam, and sent the mixture off into the steam drum of the evaporating pan. He should like to know whether that was a sound principle or not.

Mr. A. J. LIVERSEDGE said the paper was full of interesting matter, and there were many points which would repay study. He would not like to convey the impression that he was adversely criticising Dr. Lewkowitsch's address, but he had made a singular error with regard to Yaryan's apparatus. He had said that in this apparatus the liquor was sent through the tubes; but that was not Yaryan's invention, because it was sent through tubes long prior to his time. He sent the liquor through the tubes in a limited quantity; that was Yaryan's invention. Again, the heaters on the Yaryan apparatus, shown on the screen, were the invention of Lilley (who was also an American), not of Yaryan. They were extremely valuable, because one of the reasons why there was a limit to multiple effect (and it was soon reached) was the necessity of raising the liquor to the boiling temperature in the first effect, and sometimes it might take as much heat to do that as to do the whole of the evaporation.

Dr. LEWKOWITSCH, in reply to Mr. Bernays' question, explained again the theory of multiple effect plant, and showed why a double effect with the same heating surface in each vessel did not evaporate twice as much as a single effect of the same heating surface, as is fixed in each vessel of the double effect. By utilising the latent heat of the steam in a double effect twice, one only required half the coal (or heating steam), but one had to pay for twice the size of apparatus. In his theoretical explanations he had avoided all complications occurring in practice, and assumed an ideal case where there was no loss of heat. As to the Kestner apparatus, he must acknowledge that he had been somewhat flippant, although he had said "with all due apologies to Kestner" in trying to explain its principle to an audience, which did not entirely consist of engineers conversant with evaporating plant. But he had mentioned that in Kestner's apparatus the tubes, besides being vertical, were much longer, and that the full effect of film evaporation—"grimpage" as it was called—was obtained. But to a general audience, which was only interested in the principles of the subject, the mere word, "grimpage," would not explain much, and he did not think he would have been justified in spending more of the time at his disposal in explaining the whole of Kestner's system. In reply to Dr. Shack-Sommer, the differences of temperature he had taken were quite arbitrary, although they were governed to some extent by the difference of the temperature of the heating steam and 46° C. He had tried to deal with the matter in the simplest way, and took arbitrary figures in order to bring out clearly the principle involved. He had had no experience of the telescopic arrangement to which Dr. Schack-Sommer had referred, and therefore could offer no opinion about it. If the rapid circulation did actually do what was claimed for it, there would be no deposit of salt on the tube, but

according to his experience, there always was. He did not deny the circulation, but he denied that it was strong enough to wash away the deposited salt. With respect to the question put by Mr. Briggs, he had seen that patent, and it had been abstracted in our Journal; as far as he remembered, it appeared to him to be more or less a recrudescence of the old system of Pequeur in the twenties of the last century. Pequeur, who is considered by some writers the father of multiple evaporation, had Rillienx in his employ as an engineer. But, as the latter could not convince Pequeur of the advantages of his own system, he left in disgust for America, so that American sugar makers had the advantage of his invention long before European manufacturers. With regard to the Yaryan apparatus, he did not think he should have gone in his paper into all the different points that had been raised in a law suit between Lillie and Yaryan. The engineers who put up the Yaryan apparatus shown on the screen, used the pre-heaters, and whether the latter were Lillie's invention or not, did not concern his audience. He had not even mentioned Lillie in his paper. Lillie claimed many advantages for his film evaporation, which others disputed, but these matters were all outside the scope of a general paper of this kind.

## New England Section.

Meeting held at Boston, on Friday, October 6th, 1905.

MR. HENRY HOWARD IN THE CHAIR.

The CHAIRMAN introduced Mr. Ivan Levinstein, past president of the Society, who offered a welcome, in the name of the older sections of the Society, to the New England Section. After a reference to the social and intellectual advantages of membership, and describing the Journal as the best technical chemical Journal in any language, he advised members to keep an eye on legislation affecting their interests, e.g., spirit duties and patent legislation. In the course of his remarks on the latter subject, he traced the development of patent law, and pointed out inconsistencies between United States and British law.

## APPLICATION OF ELECTROLYTIC CHLORINE TO TEXTILE BLEACHING.

BY H. S. DUCKWORTH.

In presenting this paper no claim is made for originality either in the application of electrolytic chlorine or in the apparatus for generating the same, but I shall try to show some interesting results from an apparatus with which we have now had nearly three years' experience. Mr. Charles H. Fish, Agent of Cocheo Manufacturing Co., read a paper before the New England Cotton Manufacturers' Association on this subject last year, and this paper treats of the same matter with a fuller discussion of our general results.

The idea of producing chlorine at the point at which it is to be used has been worked on for many years. There are two general systems for the electrolysis of brine solutions for the production of chlorine, depending on whether or not a diaphragm is used between the electrodes. With a diaphragm, chlorine and caustic soda are produced separately, without it they unite to form sodium hypochlorite, or what is generally known as electrolytic chlorine. The electro-chemistry of the decomposition of brine is very simple, and much time and money has been expended in New England on the mechanical arrangement of a cell that could compete successfully with the commercial bleaching powder, but the cost of working has generally been too high to begin with, the installation expense very large indeed and the up-keep of the apparatus very expensive, and, indeed, sometimes almost impossible to maintain. I have intimate knowledge of such a plant installed in a print

works at Lowell. This was a very ingenious arrangement of an electrolytic cell with a diaphragm which at the start off worked beautifully, but the maintenance grew heavier and heavier until finally, in disgust, the whole plant was thrown out. As far as I am aware the efforts of our American chemists seem to have been mainly towards a diaphragm cell, in which the chlorine is carried away and absorbed in milk of lime, and the resultant bleaching liquor must compete with identically the same compound made by dissolving bleaching powder. The chlorine in the liquor thus prepared is a little more active and efficient than in that made from bleaching powder, but that is all the advantage that it possesses.

The Haas-Oettel apparatus, which I am about to describe, and which is the subject of this paper, was originated by Dr. Felix Oettel. It has now been running continuously for three years at the print works of The Cochecho Manufacturing Co., and during that time not one cent has been laid out on it in the way of repairs. It consists of an electric cell or electrolyser made of asphalt composition, and placed within a watertight tank, which tank is carefully insulated to prevent loss of electric current. The electrodes are on the so-called double pole system, that is, with one pole at each end of the apparatus and a number of intermediate electrodes that have no contact with each other, or with the current except as the current passes through the solution. The end or pole electrodes are of carbon,  $\frac{3}{8}$  in. thick, standing vertically and extending completely to the bottom of the electrolyser. The intermediate electrodes are carbon plates about  $\frac{3}{8}$  in. thick, fitting tightly across the apparatus in slides, thus subdividing it into numerous cells. These intermediate electrodes do not fill the entire space from top to bottom—they rest upon a non-conducting plate of the same thickness, and support a similar non-conducting plate that projects above the surface of the liquid. This latter arrangement is adopted for two reasons:

First.—Each cell thus constituted forms a dead or non-conducting space into which dirt and impurities, carried by the liquor, are deposited, without causing short circuiting or loss of electric energy.

Second.—The electrodes are covered with a head of liquor, and the bubbles of chlorine gas given off at the electrodes, pass through this head of liquor and are absorbed by it, with the result that there is not the slightest odour of chlorine in the room where the apparatus works. These separate cells have no communication with each other, but each cell has a small external opening at the bottom communicating with the brine in the tank, and one at the top also communicating with the brine in the tank. The tank itself is filled with brine until it is on a level with the opening at the top of each cell. The brine flowing through the openings fills each cell to the same level. When the current is turned on, a vigorous evolution of hydrogen gas ensues, which causes the liquor in each cell to be carried upward with the escaping gas, thus giving it a head of one-half to 1 in. over the brine in the tank outside the electrolyser. The brine, of course, flows out from the cell through the opening into the tank, and a corresponding amount is drawn in at the bottom of the cell to take its place. Thus there is a constant circulation caused by this evolution of gas.

The mode of working is as follows:—The apparatus is filled with brine to the proper level, and the switch thrown; the evolution of hydrogen begins at once and the circulation is entirely automatic and sufficient. A thermometer is placed in one of the cells to record the temperature, which should not exceed 28° C. The temperature is regulated by lead coils placed at either end, through which a part of the bleach house water supply is allowed to flow. A cross over switch is necessary in order to send the current through the apparatus in the opposite direction after every filling. This is in order to clean the carbon plates of the slight deposit of calcium and magnesium salts that form on it. It does this perfectly, and the plates are always clean. A fuse is placed in the current near the machine, so that if by any accident the apparatus should cease to circulate, no damage could result. The management is extremely simple and once rightly established an ordinary workman or even a boy

can obtain good results. No attendance is necessary except at the time of filling or emptying, although at first it is, of course, desirable to watch the temperature and make hourly analyses to be sure of the efficiency. At the expiration of the allotted time the plug at the bottom of the tank is drawn and the charge allowed to flow down into a storage tank, and the apparatus is flushed out with a hose, when it is ready for a second filling. The current used is a continuous one of 110 volts, such as is ordinarily used for lighting. No particular electric apparatus is necessary, although it is desirable to have an ordinary voltmeter or ammeter located at some convenient point in order to know exactly the conditions of the current.

The apparatus, as set up at the Cochecho Manufacturing Co., is contained in a tank 45 in. wide, 30 ins. long and 35 ins. deep, inside measure, although the first apparatus had a little larger tank holding a larger amount of liquor. It was found, however, that greater efficiency could be obtained by reducing the size of the tank and charging it, or refilling it with the solution more frequently.

The particular advantages as shown in this apparatus are as follows:—

- I. The initial cost is comparatively low.
- II. The up-keep of the apparatus costs very little, there being nothing to wear out except the electrodes, which are of carbon and inexpensive.
- III. There are no moving parts; no pumps or arrangements requiring attention. No power—it can be placed anywhere.
- IV. Simplicity in operation. Once adjusted, no supervision is required, and an ordinary boy can obtain good results.
- V. There is no waste of chlorine, and, therefore, there is absolutely no objectionable odour of vapours of any sort. The apparatus works cleanly, and can be located at any point convenient to the work.

From an experience of about three years of continuous running we can testify that the apparatus is quite efficient. It will be interesting to know that improvements in construction are now under way, looking towards even greater neatness, compactness and desirability, and we hope at the same time to show greater efficiency.

With the above apparatus, it is possible to produce in 5½ hours 126 galls. of sodium hypochlorite solution containing 14.4 grms. of chlorine to the litre, or a total of 6.86 kilos. of chlorine, or 15.12 lb.

Bleaching powder usually contains 35 per cent. of active chlorine, and allowing 8 per cent. for waste and loss in making up the solution, which is considered a fair amount, this 15.12 lb. chlorine would correspond to 45.36 lb. of bleaching powder, but here it must be noted that the electrolytic chlorine is much more efficient than the chlorine from the chloride of lime. Three pounds of electrolytic chlorine will, without doubt, do the work of 4 lb. of chlorine from bleaching powder, and therefore the 15.12 lb. of active electrolytic chlorine is equal to about 60.48 lb. of bleaching powder.

Table I.

Capacity of tank=126 U.S. galls.=477 litres.  
Brine at 21½° Twaddell=160 lb. salt=76.66 kilos.  
Horse power at \$15.00 per year—water power basis.

Hours worked .....	1	2	3	4	5	5½
Grms. Cl per litre .....	4.65	7.90	10.44	12.58	13.91	14.38
Temp. °C. ....	17	21	21	20	21	21
Ampères at 110 volts .....	79	74	73	70	65	64
H.-P. hours .....	11.7	22.6	33.4	43.7	53.3	58.0
Cost power, in cents .....	5.61	10.84	16.03	20.97	25.58	27.84
Cost salt, in cents .....	51.54	51.54	51.54	51.54	51.54	51.54
Total cost .....	57.15	62.38	67.57	72.51	77.12	79.38
Total Cl in grams .....	2218	3768	4980	6000	6635	6859
Salt per kilo. of Cl .....	34	20.3	15.4	12.8	11.5	11.2

Salt valued at \$6.10 per ton delivered.  
Thus for 5½ hours worked 169 lbs. salt gives 6.859 kilos. Cl=15.12 lbs.

Cost, salt .....	51.54
Cost, power .....	27.84
Total .....	79.38c.
Cost of equivalent amount (60.48 lbs.) bleaching powder at 1¼ c.= .....	75.60
Freight on same .....	7.00

Total..... 82.60c.



Table 2.

Capacity of tank=126 U.S. galls.=477 litres.  
Brine at 21½° Twaddell=169 lb. salt=76.06 kilos.  
Horse power at \$25 per year—Steam basis.

Hours worked .....	1	2	3	4	5	5½
Grms. Cl per litre ..	4.65	7.90	10.44	12.58	13.91	14.38
Temp. °C. ....	17	21	21	20	21	21
Amperes at 110 volts.	79	74	73	70	65	64
M.-P. hours .....	11.7	22.6	33.4	43.7	53.3	58.0
Cost power, in cents.	9.36	18.08	26.72	34.96	42.64	46.40
Cost salt, in cents	51.54	51.54	51.54	51.54	51.54	51.54
Total cost .....	60.90	69.62	78.26	86.50	94.18	97.94
Total Cl in grms. ....	2218	3768	4980	6090	6635	6859
Salt per kilo. Cl ...	34	20.3	15.4	12.8	11.5	11.2

Salt valued at \$6.10 per ton delivered.

Thus for 5½ hours worked 169 lb. salt gives 6.850 kilos. chlorine  
=15.12 lb.

Cost salt .....	51.54
Cost power .....	46.40

Total cost .....

Cost of equivalent amount (60.48 lb.) bleaching powder at 1½c. = .....	75.60
Freight on same .....	7.00

Total .....

The above two tables show results from one run of the apparatus for 5½ hours. The time is limited to 5½ hours because this allows of two runs per *dies* of 12 hours for five days in the week, and one run on Saturday, which is in accordance with the usual hours of working of the textile industry in the East. Table 1 is based on a cost of horse power of 15 dols. per year—58 hours per week—water power basis. The cost of water power in New England varies greatly and figures are difficult to obtain, but in the Southern States, where water privileges are largely taken up and utilized by the textile industry, 15 dols. is considered a fair valuation. Table 2 is based on a cost of horse power of 25 dols. per year—steam basis. Most of our modern power plants can make as good a showing as this and some of them somewhat better. From an examination of the tables it will be seen that each electrolyser is capable of producing bleaching liquor equivalent to 121 lb. of chloride of lime in one day of 11 hours.

This question of cost is entirely one of location. The transportation of salt from Syracuse costs about 2.80 dols. per ton to the sea board. In this respect it is interesting to note that the present price of salt in Germany, denatured, with a little petroleum, is 60 pf. per 100 kilos. at the mines. This corresponds to 1.31 dols. per ton, which shows some difference as compared with our cost of 6.10 dols. delivered. Then, too, the German salt is somewhat purer than ours. Large concerns that have water power at their disposal, and oftentimes more than they can use, would find considerable economy in this process even when they are remote from the salt supply; while a concern that was obliged to depend upon coal for power, and distant from the coal fields and salt wells, could make no better showing than in Table 2, which is based on Dover, N. H. location—about as badly situated as any place in the Eastern States. Each concern must figure out for itself the pecuniary advantage of using such a process, which it can readily do from the tables and data given.

In enumerating the advantages claimed by the use of sodium hypochlorite, as against calcium hypochlorite for bleaching, I would say:

I. Intensely effective power of a nascent liquor and the great degree of permanence of whites obtained. It is well known that a gas in its nascent state is much more rapid and energetic in its action than one which has been stored. Moreover, the sodium hypochlorite is much quicker and more energetic in its action than the corresponding lime salt. There is no doubt that 3 lb. of electrolytic chlorine will do the work of 4 lb. of chlorine from bleaching powder, and will do it better, quicker and easier. It has even been claimed that the proportion of one to two will be nearer the actual condition and that even in this proportion the whites obtained by the electrochemical process will be purer and more permanent.

II. Universally greater strength and better appearance

and feel of the bleached goods. This is the most important factor in connection with this process and one upon which we cannot lay too much stress. We have made many experiments on cloth that has been boiled in the same kier, using hypochlorite of lime on one half and a corresponding amount of the sodium salt on the other, and invariably it is an easy matter for us to recognise the better feel, clearer white and better general appearance of that portion bleached with the sodium salt.

But even this is not the greatest advantage. The white obtained by the use of sodium hypochlorite is much more permanent, and, if the goods are intended for dyeing or printing, they will take the dyestuff much more evenly than the cloth bleached with hypochlorite of lime. In these days, when the tendency is to do a large part of the dyeing by means of a padding machine, the advantage gained is enormous. We believe this advantage of permanency of whites and level dyeing is largely due to the absence of lime salts in the fibre, although they may be partly explained by the greater solubility, and consequently penetrating power of the sodium salt. No one will dispute that it is difficult, indeed almost impossible, to absolutely free the fibre from lime salts after treatment with bleaching powder solution. This lime salt deposited unevenly over the fibre even in the minutest quantities interferes with the even dyeing of many colours. It seems reasonable that if a less amount of chlorine is used, and when that is expended, nothing but a small amount of common salt is left in the goods, they will be in better condition than where the greater amount of chlorine is used with the accompanying solution of different lime salts.

III. Less acid is required after "chemicking," while for many purposes only a slight washing is necessary, as the small amount of salt in the fibre will not interfere with subsequent operations.

IV. It is of especial advantage in clearing the whites in printed goods. The whites are more easily cleared, and the colours suffer less. We believe that many industries would find places for this where the lime salt is very troublesome and often entirely prohibitive.

V. The process is much cleaner and vastly more satisfactory to deal with than the ordinary process with bleaching powder.

It can be readily understood that this process is not only applicable to the whitening of cotton in any form, but it is especially adapted to the bleaching of flax, which, being difficult to bleach, suffers more from the action of hypochlorite of lime than from sodium hypochlorite. It is also applicable to the fibres used in paper making, also to the bleaching of jute, oil, artificial silk, viscose compounds, and in fact to any process where bleaching powder is now used. This process is largely used in linen bleacheries in Germany, where they often chemick the goods four or even six times. The destructive action of the lime salt on linen is well known, and goods bleached by the electro-chemical process are vastly stronger, and, indeed, are considered equal in this respect to the old grass bleach. This process is of especial use for laundries, and a small cell is made for them and other small users of chlorine. This little apparatus is complete in itself, containing brine tank, electrolyser and storage tank. It is made entirely of porcelain, and covers only a few feet of floor space. It will produce at very slight expense for running 3 kilos. of chlorine per *dies*, which is enough for most laundries, and the advantages of hypochlorite of sodium over lime for laundry use would be many.

It is to just such uses as these that we believe hypochlorite of sodium could advantageously be put. We have in mind a very successful concern who make hosiery and underwear. Their goods are made largely from Egyptian cotton, and they have much trouble from the goods yellowing after being put up in the boxes. From an investigation of their trouble I became convinced that it was due to the lime, and it could be absolutely avoided by the use of sodium hypochlorite. This concern used about a cask of bleaching powder in two weeks. One of these Haas and Oettel apparatus, charged once a day, would give them all the chlorine they need, and the expense of installation and extra expense of operation would be a mere bagatelle as compared with the value of

their goods. Indeed, in such a case I doubt if there would be any increase in cost of working, for a cask of bleaching powder after it has been opened for two weeks has lost a substantial part of its chlorine. I believe there are many industries now using small amounts of bleaching powder, like the instance referred to, where one cell or two cells could be most advantageously installed, and where any increase in cost of working would be of small consequence compared with the advantages gained.

In summing up, we claim for the process that it is simple, complete, and more satisfactory in every way than the use of bleaching powder, and while to a plant using a large amount of chlorine and not advantageously situated as regards salt and fuel, we could show no financial advantage even to them, when all other advantages are considered, we believe this process would still show up on the right side. To small users of chlorine, and especially where the value of their product is great or the process of bleaching difficult, and where any improvement would be gladly welcomed, this system should prove a great success and a solution of many difficulties.

#### DISCUSSION.

Dr. H. CARMICHAEL said he had been interested in the application of hypochlorites somewhat extensively in other fields, especially that of paper pulp bleaching. He thought that more data should be given such as current density, voltage, and chemical efficiency. It was a mistake to consider chlorine in one combination as hypochlorite to be more efficient than another. There was a difference in time of reaction, but not in real work accomplished. Cross and Bevan some years since investigated the action of magnesium and calcium hypochlorites, with the above result, although at first they were deceived by quickness of action of the magnesium compound, and really considered it more efficient. Sodium hypochlorite came between magnesium and calcium hypochlorites in speed of reaction. He would be glad to have some data on the use of magnesium chloride. He preferred platinum to carbon electrodes; the investment with platinum electrodes was, of course, much greater, but there was no depreciation with properly regulated apparatus, while with graphitised carbon electrodes the expense of renewal every year and a half or so at 10s. per lb. would be considerable. The production of sodium hypochlorite was accompanied by low chemical efficiency. With the "Cooper" apparatus it had been found advantageous to separate caustic soda and chlorine and then recombine them. It was still cheaper, however, to absorb the chlorine in milk of lime, and utilise the caustic soda elsewhere. The bleaching liquor made thus was more efficient than liquor of same strength made from bleaching powder. He would like an explanation of this fact, which he had frequently observed. His remarks applied specially to paper pulp bleaching, and he could see that perhaps for textile fabrics there would be some advantage from the use of sodium hypochlorite.

Dr. W. H. WALKER said that when Dr. Carmichael assumed that solutions of the different hypochlorites having the same content of available chlorine must also possess equal bleaching power, he was confusing ability to oxidise with ability to bleach. Factors other than content of available chlorine were of influence in the bleaching operation. At least three of these factors were the following:—

First, the extent to which the solutions were hydrolysed. Calcium hypochlorite as made from bleaching powder was necessarily saturated with calcium hydrate, while sodium hypochlorite made by direct hydrolysis was neutral. The presence of the alkaline calcium hydrate drove back the hydrolysis of the calcium hypochlorite, thus rendering it less active.

Second, the presence of carbonic acid. This acid was capable of forming free hypochlorous acid, which in turn, being the most unstable of these compounds, was the most active bleaching agent. The bleaching process, consisting of the oxidation of unstable organic colouring matter, was always accompanied by the formation of carbon dioxide. In the case of bleaching powder solutions

the calcium hydrate present united with this carbon dioxide, thus taking it out of the sphere of action and precipitating calcium carbonate on the fibre. In sodium hypochlorite, on the other hand, the action of carbon dioxide was cumulative, and accelerated rather than retarded the bleaching process. Third, experiments performed some time ago with the use of colloidal plugs of agar-agar showed that the speed of penetration of sodium hypochlorite was greater than that of the calcium salt. The effect of these factors in practice was to produce by sodium hypochlorite a more uniform and permanent colour, free from oxycellulose or over bleaching, and a more efficient utilisation of the oxidising power of the solution. The harsh feel of the goods, alluded to by Mr. Duckworth, was, in part at least, accounted for by the calcium carbonate precipitated on the fibre by the carbon dioxide formed during the reaction, and which was not easily removed by scouring.

The CHAIRMAN asked on what basis the cost per horse power, given in the tables, was arrived at?

Mr. C. H. FISH said that Mr. Duckworth's figures were very conservative. He had much to do with the apparatus, and had adopted it for use as a part of the regular equipment in the works over which he had charge. All the apparatus was purchased in Germany and brought over to America, set up, and started without any trouble whatever. It was put in to increase the capacity of the bleaching department. The second apparatus purchased and brought over later was installed, and in some respects was an improvement over the first. Possibly this apparatus was not particularly suited for large plants with high power cost, but was well adapted for units or for small plants where cost of power was not material. In any case, there were many attending advantages difficult to show or explain, but which were made apparent in and about the bleaching department, where the difficulties arising from the corrosion of piping and the destruction of floors and timber was obviated, to say nothing of the advantages to employees who, through the use of commercial bleaching powder, suffer great personal inconvenience. He thought in time sodium hypochlorite produced by this apparatus in a possibly improved form would supersede the use of bleaching powder to a very great extent.

Mr. F. E. ATTEAUX asked if the superior quality of bleaching would not offset the additional cost?

Mr. FISH said that for many classes of goods, especially of high-priced goods or those of delicate texture, the increased cost, if any, would certainly be offset by the improved quality of the product. It was especially applicable to hosiery and knit goods, while the application to laundry work was likely to be very extensive. The proprietors of a large laundry in the West stood ready to give orders for 100 apparatus whenever they could be delivered. The freedom from lime and regularity of product made it especially desirable for laundry work.

Mr. DUCKWORTH said, in reply to Dr. Carmichael, that, as he stated in the beginning of his paper, no originality either for the apparatus or for the application of hypochlorite was claimed. His object was to show the desirability and feasibility of using the sodium salt, as generated by the Haas-Oettel apparatus. The magnesium salt was out of the question, both on account of price and also because the slightest amount left in the fibre would seriously interfere with subsequent operations. He felt sure from the testimony of users in Germany that the main objections to apparatus with platinum electrodes had been the expense of repairs and renewal. The cost of a whole set of carbons was only a few dollars. Dr. Walker's remarks had very ably answered the question of Dr. Carmichael as to the efficiency of the sodium salt over the lime salt. He thought that the difference of opinion between Dr. Carmichael and himself was largely due to the fact that one had worked on wood pulp and the other on cotton fibre, and the conditions in the two cases were far different. In reply to Mr. Howard, the price given in the tables for horse power was figured on the 58 hours per week basis.



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## I.—PLANT, APPARATUS, AND MACHINERY.

(Continued from page 1101.)

### ENGLISH PATENTS.

*Separating Liquids; Methods of and Means for* —. E. G. N. Salenius, Stockholm. Eng. Pat. 22,878, Oct. 24, 1904.

SEE U.S. Pat. 784,231 of 1905; this J., 1905, 428.—T. F. B.

*Furnaces; Impts. in Reverberatory* —. B. E. Eldred, New York. Eng. Pat. 25,832, Nov. 28, 1904.

THE claim is for increasing the volume and reducing the temperature of the flame of reverberatory furnaces by burning the fuel in a practically closed chamber supplied with a mixture of air and waste chimney gases in predetermined proportions. Further, the temperature of the furnace bed can be locally raised by injecting compressed and preheated air through jets projecting downward and placed at various points successively along the furnace roof. Claim is made for the slide-valve mechanism for controlling the supply of compressed air. —W. H. C.

*Volatile Liquid from Air and Gas; Impts. in and Apparatus for Effecting the Recovery of* — by Refrigeration. E. Hesketh, London. Eng. Pat. 1287, Jan. 23, 1905.

THE air to be treated is first passed through the tubes of a horizontal tubular "interchanger," and thence to a refrigerator, where the volatile liquid and moisture are condensed. The treated air from the refrigerator is returned to the "interchanger" and circulates around the outside of the tubes. A spray of water injected into the upper part of the "interchanger" saturates the treated air with moisture. The latent heat absorbed by the evaporation of this moisture assists in the preliminary cooling of the untreated air.—W. H. C.

*Filters; Impts. in* —. T. Seitz, Kreuznach, Germany. Eng. Pat. 10,538, May 19, 1905.

THE liquid to be filtered enters a pressure vessel fitted with a number of parallel filter elements, each consisting of a frame carrying a sheet of fine gauze or the like on either side with intermediate screens or gratings, the frame walls being more or less open towards the screens and provided with draw-off branches to facilitate a quick outflow in all

directions and a uniform distribution of the filtering medium. The frames are constructed to take apart in the direction of their length. The containing vessel is cylindrical or oval in plan, and the removable filter elements are arranged in vertical rows, parallel to a diameter of the vessel if circular, and to an axis or other accent of the vessel if oval.—C. S.

*Gases; Method of and Apparatus for Separating Mixed* —. C. Clamond, Paris. Eng. Pat. 17,946, Sept. 5, 1905. Under Int. Conv., Sept. 12, 1904.

SEE Fr. Pat. 346,195 of 1904; this J., 1905, 78.—T. F. B.

### UNITED STATES PATENT.

*Drying Pasty and Liquid Materials; Apparatus for Quick* —. A. Huillard, Surcnes, France. U.S. Pat. 802,511, Oct. 24, 1905.

SEE Eng. Pat. 18,978 of 1904; this J., 1905, 916.—T. F. B.

### FRENCH PATENTS.

*Crystallisation; Process for* —. G. Schicht. Fr. Pat. 354,522, May 22, 1905.

BASKETS having hollow sides (jacketed) through which a liquid or gaseous refrigerating agent is circulated, are placed in the liquid from which the crystals are to be deposited. When the baskets are covered with crystals, they are withdrawn from the solution and the crystals are detached by circulating a heating agent through the hollow walls.—W. H. C.

*Solvents; Process for the Recovery of the Vapours of Volatile* —. Soc. J. Jean et Cie. and G. Raverat. Fr. Pat. 350,149, Sept. 1, 1904.

THE mixture of air and of vapour to be recovered is caused to bubble through glacial acetic acid or phosphoric acid contained in a suitable vessel. The vapour enters into combination with the absorbent and is retained, the air alone passing away. By suitable treatment of the resulting compound the condensed vapour may be again separated. For example, the compound of acetic acid and the vapour of benzene may be diluted, when the separated benzene will float on the diluted acetic acid and may be decanted, while the acetic acid, after concentration, is ready for use over again.—W. H. C.

*Hydro-Extractor.* N. S. Bök. Fr. Pat. 355,062, April 25, 1905. Under Int. Conv., April 27, 1904.

THE invention consists of a distributor for hydro-extractors divided into isolated separation chambers, the distributor being composed of a hollow fixed or rotatory body, fitted with outlet orifices of such dimensions that the volume of liquid delivered by them to the separation chambers is uniform in the case of each horizontal row of the orifices in question.—C. S.

*Centrifugal Apparatus for Separating Solids from Liquids; Impts. in —.* Aktiebolaget Separator. Fr. Pat. 354,416, May 18, 1905. Under Int. Conv., May 27, 1904.

THIS is an improvement on Fr. Pat. 342,115 of 1904 (this J., 1904, 895), and consists in using obliquely inclined scrapers to remove the separated solids from the drum of the separator.—W. H. C.

*Centrifugal Apparatus for Separating Solids from Liquids; Impts. in —.* Aktiebolaget Separator. Fr. Pat. 354,417, May 18, 1905. Under Int. Conv., May 27, 1904.

SEE Eng. Pat. 10,862 of 1905; this J., 1905, 958.—W. H. C.

*Liquids; Apparatus for Raising—.* Giesserei und Maschinenfabrik Oggersheim Paul Schütz. Addition dated June 2, 1905, to Fr. Pat. 314,314, Sept. 18, 1901.

THE delivery pipe of the apparatus is fitted with a hydraulic seal, into the compression chamber of which debonches a siphon tube.—C. S.

*Liquids or Mixtures of Liquids; Process and Apparatus for Mechanically Rendering — Homogeneous.* Deutsche Homogenisiermaschinen-Ges. Fr. Pat. 354,943, June 5, 1905.

THE liquid or mixture of liquids, after a preliminary mixing in a tank provided with an agitator having perforated blades, is forced by a pump through a tube in which a rod with spiral groove and which terminates in a cone is placed. The passage of the liquid along the grooves causes the rod to rotate and the liquid is pulverised between the cone and the walls of the tube.

—W. H. C.

*Water from the Washing of Coal, Minerals, &c.; Process for the Clarification of Residual —.* F. Banm. Fr. Pat. 355,097, June 8, 1905.

A PROCESS is claimed by which the muddy wash water is conveyed into a settling tank, from the bottom of which the thick mud is abstracted, and after partial drying, is delivered on to the upper surface of the large particles of waste, as they are conveyed to the dump, by a continuous (endless) band transporter.—W. H. C.

*High Vacua; Production of —, and Cooling by Evaporation.* C. A. Parsons. Fr. Pat. 355,181, June 13, 1905. Under Int. Conv., June 21, 1904.

THE claim is for the production of high vacua in coolers and condensers by the use of one or more vacuum intensifiers ("augmentateurs de vide") along with a system of condensers. The vacuum intensifiers are in the form of the well-known steam injector, but have the jet through which the steam enters very much constricted at first and then gradually widened out into a funnel- or trumpet-shaped portion, the diameter of which is many times that of the constricted portion. The high vacuum attained, when these intensifiers are worked in series and combined with suitable condensers, accelerates considerably the evaporation in the space from which they exhaust, and rapid cooling of the liquid contained therein ensues.

—W. H. C.

*Powdered Substances; Method of Facilitating the Moistening of —.* Act.-Ges. für Anilin-Fabrication. Fr. Pat. 355,440, June 21, 1905.

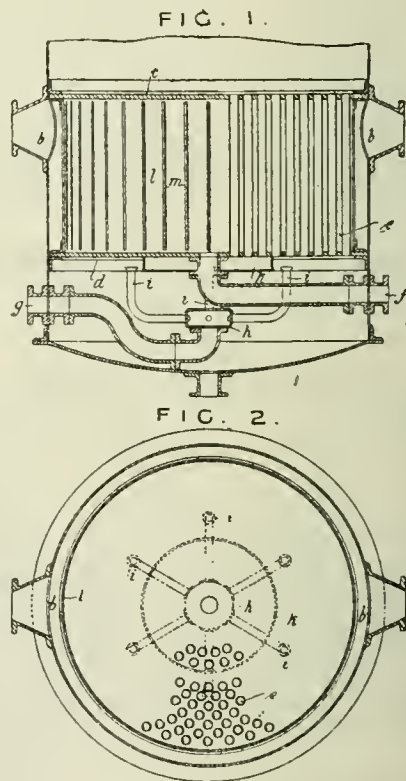
THE substance to be moistened is intimately mixed with  $\frac{1}{2}$ –2 per cent. of soap, the latter being either ready made or produced during the operation of mixing.—C. S.

# GERMAN PATENTS.

*Liquids, especially those containing Carbonic Acid; Process and Apparatus for the Purification of —.* Act.-Ges. Fabr. f. Brauerei-Einrichtungen vorm. H. Gehrke and Co. Ger. Pat. 161,025, March 17, 1903.

THE process, which is intended specially for the clarification of liquids containing dissolved carbonic acid, consists in passing the liquid under pressure through a centrifugal separator in which filter-elements are disposed parallel to the cover of the apparatus. The solid impurities are deposited on the inner walls of the separator, whilst the liquid is led away through the filter-elements. If necessary, a float or hollow chamber is provided in the separating space of the drum of the centrifugal apparatus, in order that the volume of unfiltered liquid in the separator shall not become too large.—A. S.

*Evaporating Apparatus; Vertical —.* A. Guder. Ger. Pat. 160,670, Feb. 23, 1904.



THE apparatus is of the type in which the liquid to be evaporated passes through heating tubes which are surrounded by the heating agent (steam). FIG. 1 is a vertical and FIG. 2 a horizontal section of the apparatus. The steam enters through the openings b, and passes into the heating chamber through vertical slits, m, in the mantle, l. The heating tubes, e, are fixed between the plates, c and d, and the condensed water from the steam is led away through the pipe, f. The liquid to be evaporated enters through the pipe, g, and distributor, h, the latter opening into a number of tubes, i, which deliver the liquid to the outer group of heating tubes, separated by the ring, k, from the inner group of tubes which are not supplied with liquid. The liquid rises in the outer tubes, which come in contact with the hottest steam, and is thrown out at the top; after the disengagement of steam bubbles, it descends through the tubes in the inner group, the steam surrounding which is at a somewhat lower temperature. It is claimed that the heating agent (steam) is kept in vigorous motion,



so that uniform heating is attained, which, combined with the regular circulation of the liquid through the tubes, prevents incrustation.—A. S.

## II.—FUEL, GAS, AND LIGHT.

(Continued from page 1103.)

*Sulphur in Spent Oxide; Determination of Free* — O. Pfeiffer. XXIII., page 1191.

### ENGLISH PATENTS.

*Fuel and other Briquettes; Manufacture of* — L. Márton, Budapest, Hungary. Eng. Pat. 21,755, Oct. 10, 1904.

SEE Fr. Pat. 347,092 of 1904; this J., 1905, 270.—T.F.B.

*Fuel Briquettes; Apparatus for Treating* — B. Wagner, Berlin. Eng. Pat. 241, Jan. 5, 1905.

SEE Fr. Pat. 350,536 of 1905; this J., 1905, 721.—T.F.B.

*Fuel; Agglutinants for use in Solidifying Pressed* — R. Middleton, Leeds. Eng. Pat. 347, Jan. 7, 1905.

A DRYING oil is partly oxidised (this operation not being carried too far) and used as a waterproofing and enriching binder for dust fuel, the ingredients being incorporated in a mixer fitted with knives or beaters, and then passed forward to the pressing rams and consolidated under heavy pressure.—C. S.

*Fuel; Combustion of Liquid* — [under Water-Tube Boilers.] Sir W. G. Armstrong, Whitworth and Co., Ltd., E. L. Orde, and W. H. Sodeau, Newcastle-upon-Tyne. Eng. Pat. 25,578, Nov. 24, 1904.

A NOZZLE for spraying oil is directed into an aperture in the front of the furnace, the nozzle and aperture being surrounded with an air chamber for the supply of compressed air. By this means a stream of air is caused to surround and be impelled in the same direction as the spray of liquid fuel, with velocity sufficient to enable it to retain approximately its initial direction and form until it has reached the region of active combustion within the furnace, by which time the spray will have become intermixed with several times its weight of air.—H. B.

*Gases; Method of Treating Distillation* — to Obtain an Illuminating Gas in a Highly Compressed Form, suitable for Transport. H. Blau, Augsburg, Germany. Eng. Pat. 23,675, Nov. 2, 1904. Under Int. Conv., Nov. 2, 1903.

SEE Fr. Pat. 347,508 of 1904; this J., 1905, 430.—T.F.B.

*Distillation, especially of Tars or Tarry Products, and for use in the Manufacture of Carburetted Water Gas and like Processes.* G. Wilton. Eng. Pat. 25,879, Nov. 28, 1904. III., page 1165.

*Gas Producers; Impts. in* — E. Hall-Brown, Glasgow. Eng. Pat. 27,571, Dec. 17, 1904.

A PRODUCER, for use with bituminous fuel, of the type in which the tarry gases collecting above the fuel are led downwards and passed through the incandescent zone, is provided near the top with an outlet pipe, fitted with a steam or air injector nozzle, by means of which the tarry gases are drawn off and delivered into casings at, or near, the level of the fire-bars or combustion zone. From these casings the tarry gases pass through numerous door-controlled inlets, at different levels, into the incandescent fuel. At a suitable level or levels for drawing off the fixed gases, channels are provided in the walls of the producer, these channels communicating with the interior of the producer through several door-controlled openings, and with the outlet pipe for the final discharge of the fixed gas.—H. B.

*Suction Gas Producers.* H. Smith, Lexington, U.S.A. Eng. Pat. 4043, Feb. 27, 1905.

SEE U.S. Pat. 786,063 of 1905; this J., 1905, 540.—T.F.B.

*Gases; Apparatus for Making Heating or other* — W. G. Heys, Manchester. From the Leede Process Co., Philadelphia. Eng. Pat. 8227, April 18, 1905.

SEE Fr. Pat. 353,502 of 1905; this J., 1905, 1007.—T.F.B.

*Producer Gases; Process and Apparatus for the Production of* — F. Jahns, Von der Heydt, Germany. Eng. Pat. 9885, May 10, 1905. Under Int. Conv., Nov. 1, 1904.

SEE Addition, dated March 9, 1905, to Fr. Pat. 327,214 of 1902; this J. 1905, 961.—T. F. B.

*Gas Producers; Impts. in* — A. Fichet and R. Haurtey, Paris. Eng. Pat. 10,706, May 22, 1905.

SEE Fr. Pat. 350,047 of 1904; this J., 1905, 1057.—T.F.B.

*Gas; Material or Composition for use in Manufacturing Air* — W. Moores and A. A. Bailey, London. Eng. Pat. 11,751, June 5, 1905.

CARBURETTED air is produced by forcing air through a pulp composed of wood, fibre, paper, or the like which has previously been saturated with a "solution" of alum  $\frac{1}{2}$  oz., quicklime 2 oz., caustic soda 2 drms. in 2 galls. of water, and to which, after drying, a quantity of benzoline has been added.—H. B.

*Gas Producers; Impts. in* — W. Towns, Liverpool. Eng. Pat. 14,090, July 8, 1905.

A GAS producer for use with bituminous fuel is provided at the top, and to one side, with a purifying chamber containing incandescent coke or other non-bituminous fuel, through which the tarry gases from the producer are passed. The coke is kept incandescent by means of an air blast, introduced at the foot of the chamber at a point opposite to that at which the tarry gases enter.—H. B.

*Gas Generators; Apparatus for Supplying and Vaporising Water for* — A. Illy, Paris. Eng. Pat. 14,334, July 11, 1905.

THE admission of water vapour to the generator, which is of the suction type, is regulated automatically by means of the pressure and heat of the exhaust gases of the engine, fed with the generator gas. In one form of the invention, a part of the exhaust gases is discharged through a branch pipe from the main exhaust, the pipe being contracted at one point to form an injector nozzle; the injector is surrounded by a chamber which communicates with another chamber containing a flexible diaphragm, which carries the valve of the water reservoir. At each blast of exhaust gases through the injector, a partial vacuum is created in the said chambers, the valve of the reservoir is raised, and a certain volume of water is admitted to the vaporiser. The vaporiser consists of a series of blades fixed to the exterior of a vertical portion of the main exhaust pipe, which is enclosed in a casing through which the air required by the generator is drawn at each suction stroke of the engine. The air is thus heated by contact with the exhaust pipe, and carries off the steam produced as the water from the feeding device falls upon the blades. Other forms of feeding device are described.—H. B.

*Washers or Scrubbers for Purifying Gases; Construction of Rotary* — R. W. B. Creeke, Leven, Fife, N.B. Eng. Pat. 27,820, Dec. 20, 1904.

A NUMBER of circular brushes rotate upon a horizontal shaft arranged within a rectangular casing having an arched upper part. Each brush is somewhat drum-shaped, consisting of two end drum cheeks, keyed to the shaft and surrounded by two concentric drums of staves, filled with bass fibre. The lower part of the scrubber is divided into a series of troughs by means of partitions extending downward from the shaft, so that each brush dips into a separate trough. The gas to be purified passes through the apparatus in one direction, finding its way through the wet fibre of the brushes, whilst the wash-liquor flows through from trough to trough in the opposite direction.—H. B.

*Gas from Gas Producers, Blast-Furnaces and the like; Method of and Apparatus for Purifying the* — J. E. Thornycroft and John I. Thornycroft and Co., Ltd., Chiswick, Eng. Pat. 28,295, Dec. 23, 1901.

WATER alone, unmixed with air, is forced, in the form of spray or mist, into the gas on its way from the producer or furnace to the gas engine, the moistened impurities being removed before the gas enters the engine. The crude gas passes down and then up through a vertical casing, divided into two compartments by means of a depending partition, and encounters therein vertically directed streams of spray or mist, which issue from nozzles fed with water by a pump driven by the gas engine. Some of the water and impurities collect at the bottom of the casing; the others are removed in a separating chamber, through which the gas next passes, the gas, issuing from a "rose" at the end of the inlet pipe, being bubbled through water in fine streams. The purified gas then enters the cylinder of the gas engine.—H. B.

*Gases; Impts. in Purifiers [Washers] for* — W. Towns, Liverpool. Eng. Pat. 10,993, May 26, 1905.

A HORIZONTAL, cylindrical casing is divided into several compartments by means of diaphragms having central openings. A central shaft extends horizontally through the casing, supporting a rotating fan or disperser in each compartment. The fans are formed of discs with blades on one side, and are arranged close to the diaphragm: at one side of the compartment so that the blades face the gas which enters through the central opening. Pipes are provided for introducing water, through each central opening, into the fans, and water-sealed outflow pipes at the bottom of the casing serve to lead off the wash water and impurities.—H. B.

#### UNITED STATES PATENTS.

*Heating Composition.* M. Bamberger and F. Böck, Vienna. U.S. Pat. 802,256, Oct. 17, 1905.

SEE Fr. Pat. 343,724 of 1904; this J., 1904, 1021.—T. F. B. *Fuel; Process for Manufacturing Artificial* — J. Knops, Aix-la-Chapelle, Germany. U.S. Pat. 802,516, Oct. 24, 1905.

SEE Ger. Pat. 158,756 of 1904; this J., 1905, 722.—T. F. B. *Gas Producer.* J. R. George, Assignor to Morgan Construction Co., Worcester, Mass. U.S. Pat. 802,931, Oct. 24, 1905.

AIR is supplied to the bottom of the heating chamber by means of a conduit containing two independent air passages terminating in separate air pipes—one central, the other annular—leading to a pair of distributing hoods which are concentric with the heating chamber and deliver air thereto at different radial distances from the centre of the chamber. Means are provided for supplying air under pressure, and regulating the flow through each of the air passages by a damper.—C. S.

#### FRENCH PATENTS.

*Water from the Washing of Coal, Minerals, &c.; Process for the Clarification of Residual* — F. Baum. Fr. Pat. 355,097, June 8, 1905. I., page 1162.

*Coal; Method of Enriching Small Lean* — H. Koppers. Fr. Pat. 355,355, June 19, 1905. III., page 1166.

*Furnace for Long Gas-Retorts; Double Generator* — Stettiner Chamotte-Fabrik A.-G. vorm. Didier. Fr. Pat. 355,135, June 10, 1905.

EACH set of retorts is heated by means of a single generator, which is charged from one side of the bench only, and is so constructed that one portion of the generator gas is used for heating the rear halves of the retorts, and the other portion for heating the front halves of the retorts. The retort setting is divided by a transverse partition into two compartments, the one containing the rear half of each retort, with appropriate combustion and air flues, and the other the front half, with similar flues. A transverse wall depends from the top of the generator downwards, some distance into the body of fuel, thus forming front and rear generator chambers, which communicate with each other through the bed of fuel only. The gases from the

rear chamber pass upwards through the rear portion of the retort setting, whilst those from the front chamber rise through the front portion, the quantities of gas led through the respective portions being regulated by means of dampers in the waste-gas flues.—H. B.

*Coke and Gas; Apparatus for Making* — J. Armstrong. Fr. Pat. 355,428, June 21, 1905. Under Int. Conv., June 22, 1904.

SEE Eng. Pat. 14,157 of 1904; this J., 1905, 665.—T. F. B.

*Generator Consuming Small Coal or Coal Dust.* Ver. Anthracit Werke G.m.b.H. First Addition, dated May 17, 1905, to Fr. Pat. 335,291, Sept. 11, 1903 (this J., 1904, 181).

THERE are described herein numerous improvements and modifications in the constructional details of the generator described in the principal patent, the objects being to facilitate the removal of clinker, ensure the equal distribution, and uniform descent, of the fuel, and to permit of the uninterrupted operation of the generator while the clinker is being removed.—H. B.

*Hydrogen; Manufacture of* — H. S. Elworthy. Fr. Pat. 355,324, June 17, 1905.

A MIXTURE of water-gas and steam is heated, in presence of such metals as nickel or iron, to a sufficiently high temperature to induce the reaction,  $\text{CO} + \text{H}_2\text{O} = \text{CO}_2 + \text{H}_2$ , whereby the hydrogen originally present in the water-gas is increased by a volume equal to that of the carbon monoxide contained in it. The proportion of carbon dioxide is also proportionately increased, but this may be readily removed by absorption by water under pressure, or by alkalis, or by other known means. Instead of completely converting the carbon monoxide contained in water-gas as described, the process may be arrested so that the conversion is only partial. The carbon dioxide formed is then withdrawn as before, and the mixture of carbon monoxide and hydrogen is passed over heated metallic nickel, as described in Eng. Pat. 14,333, of June 25, 1904 (this J., 1905, 1006), to obtain a gas rich in methane, thus,  $\text{CO} + 3\text{H}_2 = \text{CH}_4 + \text{H}_2\text{O}$ . The processes may be varied in described ways. (Reference is also made to Eng. Pat. 12,461 of May 31, 1903; and to Fr. Pat. 335,120, of May 30, 1903; this J., 1903, 900, and 1904, 112.)—E. S.

*Methane or a Gaseous Mixture rich in Methane; Process of Preparing Pure* — P. Sabatier. Fr. Pat. 355,325, June 17, 1905.

RICHÉ gas (this J., 1903; 411 and 1905, 78) or any analogous gas containing methane, hydrogen, carbon monoxide and carbon dioxide, is purified by passing it over copper turnings heated to about 600° C., and is then led over nickel, cobalt, or iron (reduced from their oxides) heated to nearly 500° C. Under these conditions the carbon monoxide is converted partly into the dioxide and partly into methane, the resulting gas containing exclusively hydrogen, methane, and carbon dioxide. The last-named may be removed by washing with caustic alkali; or, if pure methane be required, the unwashed gases are mixed with so much hydrogen that, on passing the mixture over nickel, cobalt or iron, heated to 250°–500° C., the hydrogen and carbon dioxide react upon one another, with formation of methane and water. The water is removed by condensation, and the remaining gas consists of pure methane.—H. B.

*Gases; Process of Carburetting Combustible* — P. Sabatier. Fr. Pat. 355,419, June 20, 1905.

WATER-GAS, Riché gas, Dowson gas and the like are first purified by passing them over copper, heated to about 600° C., and then washing them in a scrubber; a quantity of purified acetylene is next added, and the mixture is passed over a catalyser consisting of iron, nickel, cobalt or copper (obtained by reduction of the oxides), heated to 100°–200° C. The acetylene combines with a certain proportion of the hydrogen in the mixture, forming non-condensable, unsaturated hydrocarbons, which impart a high lighting power and calorific value to the gas produced.—H. B.



### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(Continued from page 1103.)

*Hydrocarbons in Louisiana Petroleum. II.* C. E. Coates and A. Best. J. Amer. Chem. Soc., 1905, 27, 1317—1321 (see this J., 1903, 1312).

Two new crude petroleum and a sample of an oil-bearing sand have been examined. The preliminary examination of the specimens of petroleum gave the following results:—

	Bayou Bouillon oil.	Bayou Laroupe oil.
Sp. gr. at 25° C. ....	0.9669	0.9604
Distillation begins (Engler flask) 275° C. ....	275° C.	265° C.
Fraction up to 300° C.; per cent. ....	11	6
Fraction 300°—350° C.; per cent. ....	62	7
Sulphuretted hydrogen evolved on heating .....	very little	none
Colour of lower fraction .....	yellow	yellow
Estimated depth of well .....	900 ft.	400 ft.
Percentage of sulphur in crude oil .....	0.57	low
Residue .....	asphaltic	asphaltic
Fuel value, B.T.U. ....	18500	—

The sample of oil-sand was extracted with gasoline,

and the solution evaporated, about 10 c.c. of a black oil being thus obtained. On distillation, this oil gave about 10 c.c. between 300° and 350° C., and about 10 c.c. between 350° and 380° C., the residue being asphaltic. On extraction with carbon bisulphide, the sand yielded 5.46 per cent. of oil, whilst by drying at 100° C. for four hours, "0.4 per cent. water" was lost. The fraction distilling between 300° and 350° C. had the refractive index 1.4833 at 25° C., whilst that distilling between 350° and 380° C. had the refractive index 1.5200. On combining the two fractions, a liquid having the sp. gr. 0.9047, and the refractive index 1.5013 at 25° C., was obtained, the figures for the corresponding fraction (300°—380° C.) of Bayou Bouillon petroleum being 0.9059 and 1.5080 respectively.

The fraction distilling between 300° and 360° C. from the Welsh oil (this J., 1903, 1342) showed a viscosity of 3.63 compared with water, at 29° C., in an Engler viscosimeter, and 2.1 as compared with water, at 38° C., in a standard Pennsylvania Railroad pipette.

A study was made of the fractions distilling up to 300° C. from Jennings, Welsh and Bayou Bouillon oils in a similar manner to that followed in the case of the Breau Bridge oil (*loc. cit.*). The chief results obtained are shown in the following table:—

		Boiling point.	Specific gravity.	Refractive index at 25° C.	Most likely consisting of:	Remarks.
Jennings oil.	Fraction 1 ..	180°—185° C. at 760 mm.	0.8373 at 22° C.	1.4535	C <sub>11</sub> H <sub>20</sub>	{ Water-white, marked odour of turpentine, optically inactive.
	Fraction 2 ..	150°—155° C. at 80 mm.	0.8649 at 22° C.	1.4692	C <sub>13</sub> H <sub>24</sub>	
	Fraction 3 ..	200°—205° C. at 80 mm.	0.8801 at 22° C.	1.4805	C <sub>16</sub> H <sub>32</sub>	
Welsh oil.	Fraction 1 ..	145°—150° C. at 80 mm.	0.8551 at 22° C.	1.4662	C <sub>12</sub> H <sub>22</sub>	{
	Fraction 2 ..	165°—170° C. at 100 mm.	0.8679 at 25° C.	1.4666	C <sub>13</sub> H <sub>21</sub>	
	Fraction 3 ..	175°—180° C. at 33 mm.	0.8736 at 28° C.	1.4760	C <sub>17</sub> H <sub>32</sub>	
Bayou Bouillon oil.	Fraction 1 ..	140°—145° C. at 33 mm.	0.8557 at 25° C.	1.4691	C <sub>13</sub> H <sub>24</sub>	{
	Fraction 2 ..	170°—175° C. at 33 mm.	0.8871 at 29° C.	1.4828	C <sub>16</sub> H <sub>32</sub>	
	Fraction 3 ..	190°—195° C. at 33 mm.	0.8966 at 27° C.	1.4883	C <sub>17</sub> H <sub>30</sub>	
	Fraction 4 ..	200°—205° C. at 33 mm.	0.9006 at 27° C.	1.4916	C <sub>18</sub> H <sub>32</sub>	
	Fraction 5 ..	225°—230° C. at 33 mm.	0.9104 at 28° C.	1.4972	C <sub>19</sub> H <sub>34</sub>	

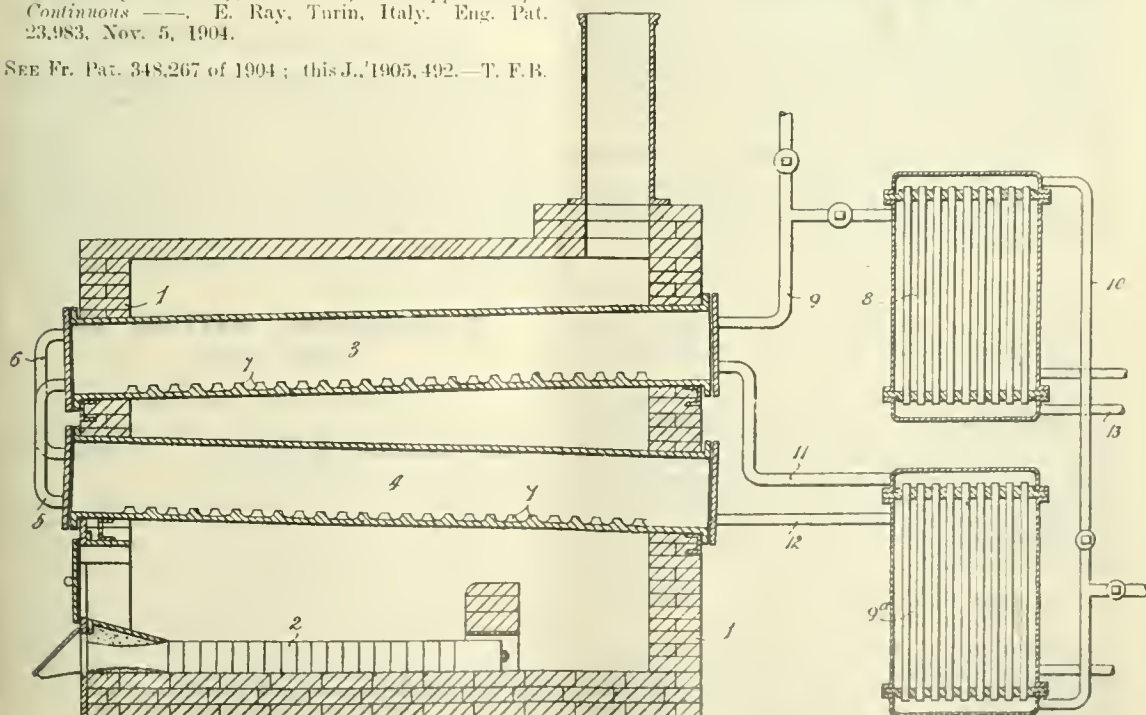
—A. S.

#### ENGLISH PATENTS.

*Distillation [Tars, &c.]; Process of and Apparatus for Continuous* —. E. Ray, Turin, Italy. Eng. Pat. 23,983, Nov. 5, 1904.

See Fr. Pat. 348,267 of 1904; this J., 1905, 492.—T. F.B.

*Distillation especially of Tars or Tarry Products, and for use in the Manufacture of Carburetted Water Gas*



and like Processes. G. Wilton, London. Eng. Pat. 25,879, Nov. 28, 1904.

THE tar is introduced by pipe 13 into the bottom compartment of condenser 8, and rising through the pipes becomes heated by the products of distillation from retort 3. It then passes down pipe 10 into the lower part of condenser 9a, where it is further heated by the residue of the distillation coming from retort 4. Passing through tube 11, it enters retort 3, which is inclined at a suitable angle, and flows down it in a slow stream; the bottoms of the retorts are provided with numerous shallow ribs or baffle plates (as 7), causing the tar to take a circuitous course. On reaching the lower end of retort 3, the tar passes through pipe 5 into retort 4, where it is further distilled, and the residue is run off through 12 into condenser 9a. The distillation products from retort 4 pass through pipe 6 to retort 3, and thence to condenser 8 by pipe 9. The retorts are enclosed in a brickwork casing 1, and heated by a furnace 2, so that the lower retort is more strongly heated than the upper one, and the tar is progressively distilled.—T. F. B.

*Mineral Oils in general and Petroleum in particular; Process for Transforming — into Soap.* M. Kuess, Tunis. Eng. Pat. 23,727, Nov. 2, 1904. Under Int. Conv., Nov. 3, 1903.

IN this process the petroleum or other mineral oil (say, 8 kilos.) is thoroughly incorporated with rosin (1½ kilos.) and with melted fat (1½ kilos.), and the mixture treated with caustic soda solution (650 grms. in 1300 c.c.) and allowed to stand for two hours with constant agitation. It is then mixed with, say, 325 grms. of commercial hydrochloric acid, added little by little, and stirred until cool, after which it is treated with more caustic soda solution (325 grms. in 1300 c.c.), again allowed to stand, preferably for one or two days, and finally boiled for four hours and poured into moulds. It is claimed that this soap has great antiseptic and cleansing properties, that it is soluble in water, and that it is free from any unpleasant odour.—C. A. M.

#### UNITED STATES PATENTS.

*Candles; Manufacture of Composite Paraffin —* G. W. Gray, Whiting, Ind., Assignor to the Standard Oil Co., Chicago, Ill. U.S. Pat. 802,100, Oct. 17, 1905.

THREE parts of hydroxystearic acid (see U.S. Pat. 772,129 of 1904; this J., 1904, 1102) are dissolved in one part of a suitable solvent (e.g., stearic acid), and the solution is mixed with paraffin wax to form a stock for the manufacture of composite candles.—T. F. B.

*Wax; Artificial —* J. Lewy, Königsberg, Germany. U.S. Pat. 802,169, Oct. 17, 1905.

AN artificial wax is prepared by mixing "paraffin" with a naphthol (especially β-naphthol), with or without addition of stearin or ceresin or both.—T. F. B.

#### FRENCH PATENTS.

*Coke-Oven; Horizontal, Regenerative — with Double Vertical Flues.* F. J. Collin. Fr. Pat. 354,919, May 30, 1905.

A DOUBLE row of vertical flues, separated by a central wall, is placed between each oven. Each pair of vertical flues is connected by an opening formed in the upper part of the dividing wall, and each flue is connected with a separate main flue which passes beneath the sole of the oven. The gas rises in one vertical flue and descends in the other, and the reversal of the current of gas may be made to affect the whole row or only a few of the vertical flues.—W. H. C.

*Coal; Method of Enriching Small Lean —* H. Koppers. Fr. Pat. 355,355, June 19, 1905.

NON-COKING coal is distilled to drive off the volatile matters, principally ammonia, in order to produce a fuel of increased calorific value whilst recovering by-products. The hot residue is then incorporated with the usual binding material (tar or pitch) and pressed into briquettes

in the usual manner. Distillation is conducted in a vertical or inclined retort, charged at the top and emptied at the bottom. Heat is applied from the outside, and at the lower part (which may be of cast iron) is arranged a cooling zone, the heat liberated from which is utilised in heating up the air of combustion for the furnace.—C. S.

*Ammoniacal Gas contained in Gases of Distillation; Recuperator for Arresting —* A. Mars, J. Bacqua and M. Laurette. Fr. Pat. 355,375, March 17, 1905.

THE gases of distillation are caused to traverse chambers in which baskets or packages filled with a mixture of humus, turf, or sawdust, treated with sulphuric acid, are arranged in successive tiers separated by spaces, the packages being also separated on each plane by intervals unconformable to those above and below, so that the gases may be compelled to pass through the porous material. It is claimed that the process, while drying the gas and removing its ammoniacal constituents, yields a product of direct manurial value.—E. S.

*Emulsions of Coal Tar Oils, Phenols, and similar Products, also of Crude Mineral Oils and their Residues; Process for Preparing Aqueous —* W. Spalteholz. Fr. Pat. 355,342, June 19, 1905.

COAL tar oils and derivatives and mineral oils and their residues may be emulsified by the aid of alkaline solutions of casein or of the products obtained by the partial decomposition of casein or other albuminoid with bases or acids, or by fermentation. For example, a liquid, miscible with water, containing 30 to 35 per cent. of phenol, is obtained by mixing 650 kilos. of creosote oil with 350 kilos. of an aqueous solution containing 12 kilos. of casein and 12 kilos. of ammonia (sp. gr. 0.945).—T. F. B.

*Oil; Method of Distilling Mineral —* S. Stransky. Fr. Pat. 355,414, June 20, 1905.

THE contents of the still are set in motion as soon as the operation is started, and are kept in that condition throughout the process, in order to prevent coking on the bottom of the still by keeping in suspension the diminished quantity of particles of carbonised matter from the heavy hydrocarbons, and avoiding local overheating. With this object the still is fitted with a stirring apparatus extending right to the bottom of the vessel.—C. S.

*Oils; Chemical Purification of [Mineral] —* J. Fischer. Fr. Pat. 355,465, June 22, 1905.

IN this process the oil (petroleum oil, lubricating oil, &c.), is made to pass upwards through layers of material such as perforated discs, pebbles, &c., which keep it for some time in contact with the purifying agent, e.g., sulphuric acid. Claim is also made for various modifications of apparatus for carrying out this process, and for various forms of the retarding substances, a battery of apparatus being used for the purification of large quantities of oil. The purifying agent is made to traverse the layers either in the same or the opposite direction to the oil.—C. A. M.

## IV.—COLOURING MATTERS AND DYESTUFFS.

(Continued from page 1106.)

*Ethylaniline; Simple Method of Preparing Pure Mono — from Commercial Monoethylaniline.* G. Blume and H. Klöfner. Ber., 1905, 38, 3276.

NINETY-SEVEN grms. of commercial mono-ethylaniline were treated with 65 c.c. of concentrated hydrochloric acid, and the hydrochloride which crystallised out after a short time, was separated with the aid of the pump, and pressed. Further small quantities of the hydrochloride were separated by passing gaseous hydrochloric acid through the mother liquor. The total quantity of hydrochloride obtained, after drying upon a porous tile, was 101 grms., equivalent to a yield of about 80 per cent. The hydrochloride was decomposed with caustic soda and distilled with steam, and the ethylaniline was separated from the distillate, dried and re-distilled.—A. S.



**2-Hydroxy-1,4-Naphthoquinone; Note on a Simple Method of Preparing** — H. Teichner and H. Weil. Ber., 1905, 38, 3376—3377.

If 1,2-naphthoquinone is oxidised with an excess of hydrogen peroxide and caustic soda, an intramolecular change takes place, and 2-hydroxy-1,4-naphthoquinone is formed. Similarly 1,2-naphthoquinone-6-sodium sulphate (the quinone of Schäffer-salt) forms 2-hydroxy-1,4-naphthoquinone-6-sodium sulphate under these conditions. On the other hand 1,2-naphthoquinone-3,6-sodium disulphonate (the quinone of R-salt) behaves quite differently and does not form a corresponding hydroxy derivative of 1,4-naphthoquinone, probably owing to the influence of the sulphonic group in position 3.

—H. L.

**Oxyazo Compounds; Constitution of** — H. Teichner. Ber., 1905, 38, 3377—3380.

The author condensed 1,2-naphthoquinone-3,6-disulphonic acid ("R-quinone") with phenylhydrazine and shows that the hydrazone obtained is not identical with the azo dyestuff obtained by combining R-salt with diazobenzene. On the other hand the hydrazones obtained from 1,2-naphthoquinone-6-sulphonic acid ("S-quinone") and other sulphonic derivatives of 1,2-naphthoquinone were found to be exactly similar to the corresponding azo dyestuffs in their reactions and tinctorial properties.

"R-quinone" readily reacts with aniline, forming in good yield orange-coloured crystals of the constitution

$$\begin{array}{c} \text{O} \\ \diagup \\ \text{C}_{10}\text{H}_3(\text{SO}_3\text{Na})_2\text{NH}\cdot\text{C}_6\text{H}_5 \\ \diagdown \\ \text{O} \end{array} \quad [\text{O}_2 : (\text{SO}_3\text{Na})_2 : \text{NHC}_6\text{H}_5 :: 1 : 2 : 3 : 6 : 4].$$
 This substance may be condensed with *o*-toluylenediamine, to form an azine dyestuff, a characteristic reaction for *o*-diketones. On the other hand the corresponding derivative of "S-quinone" does not react with *o*-toluylenediamine.

The presence of a sulphonic group in position 3 causes the formation of  $\beta$ -naphthoquinone derivatives in the case of "R-quinone," whereas the "S" and other 1,2-naphthoquinone derivatives go over into derivatives of  $\alpha$ -naphthoquinone. (See also preceding abstract.)—H. L.

**Titanium Chloride in Volumetric Analysis; Use of** — E. Knecht and E. Hibbert. XXIII., page 1192.

#### ENGLISH PATENTS.

**Colouring Matters containing Sulphur [Sulphide Dyestuffs]; Black** — Read Holiday and Sons, and J. Turner and H. Dean, Huddersfield. Eng. Pat. 26,345, Dec. 3, 1904.

BLACK sulphide dyestuffs are obtained by boiling 1,2,4-dinitrochlorobenzene with alkalis, sodium sulphide and sulphur in aqueous solution at 100°—130° C. for 15—30 hours.—H. L.

**Benzene Derivatives and [Sulphide] Dyestuffs therefrom; Manufacture of** — R. B. Ransford, Upper Norwood, Surrey, From L. Cassella and Co. Frankfurt on Maine, Germany. Eng. Pat. 26,361, Dec. 3, 1904.

PHOSGENE is introduced into an aqueous solution of 1-acetamino-2,4-diaminobenzene containing sufficient sodium carbonate to neutralise the hydrochloric acid formed. A colourless substance separates, which is dried and then heated with 3 parts of sulphur to 240° C. for some time. A dyestuff is thus obtained, which is soluble in dilute sodium sulphide solution and dyes cotton in greenish-yellow shades from this medium.—H. L.

**Dyestuffs; Manufacture of New Sulphurised [Sulphide]** — C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 27,091, Dec. 12, 1904.

THE new dyestuffs are prepared by heating mixtures of diformyl-*m*-toluylenediamine and *p*-phenylenediamine with sulphur at temperatures of 200° C. and over. They dye cotton directly in intense yellow to orange-yellow shades from baths containing sodium sulphide. (Compare Third Addition to Fr. Pat. 306,655 of 1903; this J. 1903, 792.)—H. L.

**Lakes [from Azo Dyestuffs]; Manufacture of New Colour** — C. D. Abel. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 27,093, Dec. 12, 1904. XIX., page 1180.

**Dyestuffs; Manufacture of Sulphurised [Sulphide] —, and of a Parent Material therefor.** C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 27,292, Dec. 14, 1904.

AN insoluble condensation product is obtained by boiling an alcoholic solution of *m*-toluylenediamine (1 mol.) with carbon bisulphide (2 mols.) for 24 hours. By fusing this substance, with or without the addition of benzidine, with sulphur at a temperature of 210°—220° C., new dyestuffs are obtained. The latter produce clear shades, varying from greenish-yellow to orange-yellow, on unmordanted cotton from their solution in aqueous sodium sulphide, which are stated to be of remarkable fastness to washing.—H. L.

***p*-Amidophenolsulphonic Acid; Manufacture of** — C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 27,198, Dec. 16, 1904.

SEE Ger. Pat. 160,170 of 1904; this J., 1905, 886.—T. F. B.

**Colouring Matters of the Anthracene Series [Anthracene Dyestuffs]; Manufacture of New** — J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 28,593, Dec. 28, 1904.

SEE Addition of Jan. 6, 1905, to Fr. Pat. 349,531 of 1901; this J., 1905, 841.—T. F. B.

**Anthracene Series; Manufacture of Compounds of the — and of Colouring Matters [Anthracene Dyestuffs] therefrom.** J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 7022, April 3, 1905.

SEE Third Addition, dated March 20, 1905, to Fr. Pat. 349,531 of 1904; this J., 1905, 1010.—T. F. B.

**Dyestuffs; Manufacture of Yellow Sulphur [Sulphide]** — G. B. Ellis, London. From Chem. Fabr. vorm. Sandoz, Basle. Eng. Pat. 5572, March 16, 1905.

GREENISH-YELLOW to orange-yellow sulphide dyestuffs are obtained by melting diformyl-4,6-diamino-1,3-xylene with sulphur in the presence of heavy volatile aromatic amines such as benzidine, its homologues and derivatives, at temperatures varying from 180°—220° C.—H. L.

**Dyestuff Especially Suitable for the Preparation of Colouring Matter Lakes; Manufacture of a New Tetrazo [Azo]** — H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9139, May 1, 1905.

SEE Fr. Pat. 353,816 of 1905; this J., 1905, 1061.—T. F. B.

#### UNITED STATES PATENTS.

**Dyestuff; Yellow-red Azo** — W. Herzberg, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 800,914, Oct. 3, 1905.

SEE Eng. Pat. 27,093 of 1904, page 1180.—T. F. B.

**Dye [Anthracene Dyestuff]; Anthraquinone** — P. Thomasehewski, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 801,418, Oct. 10, 1905.

A DYESTUFF, which is a hydro-azine of the anthracene series, is obtained by heating 1-hydroxy-3-bromo-4-aminoanthraquinone with cupric chloride and a suitable diluent. It is reduced by alkali hydrosulphites to a hydro compound, solutions of which dye unmordanted cotton pure greenish-blue shades. T. F. B.

**Dye [Sulphide Dyestuff] and Process of Making same; Brown Sulphur** — A. L. Laska, Assignor to K. Oehler, Anilin- und Anilin-farbenfabr., Offenbach on the Maine, Germany. U.S. Pat. 801,598, Oct. 10, 1905.

A MIXTURE of a *m*-diamine of the benzene series with the condensation product of formaldehyde and resorcinol is

melted with an alkali polysulphide: the resulting dye-stuffs give brown solutions in a solution of an alkali sulphide, which dye fast brown shades on cotton.—T. F. B.

*Dyestuff; Green-Blue Sulphur [Sulphide] — and Process of Making same.* I. Levinstein and E. E. Naeff, Manchester. U.S. Pat. 802,049, Oct. 17, 1905.

SEE Eng. Pat. 26,700 of 1903; this J., 1904, 1084.—T. F. B.

#### FRENCH PATENTS.

*Thiazol-sulphonic Acids; Production of —.* Farbenfabr. vorm. F. Bayer und Co. First Addition, dated March 11, 1905, to Fr. Pat. 353,928, March 6, 1905 (this J., 1905, 1061). Under Int. Conv., June 30, 1904.

THE thiazolsulphonic acids claimed in the main patent can also be produced by replacing the benzyldieneaminoaryl-sulphonic acids by the corresponding benzylamine derivatives. The latter are prepared by the action of benzyl haloides, such as benzyl or nitrobenzyl chloride, on aromatic aminosulphonic acids, such as 2.5.7-aminonaphthol-sulphonic acid, in the presence of sodium acetate.—H. L.

*Azo Dyestuffs Capable of Being Chromed on the Fibre; Production of —.* Soc. pour l'Ind. Chim. à Bâle. First Addition, dated May 10, 1905, to Fr. Pat. 351,125, Jan. 4, 1905 (this J., 1905, 840). Under Int. Conv., Dec. 27, 1904.

THE present addition to the main patent covers the combination of 1-diazo-2-acetyloxynaphthalene-sulphonic acids with naphthols, dihydroxynaphthalenes, naphthol-sulphonic acids, dihydroxynaphthalene-sulphonic acids and aminonaphtholsulphonic acids, with elimination of the acetyl group after combination. Further, the combination of 1-diazo-2-hydroxynaphthalenesulphonic acid (obtained by hydrolysis of 1-diazo-2-acetyloxynaphthalenesulphonic acids, or in any other manner) with 1.6-, 1.5-, 1.8-, or 2.7-dihydroxynaphthalene is also claimed.

A number of examples are given. Thus, by combining 1-diazo-2-acetyloxynaphthalene-4-sulphonic acid with 1.4-naphtholsulphonic acid a dyestuff is obtained which dyes wool from an acid bath in Bordeaux shades, turning to blue by after-chroming on the fibre. A slightly greener shade of blue is obtained after chroming from 1.5-naphtholsulphonic acid; while 2.6-naphtholsulphonic acid gives a blue-black. From the same first component and 1.8.3.6-dihydroxynaphthalenedisulphonic acid pure bright blue shades turning to bluish-green on chroming, are obtained. Similar shades both before and after chroming are obtained from 1.8.4-, and 1.8.4.6-dihydroxynaphthalene- mono- and disulphonic acids; 2.3.6-dihydroxynaphthalenesulphonic acid yields Bordeaux shades, turning to blue-black on chroming.

The same diazo-component and 1.8.3.6-aminonaphtholdisulphonic acid yield pure blue shades, turning to greenish-black on chroming; and other 1.8-aminonaphtholsulphonic acids, such as the 1.8.4-, 1.8.5-, 1.8.2.4-, and 1.8.4.6-acids produce a similar result. Bordeaux to dark violet shades turning to greenish-black are obtained from 2.7.6- and 2.5.7-aminonaphtholsulphonic acids.

1-Diazo-2-hydroxynaphthalene-4-sulphonic acid and 1.6-dihydroxynaphthalene yield a dyestuff which dyes wool from an acid bath in Bordeaux shades, turning to a deep black with green overcast by chroming. The chromed dyeings of this combination, it is stated, are very fast to light, milling and finishing, and do not change in artificial light. The corresponding dyestuffs from 2.8-, 2.7-, or 1.5-dihydroxynaphthalene also yield black shades after chroming; the direct dyeings from the 2.8-dihydroxynaphthalene dyestuff are blue.—H. L.

*Dyestuffs Derived from Dihydroxyquinoline; Production of Azo —.* Badische Anilin und Soda Fabrik. Fr. Pat. 353,146, June 10, 1905. Under Int. Conv., Dec. 2, 1904.

SEE Eng. Pat. 11,202 of 1905; this J., 1905, 840.—T. F. B.

## V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(Continued from page 1107.)

#### ENGLISH PATENTS.

*Yarns; Apparatus for Sproyng and Conditioning —.* G. and A. Wray, Keighley. Eng. Pat. 23,651, Nov. 2, 1904.

YARNS, in the form of cops, or wound upon bobbins or spools, are "damped" while being conveyed upon a travelling apron through a continuously-acting water-spray apparatus. During their passage through this they touch a contact-piece which turns them half-way round, so that those parts of their outer surfaces which were at first not exposed to the descending water-spray are now presented to it, and the cops, &c., become thoroughly moistened. In an alternative arrangement, two aprons, one above the other, are employed. The cops are carried by the upper one of these half-way through the apparatus, and are then overturned upon the lower one. The excess of the water employed in the operation falls into a tray beneath the apron or aprons, whence it is conducted into a receptacle, from which it is pumped to the spray-producer at any desired pressure, giving a fine or coarse spray as required.—E. B.

*Dyestuffs on Fabrics, Warps, or the like; Method of and Apparatus for Distributing —.* O. Imray, London. From Farb. vorm. Meister, Lucius und Brüning, Hoechst on the Maine. Eng. Pat. 27,871, Dec. 20, 1904.

BLENDED shades, varying from light to dark, or from one colour to another, are produced by spraying a dyestuff solution on to a fabric by a rotating brush or brushes in the following manner.

Fig. 1 is a transverse section and Fig. 2 a part front elevation of the apparatus. A brush cylinder *a* is supplied with a dye solution by a distributing cylinder *b*, from two colour cylinders *c*, *d*, each consisting of a number of small cylinders such as *c*<sup>1</sup>, *c*<sup>2</sup>, *c*<sup>3</sup>, revolving in separate compartments *c*<sup>1</sup>, *c*<sup>2</sup>, *c*<sup>3</sup> of a dye-trough, thus supplying the distributing cylinder with the same or different colours. The component cylinders of cylinder *d* revolve in subdivisions of the trough *f* and are so mounted on their shaft, that they alternate with the cylinders *c*<sup>1</sup>, *c*<sup>2</sup>, and *c*<sup>3</sup>. The wire bristles of the brush cylinder *a* come in contact with a wire screen *h*, of which the meshes are about 5 mm. width, held in a stretched condition by bars *g*, *g*<sup>1</sup>, at a short distance in front of the fabric *k*. The latter travels over

FIG 1

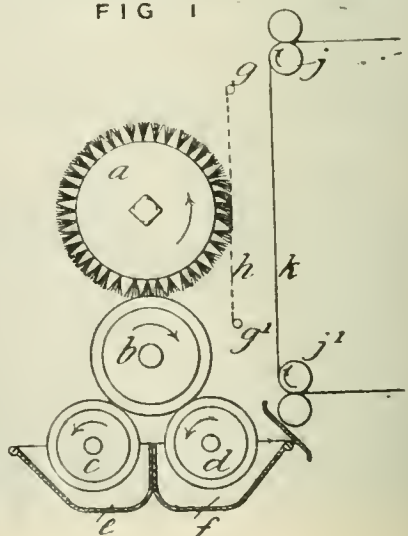
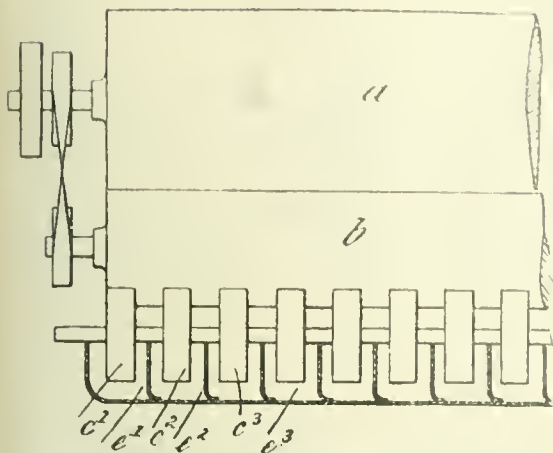




FIG. 2.



the guides  $j, j^1$ , and after having received the spray, travels between squeezing rollers. The speed at which the fabric and cylinders revolve may vary according to the effect desired; it is preferable for the speed of the fabric to be less than the circumferential velocity of the brush cylinder.

If the separate dye compartments are supplied with dye solutions of successively greater strength, the fabric is dyed in shades uniformly increasing in depth from one side of the goods to the other. The effects may, however, be greatly varied. Thus, if comparatively many colours are sprayed on to a feebly moistened piece of woollen fabric which is slowly passed before the brush, the separate drops run completely into one another. On the other hand if the cylinder be supplied with comparatively few colours and a dry paper is passed quickly before it, the paper will be uniformly sprinkled with fine drops which lie closely together but do not run into each other. A uniformly shaded appearance is thus produced on the paper.

Various modifications of component parts of the machine are also described.—H. L.

#### FRENCH PATENTS.

*Textile Material or Paper Pulp; Application of a Plant [Gyspet] for Obtaining* —. P. Boy. Fr. Pat. 350,117, Aug. 16, 1904.

GYPSET (*Festuca crica*), a plant which is abundant in France, particularly in Ariège, can be utilised in the usual manner to produce a textile fibre or paper pulp.—T. F. B.

*Fibres, Films, Blocks or Slabs; Plastic and Transparent Substance for the Manufacture of* —. H. C. M. L. Cathelineau and A. A. René, Fleury. Fr. Pat. 354,942, June 5, 1905.

(1) 3 PARTS of phenol are mixed and well stirred with 1 part of casein. The mass is allowed to stand for 24 hours, and is then warmed up on the water-bath. A very limpid fluid is thus obtained which can be drawn out, like artificial silk, into threads capable of being woven into a fabric. Spread on to a flat surface it forms, on cooling, perfectly transparent films, which can be used for photography or for the cinematograph. These films possess the very valuable property it is claimed, of being non-inflammable, and the cost of production is low. The elasticity and tenacity may be increased by adding varying quantities of cellulose nitrates, hydrates or acetates to the product, while yet in a fluid state.

(2) 17 parts of phenol are mixed with 40 parts of casein. The mixture is then pressed, and the resulting paste is heated to 100° C., and again pressed. A transparent block, which can be cut up into slabs is obtained on cooling. Marble effects may be obtained by adding suitable colouring matters to the mixture either before or after heating. The pliability or elasticity is increased by the addition of nitrocellulose, acetanilide, "terpene," or glycerin. In both instances guaiacol or creosote may replace phenol.—H. L.

*Silk; Artificial "Rubbered"* —. P. Germain. Fr. Pat. 355,016, June 7, 1905.

A SOLUTION of caoutchouc or similar gum in acetone is added, in any desired proportion, to a solution of nitrocellulose in acetone, and the mixture is made into threads by passing it into water or other suitable liquid. The resulting threads are stated to be very brilliant in appearance, extremely elastic, and very resistant to the atmosphere and to water. The product is not more inflammable than natural silk.—T. F. B.

*Benzene employed for Cleaning Textiles; Process and Apparatus for Recovery of the* —. E. Delhotel. Second Addition, dated May 4, 1905, to Fr. Pat. 344,848, July 16, 1904 (this J., 1904, 1213).

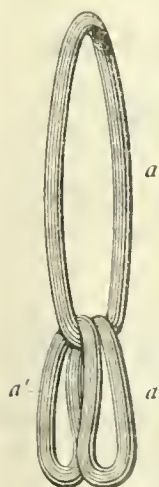
BETWEEN the heated chamber and the condensing tower of the principal patent, a series of enclosed tubes or similar device is interposed, and through this both the ingoing dry air and the hot escaping gases containing the recovered benzene are made to pass. One of the currents passes inside and the other outside the tubes in different directions. By these means an interchange of heat between the two takes place; with the result that a quantity of benzene is already condensed in this apparatus, which thus relieves the condensing tower and saves cooling water. Simultaneously there is a corresponding decrease in the fuel necessary for the heating chamber. (See also First Addition, this J., 1905, 727.)—H. L.

*Ramic and other Bast Fibres, Treating [Degumming and Bleaching]* —. J. Harris. Fr. Pat. 354,599, May 24, 1905. Under Int. Conv., Dec. 30, 1904.

FIBROUS masses of ramic, &c., in the dry, natural condition, are degummed, bleached, and separated into ultimate fibres, by the following process:—The fibrous strips are steamed, after being moistened with a dilute (1 per cent.) solution of caustic alkali, and then for a second time, after immersion in a (2 per cent.) solution of common salt or in a bath of linseed oil, soft soap and dilute caustic alkali. After rinsing, the strips are partly dried and are again placed in the steaming apparatus, where they are acted upon by ozone and steam, either separately or together. The fibres are next mechanically separated with combs or cylinders. They are finally rendered lustrous by immersion in a bath of linseed oil, emulsified with soap. The fibres are thus obtained in a state suitable for spinning.—E. B.

*Yarns [in the form of Chains]; Process of Bleaching, Dyeing and Finishing* —. E. Engel. Fr. Pat. 354,494, May 20, 1905.

YARNS, in the form of hanks, are connected together to form long continuous chains, by taking a hank  $a$  (see figure), passing a second hank  $a'$  through this, allowing its ends to fall to the same distance on each side of the first hank, thus making two loops, and then placing a third hank in the same fashion in the loops thus produced, and so on with the rest of the hanks. The chains of hanks are then passed, singly or a number of them together, through dye-baths, &c., or successively through mordanting and dye baths, &c., the yarns, it is stated, being thus dyed, &c., without the threads becoming entangled.—E. B.



*Blankets and Similar Textiles; Method of Dyeing in Graded Tints [Ombres]* —. L. and H. Pépin. Fr. Pat. 354,505, May 22, 1905.

BLANKETS, sheetings and similar tissues are stretched upon a system of rollers, arranged in two sets, one above the other, within a dye-vessel, which is partly filled with a concentrated dye-liquor. Water is gradually

added to dilute the bath, causing the tissues to become dyed in regularly graded tints. The rollers of the upper set are mounted in a frame which is moved slightly to and fro during the dyeing operation, to prevent any portions of the tissues from remaining long in contact with the rollers and thus becoming imperfectly dyed.—E. B.

*Textiles, Paper, Leather, &c.; Decoration of all kinds of* — L. Guetton-Dangon. First Addition, dated Aug. 6, 1904, to Fr. Pat. 349,341, March 19, 1904 (this J., 1905, 617).

THE loose patterns of the principal patent are fixed round a cylinder in any required arrangement, and in such a manner that they can be easily and quickly removed. The goods are passed between this roller and another revolving at the same rate, which may be heated if required.—H. L.

*Hydrosulphites; Production of — Dry and Quite Stable.* Badische Anilin und Soda Fabrik. Third Addition, dated May 6, 1905, to Fr. Pat. 341,718 of March 28, 1904. VII., page 1172.

*Discharging [Dyed Textiles] on Coloured Grounds; Method of* — Badische Anilin und Soda Fabrik. Fr. Pat. 355,117, June 9, 1905. Under Int. Conv., April 25, 1905.

SEE Eng. Pat. 12,169 of 1905; this J., 1905, 966.—T. F. B.

ERRATUM.—This Journal 1905, 1107, col. 2, the second title from top is wrong, and should read: "*Wool; Process and Apparatus for Degreasing* —" A. H. Burt, H. Jackson and C. A. Finch. Fr. Pat. 354,667, May 26, 1905.

Please gum slip which appears on cover, and with correct title, over aforesaid erroneous title, *loc. cit.*

#### GERMAN PATENT.

*Wool; Process for Degreasing and Cleansing Raw — by Means of Carbon Tetrachloride.* Délainage Ver-viétois Peltzer and Co. Ger. Pat. 160,375, Jan. 28, 1903.

THE patent provides a process for preventing loss of carbon tetrachloride in the scouring of wool. The air containing carbon tetrachloride, in a state of vapour or in suspension, is led from the scouring apparatus through a body of material which absorbs carbon tetrachloride. Raw wool may be used for this purpose, so that, when it is saturated with the solvent, it may be transferred to the scouring apparatus.—T. F. B.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(Continued from page 1108.)

#### ENGLISH PATENT.

*Dyestuffs on Fabrics, Warps or the like; Method of and Apparatus for Distributing* — O. Imray. From Farb- u. v. m. Meister Lucius und Brüning. Eng. Pat. 27,871, Dec. 20, 1904. V., page 1168.

#### FRENCH PATENT.

*Textiles, Paper, Leather, &c.; Decoration of all kinds of* — L. Guetton-Dangon. Addition, dated Aug. 6, 1904, to Fr. Pat. 349,341, March 19, 1904. V., see above.

## VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(Continued from page 1109.)

*Chamber Process [Sulphuric Acid Manufacture]; True Value of the Fan in the* — H. Rabe. Z. angew. Chem., 1905, 18, 1735—1739.

THE author points out that the rate of working of a set of chambers is determined by the gas-velocity, understanding by that the volume of gas passing through unit volume of chamber space per second. Provided this quantity be

kept the same, no throttling at any particular place can affect the working of the chambers. If the current of gases be "throttled" in front of the Gay-Lussac tower, for instance, and the volume of gas passing through the chambers per second be reduced, the volume passing through the Gay-Lussac tower is correspondingly reduced, and the same effect would have been produced by throttling behind instead of in front of the Gay-Lussac tower. This is equally true whether chimney-draught or fan-propulsion be the motive power; and as far as the use of the fan to increase the intensity of the working is concerned, the fan is to be looked on simply as a means of overcoming frictional resistance, and its position in the system must be a matter of indifference. Provided the fan creates a certain gradient of pressure from end to end of the system, it makes no difference whether there is throughout a *plus* pressure, throughout a *minus* pressure, or partly one and partly the other, compared with the pressure of the atmosphere. The differences in pressure which produce the motion of the gases are so small compared with the atmospheric pressure—or even compared with the variations of atmospheric pressure at different times or in different localities—that the absolute pressure under which the process is conducted can have no influence on the results. It is thus quite impossible to make the working of the burners "independent" of that of the chambers (Lüty, this J., 1905, 922) by a fan, wherever situated; the fan simply affords a means of controlling and varying the rate of working of the system as a whole.

Naturally, other circumstances may point out one place or another as the most advantageous for the fan—for economy of power, for instance, it would be placed at the end of the system, where the volume of gas to be dealt with is least, or, if it must not encounter acid gases, it would be placed before the burners and drive the air through them—but, looked at simply as a means of overcoming frictional resistance, and hence of either allowing the introduction of apparatus producing such resistance—dust chambers, plate towers—or of carrying a greater volume of gases than formerly through a given system, its effect is entirely independent of its position.

—J. T. D.

*Saltpetre [Potassium Nitrate]; Report on the Manufacture and Composition of Indian* — D. Hooper. Agricult. Ledger, 1905 [3], 17—48. Office of the Superintendent, Government Printing, Calcutta, India. Price 6d.

IN this report the author discusses the process of nitrification, with special reference to the conditions obtaining in India; gives an account of the districts where nitre earths occur, and where the salt is manufactured; describes the process of manufacture; and also gives a series of analyses of samples of nitre earths, crude and refined saltpetre, and impure and purified table salt and other by-products.—A. S.

*Potassium Chromates.* F. A. H. Schreinemakers. Chem. Weekblad., 1904, 1, 837—848. Chem. Centr., 1905, 2, 1067.

JAEGER and Krüss (Ber. 1889, 22, 2028) have previously examined the four salts  $K_2CrO_4$ ,  $K_2Cr_2O_7$ ,  $K_2Cr_3O_{10}$ ,  $K_2Cr_4O_{13}$ . They prepared the tri- and tetra-chromates by treating the bichromate with nitric acid. The author finds that these salts can also be prepared by adding the requisite quantities of chromium trioxide to the normal chromate or bichromate. The ternary system comprising water, potassium oxide and chromium trioxide was examined at 30° C. At this temperature, 100 grms. of water will dissolve 64.91 grms. of normal potassium chromate and 18.12 grms of potassium bichromate, and it is, therefore, not possible to separate the normal chromate from a solution of the bichromate by addition of the base (potassium hydroxide) as in the case of the ammonium chromates. In both cases, however, the bichromate can be separated from a saturated solution of the normal chromate by the addition of chromium trioxide. As in the case of the ammonium salts, the tri- and tetra-chromates of potassium are decomposed into bichromate by addition of water at 30° C. (See following abstract.)—A. S.

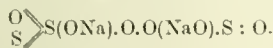


**Ammonium Chromates.** F. A. H. Schreinemakers. Chem. Weekblad., 1904, 1, 395—410. Chem. Centr., 1905, 2, 1066—1067.

The author examined the ternary system comprising chromium trioxide, ammonia, and water, at 30° C. Normal ammonium chromate cannot be dried at 100° C. without decomposition; even at lower temperatures it gives off ammonia, with formation of the bichromate. The normal chromate and bichromate dissolve in water without decomposition, but the tri- and tetrachromates are decomposed by water. All the other ammonium chromates can be prepared from the normal chromate by the addition of chromium trioxide. At 30° C. 100 grms. of water will dissolve about 40.4 grms. of normal ammonium chromate, 47.17 grms. of ammonium bichromate, and 165.1 grms. of chromium trioxide.—A. S.

**Trithionates; Reduction of —, to Sulphites by Arsenite or Stannite.** A. Gutmann. Ber. 1905, 38, 3277—3281.

In continuation of his researches into the reactions of other sulphur acids (this J., 1905, 618), the author now finds that when sodium trithionate is reduced by sodium arsenite, 1 mol. of trithionate yields 1 mol. of arsenate and 1 of sulphoxyarsenate, thus giving up one atom of sulphur and one of oxygen:—Typically,  $S_3O_5 = 2SO_3 + S + O$ ; actually,  $S_3O_5Na_2 + 2AsO_3Na_2 + 2NaOH = 2Na_2SO_3 + As_2SO_3Na_2 + AsO_4Na_2 + H_2O$ . Accordingly, the constitutional formula of the trithionate must be—



The reduction of trithionate by stannite takes place similarly. Dithionates are not affected by arsenite or stannite in alkaline solution.—J. T. D.

**Sulphuric and Nitric Acids; Examination of Mixed —.** G. Lunge and E. Berl. XXIII., page 1191.

**Titanium Chloride in Volumetric Analysis; Use of —.** E. Knecht, and E. Hibbert. XXIII., page 1192.

#### ENGLISH PATENT.

**Carbonic Acid Gas Producing Apparatus.** J. C. Stead. London. Eng. Pat. 26,659, Dec. 7, 1904.

The invention is an improvement on Eng. Pat. 18,710, of 1904 (this J., 1905, 132), according to which a mixture of gases containing carbon dioxide is passed through a series of cylinders containing lye in which the carbon dioxide is absorbed, and is subsequently released by boiling, from the most highly saturated portion of the bicarbonated lye. Under the present invention, the "boiling-off" vessel is placed on a lower level than the connected vessels, so that it can receive its charge of bicarbonated lye through the action of gravity. The carbon dioxide expelled, passes upwards through a siphon tube to the bottom of a "lye-heating" vessel, below a screen which scatters and thus spreads the gas on its ascent. This latter vessel is charged with cool lye from the next absorbing cylinder to that from which the "boiling-off" cylinder is supplied, and this cool lye is thus warmed, and so heat, that of the hot carbon dioxide, is economised. The carbon dioxide is thus also, not only cooled, but completes the saturation of the lye within the vessel. From this vessel the gas passes to a reservoir. The lye, thus warmed and saturated, is then caused to flow through the siphon tube into the "boiling-off" vessel below; the contents of the latter having been previously discharged ready for recarbonating.—E. S.

#### UNITED STATES PATENTS.

**Lime and Lime-Containing Substances Process of Slaking —, and certain Novel Products of said Process.** C. Ellis, New York. U.S. Pat. 802,354, Oct. 17, 1905.

The lime is delivered from a hopper having a horizontal discharge pipe, furnished with a conveyor, and terminating in a vertical pipe, which delivers the lime into a chamber

in which a central horizontal shaft carrying paddles is rotated. In the roof of the chamber a perforated pipe, with valved connection to a water pipe, discharges upon the agitated lime a quantity of water approximately three-fourths to four-fifths of the quantity necessary for its complete hydration. From the hydrating chamber, the lime is projected into a lower and larger chamber, through which also a horizontal shaft passes, carrying agitators, and mechanically operated. The product is claimed as a "dry short-slaked lime." Compare U.S. Pat., 800,635, of Oct. 3, 1905; this J., 1905, 1109.—E. S.

**Ammonia-Gas Condenser.** A. H. Baer, Waynesboro, Pa. U.S. Pat. 802,904, Oct. 24, 1905.

The condenser or cooler consists of several connected sets, each of three pipes, one within the other, with passages between their adjacent sides, the outside pipes being connected by fittings having openings leading from one set to the next, and an inlet and outlet at opposite ends of the passage. The intermediate pipe extends at each end considerably beyond the outer pipe, one end being tightly engaged with the fitting, beyond which it is closed; the other end, extending through the front fitting, is provided with a second fitting upon its outer end. The inside pipe, which leads through and extends beyond the intermediate pipe, communicates at one end with the annular space between it and the latter, and at the other end is connected by a tight joint with the fitting on the outer end of the intermediate pipe, this fitting opening into a chamber communicating with the said pipe, and having an open end communicating with the interior of the inside pipe. Branch pipes connect the inside pipes of adjacent sets.—E. S.

**Chlorates and Bichromates; Process of Producing —.** A. E. Gibbs, Niagara Falls. U.S. Pat. 802,205, Oct. 17, 1905.

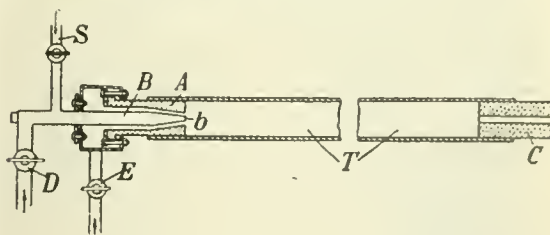
SEE Fr. Pat. 341,223 of 1904; this J., 1904, 866.—T.F.B.

**Filling Material; Process of Manufacturing a —.** J. D. Pennock, Syracuse, Assignor to The Solvay Process Co., New York. U.S. Pat. 802,657, Oct. 24, 1905.

SEE Fr. Pat. 341,223 of 1904; this J., 1904, 866.—T. F. B.

#### FRENCH PATENTS.

**Sulphuric Acid; Manufacture of —.** L. E. M. Brochon. Fr. Pat. 355,252, June 15, 1905.



The main object of the invention is to burn sulphur (or pyrites) in excess of air under such pressure that the product may consist, in part, of strong sulphuric acid, and even, under favourable conditions, of the anhydride, at least in the early stage of the process, although sulphur dioxide is included among the products.

The drawing shows one form of apparatus in which the process may be conducted. Sulphur or powdered pyrites is admitted through the vertical tube S into the horizontal tube B, narrowed to a small aperture at b, and removably fitted to the wall of the chamber above E. Air under pressure (say, of 10 atmospheres) is forced through the tubes D and E; that through D carrying with it the powdered sulphur, and that through E traversing (and cooling) the annular space between B and the plug A, supplying excess of air to the sulphur which is inflamed beyond the exit b in the tube T. The acid vapours formed escape through the narrow channel in

the plug C at the farther end of the combustion tube, into condensing vessels, or into ordinary lead chambers of the sulphuric acid manufacture, the expansion of the gases on emergence sufficing to cool the vapours sufficiently without the intervention of special coolers.—E. S.

*Hydrosulphites; Production of* — *Dry and quite Stable.* Badische Anilin und Soda Fabrik. Third Addition, dated May 6, 1905, to Fr. Pat. 341,718, of March 28, 1904 (this J., 1904, 900).

ANHYDROUS zinc hydrosulphite is treated with a concentrated caustic soda lye, preferably heated, and the sodium hydrosulphite, free from water of crystallisation, thus obtained, is washed with alcohol, and dried *in vacuo* or over sulphuric acid at a temperature of 50° C. (See also First and Second Additions to the main patent; this J., 1905, 333.)—E. S.

*Seaweed; Treatment of* — *for the Extraction of Mineral and Organic Chemical Matters.* Mme. Laureau, née J. H. Laureau. First Addition, dated May 24, 1905, to Fr. Pat. 352,069 of March 6, 1905 (this J., 1905, 892).

LIQUID from seaweed, whether limed or not, is treated with a solution of an alum, aluminium sulphate, or certain other salts, to precipitate fucose, which can be subsequently recovered from the precipitate by treatment with an acid. The liquid thus freed from fucose is concentrated, set to crystallise, and the mother liquors are treated to obtain iodine, &c.—E. S.

*Sulphur Contained in Materials which have been used for Gas Purification; Process for Extracting and Purifying the* — A. V. Cornillaux. First Addition, dated June 6, 1905, to Fr. Pat. 353,932, March 25, 1905.

SEE Eng. Pat. 7616 of 1905; this J., 1905, 1066.—T. F. B.

*Hydrogen; Manufacture of* — H. S. Elworthy. Fr. Pat. 353,324, June 17, 1905. II., page 1164.

#### GERMAN PATENTS.

*Magnesium Chloride; Process for the Dehydration of* — Salzbergwerk Neu-Stassfurt. Ger. Pat. 161,662, March 7, 1903.

THE magnesium chloride is heated *in vacuo* to a temperature of over 100° C.—A. S.

*Antimony Oxide; Process for the Manufacture of* — *from Antimony Sulphide and Sulphide Antimony Ores.* S. Metz. Ger. Pat. 161,776, April 24, 1904.

THE finely-powdered antimony compound or ore is heated with sulphuric acid and an alkali sulphate, the solution is allowed to cool, and the crystals which separate are removed and boiled with water to obtain antimony oxide. It was found that the antimony of antimony sulphide, is quantitatively converted into antimony sulphate at a temperature of 130° C. by this method, the sulphur escaping as sulphur dioxide. The antimony crystallises out from the solution in the form of a double antimony-alkali sulphate, which, on treatment with boiling water, yields antimony oxide, sulphuric acid and alkali sulphate.—A. S.

### VIII.—GLASS, POTTERY, AND ENAMELS.

(Continued from page 1110.)

#### UNITED STATES PATENT.

[*Porcelain*] *Transfer Ornamentation; Process of* — W. Wachter, Leipzig, Assignor to M. Magdeburg, Zehlendorf, Berlin. U.S. Pat. 802,616, Oct. 24, 1905.

THE process for ornamenting porcelain, stoneware, majolica, bricks, metal sheets and the like, consists in coating the transfer paper with a gummy solution of one or more carbohydrates, then with a layer of glaze, upon which the design is printed in suitable colours. The design is then transferred to the object to be decorated, coated with glaze and burned. The adhesive solution

suggested, and also used for grinding the colours in, consists of 100 grms. of water, 200 grms. of mucilage of "carigeen-moss," and 300 grms. of burnt sugar.

—W. C. H.

### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(Continued from page 1110.)

*"Diamantin": A Protecting Medium for Refractory Blocks.* C. Loeser. Chem. Ind., 1905, 28, 643—647.

"DIAMANTIN" is used as a lining for ovens and furnaces, especially for the protection of parts against the attacks of ash, slag, molten metals, molten glass, lime, cement and similar bodies. It is produced, at the temperature of the electric arc, from aluminium oxide with a small addition of silica. For use it is mixed with a little highly-refractory plastic clay and water to a more or less thin paste, which is spread upon the refractory blocks, to which it adheres quickly forming a tough covering that cannot be easily removed when once subjected to fire.

To test the efficacy of "diamantin," small oblong blocks were prepared on one of the broader faces of which a shallow oblong indentation was made. The blocks were made of the finest washed kaolin with about 36 per cent. of unburnt Dörlau clay, mixed with an equal amount of broken saggars, ground to about 3 mm. grain, and burnt at 1430° C. The indented faces of a number of these were coated with a layer of "diamantin"  $\frac{1}{2}$  to 1 mm. thick, and four series of tests were made.

In the first series the indentations of some protected and unprotected blocks were half filled with ash of brown-coal, and raised three times to about 1450° C. In the unprotected tests a dark, greenish-black, porous, lava-like mass formed, which had eaten into the corners of the hollows, and ramified into the pores. The bottom of the protected hollows was covered with an uneven thick fused mass, in which were imbedded some more refractory particles.

The test pieces for the second series were similarly prepared and treated, but a piece of lime 2×2×4 cm. was placed on the ash of brown-coal. The main results on burning were that with the unprotected tests the layer of ash was absorbed, the lime being burnt to a greenish-black clinker, which was cemented to the base of the hollow; but with the protected tests the ash showed hardly any sign of melting or glazing, and the lime could be easily lifted out. "Diamantin" should, therefore, be valuable as a lining for rotary kilns.

In the third series of tests the effect was tried of the following mixture, corresponding with Seger cone No. 610, and melting at 950° C.

0.3 K <sub>2</sub> O	0.2 Fe <sub>2</sub> O <sub>3</sub>	3.5 SiO <sub>2</sub>
0.7 CaO	0.3 Al <sub>2</sub> O <sub>3</sub>	0.5 B <sub>2</sub> O <sub>3</sub>

In the unprotected tests, the molten glaze penetrated into cracks and pores of the block, and formed difficultly fusible silicates with portions of it. The layer between glaze and block was of a milky opaque appearance. In the protected test there was no penetration of the block by the molten glaze, which was separated from the block by a lava-like layer with a fine-pore structure.

In the fourth series of tests a mixture, fusing with difficulty, corresponding to Seger cone No. 10, was used:—

0.3 K <sub>2</sub> O	1 Al <sub>2</sub> O <sub>3</sub>	10 SiO <sub>2</sub>
0.7 CaO		

In the unprotected tests the mass formed a fused mass, too viscous to reach the edges of the hollow, and with soft ascending edges, which could be chiselled off the block only with much more difficulty than the cake formed in the hollow protected with diamantin, which had much steeper edges.—W. C. H.

#### ENGLISH PATENT.

*Cement Making; Rotary Kilns for* — E. Gobbe, Jumet, Belgium. Eng. Pat. 27,753, Dec. 19, 1904.

SEE Fr. Pat. 346,383 of 1904; this J., 1905, 136.—T.F.B.



## UNITED STATES PATENTS.

*Wood; Method of Preserving* — W. E. Everett, Tacoma, Wash. U.S. Pat. 801,859, Oct. 17, 1905.

THE method consists in setting free and exhausting the sap and resins to a desired depth of the wood or other fibrous material to be treated; and either first lixiviating under heat and pressure and then forcing a solution of a suitable acetate into the pores of the material, or at once treating with the acetate solution; after which the material is treated with an aqueous solution of ammonia and carbon dioxide, and then with an aqueous solution of an alkali silicate. Finally any soluble matter remaining is drawn off and exhausted, and the material is dried.

—A. G. L.

*Fireproofing Compound [for Wood]*. W. D. Patten, New York, N.Y. U.S. Pat. 802,311, October 17, 1905.

THE compound contains dihydrogen sodium orthophosphate and ammonium sulphate in such proportions that the compound is freely liquid at a temperature below the point at which wood ignites.—A. G. L.

*Wood; Preservation of* — W. B. Chisolm, Charleston, S. C. U.S. Pat. 802,680, Oct. 24, 1905.

THE method consists in impregnating the pores of wood and providing it with an exterior preservative and protecting coating of fused calcium sulphide. Wood so treated is also claimed as a new article of manufacture.—W. C. H.

*Plaster Compounds; Method of Making Ingredients for* — J. H. Hint, Brookline, Mass. U.S. Pats. 801,873 and 801,874, Oct. 17, 1905.

QUICKLIME, with or without the addition of marble-dust, is introduced into a closed vessel, water in excess of that required to slake the lime, but insufficient to make the mass pasty is added, and the excess of moisture is removed by exhausting the vessel whilst the charge is still hot. The air may also be exhausted from the vessel containing the quicklime (and marble) before adding the water.—A. G. L.

*Bricks or Blocks; Manufacture of Lime and Sand* — E. Stöfler, Zürich, Switzerland. U.S. Pat. 802,608, Oct. 24, 1905.

SEE Eng. Pat. 11,523 of 1904; this J., 1905, 198.—T. F. B.

*Cement; Apparatus for Burning Portland* — T. A. Edison, Llewellyn Park. U.S. Pat. 802,631, Oct. 24, 1905.

SEE Eng. Pat. 1404 of 1903; this J., 1903, 555.—T. F. B.

## FRENCH PATENTS.

*Marble, Granite, &c., Manufacture of Artificial* — L. Lefranc. Fr. Pat. 355,222, May 23, 1905.

A MIXTURE in molecular proportions of fluorspar with gypsum (or calcium carbonate, clay, sand or other alkali or alkaline earth oxides) is fused in a suitable furnace at a temperature of 1000° to 1500° C. until perfectly homogeneous, then run into closed and heated moulds and cooled very slowly. To imitate marble, colouring bodies such as ferric oxide or copper salts are added to the mass at the moment of cooling; for granite, hard graphite or carborundum is added in the same way. The moulds are carried on trucks which are worked in a tunnel leading from the mouth of the furnace, and through which the hot waste gases are made to pass, heating the moulds in so doing.—A. G. L.

*Fibres, Films, Blocks or Slabs; Plastic and Transparent Substance for the Manufacture of* — H. C. M. L. Cathelineau and A. A. René-Fleury. Fr. Pat. 354,942, June 5, 1905. V., page 1169.

*Lime, Cement and Puzzuolana; Manufacture of* — Soc. Anon. des Chaux et Ciments Romain Boyer. Fr. Pat. 355,132, June 10, 1905.

TO the raw materials before burning are added either polybasic acids, e.g., sulphuric, sulphurous, phosphoric, or boric acid, or substances capable of forming such acids during the subsequent burning, e.g., sulphur or phosphorus.

—A. G. L.

*Cement-Kiln; New Form of* — Soc. A. B. Lemain et Cie. Fr. Pat. 355,483, June 23, 1905.

THE kiln is characterised by having a conical grate placed in the centre of the hearth. Air is admitted through this grate, being supplied by horizontal channels, provided with dampers, in the base of the kiln. Discharge openings for the burnt material are placed on a level with the bottom of the kiln, and passages leading to openings higher up in the kiln are provided, by means of which air is made to pass over the burnt material, cooling the latter, and itself becoming heated in so doing. The action of the kiln is continuous, raw materials being charged in through openings near the top, the burnt gases escaping through other openings in the same part of the kiln. Coal, poor in quality, or other fuel, is used, and it is claimed that a saving of more than 35 per cent. in labour, fuel, &c., is effected by using this form of kiln.—A. G. L.

## X.—METALLURGY.

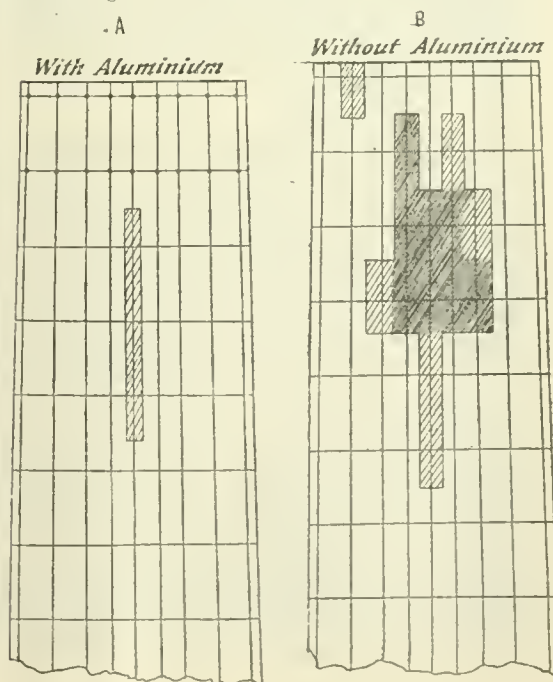
(Continued from page 1114.)

*Steel; Production of* — with use of ready-formed Slag. O. Goldstein. Stahl u. Eisen, 1905, 25, 1230–1231.

WITH ores containing too much phosphorus for the Bessemer and too little for the Thomas process, steel production by the basic Martin process is very slow, because of the large amounts of ore, and of flux for the sulphur and phosphorus in this ore, that have to be added to the bath. Such ores are successfully dealt with, in Mexico and the Southern States of North America, by the duplex process, combined with Knott's slag process. The pig, containing 1 per cent. of phosphorus, is treated in the acid converter (or, with scrap, in a basic Siemens-Martin furnace) till the carbon is reduced to about 1 per cent. It is then poured into a basic Siemens-Martin furnace, containing the slag from a former operation, lime added to make up for the loss of slag during pouring, and a little felspar. Reaction sets in at once, and the charge of 30 tons is finished in 2½ hours. With a tilting furnace, the slag may remain in during the whole time; with a fixed furnace, it must be poured out and replaced after pouring the steel. The finished steel contains only 0.006 to 0.012 per cent. of phosphorus.—J. T. D.

*Steel Ingots; Segregation in* — B. Talbot. Iron and Steel Inst., Sept., 1905. [Advance Proof.]

IN order to determine the effect of aluminium in hindering segregation, the author carried out a series of parallel tests on ingots from the same "heat," with and without



the addition of a small amount of aluminium. The ingots were taken from both acid and basic open-hearth furnaces, and varied in weight from  $1\frac{1}{2}$  to  $3\frac{1}{2}$  tons; the smaller ingots showed the effect of segregation quite as distinctly, if not more so, than the larger ones. The results are given in a series of tables. It was found that, as a rule, in ingots (5 ft. 6 in. high) to which no aluminium had been added, excessive segregation down the central line of the ingot occurred from about 6 in. from the top to about half-way down; sulphur showed the greatest tendency to segregate, followed by phosphorus and carbon, whilst, in the case of manganese, the segregation was so slight as to be almost negligible. By the addition of aluminium (3–4 oz. per ton), ingots of much more uniform composition were obtained. The effect of the aluminium was shown very distinctly in the case of two acid steel ingots, each 18 in. by 22 in. by 67 in., and weighing 6000 lb. The ingots were "top-poured," and to one, an addition of 4 oz. of aluminium per ton was made. The metal in the ladle, before the addition of the aluminium, contained 0.38 per cent. of carbon, 0.061 per cent. of sulphur, 0.052 per cent. of phosphorus, and 0.52 per cent. of manganese. The amount of segregation of the sulphur in these two ingots is shown in the accompanying diagram. The lighter shaded portions represent areas on the surface of the ingot when cut through longitudinally, in which the percentage of sulphur has increased more than 25 per cent. over the amount shown by the ladle test, whilst the darker shaded portion represents an increase of 75 per cent. over the ladle test. The drillings for analysis were taken at the points where the vertical and horizontal lines intersect, and where the amount of sulphur was above the limit, the borders of the area to be shaded were taken half-way between such point and the nearest point where the amount of sulphur was below the limit. A point of some importance brought out in the course of the experiments was the uniformity in the percentages of carbon in fairly high carbon basic steel, obtained by the addition of solid carbon to the steel while running into the ladle. It is generally held that the addition of small amounts of aluminium causes a marked increase in the fluidity of molten steel, but the author's experience is that aluminium makes the metal set more quickly. In fact, the setting effect on the top of the ingot is so marked that at one works, at which it is the custom to add aluminium regularly, the ingots are never sanded over or stoppered down, no such treatment being necessary either with acid or basic open-hearth steel. When the aluminium is added to the metal as it is run into the ladle, the effect is not so pronounced as when the addition is made to the molten metal in the ingot mould.—A. S.

*Nickel Steel; Reversible and Irreversible Transformations of —* L. Dumas, Iron and Steel Inst., Sept., 1905. [Advance Proof.]

The discovery by Hopkinson in 1889 of the irreversible transformation of a 25 per cent. nickel steel remained for long an isolated fact. Osmond discovered that other nickel steels exhibited similar phenomena, and Guillaume showed that the transformation point on cooling became lower as the percentage of nickel rose from 0 to 25, and that above that percentage the transformation (occurring now at a higher temperature as the nickel increases) is reversible. Osmond (this J., 1899, 278) determined the transformation points on heating and cooling of steels with all percentages of nickel, and expressed his results in curves, which show that as the nickel rises, the irreversible points are lowered, and the range between the heating point and the cooling point increases; that just above 25 per cent. of nickel reversible transformation occurs at about the same temperature as irreversible transformation on cooling just below that percentage; and that the reversible transformation point rises (heating and cooling points, of course, close together) to a maximum at 70 per cent. of nickel, and then gradually falls.

The author points out that carbon produces, twentyfold as strongly as nickel, depression of the irreversible transformation point—in Osmond's austenite-steel transformation occurs at  $-150^{\circ}\text{C}$ . High proportions of carbon, however, readily segregate in an iron-carbon steel, whilst if nickel be present it more readily remains uni-

formly distributed, and the presence of nickel (itself acting in the same direction) does not sensibly modify the effect of the carbon in lowering the irreversible transformation point. Carbon has no effect on the reversible transformation, and by using nickel steels high in carbon and thus greatly lowering the irreversible point, the author has shown that steels below 25 per cent. of nickel exhibit reversible transformation, and that Osmond's curve can be continued towards the zero of nickel, crossing the curve of irreversible transformation. With low-carbon steels, the magnetism due to the reversible transformation is, if the nickel be below 25 per cent., masked by the stronger effects of that due to the irreversible transformation.

Manganese acts similarly to nickel and carbon, and is intermediate in the intensity of its action. The points of transformation of two manganese steels, containing respectively manganese 8.29, carbon 0.06, and manganese 10.83, carbon 0.29 per cent., are  $175^{\circ}\text{C}$ . and  $-78^{\circ}\text{C}$ . In the absence of nickel, manganese steels show no reversible transformation.

The reversible and irreversible transformations appear to be distinct phenomena, and it seems that neither is definitely limited by a fixed percentage of nickel, and that irreversible transformation is exhibited by steels with more than 25 per cent. (though unless the carbon and manganese are very low the transformation-point is impracticably low for demonstration), and reversible transformation by those with less. The reversible transformation produces but a weak degree of magnetism, and has practically no influence on the mechanical properties of the steel.

Chromium produces, in nickel carbon steels, a considerable lowering of the irreversible point; but it seems to have little intrinsic effect, but to increase the activity of the carbon, for its effect diminishes with the amount of carbon present. It no doubt acts as a solvent of carbon, favouring the diffusion of the carbon through the steel. Mechanically, also, it seems to act on the nickel, and to improve the quality of the steel.

The irreversible transformation has an important effect on the mechanical properties of the steel; it can be studied either by examining the steel at varying temperatures or by varying the percentage of nickel and working at the same temperature. (In all cases it is to be remembered that transformation is completed not at a point but over a zone of temperature.) A 16 per cent. nickel steel, heated to  $700^{\circ}\text{C}$ ., and placed on a lathe while above  $150^{\circ}\text{C}$ . can be turned readily, but below that temperature becomes hard and brittle, and at the same time magnetic. The following figures show the differences in mechanical properties due to transformation, and also those due to "working." The first two are a low-carbon steel, with transformation-point above the ordinary temperature, and a high-carbon steel of the same nickel-content, with transformation-point below it. The first is deformed at one place only, the second undergoes preliminary deformation along its whole length, and only after that a deformation at the point of ultimate fracture. The elastic limits are respectively 87 and 42 per cent. of the tensile strength, and the preliminary deformation in the second case is a kind of "working," producing results similar to the various kinds of working instanced further down the table. These two steels (A) and (B) contained, respectively, carbon, 0.16, 0.53; manganese, 0.13, 0.83; chromium, 0.0, 3.02; nickel, 15.92, 16.05 per cent.

Kind of Steel.	Elastic limit.	Tensile strength.	Elongation.	Contraction
	Egms per sq. mm.		Per cent.	Per cent.
Magnetic (A) . . .	76.2	89.2	19.0	54.5
Non-magnetic (B) . . .	32.8	77.5	73.0	68.0
28 per cent. nickel				
Before drawing	32.1	57.8	34.0	55.0
After drawing	92.1	92.1	11.7	63.5
23 per cent. nickel				
No treatment	30.9	71.8	35.0	41.5
Cooled at $73^{\circ}\text{C}$ .	102.6	137.0	20.3	21.5
Drawn . . . . .	129.5	139.0	13.3	28.2
Drawn & cooled	141.5	149.0	12.7	32.1



In all these cases, not only is the tensile strength increased by working, but the elastic limit is made more nearly to approach it. Irreversible transformation thus produces a similar effect to working.

Irreversible transformation on cooling is accompanied by a sudden increase in volume. This is probably a molecular increase, the molecules having lost the faculty of slipping over one another, as though subjected to pressure. No doubt the nickel molecules compress those of iron, and the "working" effect increases the elastic limit, till, above 20 per cent. of nickel, the iron changes its state, the volume of the molecules diminishes, pressure is relieved, and ductility reappears. Micrographic examination shows that a polished sample of nickel steel, which has been cooled so as to partially transform it, exhibits projections in the transformed portions, which have become martensite. Other physical properties are also changed during transformation. Reversible transformation, though it has no noticeable effect on the mechanical qualities of the steel, modifies many of the physical properties, especially, as has been shown by Guillaume, the dilatation and the elasticity.

Tests of tensile strength of steels with varying amounts of nickel show that the elastic limit and tensile strength both increase as the nickel increases up to 15 per cent., but above that the elastic limit decreases, though the tensile strength still increases, till 21 per cent. is reached; above which amount both undergo a sudden fall, and the elongation rapidly increases. About this percentage the transformation-point on cooling falls below the ordinary temperature. Above 27 per cent. of nickel very slight alterations in the mechanical qualities occur.

Physical treatment—annealing, quenching, or working—raises the irreversible transformation-point of steels which have it about the ordinary temperature. Determinations on a number of steels after quenching and working show that those with more than 21 per cent. of nickel undergo a rise which may bring the cooling point almost up to the heating point, itself slightly raised, while those containing 15–21 per cent. are hardly affected (being, so to speak, already "worked," as they have at the ordinary temperature undergone the transformation), and those with less than 15 per cent. have the two points slightly lowered but not approximated. Physical treatment produces similar effects on the mechanical properties of nickel steels; that is to say, those which at the ordinary temperature have undergone transformation are insensitive, while those not transformed are very susceptible to alteration. The effect on such steels of working is to raise the elastic limit and lessen the elongation; this may occur even to a greater extent than through transformation by cooling, but the stresses so produced are (unlike those due to transformation) irregularly distributed, and chiefly confined to the outer layers, and they are entirely destroyed by annealing at 900° C. Quenching from 800°–900° C. somewhat hardens transformed steels, but softens considerably those not transformed. In the case of carbon steels, quenching alters the distribution of the carbon, and thus the chemical composition, and its effects are destroyed by heating to a temperature high enough to allow the inverse change to take place; but with nickel steels the change seems to be physical, and the resulting state is stable enough to stand successive reheatings, and even to be accentuated by repeating the treatment. Annealing at 900° C. produces effects similar to quenching, but less marked. Annealing at 400° C. softens nickel steels with high elastic limits, as it does quenched carbon steels. The effect produced depends on whether or not the steel is raised to a temperature above its transformation point; in the first case it becomes non-magnetic, and its hardness is increased, but in the second it remains magnetic throughout, and its hardness is diminished.

The author considers that the untransformed steels contain  $\gamma$ -iron, and that the irreversible transformation is due to the formation of  $\beta$ -iron, accompanied by the appearance of internal stresses, a certain proportion of  $\alpha$ -iron being at the same time formed, to which alone the magnetic properties are due.—J. T. D.

*Sulphur; Determination of — in Iron.* J. Petró. XXIII., page 1191.

*Silver in Blister Copper; Determination of —.* C. C. Sample. XXIII., page 1191.

#### ENGLISH PATENTS.

*Vanadium; Method of Treating Ores of —.* A. H. Perret, Paris. Eng. Pat. 26,881, Dec. 9, 1904.

SEE FR. Pat. 348,633 of 1904; this J., 1905, 496.—T.F.B.

*Gas from Gas Producers, Blast-Furnaces and the like; Method of and Apparatus for Purifying the —.* J. D. Thornycroft, and J. I. Thornycroft and Co., Ltd., Eng. Pat. 28,295, Dec. 23, 1904. II., page 1164.

*Steam from Hot Slag; Apparatus for Generating —.* G. Mitchell, Los Angeles, Cal. Eng. Pat. 2795, Feb. 10, 1905.

THE claim is for improvements in apparatus described in Eng. Pats. 20,225 and 28,795 of 1902 (cf. J., 1903, 302), and consists in combining a rotary slag carrier with the steam generator. The slag carrier consists of a drum rotating in a steam-jacketed casing mounted above the steam generator, and provided with radial slag chambers alternating with radial steam chambers. The contact between the drum and the casing is made tight by split rings forced against the casing by steam admitted to the radial steam chambers. The steam is conveyed to the chambers in the drum by a hollow shaft on which the drum rotates. As the radial slag chambers come into the highest position they pass under a hopper from which they are filled with slag. When in the course of rotation they reach the lowest position they are opposite the opening into the steam generator; at this point steam enters the chamber from the hollow shaft and forces the slag into the generator.

—W. H. C.

#### UNITED STATES PATENTS.

*Iron, Ingot-Steel, &c.; Process for the Deoxidation of Ingot —.* R. Eichhoff, Essen-Rüttenscheid, Germany, Assignor to Elektrostahl Ges.m.b.H., Remscheid-Hasten, Germany. U.S. Pat. 801,656, Oct. 10, 1905.

THE metal is smelted and purified in a Bessemer, Thomas, or other furnace, separated from the slag, and then covered with a layer of neutral slag in another receptacle. The molten metal is cooled to just above its solidifying point, reducing agents are added to reduce the oxidation products which have separated from the metal and passed into the slag, and the metal is then again heated while still under the neutral slag, mixed if desired with a suitable substance to form an alloy, and cast.—A. S.

*Steel, Armour Plates, &c.; Method of Treating —.* R. A. Hadfield, Sheffield. U.S. Pat. 802,188, Oct. 17, 1905.

SEE Eng Pat. 15,220 of 1904; this J., 1905, 736.—T.F.B.

*Precious-Metal-Bearing Materials; Process of Treating —.* C. W. Merrill, Lead, S.D. U.S. Pat. 801,470, Oct. 10, 1905.

THE substance is crushed, and the pulp after being freed from any liquid contained in its interstitial spaces, is treated first with compressed air and then with a solution containing cyanogen.—A. S.

*Furnace; Zinc-Smelting —.* E. C. Hegeler, Lasalle, Ill. U.S. Pat. 794,799, July 18, 1905.

THE invention relates to that class of Belgian zinc-smelting furnaces in which the retorts are arranged transversely in a horizontal flue or chamber of great length. The improved apparatus claimed is shown in Figs. 1 and 2. Fig. 1 is a sectional plan of the entrance end of the retort chamber, together with a portion of the gas flue. Fig. 2 is a sectional elevation on the line 2-2 of Fig. 1. The long horizontal retort chamber is divided into two compartments A, A by the central wall A<sup>1</sup>, which is provided with steps on which the rear ends of the retorts B rest. The retorts are arranged in horizontal and vertical rows;

the distance between the retorts in the horizontal rows is ordinarily about 2 ins., but at intervals the rows are placed further apart, so that groups of retorts are formed with intervening vertical spaces, *a, a*. The roof of the retort chamber is formed of a series of high sections or arches *C*, alternating with low sections or arches *C*<sup>1</sup>, the high sections forming a series of recesses, in which no retorts are placed. The bottom or floor of the chamber is flat except at the points directly below the recesses in the roof, where it is provided with ridges *C*<sup>2</sup>, preferably formed of heaps of sand, the apex of the heap being a little below the underside of the lower row of retorts.

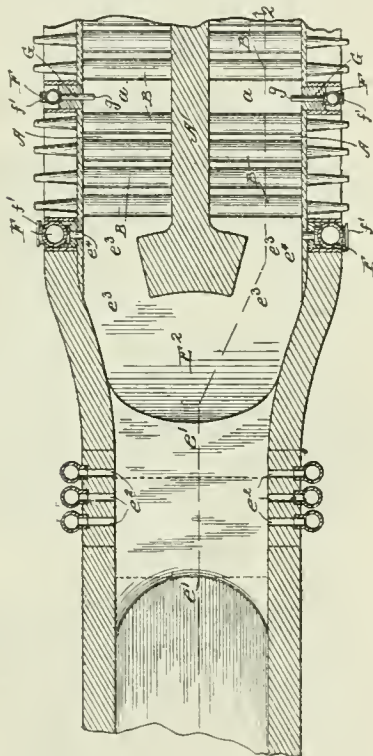


FIG. 1.

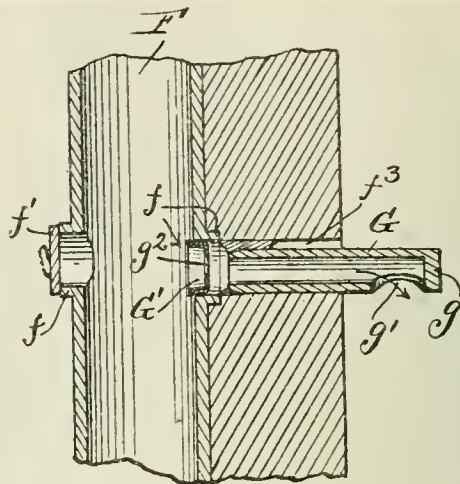


FIG. 3.

These ridges form a series of recesses in which also no retorts are placed. The generator-gases used as fuel enter the gas flue leading to the entrance end of the retort chamber through the passage *E*<sup>1</sup> and pass through a contracted passage *e*<sup>1</sup> *e*<sup>1</sup> in the opposite sides of which are air inlet openings *e*<sup>2</sup> *e*<sup>2</sup>, through which is supplied nearly the whole of the air required before the gases enter the retort chamber. The mixture of gas and air passes into the vertical portion *E*<sup>2</sup> of the gas flue, which it descends and then passes through openings *e*<sup>3</sup> *e*<sup>3</sup> into the retort chamber, additional supplies of air being provided through smaller inlets *e*<sup>4</sup> placed just before the first row of retorts. The air supply to the retort chambers enters through inlets opening into the vertical spaces *a, a*. The air inlet device is shown in Fig. 3, where *F* is the air-inlet pipe receiving air from the main *F*<sup>1</sup> (see Fig. 2). The pipe *F* (Fig. 3) is provided with openings in its inner side having flanges *f*, and similar openings in its outer side closed by a sliding door *f*<sup>1</sup>. The opening in the flange *f* opens into a short burnt fire-clay tube *G*, which is fixed by means of fire-clay in a hole *f*<sup>3</sup> in the fire-brick wall of the retort chamber. This tube *G* projects a short distance into the retort chamber; it is closed at the end *g*, but has a side opening *g*<sup>1</sup>. The amount of air admitted is regulated by a removable sheet-iron stopper *G*<sup>1</sup> with a slot *g*<sup>2</sup>, which is inserted into the flange *f* at its junction with pipe *F*.—A. S.

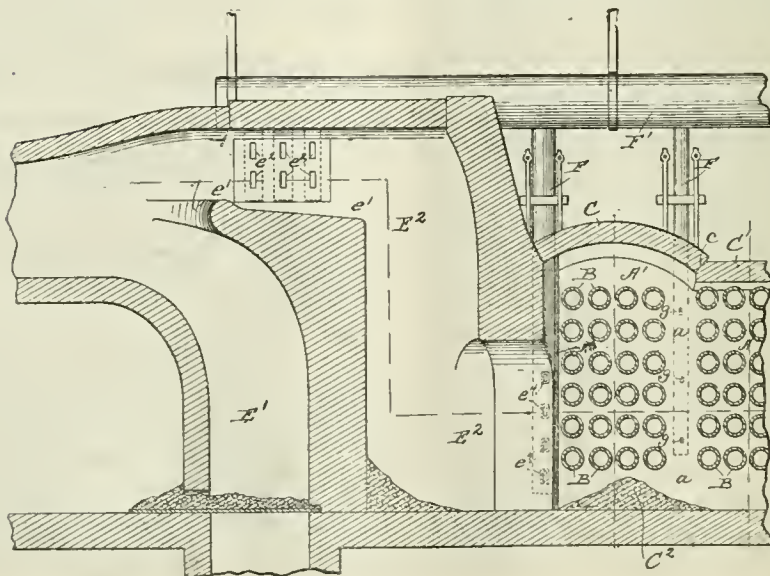


FIG. 2.



*Pyrrhotite; Method of Separating — from Chalcopyrite and Gangue.* J. N. Judson, South Stafford, Vt. U.S. Pat. 801,879, Oct. 17, 1905.

ORES containing non-magnetic or slightly magnetic varieties of pyrrhotite, associated with chalcopyrite and gangue minerals, are heated to such a degree that the particles of pyrrhotite acquire "a surface iridescence or film of rainbow colours," and become more magnetic than the chalcopyrite, without any considerable loss of sulphur. The pyrrhotite is then separated from the heated ore by magnetic attraction.—A. S.

*Furnace.* J. A. Herrick, Philadelphia. U.S. Pat. 802,102, Oct. 17, 1905.

THE furnace contains a heating chamber; a number of regenerators at each end, arranged transversely to the chamber; a number of separate gas passages connected with each end of the heating chamber and extending downwardly between the regenerators; a separate slag pocket connected with the bottom of each passage and separated from the connections of same with the corresponding regenerator; a number of air passages connecting each end of the heating chamber with different parts of the regenerators; and separate ports connecting one of the regenerators with the gas passages above the slag pockets, the heating chamber being supported at its respective ends by only one of the regenerators.—C. S.

*Furnace; Tilting —* F. H. Treat, Pittsburg, Pa. U.S. Pat. 802,151, Oct. 17, 1905.

THE furnace is supported by a framework of transverse beams secured to longitudinal girders resting on curved end rockers. The latter engage with guide-rollers which hold the furnace in position and cause it to tilt as the rockers move. The rockers are actuated by racks carried by movable hollow box-girders or beds resting on horizontal sets of rollers.—A. S.

*Furnace; Drying and Roasting —* C. E. Ballow and E. Stein, Guanaecvi, Mexico. U.S. Pat. 802,191, Oct. 17, 1905.

THE furnace is provided with a drying stack having a discharge into the atmosphere at the upper end, and an ore discharge at its lower end; a roasting stack with an ore discharge at the lower end; a dowlake flue passing from the top of the roasting stack to the base of the drying stack; means for heating the roasting stack, and an auxiliary heater at the base of the drying stack; corrugated agitating rollers (with means for operating same) mounted in the drying and roasting stacks; shelves mounted in the stacks and projecting between the rollers, some of which latter have tubular axes projecting through the stack walls to permit the circulation of a cooling medium between the axes.—C. S.

*Nickel and Copper Sulphides; Method of Separating —* A. Monell, New York. U.S. Pat. 802,012, Oct. 17, 1905.

A MATTE containing metallic sulphide is treated in an open-hearth furnace with a material (e.g., sodium sulphate and a reducing agent), which acts as a solvent for some of the sulphides present, and the mixture is heated to the fusing point of the solvent. The fused mass is "poled" or agitated until practically the whole of the soluble sulphides has been dissolved, and the insoluble sulphides are allowed to settle, and are then removed.—A. S.

*Nickel-Copper Matte; Method of Treating "Copper Tops" in the Refining of —* R. E. Maffett, Bayonne, N.J., Assignor to the International Nickel Co., New York. U.S. Pat. 802,148, Oct. 17, 1905.

"COPPER-IRON tops," containing sulphides of copper and iron and an alkali sulphide are "weathered" in order to oxidise the alkali sulphide to sulphate. The material is then heated in an oxidising atmosphere, the fused alkali sulphate is separated by gravity, and the residual copper is heated and refined.—A. S.

*Oxides; Process of Reducing Metallic —* T. S. Blair, Jun., Woodmere, N.Y., Assignor to B. C. Lauth, Pittsburg, Pa. U.S. Pat. 802,493, Oct. 24, 1905.

THE metallic oxide mixed with gangue is kept in motion

so that all the particles of oxide are brought successively to the surface, and the moving material is treated with a reducing gas at a temperature sufficiently high to bring about the desired reaction, and with a supply of free oxygen insufficient to consume the reducing agent. The "reducing temperature is then changed to a non-reducing one" by increasing the supply of air, and the temperature is raised to a degree sufficient to fuse the gangue or extraneous matter and "burn out" the metalloids, but not to fuse the reduced metal. The metal is finally "balled" together and the fused gangue separated.—A. S.

*Oxides; Process for the Reduction of Metallic —, and the Separation of the Resulting Metals.* A. J. Rossi, New York, Assignor to J. MacNaughton, Tahawus, N.Y., and P. C. Peck, New York. U.S. Pat. 802,941, Oct. 24, 1905.

THE first step in the process consists in the preparation of a bath of a molten reducing metal, the oxide of which has a heat of formation at the working temperature greater than that of the metallic oxide under treatment. Aluminium is mentioned as a suitable reducing metal, and the bath must be free from iron or other foreign metals. The metallic oxide under treatment is immersed in the bath of molten metal and the mass is maintained at a suitable temperature, until the reduced metal has segregated and separated from the other constituents of the mixture.—A. S.

#### FRENCH PATENTS.

*Cementation of Steel, Iron, &c.; New Process of Rapid —* J. Iecarme. Third Addition, dated May 8, 1905, to Fr. Pat. 327,984, June 6, 1902.

THE cemented billets, &c., after complete cooling are reheated to a temperature between 950° C. and 1100° C. according to their character, and then plunged into cold water or other tempering liquid; or the pieces are heated to about 1050° C., left to cool to between 800° C. and 850° C., and finally tempered in a cold liquid.—J. H. C.

*Nickel and Cobalt; Separation of —* J. Bernard. Fr. Pat. 354,941, June 5, 1905.

COBALT is precipitated as pure peroxide from solutions containing nickel by means of a solution of a hypochlorite previously neutralised and freed from alkali carbonates and caustic alkalis. In the case of liquors poor in cobalt, the hypochlorite is used in excess together with calcium carbonate or magnesium carbonate, so as to precipitate the whole of the cobalt with some nickel. This precipitate is dissolved in acid, and the greater part of the cobalt is reprecipitated, the hypochlorite being now used in such quantity that the chlorine present is insufficient to cause the peroxidation of the whole of the cobalt.—J. H. C.

*Minerals; Concentration of — by Means of Water and Air.* H. L. Sulman, H. F. K. Picard and J. Ballot. Fr. Pat. 354,959, June 5, 1905.

THE finely-powdered mineral is freely exposed to air, and then spread over the surface of a current of water, preferably acidulated, when the mineral particles float, while the greater part of the gangue sinks. The upper layer of water with its burden of enriched mineral is passed on to a shaking table, where it is treated with jets of air whereby a further separation is effected.—J. H. C.

*Minerals; Concentration of —* H. L. Sulman, H. F. K. Picard and J. Ballot. Fr. Pat. 354,960, June 5, 1905.

THE finely-pulverised mineral, while suspended in acidulated water, is agitated with a small proportion of some oily substance containing oleic acid equal to a fraction of 1 per cent. of the weight of mineral, until it forms a sort of scum which can be separated from the gangue, heat being sometimes employed to assist this operation. In some cases the whole mixture is subsequently passed through hydraulic separators whereby the sands and earthy matters are further separated, after which the mineral scum is further concentrated by alternate exposure to air and water on a shaking table.—J. H. C.

*Water from the Washing of Coal, Minerals, &c.; Process for the Clarification of Residual* — F. Baum. Fr. Pat. 355,997, June 8, 1905. I., page 1162.

*Cupolas and Other Similar Wind Furnaces; Water-Jacket for* — C. W. Hawkes and F. Klepetko. Fr. Pat. 354,983, June 6, 1905.

THE water-jacket is formed of an outer and an inner plate, held together by tie-rods or bolts, the plates being kept apart by distance pieces placed between them. The tuyère blocks pass through the water-jacket from plate to plate, the joints being made by a ring or by turning the ends of the tuyère tubes over the plate.—W. H. C.

*Metallic Cables; Process of Rendering — Non-oxidisable.* M. Audiau. Fr. Pat. 355,331, June 17, 1905.

CLAIM is made for the application of a coating of iron silicate to bright or galvanised metallic cables or polished metal surfaces in general, by immersing the metal in an aqueous solution of borax and ferric oxide and subsequently treating it with sodium or potassium silicate or fusible basic scoræ.—C. A. M.

#### GERMAN PATENT.

*Metals; Process for the Manufacture of Alkali, Alkaline-Earth, Earth and Heavy — or of Alloys of these Metals.* J. Malovich et Cie. Ger. Pat. 161,428, April 8, 1903. Addition to Ger. Pat. 159,632, Aug. 14, 1902 (this J., 1905, 738).

ACCORDING to the present patent the oxide or salt of the metal to be reduced, is heated with a mixture of the sulphate or sulphite of the same metal and sulphur; or the sulphate or sulphite of a metal alone is heated with sulphur. For example, sodium is produced by heating sodium carbonate and sodium sulphate with sulphur, and calcium in a similar manner from calcium oxide, calcium sulphate and calcium sulphide. Barium can be obtained by heating 100 parts of barium sulphate with, at least, 40 parts of sulphur for seven hours at about 1800° C. According to one claim, a crucible is charged with a mixture of sulphur and the sulphate or sulphite of the metal, and is strongly heated, and the gases and vapours evolved, are led through the oxide or salt of the metal contained in another crucible.—A. S.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(Continued from page 1117.)

### (A.)—ELECTRO-CHEMISTRY.

*Electrolysis with Alternating Currents, and Passive Copper.* M. Le Blanc. Z. Elektrochem., 1905, 11, 705—708.

WHEN an alternating current is passed through a solution of copper sulphate between copper electrodes, no change occurs if the alternations are symmetrical. With asymmetrical currents up to 15500 ~ per minute, one electrode is found to gain as much as the other loses. This, however, only holds when both electrodes have a crystalline surface. On heating an electrode to incipient fusion and plunging it into alcohol, the copper becomes superficially passive, and no longer goes into solution as a bivalent ion, according to Faraday's law. The copper deposited on a passive electrode by asymmetrical alternating currents is itself passive, whereas that deposited by direct currents is normal. Passive copper shows a P.D. of 0.013 volt. against normal copper in copper sulphate solution. Prolonged treatment with alternating currents in potassium cyanide solution restores passive electrodes to the normal or crystalline condition.—W. A. C.

*Zinc and Manganese as Anodes.* W. J. Müller. Z. Elektrochem., 1905, 11, 755—763.

ANODES of zinc or manganese behave normally in acid or neutral electrolytes. In alkaline sodium sulphate or phosphate baths they become markedly passive. The author's experiments favour the theory that passivity is

here due not to a non-conducting layer on the electrode, but to the formation of a modification of the metal which has a higher electrochemical valency than the normal one.—W. A. C.

*Lead; Rapid Determination of — in the Electrolytic Way.* R. O. Smith. XXIII., page 1191.

#### ENGLISH PATENTS.

*Insulating Material for Electrotechnical Purposes.* A. Rudenick, Bergedorf, Germany. Eng. Pat. 23,765, Nov. 3, 1904.

A PRODUCT of high insulating quality is obtained by pressing into the form of plates a mixture of 9 parts of asbestos and fibrous substances with 1 part of resin, wax, or gum. The plates are dried, and then baked until sufficiently hard.—M. J. S.

*Electric Arcs; Impts. in, and Apparatus for the Production of Reactions in Gases by means of* — J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 26,602, Dec. 6, 1904.

A CENTRAL rotatable disc electrode is mounted in the furnace in which the reaction is to be effected, and is surrounded by stationary electrodes connected to the terminals of a source of a polyphase electric current. The rotating electrode is provided with radial wings, and acts like a fan, causing the gases entering the apparatus to pass through the spaces between the rotating and the stationary electrodes, and "drag" the arcs with them, whereby the electric discharge is spread through practically the whole of the annular space between the central electrode and the furnace wall.—A. S.

*Alcohols; [Electrolytic] Manufacture of Aromatic* — C. Mettler. Eng. Pat. 18,674, Sept. 15, 1905. XX., page 1188.

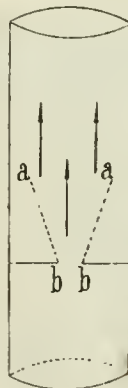
#### UNITED STATES PATENT.


*Solid Materials; Method of [Electrically] Treating* — K. Birkeland and S. Eyde, Christiania. U. S. Pat. 802,620, Oct. 24, 1905.

SEE Eng. Pat. 20,003 of 1904; this J., 1905, 34.—T. F. B.

#### FRENCH PATENTS.

*Arc; Self Regulating Apparatus for Submitting Gases and Vapours to the Action of the Electric* — A. A. Naville, P. A. Guye and C. E. Guye. Fr. Pat. 350,120, Aug. 17, 1904.



THE apparatus takes the form of what is called an "electric flue," the draught of the gases up a vertically placed tube being occasioned by the heat of the arc. The arc itself plays between horn-shaped electrodes, similar to some forms of lightning arresters, placed in these cylinders. The upward current of the gases blows the arc up the electrodes from the points *bb*, between which it is struck, towards *aa*. The position along the electrodes between which the discharge at any instant takes place, depends upon the voltage available at that moment. 

It is preferable to arrange several arcs electrically in series, but to have the "flues" carrying the gases in parallel.—R. S. H.

*Ozoniser; Electric* — C. A. Sahlström. Fr. Pat. 355,411, June 20, 1905. Under Int. Conv., June 21, 1904.

THE apparatus is of the type in which the two electrodes are formed of metal foil on opposite sides of a plate of glass



or other dielectric. To insure good contact and prevent the production of sparks, the metal foil has a large number of small tongues stamped out from its surface and turned down so that the points touch the dielectric with which they can be kept in contact by slight pressure.—R. S. H.

### (B).—ELECTRO-METALLURGY.

*Calcium; Electrolytic* — J. H. Goodwin. Proc. Amer. Philos. Soc., 1904, 43, 381—392. Chem. Centr., 1905, 2, 1154—1155.

For the electrolytic preparation of metallic calcium, the author used as anode a tall cylindrical vessel of Acheson graphite, on the bottom of which, insulated from the graphite by asbestos, were copper cooling tubes, so that the lowermost layer of calcium chloride was prevented from melting. The cathode was a  $\frac{1}{2}$ -in. iron rod provided with a screw, by means of which it could be raised or lowered. The calcium which first separated on the iron rod, acted as cathode during the remainder of the electrolysis, and by gradually raising the iron rod, sticks of calcium were obtained, protected from oxidation by a coating of calcium chloride. In six experiments with 17.7 volts and 163 ampères, an average current-yield of 26.6 per cent. of calcium was obtained; the maximum current-yield was 41.2 per cent. with 19 volts and 160 ampères in six hours. The separated metal had the following composition:—Silicon, 0.03; iron, 0.02; aluminium, 0.03; calcium, 98.00; magnesium, 0.11; chlorine, 0.90; and oxygen (by difference), 0.91 per cent. One stick of calcium obtained, was 56 cm. long, had a diameter varying between 3.2 and 8 cm., and weighed 295 grms. The temperature of the electrolyte must be kept within narrow limits, so that the metal is separated in a fused and not a spongy condition, and adheres to the cathode firmly enough to be withdrawn from the bath without breaking.

By melting together several sticks of calcium in a well-cleaned iron tube, and afterwards cooling, reddish-violet cubical crystals were obtained, having the sp. gr. 1.5425 at 28.1° C., and possessing the following composition:—Gangue matter, 0.03; silica, 0.77; ferric oxide, 0.46; alumina, 0.77; calcium, 91.28; magnesium, 0.11; chlorine, 1.28; carbon and nitrogen, traces; and oxygen (by difference), 5.30 per cent. The crystals were very soft and could be hammered into sheets as thin as paper, but frequently exploded under this treatment. They showed a lustrous fracture, the freshly-cut surface having a somewhat yellowish tinge. The metal can be heated to redness without burning, but does not harden when quenched in water; at 300°—400° C. it is as soft as lead. Its specific resistance is 3.43 microhms per c.c. at 0° C., with a temperature coefficient of 0.00457. It has a tensile strength of 612 kilos. per sq. cm., and an extension of 23 per cent. for 1 cm., 15 per cent. for 2 cm., 11 per cent. for 3 cm., and 6.6 per cent. for 5 cm. Calcium is harder than sodium, lead and tin, almost as hard as aluminium, but softer than zinc, cadmium and magnesium.—A. S.

### ENGLISH PATENT.

*Vanadium; Process of Obtaining Metallic* — from its Ores or other Vanadian Compounds. P. Auchinachie, Wrexham, North Wales. Eng. Pat. 22,422, Oct. 18, 1904.

THE ore is digested with sulphuric acid, in some cases with addition of sodium nitrate, and the diluted and cleared solution is electrolysed to obtain vanadium oxide; or it is treated chemically. In the latter case, the suboxide obtained, by nearly neutralising the solution with sodium carbonate, is boiled with sulphuric acid with addition of sodium nitrate, to obtain the pentoxide. Whichever oxide is obtained, it is mixed with carbon, and heated to about 2000° C. in an electric or other high temperature furnace, to obtain metallic vanadium, which may be freed from carbon by grinding and washing with water. (Reference is made to Eng. Pat. 12,727, of June 6, 1904; this J., 1904, 986.)—E. S.

### UNITED STATES PATENT.

*Metals [Aluminium]; Process of Reducing —, and Making Alloys.* H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 802,153, Oct. 17, 1905.

THE material is fused by passing through it an alternating heating current, which is not capable of separating the metal, and the metal (aluminium) is separated by means of another current passed through the fused material in a path disposed at an angle to the path of the heating current.—A. S.

ERRATUM.—This J., 1905, 1116, col. 2, l. 11 from bottom, add the name of Patentee, "H. H. Chance, Pa., U.S."

### FRENCH PATENTS.

*Furnace; Electric* — Soc. Anon. Électrométallurgique (Procédés Paul Girod). First Addition, dated May 22, 1905, to Fr. Pat. 350,524 of Jan. 4, 1905 (this J., 1905, 739).

THIS addition to the previous patent consists in employing the vat or the exterior metallic hooping as one of the poles, the stonework being pierced with channels which connect the external metallic armature with the interior of the furnace. The outside armature is cooled in any convenient manner, in order to solidify the metal in the channels, or the latter may be previously filled with metallic powder or fragments, so that the metal may solidify in the interstices of the material.—B. N.

*Furnaces; Impts. in Electric Arc* — Soc. Anon. de Métallurgie Electro-Thermique. First Addition, dated May 26, 1905, to Fr. Pat. 339,593 of Jan. 14, 1904 (this J., 1904, 718).

THE furnace comprises a single arc and a single charging channel only, the fusion chamber being closed at its lower end by a refractory wall, in the bottom of which is pierced the tap hole for emptying the furnace. This renders practicable the installation of a battery of several similar furnaces.—B. N.

*Furnace; Electric* — P. Girod, Third Addition, dated May 29, 1905 to Fr. Pat. 329,822 of Feb. 28 1903 (this J., 1903, 1054; 1904, 1225; 1905, 740.)

THE modification described is suitable for a large battery of crucibles. The furnace contains a number of chambers for the crucibles, the walls of these chambers being surrounded by the resistance material which also fills the bottom of the chamber, below the crucibles. The heating current passes independently through these two sections of the resistance, and is conducted to the material by graphite blocks. The various portions of the furnace are provided with removable covers. The advantages of the present construction are stated to lie in the reduction of radiation losses and the possibility, by a suitable grouping of the sections of the resistance, of using almost any voltage of current which is available. The furnace shown in the patent is designed to heat 126 crucibles.—R. S. H.

*Furnaces; Impts. in Electric Induction* — O. Frick. Fr. Pat. 355,456, June 22, 1905. Under Int. Conv., Nov. 21, 1904.

THE annular crucible of an induction furnace is provided with a cover having only a single opening through which the materials are charged and the contents inspected. In order that this can be properly effected, either the cover or the main furnace can be rotated around a vertical axis. Two forms of furnace are described in one of which the charging is effected by hand, in the other automatically.—R. S. H.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

(Continued from page 1117.)

### ENGLISH PATENTS.

*Soap; Process and Apparatus for the Preparation of* — J. E. and C. S. Bedford, both of Leeds, and B. Crowther, of Gomersal, Yorks. Eng. Pat. 21,596, Oct. 8, 1904.

CLAIM is made for a process of manufacturing soap or soap.

powder by reducing its constituents to a fine state of division whilst under the influence of heat and a vacuum, the result being to effect saponification and then to concentrate and deodorise the product. The apparatus claimed for the process consists of a steam-jacketed horizontal cylinder provided with a horizontal shaft carrying revolving heating arms, and connected with a vacuum pump and means for condensing the evaporated vapour.—C. A. M.

*Disinfectant and Detergent Compounds.* J. F. Hawliczek. Eng. Pat. 23,463, Oct. 31, 1904. XVIII.C., page 1185.

*Mineral Oils in general and Petroleum in particular; Process for Transforming — into Soap.* M. Kuess. Eng. Pat. 23,727, Nov. 2, 1904. III., page 1166.

#### UNITED STATES PATENTS.

*Press for Extracting Oil from Seeds and the like.* V. D. Anderson, Cleveland, Ohio. U.S. Pat. 801,704, Oct. 10, 1905.

BELOW a continuously acting press is placed a strainer provided with a closely-fitting internal screw. Means are supplied for returning the solid matter withdrawn from the strainer by the screw to the press for further treatment. The oil expressed is collected in a settling tank where the "foots" are separated and returned to the press. The settling tank is provided with a heating device. (See also Fr. Pat. 328,945, 1903; this J., 1903, 1006.)

—W. P. S.

*Candles; Manufacture of Composite Paraffin —.* G. W. Gray. Assignor to the Standard Oil Co. U.S. Pat. 802,100, Oct. 17, 1905. III., page 1166.

#### FRENCH PATENT.

*Hydrolysing Substances Contained in the Seeds of Plants; Separation of —.* Ver. Chem. Werke. Fr. Pat. 350,122, Aug. 18, 1904.

THE crushed seeds are treated with a liquid immiscible with water, and possessing a higher specific gravity (1.2 to 1.4), e.g., a mixture of chloroform and petroleum spirit. The seed-husks and aleurone are deposited in two layers, whilst the uppermost layer, which contains the enzymic agent in suspension, is decanted, and the solvent evaporated. The substance thus obtained is very active, 0.1 grm. being sufficient for the hydrolysis of 100 grms. of oil. It is used as described in Fr. Pat. 328,101, of Oct. 9, 1902 (this J., 1904, 69).—C. A. M.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(Continued from page 1118.)

#### (A.)—PIGMENTS: PAINTS.

##### ENGLISH PATENTS.

*White Lead; Electrolytic Method and Apparatus for the Production of —.* E. B. Koopman, London. From C. P. Townsend, Washington. Eng. Pat. 21,562, Oct. 7, 1904.

SEE Fr. Pat. 349,001 of 1904; this J., 1905, 627.—T. F. B.

*Lakes; Manufacture of Orange or Yellow-red Colour — [from Azo Dyestuffs].* C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 27,092, Dec. 12, 1904.

SEE Fr. Pat. 354,676 of 1905; this J., 1905, 1117.—T. F. B.

*Lakes [from Azo Dyestuffs]; Manufacture of New Colour —.* C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 27,093, Dec. 12, 1904.

LAKES varying in colour from orange to purple, and very fast to light, are obtained by converting into metal salts the sodium salts of the azo dyestuffs produced by combining the diazo compound of an aminosulphonic acid of the benzene or naphthalene series in which the sulphonic group is ortho to the amino group, with 2,7-dihydroxynaphthalene in which one of the hydroxy groups is substituted by an alkyl radical, or by a benzenesulphonic or

p-toluenesulphonic residue. The diazo compound may be first combined with 2,7-dihydroxynaphthalene, and the resulting dyestuff treated with benzenesulphonic chloride, &c.—T. F. B.

*Lakes; Manufacture of Red Colour — [from Azo Dyestuffs].* C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 27,094, Dec. 12, 1904.

SEE Fr. Pat. 354,649 of 1905; this J., 1905, 1117.—T. F. B.

#### UNITED STATES PATENT.

*Pigments; Manufacture of Printing Ink —.* P. Fireman, Alexandria, Va., Assignor to E. G. Portner, Washington. U.S. Pat. 802,928, Oct. 24, 1905.

THE pigment, composed of magnetic black ferro-ferric oxide, is made by dissolving a ferrous salt, precipitating it completely in the cold by means of an alkali, and oxidising the precipitate by a current of air, until the proportion of ferrous to ferric iron is within the limits 1.0:0.8 to 1:2; the amount of oxidation is determined by analysis of samples taken from time to time. The product is then filtered, washed and dried in air or *in vacuo*. Owing to the oxidation unavoidable in the drying process, the product contains ferrous to ferric iron within the limits of about 1:2 to 1:3, and when "rubbed on white paper will leave a black impression without brown streaks, and when mixed with a suitable varnish will print a decided black.—W. C. H.

#### (B.)—RESINS, VARNISHES.

##### ENGLISH PATENT.

*Linoleum, Oilcloth, and the like Materials; Machinery for Printing the Pattern on —.* H. C. Shaw, St. Helens. Eng. Pat. 27,037, Dec. 12, 1904.

SINCE it is found impracticable to deposit on linoleum a sufficient body of paint, in accurate register, by rotating cylinders, the present invention provides a method of printing, by machinery, from the ordinary flat blocks used for hand printing. It consists (in combination with the means of impression and means for moving and guiding the linoleum) in carrying the printing blocks in a series of traversable block "carriers, each of which is provided with an inking device and is adapted for bringing the block which it carries into engagement with the impression device, and for guiding it whilst the impression is being made, so as to ensure alignment and preserve the register."—M. J. S.

#### (C.)—INDIA-RUBBER, Etc.

*Rubber; Solubility in Benzine [Petroleum Spirit] of Different Kinds of —.* S. Axelrod. Gummi-Zeit., 1905, 19, 1053–1056; 20, 105.

THE benzine employed had a sp. gr. of 0.6898 and distilled between 60° and 120° C. A solution containing a known amount of rubber dissolved in benzine was prepared, and the consistency determined by means of a viscosimeter constructed of a separating-funnel and a graduated cylinder. The time required for 100 c.c. of the solution to run from the funnel to the cylinder was noted, and this, divided by the corresponding figure for benzine alone, gave the "degree of viscosity" of the solution.

The following fifteen different rubbers were examined:—

Kind of Rubber.	Resin-content.	Loss on washing.
	Per cent.	Per cent.
1. Para fine hard cure .....	3.4	15.0
2. Bolivian Para .....	3.1	18.0
3. Peruvian balls .....	3.6	19.0
4. Sierra Leone .....	5.1	32.0
5. Upper Congo strips .....	5.2	11.0
6. Peruvian balls la la .....	5.86	24.0
7. Manoh twists .....	6.5	17.0
8. Congo balls .....	6.8	11.0
9. Ceylon Para sheets .....	8.6	8.0
10. Borneo I .....	10.8	18.0
11. Manoh twists .....	10.6	42.5
12. Cameroon balls .....	12.6	46.0
13. Upper Congo .....	22.2	8.0
14. Blue cakes .....	26.9	20.5
15. Cameroon clusters dry .....	27.5	38.0



When tabulated in order of decreasing viscosity the arrangement becomes:—No. 1, No. 3, No. 4, No. 5, No. 10, No. 8, No. 9, No. 6, No. 12, No. 11, No. 7, No. 2, No. 14, No. 13, No. 15.

The resins accompanying the rubber, and more particularly the solid portions of them, are practically insoluble in benzene, and so doubtless increase the viscosity of the solutions. In order to determine to what extent this is the case, samples of the de-resinified rubber (de-resinified either with acetone or absolute alcohol) were treated in the same way as the original samples, and arranged in the following order of decreasing viscosity:—No. 1, No. 3, No. 5, No. 9, No. 10, No. 6, No. 8, No. 4, No. 2, No. 12, No. 7, No. 11, No. 13, No. 14, No. 15.

With two exceptions the de-resinified rubber solutions possess lower consistencies than those of the original rubbers. The difference is more especially marked in the case of rubbers containing solid and crystalline resins, as, for example, Nos. 4, 13 and 15, which are improved in viscosity by extraction. These contain resins which are fluid in character, and which, in accordance with Dietrich's view, may be regarded as acting as solvents for the rubber.

Solutions of the same kinds of rubber in benzol of high boiling-point were prepared and examined, with a view to determining whether the constituents insoluble in benzene and the resins exert any influence upon the viscosity of the solutions. All the solutions were practically clear and transparent. The arrangement in order of decreasing viscosity proved to be identical with that of Table II. for the rubbers examined, viz., as follows:—No. 3, No. 4, No. 5, No. 9, No. 6, No. 7, No. 2. This agreement appears to give a negative answer to the question, and supports the idea that the arrangement is independent of the properties of the solvent.

The degree of viscosity ( $\eta$ ) and the percentage composition of the solution ( $p$ ) are connected by the equation  $\eta = c \cdot p^r$  where  $c$  is a constant depending on the kind of rubber, and  $r$  the tangent of the angle which the (straight line) curve drawn to the logarithms of the figures of the viscosity tables, makes with the horizontal.

It is noteworthy that the benzol solutions show a higher consistency than those in benzene, thus confirming Ditmar's observations; and also that the arrangement of the various kinds of rubber in Tables II. and IV. corresponds with the "quality" of the rubber.—E. W. L.

*Rubber; New Method of Determining* —. J. Torrey. XXIII., page 1193.

#### ENGLISH PATENTS.

*Rubber; Process of Cleaning* —. W. A. Lawrence, New York. Eng. Pat. 7129, April 4, 1905.

SEE U.S. Pat. 787,518 of 1905; this J., 1905, 553.—T.F.B.

*India-Rubber Substitute*. L. H. Jacobs, G. Jacobs, and C. S. Brockwell, London. Eng. Pat. 24,966, Nov. 17, 1904.

GLUTINOUS and gelatinous materials, such as gelatin, gums, glues, &c., with or without the addition of pitches, which may be either mineral or vegetable, are digested with alkali and then precipitated by adding an acid. The liquid is decanted from the precipitate; the latter is heated to 120° F., and then treated with a solution of vegetable or mineral oil in naphtha. After further digestion the naphtha is distilled off, and the residual product is an elastic mass, which may be used as a substitute for rubber.—M. J. S.

#### FRENCH PATENTS.

*Silk; Artificial "Rubbered"* —. P. Germain. Fr. Pat. 355,016, June 7, 1905. V., page 1169.

*Rubber and other Analogous Gums; Process of Vulcanising and Regenerating* — [with Nitrocellulose]. P. Germain. Fr. Pat. 355,017, June 7, 1905.

A SOLUTION of rubber is mixed in suitable proportion with a solution of nitrocellulose in acetone, a plastic and homogeneous paste being thus obtained. After evapora-

tion of the solvent, the caoutchouc is stated to be oxidised by the nitrocellulose, and a product is obtained having the properties of ordinary vulcanised rubber, but of a white colour and inodorous. Waste rubber, which has been vulcanised by this process, can be regenerated by merely treating it with a mixture of acetone and a rubber-solvent.—A. S.

#### XIV.—TANNING, LEATHER, GLUE, SIZE.

(Continued from page 1118.)

*Gelatin; Air-Bubbles in* —. C. Beadle. Paper and Pulp, 1905, 10, 631.

THE presence of minute air bubbles in cakes of commercial gelatin often imparts to them an unpleasant cloudy appearance. Duncker (Papier-Zeit.) states that these minute bubbles are the result of the rapid, continuous process of drying the sheets of gelatin by a counter-current of hot air. Owing to the rapid drying a hard dry skin is formed on the outside of the cake, leaving a central layer from which the moisture escapes only with difficulty, and in which the air bubbles remain behind. Since the best qualities of gelatin dry most rapidly, the presence of these minute bubbles is, to a certain extent, an indication of superiority, and they very rarely occur in the poorer qualities of gelatin. Gelatin dried slowly in the old way is liable to be damaged by fermentation during drying; in such cases large bubbles of gas are formed in the sheets, and are a sign of bad quality.—J. F. B.

#### ENGLISH PATENTS.

*Tanning; Impts. in — and in the Treatment of Waste Tanning Materials and Liquors*. E. E. M. Payne, Aylesbury, Bucks. Eng. Pat. 26,778, Dec. 8, 1904.

THE patentee claims the recovery and utilisation of the insoluble leather-forming constituents contained in waste tanning materials and liquors. These waste materials and liquors are treated with an alkaline solution, as caustic soda, which dissolves the insoluble active tanning matters; the liquor then, if necessary, may be made neutral. Neutral or slightly acid skins are immersed in the liquor and afterwards treated with an acid, with or without subsequent tanning.—W. B. H.

*Glue and Gelatin; Process of and Apparatus for Manufacturing* —. H. Hilbert, Heufeld, Germany. Eng. Pat. 27,425, Dec. 16, 1904.

SEE Fr. Pat. 349,045 of 1904; this J., 1905, 628.—T. F. B.

#### UNITED STATES PATENT.

*Animal Sinews; Process for Treating* —. W. Polatsik, Assignor to S. Florsheim, both of Chicago, Ill. U.S. Pat. 801,547, Oct. 10th, 1905.

THE process consists in immersing animal sinews successively in petroleum or benzene to remove the "outer fleshy animal skin"; in a hardening and preserving bath, as boric acid, or alum and copper sulphate; and in an alkaline bath to remove fatty matter from the fibrous part of the sinew. The sinews are afterwards tanned and disintegrated.—W. B. H.

#### FRENCH PATENT.

*Hides and Skins; Process of Tanning* —. C. Baron and J. Aubert. First Addition, dated May 27th, 1905, to Fr. Pat. 347,097, Oct. 14, 1904 (this J., 1905, 284).

IN this addition practical details of carrying out the process described in the main patent are given; thus the rosin soap is composed of 60 kilos. of rosin; 20 kilos. of 95 per cent. caustic soda; and 20 litres of water. 5 to 15 per cent. of this soap, calculated on the weight of the prepared pelt is used. The hides remain in this first bath 24 to 72 hours. The weight of aluminium sulphate in the second bath should be 20 per cent. more than that of the soap used. After tanning, the hides are submitted to the action of albuminoids and fats to fill the fibres and

prevent the "grain" from cracking; they are then dried in the air and afterwards at a temperature not exceeding 35° C.—W. B. H.

## XV.—MANURES, Etc.

(Continued from page 1119.)

### FRENCH PATENTS.

"Phospho-Guano"; *Manufacture of — in part from Bones.* E. Guérif. Fr. Pat. 355,374, Feb. 11, 1905.

BONES, after being soaked in water, are heated in an earthenware vessel with sulphuric acid, in stated proportion. The product is dried in the same vessel, with addition of a mineral phosphate, and after cooling and addition, in some cases, of ammonium sulphate and potassium chloride, the manure is sacked for delivery. —E. S.

*Ammoniacal Gas contained in Gases of Distillation; Recuperator for Arresting —.* A. Mars, J. Bacqua and M. Laurette. Fr. Pat. 355,375, March 17, 1905. III., page 1166.

## XVI.—SUGAR, STARCH, GUM, Etc.

(Continued from page 1119.)

*Maple Products; Detection of Cane Sugar in —.* A. G. Woodman. XXIII., page 1191.

*Sugars; Some Colour and Spectral-Reactions of the Principal —.* E. Pinoff. XXIII., page 1192.

*Glucosides; Experimental Investigation of the Nature of the Sugars of some —.* H. Ter Meulen. XX., page 1186.

### ENGLISH PATENT.

*Potatoes; Preservation [Freezing] of —.* F. Lankow, Kiel, Germany. Eng. Pat. 1048, Jan. 19, 1905.

THE treatment consists in successively freezing, thawing, pressing and drying the potatoes with the object of using them as raw material in the manufacture of beer, spirits, yeast, potato-meal and starch. For the latter purposes the potatoes are perforated and then subjected to a rapid but thorough freezing process. The temperature should not be below -3° C. For the production of fine-meal the potatoes are frozen slowly and for a long time without previous perforation. After pressing to remove the potato juices the potatoes are finely divided, dried and ground up. The peel is removed if the potatoes are to be used for making fine-meal, otherwise it is left on.—W.P.S.

### UNITED STATES PATENT.

*Lactalbumin and Milk Sugar; Process of Producing —.* A. S. Ramage, Assignor to Ramage Technical Co. U.S. Pat. 801,691, Oct. 10, 1905. XVII.A., page 1184.

### FRENCH PATENTS.

*Sugar; Process of Purifying and Preserving Raw —.* M. Weinrich. First Addition, dated June 9, 1905, to Fr. Pat. 325,882, Sept. 26, 1902 (see this J. 1902, 1547 and 1903, 754).

THE process described in the original patent can be extended to the treatment of massecuites, centrifugal syrups and molasses for the purpose of raising their degree of purity. The dissolved impurities are destroyed by treating the materials with a small proportion of quicklime in the form of a fine powder, mixing thoroughly and raising the temperature to such a point, e.g., 43°–45° C., that the lime reacts with the impurities and colouring matters without decomposing the glucose or producing caramel and lime salts. The liquid is then diluted and neutralised with carbon dioxide.—J. F. B.

*Seaweed; Treatment of — for the Extraction of Mineral and Organic Chemical Matters.* Mme Lanrean, née J. H. Laurean. Addition, dated May 24, 1905, to Fr. Pat. 352,069, March 6, 1905. VII., page 1172.

## XVII.—BREWING, WINES, SPIRITS, Etc.

(Continued from page 1121.)

*Barley; Relations of the Proteids to the Malting Qualities of —.* M. Wallerstein. (Paper read before the Amer. Brewing Inst.) The Brewers' J., 1905, 41, 523–524, 568–569, and 618–620.

THE above question is discussed from the point of view of American barleys and American malting practice. With the exception of Montana and California Bay barleys, the American barleys are distinctly richer in protein than the average European barleys. Certain German authorities have put forward the hypothesis that the percentage of extract yielded by the malt is inversely proportional to the percentage of protein in the barley. The author shows that in the case of American barleys, although a certain tendency in this direction is observed, the dependence of the yield of extract on the protein is by no means regular. The percentage of husk plays a very prominent part as an additional factor in determining the yield of extract. A further difference between the majority of American barleys and European barleys is the smaller size of the corns. In Germany, corns which pass through a 2.2 mm. hole are regarded as "outshots," and are not malted, but most American barleys contain 25–50 per cent. of such corns. It is shown in a table that barleys with the largest and heaviest corns generally give malts with the highest yields of extract, and this factor may frequently outweigh the influence of the protein factor. American malting conditions are frequently regarded in Europe as "forced," but the author shows that the shorter time on the floor required to give good modification of the endosperm is due to the smaller size of the corns, and that the large-corned Montana barley, poor in protein, requires the same length of treatment as European barleys. In the author's opinion the most suitable type of barley for American conditions is a 6-rowed, rather small, but full-corned barley, containing between 10.5 and 12 per cent. of proteids. Owing to the fact that in America 30–40 per cent. of raw cereal is mashed with the malt, the low protein standard, which is regarded as desirable on the Continent, would be unsuitable, and 10.5 per cent. is really the lowest limit. American beers are more stable and less sensitive to chill than German beers, owing to their low percentage of proteids, this low protein content being due to the use of raw grain and to the fact that the beers are generally stored at a very low temperature for several weeks before filtration, whereby the unstable albuminoids are eliminated.—J. F. B.

*Barleys; Relation of Protein Content and Degree of Modification of Austrian — to the Yield of Extract and Degree of Mellowness of the Malt.* E. Prior. Allgem. Z. Bierbrau. und Malzfab., 1905 [37]; Z. ges. Brauw., 1905, 28, 722–723.

THE author has studied in the case of 48 samples of barley of Austrian origin the relations existing between the protein content and degree of modification of the barley and the yield of extract from coarse and fine grist of the malt, also its degree of mellowness and the colour of the worts. He concludes that appreciable differences exist between the proportion of protein in the barley and that in the malt, and that the yield of extract is not directly related to the protein content of the barley. In addition to the general conclusions formulated in his previous paper (this J., 1905, 1078), the author states that in the case of Austrian barleys, those with a protein content of 10–11 per cent. showed on an average equal values for the degree of modification of the barley, yield of malt extract, and degree of mellowness of the malt as those barleys with a protein content of 9–10 per cent. Consequently, Haase's theory, that barleys containing over 10 per cent. of protein are inferior in quality, is not applicable to Austrian barleys. Moreover, even the barleys with protein contents of 11–12 per cent. gave, for the most part, malts with extracts exceeding 77 per cent. The author regards the degree of modification of the barley endosperm (see this J., *loc. cit.*) as one of the mc



important factors in determining the brewing value of a barley; it outweighs the protein factor. The majority of Austrian barleys give better yields of malt extract than would be expected according to Haase's protein law, which was formulated for Silesian barleys. With any given percentage of nitrogen, it depends principally on the degree of modification of the barley and on the mellowness of the malt whether Haase's law is followed or not, and this law only holds for these Austrian barleys which are relatively steely.—J. F. B.

*Amylase; Development of — during the Germination of Barley.* J. Effront. *Comptes rend.* 1905, 141, 626—628.

DURING the germination of barley the saccharifying and liquefying powers develop unequally. The former increases irregularly up to about the twenty-third day, when it attains its maximum, and then gradually decreases. On the other hand, the liquefying power rises steadily until a maximum is reached on the twenty-seventh day, and then remains constant for a considerable time. The process of development of the two functions of the amylase in barley is expressed in the following table:—

Duration of Germination in Days.	Saccharifying Power.	Liquefying Power.
6	1.06	6.6
10	1.68	11.4
12	1.40	13.1
14	1.38	16.4
16	1.80	18.0
20	2.20	22.8
23	2.50	32.0
25	2.30	36.0
27	2.10	40.0
30	2.18	40.0

The saccharifying and liquefying powers were determined in all the tests on the same number of grains. Their value is expressed respectively by the amount of maltose formed and of starch liquefied by the diastase of 1 gm. of barley. The method serving for these analyses are described in the author's treatise on "Les Enzymes." The difference in the development of the two properties of amylase is very marked when the grain is allowed to germinate in sunlight: the liquefying power rises to its maximum whilst the saccharifying power is reduced by about 50 per cent. In the course of the investigation, the endeavour was made to establish the conditions under which malt of maximum activity is obtained. When the germination is allowed to take place at 15° C., the maximum of diastase is developed after 10 or 11 days. The influence of certain chemicals on the germination of barley is described, the chemicals being added in the steeping cistern. Germination is favoured by phosphates, lime-water, copper sulphate (0.5 gm. per litre), and xylene (1 c.c. per litre), the latter also increasing the saccharifying power. Ammonium chloride increases the liquefying power, whilst lactic acid (2 grms. per litre), vegetable peptone and calcium hypochlorite promote germination and increase the diastatic properties of the malt. The plumule is developed to the detriment of the radicle by steeping the grain in 0.1 per cent. copper sulphate solution or in N/10 sodium hydroxide solution; in some cases malt is obtained completely devoid of radicle when thus treated. The action of calcium hypochlorite is interesting; in the presence of alkali it favours germination, but is detrimental to the formation of diastase, whilst in the ordinary condition it increases the diastatic power by about 50 per cent. The best results are obtained when the solution contains from 0.5 to 0.7 gm. of active chlorine per litre.—W. P. S.

*Acetic Acid; Production of — during Alcoholic Fermentation.* R. Reisch. *Centralbl. Bakt.* 1905 [Abth. 2], 14, 572—581; *Wochensh. Brau.*, 1905, 22, 611—612.

THE production of acetic acid by yeast takes place simultaneously with that of alcohol. The quantity of acetic acid produced is a characteristic of the race of yeast and appears to be to some extent proportional to its fermentative power. As soon as fermentation really

begins, a sudden and considerable increase of the percentage of acetic acid is observed. The formation of acetic acid soon becomes weaker, and, when about one-half of the sugar has been fermented, it ceases altogether. The addition of alcohol to the wort, before fermentation, has no influence on the quantity of acetic acid produced, but the previous addition of acetic acid has a powerful inhibitive influence on this function of the yeast. Larger quantities of acetic acid are produced in fermentations by yeast cell-juice than in fermentations by yeast cells; this is attributed to the removal of the regulating influence of the living protoplasm on the enzyme which produces the acetic acid. The author regards this enzyme as belonging to the class of "protective" enzymes, i.e., those which produce substances inimical to competitive organisms, but relatively harmless to the yeast itself.—J. F. B.

*Wood Spirit; Detection of — in Alcoholic Preparations.* R. Peters. XXIII., page 1192.

#### ENGLISH PATENTS.

*Potatoes; Preservation [Freezing] of —.* F. Lankow. Eng. Pat. 1048, Jan. 19, 1905. XVI., page 1182.

*Fermenting Liquids; Apparatus for Aerating —, and for Preparing Vegetable and other Infusions.* A. J. Murphy, Leeds. Eng. Pat. 26,136, Dec. 1, 1904.

THE apparatus consists of a number of perforated tubes or cylinders arranged in a vertical position between perforated base and top plates, and around a central rod. The tubes are filled with shavings, wood chips, leaves, granulated metal or the like, and the apparatus is suspended over the tank containing the fermenting liquid, by means of a turning-jack adapted to keep it in continual motion. The apparatus is lowered into the liquid, then raised, rotated for a time, lowered again, and so on. An apparatus of larger size may be built up by fitting a number of the above tubes in a cage one above another. For making infusions, &c., the materials are placed in the perforated tubes and then lowered and rotated in the solvent.—W. P. S.

*Fermentation [Distillery]; Process of —.* J. T. Board, Willsbridge, and T. H. Board, Bristol. Eng. Pat. 26,698, Dec. 7, 1904.

FERMENTATION is conducted in three stages:—A very small quantity of thick mash is first prepared with malt, rye and molasses; this is then soured to a suitable degree and fermented with yeast. When the fermentation is complete, the yeast is separated from the thick mash by washing through a sieve. The yeast is then suspended in a column of water in which the mature cells settle to the bottom, whilst the immature yeast and other ferments remaining in the water are thrown away. The mature yeast is employed for pitching a quantity of clear wort (e.g., about 6 per cent. of the total wort), and when this is partially fermented it is pitched in the main wash.

—J. F. B.

*Beer; Process for the Manufacture of a Product which Enables — to be Hopped in a Rational and Economical Manner.* G. Barker, Birmingham. From G. Ronnberg and Co., Brussels. Eng. Pat. 11,147, May 29, 1905.

SEE Fr. Pat. 354,160 of 1905; this J., 1905, 1121.—T. F. B.

#### FRENCH PATENT.

*Alcohol, &c.; Plates for Apparatus for Concentrating and Rectifying —.* F. Calmant. Fr. Pat. 354,674, May 26, 1905. Under Int. Conv., March 28, 1905.

THE special form of plate for rectifying columns is shown in cross-section in Fig. 1 and in plan in Fig. 2. The plate, 1, fixed to the walls of the column, is pierced by a number of holes, 3, from each of which rises a tube, 4, bent in the form of an inverted U and terminating in a rectangular box, 5, with perforated sides, the bottom of which is situated at a distance of 2 cm. above the plate. The alcoholic vapours rising through the tubes in the

Fig. 1.

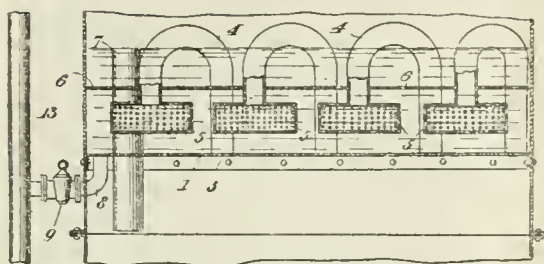


Fig. 2.

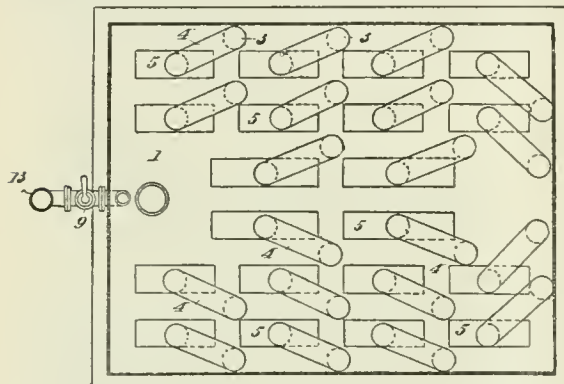


plate are distributed in passing through the perforations in the boxes, and are again subdivided in their passage through the liquid by means of a perforated baffle-plate, 6, extending right across the column at a distance of 1.5 cm. above the boxes. The level of the liquid on the plate is maintained at a height of 3 cm. above the baffle-plate by the overflow pipe 7. The pipe 8, and the external cock 9, enable the liquid to be drawn off the plate through the pipe 13, whenever it is desirable to do so.—J. F. B.

#### GERMAN PATENT.

*Liquids, especially those containing Carbonic Acid; Process and Apparatus for the Purification of —.* Act.-Ges. Fabr. f. Brauerei-Einrichtungen vorm. H. Gehrke and Co., Ger. Pat. 161,025, March 17, 1903. I., page 1162.

### XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(Continued from page 1122.)

#### (A.)—FOODS.

##### UNITED STATES PATENT.

*Lactalbumin and Milk Sugar; Process of Producing —.* A. S. Ramage, Assignor to Ramage Technical Co., Detroit, Mich. U.S. Pat. 801,691, Oct. 10, 1905.

WHEY is dried in the form of films, which are then dissolved in a small quantity of water. Sufficient alcohol is added to the solution to precipitate the proteids. The latter are collected on a filter and more alcohol is added to the filtrate in order to precipitate the lactose. (See also U.S. Pat. 735,148, 1903; this J., 1903, 1010.)—W. P. S.

##### FRENCH PATENTS.

*Milk free from Sugar; Process for the Preparation of —.* J. Bouma and S. B. Selhorst. Fr. Pat. 350,126, Aug. 20, 1904.

SEE Eng. Pat. 17,818 of 1904; this J., 1905, 937.—T. F. B.

*Milk, Cream and other Liquids; Process of Sterilising —, by means of Hydrogen Peroxide or other Germicide.* A. Siltverling and F. Z. Franzén. Fr. Pat. 355,457, June 22, 1905. Under Int. Conv., June 23, 1904.

THE preservative is added to the milk or other liquid as it enters a centrifugal machine, the object being to thoroughly and rapidly mix the two by the subsequent centrifugal action.—W. P. S.

*Butter; Process of Making and Preserving —.* E. Engel. Fr. Pat. 355,362, June 19, 1905.

CREAM is heated on a water-bath for a sufficiently long time to destroy the organisms which cause the butter to turn rancid, &c. After cooling, the cream is inoculated with cultures of lactic acid bacteria and churned. The butter obtained is washed and worked with sterilised water and then stored in hermetically closed tins, preferably in an atmosphere of carbon dioxide.—W. P. S.

*Grain; Process of Treating —.* C. Broeker. Fr. Pat. 355,378, April 18, 1905.

SEE Eng. Pat. 6939 of 1905; this J., 1905, 1027.—T. F. B.

#### GERMAN PATENT.

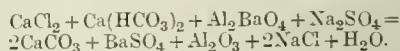
*Sterilisation and Preservation of Liquids [as Milk] which are Easily Decomposable or are Contaminated with Bacteria; Process for the —.* Farb. vorm. Meister, Lucius und Brüning. Ger. Pat. 161,184, Jan. 14, 1904.

THE process consists in keeping formaldehyde vapour in contact with the surface of the liquid, whilst fresh portions of the liquid are continually brought to the surface by agitation or similar means. It is stated that by this process sterilised milk can be prepared having the same taste and odour as the purest fresh milk, and behaving exactly the same as the latter in respect to coagulation by heating and by means of rennet. It is claimed also that formaldehyde cannot be detected in the milk after the treatment.—A. S.

#### (B.)—SANITATION; WATER PURIFICATION.

*Water; Purification of —. [Softening by means of Aluminates].* D. Peniakoff. Bull. Soc. Chim. Belg., 1905, 19, 122—136 and 159—171.

THE writer shows by actual experiment that calcium sulphate and carbonate are completely removed from water by treating the latter with barium aluminate, and that the hardness of the water is reduced to zero. If calcium chloride be present, the addition of sodium sulphate is necessary, the equation for the removal of the whole of the calcium salts being:—



Magnesium carbonate and sulphate are also completely precipitated by barium aluminate, but the chloride is not, barium chloride being formed and remaining soluble in the water. The addition of sodium sulphate decomposes this, however, giving sodium chloride and barium sulphate. In this case it is better to add an equivalent quantity of sodium aluminate. To soften a water, therefore, the amount of calcium, magnesium, sulphuric acid, chlorine and carbon dioxide (both free and combined) must be determined, and the equivalent amounts of barium aluminate, sodium aluminate, and sodium sulphate added after previously neutralising the free carbon dioxide with lime-water.—W. P. S.

*Ice; Study of Artificial —.* G. Calvi. Giorn. Farm. Chim., 1905, 54, 385—389. Chem. Centr., 1905, 2, 1293—1294.

ARTIFICIAL ice nearly always consists of two portions, an outer transparent, crystalline part, and an inner, opaque, snowy portion, in which most of the impurities



are concentrated. The results of the analysis of a sample of artificial ice are shown in the following table:—

	Water obtained by melting the ice, including the insoluble matter	Water decanted from insoluble residue.	Water obtained by melting outer crystalline portion of the ice.
	Mgms. per litre.	Mgms. per litre.	Mgms. per litre.
Dry residue at 100° C. ....	275.0	167.0	small traces
Dry residue at 180° C. ....	263.0	158.0	"
Residue after ignition .....	241.0	152.0	"
Volatile and organic matter .....	22.0	6.0	"
Silica .....	17.4	8.9	0.0
Sulphur trioxide .....	14.3	6.3	0.0
Lime .....	55.0	28.7	0.0
Magnesia .....	31.0	16.5	0.0
Chlorine .....	12.3	12.0	0.0
Nitrate-nitrogen .....	1.8	1.6	0.0
Nitrite-nitrogen .....	0.032	0.032	0.0
Ammonia-nitrogen .....	0.145	0.140	0.013
Albuminoid-nitrogen .....	0.053	0.037	0.009

—A. S.

## UNITED STATES PATENT.

*Water; Apparatus for Purifying* — [Prevention of Boiler-Scale]. R. T. Weaver, Cleveland, Ohio. Assignor to J. Schneible, Weehawken, N.Y. U.S. Pat. 801,943, Oct. 17, 1905.

For preventing the formation of scale in boilers, the water is passed on its way between the feed-water heater and the boiler through a vessel containing a filtering material and tale, granite or other silicious mineral. The vessel contains a number of chambers placed one above the other. The first chamber containing the filtering material is separated from the others by a screen, whilst between the other chambers are placed cutting plates against which the tale, &c., is forced by the current of water, and is thus partially disintegrated.—W. P. S.

## FRENCH PATENT.

*Air; Process and Apparatus for Regenerating Breathed-out* —, to Render it Fit for Respiration. M. Bamberger, F. Böck and F. Wanz. First Addition, dated June 9, 1905, to Fr. Pat. 345,490, June 21, 1904.

SEE Eng. Pat. 9185 of 1905; this J., 1905, 1027.—T. F. B.

## (C).—DISINFECTANTS.

*Formaldehyde; Studies on* —. I. Formaldehyde in Aqueous Solution. F. Auerbach and H. Barschall. XX., page 1187.

## ENGLISH PATENT.

*Disinfectant and Detergent Compounds*. J. F. Hawliczek. Liverpool. Eng. Pat. 23,463, Oct. 31, 1904.

SEVENTY parts of ordinary soft soap are mixed with 20 parts of phenol and the mixture is heated until it assumes a jelly-like consistency. From 80 to 120 parts of kieselsguhr are then added together with colouring matter, such as phenolphthalein.—W. F. S.

## XIX.—PAPER, PASTEBOARD, Etc.

(Continued from page 1123.)

## ENGLISH PATENT.

*Photographic Papers; Manufacture of* —. J. Hoffmüller. Eng. Pat. 17,303, Aug. 26, 1905. XXI., page 1189.

## UNITED STATES PATENTS.

*Wood-Pulp; Apparatus for Treating [Drying]* —. W. A. Hall, Bellows Falls, Vt. U.S. Pat. 802,754, Oct. 24, 1905.

For drying wood-pulp, a series of heated drying rolls

are provided with an endless apron or carrier passing round them; the pulp is delivered on to this apron and is broken up and somewhat disintegrated, after it leaves each of the drying cylinders, by means of stationary knives or "doctor blades" which enable the steam to escape more readily than otherwise. The pulp is thus presented to each of the drying rolls in turn as a loose and broken up mass, and is finally delivered to an apparatus in which it is compressed into bales for shipment.—J. F. B.

*Wood-Pulp; Process of Treating [Drying]* —. W. A. Hall, Bellows Falls, Vt. U.S. Pat. 802,755, Oct. 24, 1905.

THE process consists in delivering a sheet of wet pulp to one end of a series of drying cylinders, breaking it up and drying it in a loosely compacted form, and packing the dry pulp into bales in a continuous operation, as described in U.S. Pat. 802,754 (preceding abstract).—J. F. B.

## FRENCH PATENTS.

*Textile Material or Paper Pulp; Application of a Plant [Gyspel] for Obtaining* —. P. Boy. Fr. Pat. 350,117, Aug. 16, 1904. V., page 1169.

*Paper Pulp from Sage; Manufacture of* —. E. Imhans. Fr. Pat. 355,245, June 15, 1905.

SAGE plants are steamed, washed and pressed, and the essential oil and colouring matters are extracted by suitable solvents; the residual wood is cut into pieces and treated with caustic alkali or bisulphite under pressure for the isolation of the cellulose. Alternatively, the wood may simply be boiled with water under pressure.—J. F. B.

*Paper; Apparatus and Process for the Manufacture of* —. R. Binns. Fr. Pat. 355,290, June 16, 1905. Under Int. Conv., June 18, 1904.

SEE U.S. Pat. 785,704 of 1905; this J., 1905, 511.—T. F. B.

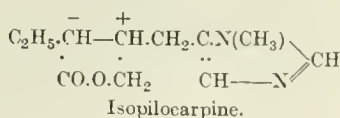
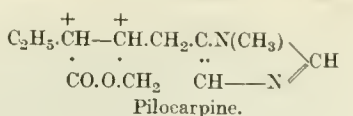
*Rubber and other Analogous Gums; Process of Vulcanising and Regenerating* — [with Nitrocellulose]. P. Germain. Fr. Pat. 355,017, June 7, 1905. XIII.C., page 1181.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

(Continued from page 1125.)

*Pilocarpine; Constitution of* —. V. Conversion of Isopilocarpine into Pilocarpine. H. A. D. Jowett. Chem. Soc. Trans., 1905, 87, 794—798.

IN a previous communication (Chem. Soc. Trans., 1903, 83, 438) the relation of pilocarpine to the isomeric isopilocarpine, the constitution of which has been established, was discussed, and it was shown that the evidence, on the whole, favoured the view that the two alkaloids were stereoisomerides. After further discussion of the question, the author points out that if this view is correct, then the conversion of pilocarpine into isopilocarpine should not be complete, but a state of equilibrium should result. Further, by acting on isopilocarpine under the conditions which convert pilocarpine into isopilocarpine, for example, heating with alkali, the same state of equilibrium should be produced, and it should then be possible to isolate some pilocarpine from the mixture. If, on the other hand, the alkaloids are structural isomerides, this reverse change should not be possible. On trying the experiment, it was found that pure isopilocarpine nitrate, like pilocarpine nitrate, is converted by the action of alcoholic potash into an equilibrium mixture consisting chiefly of isopilocarpine, with a small percentage of pilocarpine, and this result affords further evidence that the two alkaloids are not structural isomerides but stereoisomerides. The relation between the two alkaloids may be expressed as follows, the isomerism being due to the racemisation of the asymmetric carbon atom attached to the carbonyl group:—



—A. S.

*β-Coniceine.* K. Löffler. Ber. 1905, 38, 3326—3329.

FINELY powdered conhydrine was mixed with phosphorus pentoxide and sealed up in a glass tube in an atmosphere of dry hydrogen. The tube was heated up to 180°—190° C. in the course of two hours and maintained at that temperature for 20 minutes. The product was dissolved in water and extracted by ether. On fractional distillation, nearly the whole product distilled between 167° and 169° C. The distillate solidified, yielding a base melting at 40°—41°, which was identified as *β-coniceine*, obtained by A. W. Hofmann, together with an equal quantity of *α-coniceine*, by the action of fuming hydrochloric acid on conhydrine. *β-Coniceine* has a density of 0.8519 at 50° C. and  $[\alpha]_D = -52.99^\circ$  at 42° C. Thus the main product of the dehydration of conhydrine by phosphoric anhydride is the solid, secondary, unsaturated base *β-coniceine*, a small quantity of a liquid base of very similar constitution being also formed. The liquid, tertiary, saturated base *α-coniceine*, obtained when hydrochloric acid is employed, is not formed at all; hence it is concluded that in the dehydration produced by phosphoric anhydride the hydrogen of the imino group is not concerned. When the dehydration is effected for a longer time at a higher temperature, e.g. for one hour at 220° C., the product consists almost entirely of the liquid secondary base mentioned above.

—J. F. B.

*Oxysparteine; Note on —.* F. B. Ahrens. Ber., 1905, 38, 3268.

OXYSPARTEINE can be obtained in quantitative yield by the oxidation of sparteine with potassium ferricyanide in alkaline solution. The alkaline solution of ferricyanide is added to sparteine at the ordinary temperature and with agitation, until the alkaloid has completely dissolved, and no change of colour is produced on adding more ferricyanide. The oxysparteine is extracted from the solution by shaking with ether or chloroform.—A. S.

*Thalictrum Aquilegifolium; Presence of a Cynogenetic Glucoside in —.* L. van Itallie. J. Pharm. Chim., 1905, 22, 337.

THE aqueous distillate of the fresh leaves of *Thalictrum aquilegifolium* contains from 0.05 to 0.06 per cent. of hydrocyanic acid, calculated on the weight of the leaves distilled, or about half as much as is yielded by the leaves of *Prunus laurocerasus*. Acetone is also present in the distillate, but no benzaldehyde. A minute quantity of hydrocyanic acid is also found in the distillate from the stems. The acid is not present in the free state since it is not found in fresh leaves after they have been plunged into boiling alcohol; it is generated, however, in an infusion of stove-dried leaves, by the action of emulsin. The presence of a glucoside resembling phaseolunatin is, therefore, inferred. The leaves also contain a ferment which hydrolyses amygdalin. The leaves of the nearly allied plants *Thalictrum flavum* T. minus and *T. glaucum*, do not yield hydrocyanic acid on distillation.—J. O. B.

*Glucosides; Experimental Investigation of the Nature of the Sugars of some —.* H. Ter Meulen. Rec. trav. chim. Pays-Bas, 1905, 24, 444—483. Chem. Centr. 1905, 2, 1254—1555.

ACCORDING to the author the hydrolysis of glucosides by dilute acids proceeds further than hydrolysis by means of enzymes. For example, xanthorhamnin  $\text{C}_{34}\text{H}_{42}\text{O}_{20}$ , is decomposed by dilute acids into rhamnetin  $\text{C}_{16}\text{H}_{12}\text{O}_7$ , galactose and rhamnose, whereas, on hydrolysis by means of an enzyme, it yields rhamnetin and

rhamnose,  $\text{C}_{18}\text{H}_{32}\text{O}_{14}$ . In determining the nature of the sugar contained in a glucoside, hydrolysis by means of an enzyme should therefore be employed. On the supposition that enzymic hydrolysis is a reversible process, and the equilibrium can be displaced by addition of one of the reaction products, the author made use of the following method, the results appearing to justify this supposition. A number of flasks, each containing the same quantities of the glucoside water and an enzyme, and to which equal quantities of different sugars were added, was kept at a definite temperature, for a certain short period of time, and the amount of glucoside decomposed, determined in each case. In the flask in which the sugar yielded by the glucoside was identical with the added sugar, the amount of decomposition was less than in the flask to which no sugar had been added.—A. S.

*Barbaloin; Constitution of —.* I. H. A. D. Jowett and C. E. Potter. Chem. Soc. Trans., 1905, 87, 878—884.

THE authors review the work which has been done on barbaloin, and state that the evidence adduced by Léger (this J., 1902, 1037; 1903, 161) in support of a change of the formula for this substance from  $\text{C}_{16}\text{H}_{13}\text{O}_7$  (Tilden) or  $\text{C}_{16}\text{H}_{16}\text{O}_7$  (Groenewald) to  $\text{C}_{21}\text{H}_{20}\text{O}_9$  is by no means conclusive. The results of numerous analyses and of two determinations of the molecular weight of carefully purified barbaloin have confirmed the formula  $\text{C}_{16}\text{H}_{13}\text{O}_7$ , and this formula is also supported by the results of the analysis and determinations of the molecular weight of tribromobarbaloin. The specific rotation of barbaloin in 90 per cent. alcohol solution was found to be  $[\alpha]_D = -8.3^\circ$ , as compared with  $[\alpha]_D = -10.4^\circ$  found by Léger in ethyl acetate solution. A small yield of aloë-emodin was obtained by the action of hydrogen chloride in alcoholic solution on barbaloin as described by Oesterle (Arch. Pharm., 1899, 237, 81), but it was not found possible to confirm Léger's statement (this J., 1902, 1094) that aloë-emodin is formed by the action of sodium peroxide on barbaloin. The authors carried out some experiments with tribromobarbaloin,  $\text{C}_{16}\text{H}_{13}\text{O}_7\text{Br}_3$ , m.p. 191°—192° C., from which they prepared a tetra-acetyl derivative in the form of small yellow needles melting at 135° C., soluble in alcohol, but insoluble in water. Tribromobarbaloin, therefore, contains four hydroxyl groups, and probably barbaloin does also; both substances yield methylanthracene on distillation with zinc dust. Sufficient data were not obtained from which to construct a constitutional formula, but it is pointed out that the generally accepted view that barbaloin contains an emodin (trihydroxymethylanthraquinone) complex is open to serious objection. (See also this J., 1897, 756; 1898, 866; 1900, 768; 1901, 66; and 1903, 43.)—A. S.

*Patchouli Oil.* A. W. K. de Jong. Rec. trav. chim. Pays-Bas, 1905, 24, 309—312. Chem. Centr., 1905, 2, 1180.

THE author has examined the essential oils from the following three varieties of patchouli, growing in the botanical gardens at Buitenzorg:—I. *Patchouli fleurissant* (*Pogostemon Heyneanus* Bth., ?), II. *P. de Singapour* (*Pog. tomentosus* Hassk., ?), and III. *P. de Java* (a variety of *Pog. tomentosus* Hassk., ?). After drying with sodium sulphate, the oils had the following characters:—Sp. gr. at 25° C.: I., 0.922; II., 0.949; III., 0.929;  $[\alpha]_D^{25}$ : I. =  $-16^\circ 10'$ , II. =  $-51^\circ 24'$ , III. =  $-42^\circ 48'$ . On adding 90 per cent. alcohol to the oils, a turbidity was produced at first, but disappeared on further addition of alcohol. The amounts of alcohol required to dissolve 10 c.c. of oil were:—I., 100 c.c.; II., 60 c.c.; III., 7.5 c.c. By distillation at 740 mm. pressure, the following fractions were obtained:—I., 130°—250° C., 17 per cent.; II., 230°—250° C., 2 per cent.; III., 145°—250° C., 10 per cent.; 250°—270° C., I., 50 per cent., II., 60 per cent., III., 70 per cent.; 270°—280° C., I., 16 per cent., II., 20 per cent., III., 8 per cent.; 280°—300° C., I., 10 per cent., II., 10 per cent., III., 6 per cent. Oils II. and III. frequently gave green- or blue-coloured distillates, owing to the presence of Gladstone's "azulene," which, however,



may have been formed under the influence of heat during the distillation. On treating patchouli oil with concentrated sulphuric acid, heat is evolved; the residual unattacked oil amounted to 17 per cent. with I., 22 per cent. with II., and 20 per cent. with III. From this residual oil, a sesquiterpene was obtained, boiling at  $260^{\circ}$ – $263^{\circ}$  C., at 740 mm., and with  $[\alpha]_D^{25}$ : II. =  $-1^{\circ}$ , III. =  $-1.5^{\circ}$ ;

sp. gr. at  $25^{\circ}$  C., II., 0.915, III., 0.897. The author names it *dilemene*, and regards it as possibly identical with the sesquiterpene obtained by von Soden and Rojahn (this J., 1904, 1111) from patchouli oil, and having the sp. gr. 0.930,  $n_D = +0^{\circ} 45'$ , and b. pt.,  $273^{\circ}$ – $274^{\circ}$  C.—A. S.

**Formaldehyde: Studies on —.** I. *Formaldehyde in Aqueous Solution.* F. Auerbach and H. Barschall. *Arbb. Kais. Ges. A.*, 22, 584–629. *Chem. Centr.*, 1905, 2, 1081–1083.

AN aqueous solution of pure formaldehyde was prepared by subliming trioxymethylene in a current of nitrogen, and collecting the vapour in water, and the specific gravities of solutions of different strengths were determined at  $18^{\circ}$  C. The results of molecular weight determinations by the cryoscopic method showed that the molecular weight of formaldehyde in aqueous solutions depends upon the concentration of the latter. The application of the law of mass action to the values found, indicates that in aqueous solutions, mono- and tri-molecular forms of formaldehyde are present in a condition of equilibrium. The observed and calculated results are in still closer agreement if it be assumed that hydration of both the monomolecular (to methyleneglycol) and trimolecular forms takes place. In solutions containing 37–38 per cent. (by vol.) of formaldehyde, there are indications of the presence of higher polymers than  $(CH_2O)_3$ . The equilibrium between the different molecular forms of formaldehyde is reversible, so that the condition of aqueous solutions of formaldehyde, a short time after preparation, depends only upon the concentration and temperature, independently of whether they have been prepared from gaseous formaldehyde,  $CH_2O$ , or solid paraldehyde,  $(CH_2O)_3$ . Rise of temperature causes a displacement of the equilibrium in favour of the monomolecular form, the polymeric modifications being decomposed with absorption of heat.

The boiling point of the aqueous solutions decreases with increasing concentration, but is almost constant for solutions containing about 30 per cent. or more (by vol.) of formaldehyde. In the distillation of aqueous solutions of formaldehyde, however, the distillate is always poorer and the residue always richer in formaldehyde than the original solution, a fact leading to the remarkable conclusion that a higher boiling portion distils over, whilst a lower boiling portion remains behind. The residual portion has a higher vapour pressure than the fraction collecting in the receiver. The partial pressure of formaldehyde in its solutions was determined at  $100^{\circ}$  C. and  $18^{\circ}$  C. The low value found, indicates that gaseous formaldehyde when dissolved in water is, for the most part, converted into hydrated and polymerised modifications. From the values obtained in the partial pressure determinations, the authors calculated the amounts of formaldehyde contained in a given air space saturated at  $18^{\circ}$  C. with the vapours of formaldehyde solutions. The amount was only 0.66 gm. for the strongest solution examined (33.8 per cent.) and would not attain 1 gm. even with the commercial 40 per cent. methyl alcoholic solution.—A. S.

**Benzoyl Peroxide.** A. S. Löwenhart. *Therap. Monatsh.*, 1905; through *Apoth. Zeit.*, 1905, 20, 655.

ONE hundred grms. of sodium peroxide are treated with 180 grms. of benzoyl chloride at about  $4^{\circ}$  C. The compound formed is separated by filtration and crystallised from hot alcohol. The yield is between 60 and 70 per cent. of benzoyl peroxide. It is a stable, odourless body, crystallising in fine prisms; m. pt.  $103.5^{\circ}$  C. It has been introduced as a medical disinfectant on account of its anæsthetic antiseptic action.—J. O. B.

**Di-potassium Salicylate; Action of Potassium Hypo-halogenite on —.** Lassar-Cohn and F. Schultze. *Ber.*, 1905, 38, 3294–3302.

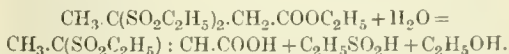
AN ice-cooled solution of potassium hypochlorite, hypobromite or hypoiodite is added to an ice-cooled solution of dipotassium salicylate. Action takes place at once, a hydrogen being displaced by the halogen, e.g.,  $C_6H_4.OK.COOK + KOCl = C_6H_3(Cl)(OK.CO)K + KOH$ . The potassium salt obtained is acidified with sulphuric acid, when the free acid is precipitated.

From 1 gm.-mol. of potassium hypochlorite and 1 gm.-mol. of dipotassium salicylate two acids are produced, monochlor-salicylic acid  $C_6H_3(COOH.OH.Cl)$  (1.2.6) and dichlor-salicylic acid  $C_6H_2(COOH.OH.Cl)_2$  (1.2.5.6). If the hypochlorite be added in the proportion of 4 gm.-mols. to 1 gm.-mol. of the salicylate, trichlorophenol is among the products.

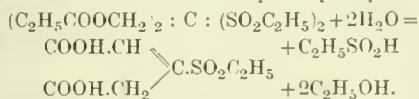
Exactly similar results are obtained with potassium hypobromite. With potassium hypoiodite, only one acid, monoiodo-salicylic acid  $C_6H_3(COOH.OH.I)$  (1.2.4), is obtained.—C. E. F.

**Sulphonal Carboxylic Acids in comparison with the corresponding Keto Acids; Stability of —, and the Physiological Activity of Acid or Basic Sulphonal Derivatives.** T. Posner. *Chem.-Zeit.*, 1905, 29, 1107–1108.

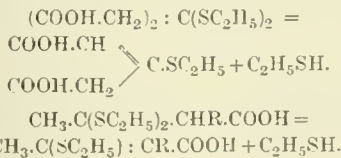
THE author reviews his work on sulphonal-carboxylic acids. On hydrolysing the disulphone of pyrotartaric ethyl ester,  $CH_3.C(SO_2C_2H_5)_2.COOC_2H_5$ , carbon dioxide and alcohol separate and ethyldene disulphone,  $CH_3.CH(SO_2C_2H_5)_2$ , is produced. The disulphone of aceto-acetic ester on hydrolysis decomposes into ethyl-sulphinic acid and the unsaturated alkyl-sulphone-isocrotomic acid:—



If the  $\alpha$  hydrogen atoms of aceto-acetic acid are replaced by alkyl groups it is possible to isolate a  $\beta$ -disulphone-carboxylic acid. The disulphone of acetone-dicarboxylic acid ester behaves in a similar way on hydrolysis:—



With a  $\gamma$ -keto acid such as levulinic acid, the mercaptol of the acid can be oxidised, or the disulphone of the ester hydrolysed without further decomposition. The mercaptol condensation compounds with  $\alpha$ - or  $\beta$ -keto acids decompose in the same way as the corresponding disulphones:—



According to experiments of Hans Meyer (*Arch. exp. Pathol.*, 1899, 42, 118.) on alcohol narcosis, only chemically indifferent substances, which are solvents for fats and similar bodies, can act as narcotics. Diethylsulphone-valeric acid was, therefore, physiologically tested. The sodium salt was non-poisonous and non-narcotic. The phenetidine and piperidine were only very slightly narcotic. The diethylamide was narcotic, but Meyer has shown that many amides in which the acid grouping is inactive have the same action. The diethylamide is said to have a smaller hypnotic action than sulphonal, but a greater depressing action on the respiratory system. The hydrochloride of aminosulphonal, although easily soluble, is without marked action, the introduction of the salt-forming group having removed the characteristic action of the chemically indifferent sulphonal. Meyer's narcosis theory is confirmed by these results.—F. S.

**Coca Leaves; Analysis of Javan —.** M. Greshoff. *XXIII.*, page 1193.

*Aldehydes and Ketones in Essential Oils; Fuller Study of the Neutral Sulphite Method for Determining some* —. S. S. Sadtler. XXIII., page 1193.

*Wood Spirit; Detection of* — in Alcoholic Preparations. R. Peters. XXIII., page 1192.

#### ENGLISH PATENTS.

*Tobacco; Process of Treating* —. J. L. Daniels, jun., New York. Eng. Pat. 8277, April 18, 1905.

TOBACCO leaves are moistened with a solution of sodium hypophosphite and are then exposed in a closed chamber to the direct action of oxygen in the form of ozone. It is claimed that the nicotine is converted by this treatment into harmless nicotinic acid and that the processes of maturing or curing are hastened by the oxidation of the gummy and nitrogenous constituents of the leaves. —J. F. B.

*Theobromine; Manufacture of Soluble Compounds of* —. C. D. Abel, London. From Actien-Ges. für Anilin-Fabrik., Berlin. Eng. Pat. 4959, March 9, 1905.

A READILY soluble compound of theobromine is made by treating barium-theobromine with an alkali salicylate, or by treating sodium-theobromine with an alkali salicylate, in the presence of a soluble compound of barium. On evaporation, a white powder soluble in water is produced. When carbon dioxide is passed through the solution, barium carbonate separates; with ferric chloride there is a violet coloration. On heating with potassium hydroxide ammonia is evolved. —F. S.

*Camphor; Manufacture of* —. A. Zimmermann, London. From the Chem. Fabr. auf Actien (vorm. E. Schering), Berlin. Eng. Pat. 26,779, Dec. 8, 1904.

CLAIM is made for the preparation of camphor by the oxidation of isoborneol esters, more especially isobornyl acetate, with chromic acid or its salts at a temperature of about 90° C. (See Fr. Pat. 341,513 of 1904, this J., 1904, 881. Also this J. 1905, 150 and 750. Eng. Pat. 8297 of 1905, this J. 1905, 857; Eng. Pat. 9550 of 1905, this J., 1905, 902. Fr. Pat. 349,886 of 1904, this J. 1905, 985.) —F. S.

*Malonyl-p-phenetidine; Manufacture of Dialkyl Derivatives of* —. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 4564, March 4, 1905.

A DIALKYL MALONYL CHLORIDE is heated with somewhat more than 2 mols. of *p*-phenetidine in benzene solution at 100° C. for 1 hour; the precipitate is filtered off, and treated with dilute hydrochloric acid to remove the excess of *p*-phenetidine. The residue, recrystallised from alcohol, gives dialkylmalonyl-*p*-phenetidine,  $R_2C(CO.NH.C_6H_4.OCH_2)_2$ , a compound sparingly soluble in water. —T. F. B.

*m-Iodin-o-oxyquinoline-ana-sulphonic Acid Readily Soluble in the Stomach; Processes for the Preparation of — and Medicaments or Internal Disinfectants containing the same.* R. Griesse, Berlin. Eng. Pat. 9656, May 8, 1905.

*m-IODO-O-HYDROXYQUINOLINE-ANA-SULPHONIC* acid (loretin) has previously been applied outwardly only in medicine. It is now found that when mixed with sodium bicarbonate, it is readily soluble in the gastric juices, and is of value as an internal disinfectant. —T. F. B.

*Dialkylmalonylurea; Process for Producing* —. W. Traube, Berlin. Eng. Pat. 14,161, July 10, 1905. Under Int. Conv., July 13, 1904.

WHEN a dialkylmalonyl chloride is heated to 120°–150° C. with 2 mols. of urethane, hydrochloric acid is split off and dialkylmalonyl-diurethane is produced. When this compound is heated with a suitable condensing agent (e.g., sodium ethylate), a molecule of alcohol is eliminated, a carboxylic ester of dialkylmalonylurea being formed. This is not isolated, but the solution is acidified with a mineral acid, when carbon dioxide is evolved, and dialkylmalonylurea is precipitated. —T. F. B.

*Alcohols; [Electrolytic] Manufacture of Aromatic* —. C. Mettler, Munich. Eng. Pat. 18,674, Sept 15, 1905. Under Int. Conv., Nov. 17, 1904.

CARBOXYLIC acids can be reduced electrolytically to the corresponding alcohols, if they are placed in the cathode compartment of an electrolytic cell with a mixture of sulphuric acid and alcohol, the cathode being a plate of pure lead. The anode should be of pure lead, and the anode compartment should contain dilute sulphuric acid. The yield of benzyl alcohol is almost quantitative. (See this J., 1905, 634; and Fr. Pat. 348,951 of 1904, this J., 1905, 559.) —F. S.

#### UNITED STATES PATENTS.

*Camphor; Process of Making* —. L. Ach, Assignor to C. F. Boehringer und Soehne, Mannheim, Germany. U.S. Pat. 802,792, Oct. 24, 1905.

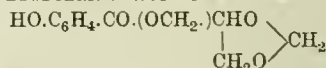
SEE Eng. Pat. 28,035 of 1904; this J., 1905, 249. —T.F.B.

*Camphor; Process of Making* —. L. Ach, Assignor to C. F. Boehringer und Soehne, Mannheim, Germany. U.S. Pat. 802,793, Oct. 24, 1905.

BORNEOL or isoborneol may be oxidised to camphor by means of "nitrous gases." The gases may be passed over solid borneol, and the liquid, said to be thus formed, saturated with the gases, or a solution of a borneol may be saturated with nitrous gases; the product is allowed to stand for several hours and is then agitated with water. —T. F. B.

*Methyleneglycerinsalicylic Acid Ester and Process of Making Same.* K. Stephan and T. Emilewicz, Assignors to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 801,484, Oct. 10, 1905.

METHYLENEGLYCERINSALICYLIC acid ester



is obtained as an oily liquid of sp. gr. 1.344 at 15° C., by the reaction of salicylic acid on a "combination of glycerin and formaldehyde"; it is soluble in ether, alcohol, chloroform, benzene, and castor oil, with difficulty soluble in olive and sesame oils, insoluble in water, petroleum spirit and glycerol; it is resolved by acids or alkalis into glycerol, formaldehyde, and salicylic acid. —T. F. B.

*Ferric Chloride and Cotarnine Hydrochlorate; Double Salt of — and Process of Making Same.* A. Voswinkel, Berlin. U.S. Pat. 802,835, Oct. 24, 1905.

SEE Ger. Pat. 161,400 of 1903; this J., 1905, 1030. —T.F.B.

#### FRENCH PATENTS.

*Odoriferous Compound [from Citral]; Manufacture of a New* —. J. Dupont. Fr. Pat. 355,315, June 17, 1905.

CITRAL can be condensed with monochloroacetone in presence of certain condensing agents, such as sodium methylate, sodium amide, or baryta water. For example, 20 grms. of sodium amide are added to a mixture of 1200 grms. of citral, 1200 grms. of monochloroacetone and 4800 grms. of benzene cooled to about 3° C.; the mixture is allowed to stand at a low temperature for some hours, when it is extracted with water, and the aqueous extract extracted with a suitable solvent; this extract is then distilled *in vacuo*, the portion distilling at about 175° C. (12 mm.), being the condensation product, which is odourless. This is converted into a cyclocitral derivative by treatment with a mineral acid (preferably phosphoric acid at below 40° C.), which is fractionated; the new product, which distils between 140° and 150° C. (12 mm.), possesses an intense odour of violets. —T. F. B.

*Carbon Tetrachloride; Manufacture of* —. C. Combes. Addition, dated Aug. 18, 1904, to Fr. Pat. 312,046, June 22, 1901 (this J., 1902, 1469).

It is found that the yield of carbon tetrachloride from the interaction of sulphur monochloride,  $\text{S}_2\text{Cl}_2$ , and carbon



at a high temperature, is greatly increased by the presence of small quantities of catalysers such as antimony trichloride, phosphorus trichloride, ferric chloride, aluminium chloride, and iodine.—F. S.

*Carbon Tetrachloride; Apparatus for the Continuous Production of —.* J. B. Febvre. Fr. Pat. 355,423, June 21, 1905.

THIS invention relates to certain improvements of a process for the continuous production of carbon tetrachloride described in Fr. Pat. 327,322 of 1902 (see this J., 1903, 962). The chlorine is made to pass up a column filled with coke impregnated with a catalyser such as manganese chloride and over which carbon bisulphide flows. The sulphur chloride formed thereby is allowed to come in contact with carbon bisulphide vapour in the presence of finely divided iron or a metallic sulphide. The present invention describes the following improvements:—(1) The chlorine is dried by passing up a tower down which sulphuric acid flows, the acid being subsequently heated in the open and used again. (2) The crude carbon tetrachloride, containing sulphur and sulphur chloride, passes into a retort heated by superheated steam. The sulphur is allowed to flow from the base of the retort, and the vapours pass upward through a fractionating column, the sulphur chloride being recovered from the base of this and used again in the process. The last traces of sulphur chloride are removed by passing the vapours through a scrubber in contact with a hot alkaline lye. (3) The use of superheated steam to regulate the temperatures. (4) Receivers at different temperatures to separate the purified product.—F. S.

*m-Tolylsemicarbazide; Process for Preparing —.* Soc. Anon. Prod. F. Bayer et Cie. First Addition, dated Aug. 29, 1904, to Fr. Pat. 349,968, June 6, 1904. (See this J., 1905, 345, 455.)

THE following additional methods are given for preparing *m*-tolylsemicarbazide:—(1) *m*-tolylhydrazine is treated with cyanogen bromide, and the *m*-tolylhydrazinecarboxylic acid nitrile thus formed, is converted into the hydrochloride of one of its iminoethers by the action of an alcohol and hydrochloric acid gas in ethereal solution; by heating these iminoethers to 130°–140° C., or by treatment with water, *m*-tolylsemicarbazide is produced. (2) By passing hydrochloric acid gas into an ethereal solution of *m*-tolylhydrazinecarboxylic acid nitrile, the chloride of *m*-tolylhydrazinecarboxylic acid imide is produced, which is converted into the semicarbazide on heating with water. (3) The amidine of *m*-tolylhydrazinecarboxylic acid, prepared by the action of cyanamide on the hydrazine, is converted into the semicarbazide by heating with baryta water, or by any other method of substituting oxygen for the imino group. (4) *m*-Tolylazocarbonamide,  $C_6H_4(CH_3)N_2CONH_2$ , obtained by treating the esters of the carboxylic acid with ammonia, is easily reduced to *m*-tolylsemicarbazide, e.g., by zinc dust and acetic acid.—T. F. B.

*m-Iodo-o-hydroxyquinoline-ana-sulphonic Acid; Process of Making —.* R. Griese. Fr. Pat. 354,007, May 5, 1905.

SEE Eng. Pat. 9656 of 1905; preceding these.—T. F. B.

*Guanines from Cyanamino-4,5-diamino-6-dioxypyrimidine and its Homologues; Process for Preparing —.* E. Merek. Fr. Pat. 355,086, May 31, 1905. Under Int. Conv., July 19, 1904.

SEE Eng. Pat. 10,976 of 1905; this J., 1905, 813.—T. F. B.

*Radio-active Surfaces and their Preparation.* H. Lieber. Fr. Pat. 355,098, June 8, 1905. Under Int. Conv. July 30, 1904.

THE invention consists of the application of a very thin layer of radium to a solid surface, and subsequently covering this layer with a thin protective layer of a substance through which the radium emanations can pass. For instance, a rod of celluloid can be dipped into

a solution or paste containing radium and, when the solvents have evaporated, it can be dipped in a solution of pyroxylin (see Eng. Pat. 20,922 of 1902; this J., 1903, 1136).—F. S.

*p-Aminobenzoic Acid; Manufacture of New Salts of the Ethyl Ester of —.* Act.-Ges. f. Anilinfabrikation. Fr. Pat. 355,193, June 13, 1905.

NEW salts of the ethyl ester of para-aminobenzoic acid can be produced in the solid state or in solution by the interaction of neutral or acid salts of naphtholsulphonic acid, or the free acid itself, upon a salt of para-aminobenzoic ethyl ester or upon the free ester.—F. S.

*Amino-alcohols; Process for the Preparation of Ethers of New —.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 355,367, June 19, 1905. Under Int. Conv., Jan. 26, 1905.

BY the action of an organomagnesium halide on a symmetrical dihalogenated acetone, compounds are obtained which are composed by water, with the formation of  $\beta$ -dihalohydrins, e.g.,  $RC(OH)(CH_2Cl)_2$ , where R represents the organic radical of the original magnesium compound. These compounds react with ammonia or primary or secondary amino compounds, to form the corresponding aminoalcohols or their derivatives. The esters of these aminoalcohols, obtained by the usual esterification processes, are stated to be of technical value.—T. F. B.

#### GERMAN PATENT.

*C-C-Dialkylbarbituric Acids; Process for Preparing —.* Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 162,219, Oct. 22, 1903.

THIOUREA is condensed with a dialkylcyanoacetic ester, and the resulting 2-thio-4,6-dioxypyrimidine derivative is oxidised by nitric acid or by hydrogen peroxide to the corresponding C-C-dialkylbarbituric acid.—T. F. B.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(Continued from page 1126.)

*Silver Bromide-Gelatin containing a Developer.* J. Precht and E. Stenger. Z. wiss. Phot., 1905, 3, 76–80. Chem. Centr., 1905, 2, 1137.

THE production of solarisation on exposing silver-bromide gelatin is strongly retarded by the presence of reducing agents, and it is, therefore, advantageous to treat ordinary photographic plates with a 1 per cent. solution of a developer before exposing them. Comparative tests showed that the intensity of illumination required to produce solarisation was 44 times greater with plates which had been treated with a developer than with ordinary plates.—A. S.

*Intensification; Use of Permanganates in —.* T. T. Baker. Phot. J., 1905, 45, 318–319.

THE negative is immersed from one to three minutes in a solution of potassium permanganate, 2 grms.; hydrochloric acid, 1 c.c.; water, 100 c.c.; rinsed, and redeveloped, preferably with quinol.—T. F. B.

#### ENGLISH PATENTS.

*Photographic Papers; Manufacture of —.* J. Hoff-sümmer, Düren, Germany. Eng. Pat. 17,303, Aug. 26, 1905.

IN order to avoid the penetration of the paper by the emulsion, a thin fibrous layer, such as thin paper, fabric, &c., is fastened by a suitable adhesive to the paper, and the emulsion is then applied in the usual manner, a coating of baryta having been previously applied, if

necessary. This process permits the employment of lower quality paper, since these do not come into direct contact with the emulsion.—T. F. B.

*Photographs; Impts. in Polychrome* —. C. L. A. Brasseur, New York. Eng. Pat. 21,210, Oct. 3, 1904.

A COLOURED, sensitised gelatin film is fixed to a glass support by means of sodium silicate solution, and an image is printed and developed on it: this image is coated with a soluble layer of gelatin and then with a layer of celluloid or other protective substance. The subsequent images are then applied in the same manner. It is stated to be necessary to colour the gelatin film before development, if satisfactory results are desired. A process for preparing screens is also described and claimed.—T. F. B.

*Photographs; Process for Producing Coloured* —. G. Koppmann, Hamburg, Germany. Eng. Pat. 24,290, Nov. 9, 1904.

THE reduction in sensitiveness caused by adding pigments to silver bromide and other emulsions in the production of photographs in colour, may be prevented by adding to the emulsion any of the dyestuffs usually employed for preparing orthochromatic plates (e.g., Eosin).—T. F. B.

#### FRENCH PATENT.

*Fibres, Films, Blocks or Slabs; Plastic and Transparent Substance for the Manufacture of* —. H. C. M. L. Cathelineau and A. A. René-Fleury. Fr. Pat. 354,942, June 5, 1905. V., page 1169.

## XXII.—EXPLOSIVES, MATCHES, Etc.

(Continued from page 1126.)

#### ENGLISH PATENT.

*Explosives*. A. C. Girard, Paris. Eng. Pat. 6045, March 22, 1905. Under Int. Conv., April 5, 1904.

SEE Fr. Pat. 349,635 of 1904; this J., 1905, 752.—T. F. B.

#### FRENCH PATENT.

*Phosphorus; Treating Yellow* — to Render it Inoffensive. M. Bals. Fr. Pat. 350,114, Aug. 12, 1904.

ORDINARY phosphorus is intimately mixed while in a fused condition or when being condensed from vapour during its production, in a closed vessel, with a salt or other body that may be melted without decomposition, contact of air being prevented, as by conducting the process *in vacuo*, or in an atmosphere of carbon dioxide. Sodium thiosulphate is one of the salts named as being adapted for the described purpose. It is recommended to add during the mixing process, some liquid of low density, such as turpentine or petroleum, to protect the minute coated particles of phosphorus effectively from the air. It is stated that phosphorus thus finely-divided and coated may be transported, and applied in the manufacture of matches, &c., without injury to the workpeople.—E. S.

## XXIII.—ANALYTICAL CHEMISTRY.

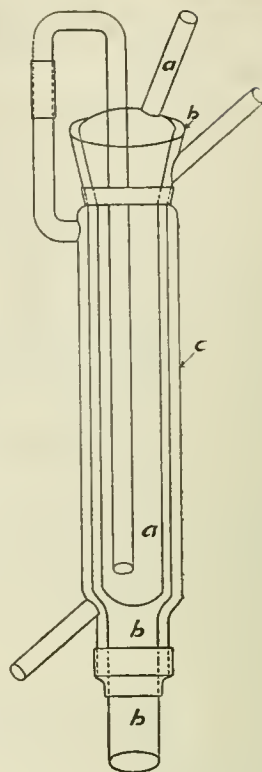
(Continued from page 1130.)

#### APPARATUS, Etc.

#### ENGLISH PATENTS.

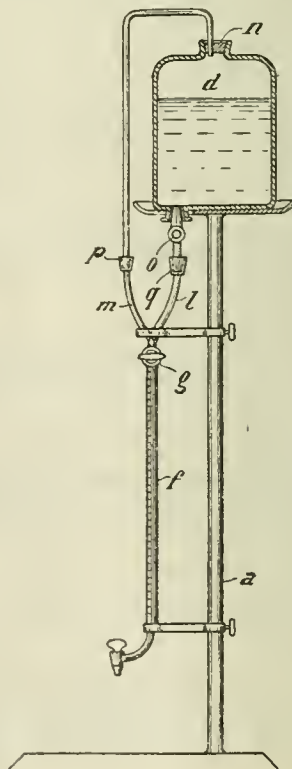
*Condensers; Impts. in* —. H. E. Burgess, London. Eng. Pat. 23,336, Oct. 29, 1904.

THE condenser claimed, consists of the three tubes *a*, *b* and *c*. The tubes *a* and *c*, are the cooling tubes and *b* is the condensing tube proper. Claim is made for constructing the apparatus of glass, metal, porcelain, or other suitable material. If of glass a ground joint is used between *a* and *b* and rubber joints between *b* and *c*; if of



metal screwed joints are used, and for porcelain, &c., any suitable joint may be used.—W. H. C.

*Titration Apparatus*—R. König. Gelsenkirchen, Germany. Eng. Pat. 15,160, July 24, 1905.





The apparatus consists of a reservoir *d* connected by tubes *l* and *m*, with a burette *f*, by means of a cock *g*: *p* and *q* are ground glass joints to enable *d* to be removed from stand *a* when necessary, in which case tap *o* would be closed. The cock *g* is so constructed that in one position it allows both tubes *l* and *m* to communicate with the burette, while in the other position (when the titration is in progress), the burette communicates with the air by a passage in the stopper.—T. F. B.

## UNITED STATES PATENT.

*Lubricants; Process for the Examination of* —. K. Wilkens, Berlin. U.S. Pat. 801,952, Oct. 17, 1905.

SEE Eng. Pat. 20,998 of 1902; this J., 1903, 1065.—T. F. B.

## INORGANIC—QUANTITATIVE.

*Sulphur in Spent Oxide; Determination of Free* —. O. Pfeiffer. J. f. Gasbeleucht., 1905, 48, 977–978.

ONE grm. of the sample (moist or air dried) is burned in a flask filled with oxygen and containing 25 to 50 c.c. of N/1 caustic alkali solution. If the sample does not ignite, owing to the proportion of sulphur being very small (spent oxide containing 3 per cent. of sulphur glows feebly, but the sulphur burns completely), it may be taken out, moistened with glycerin, furnished with a small touch-wick of tinder, the latter set fire to, and the whole replaced in the flask. After the gases produced by the combustion have been completely absorbed, 1 c.c. of strong (30 per cent.) neutral hydrogen peroxide is added to the liquid in the flask, to oxidise any sulphite to sulphate, and the excess of alkali is then titrated by means of N/1 acid and methyl orange. 1 c.c. of N/1 alkali = 0.016 grm. of sulphur. The results are accurate. If hydrogen peroxide is not added, the result may be 20 per cent. too low, as alkali hydrogen sulphite gives a neutral reaction with methyl orange.

—H. B.

*Sulphuric and Nitric Acids; Examination of Mixed* —. G. Lunge and E. Berl. Z. angew. Chem., 1905, 18, 1681–1687.

IN examining mixed acid, it is necessary to determine (a) total acidity, (b) nitrous acid by permanganate, (c) total nitrogen acids by the nitrometer. Nitric acid is then obtained from the difference of c and b, sulphuric acid from that of a and c. In special cases the sulphuric acid may be directly determined gravimetrically; the nitric acid may also be determined by the "nitron" method, subtracting from the total weight of precipitate obtained that of the "nitron" nitrite ( $C_{20}H_{12}N_4.HNO_2$ ) calculated from the nitrous acid determined by b—the results, however, are always a little low. The evaporation of the nitrogen acids and determination of the residual sulphuric is not to be recommended, as there is always loss of sulphuric acid by evaporation, so that the sulphuric acid result is too low, and consequently the nitrogen acids too high.—J. T. D.

*Sulphur; Determination of* — in Iron. J. Petré. Jernkontorets Annaler; through Chem.-Zeit., 1905, 29, Rep., 324.

THE author has examined the different methods for the determination of sulphur in iron, and finds that although the methods in which the sulphur is expelled in the form of hydrogen sulphide are quicker, those in which the sulphur is oxidised directly to sulphuric acid, without separation from the iron, are more accurate. In the method of direct oxidation the carrying down of iron salts by the precipitated barium sulphate is a source of error, but the author has found that this error can be completely prevented by precipitating the barium sulphate in the cold from a solution containing 5–10 c.c. of hydrochloric acid per 200 c.c., and allowing to stand for 24–48 hours.—A. S.

*Zinc; Separation of* —, from Iron, by Ammonia. W. Funk. Z. angew. Chem. 1905, 18, 1687–1690.

FOR accurate separation a considerable excess of ammonia is requisite. The author's method is as follows:—The solution, containing all the iron as ferric salt, should be

contained in a basin, and not more dilute than necessary. To it is added ammonium chloride, then 10 per cent. ammonia solution to neutral reaction, followed by an excess equivalent to 20–30 times the amount necessary to precipitate the iron. The covered basin is heated to 70°–80° C., the liquid filtered, and the precipitate washed with hot 5 per cent. ammonium chloride solution. The precipitate is dissolved in warm dilute hydrochloric acid, and the precipitation repeated under the same conditions. The zinc in the filtrates may be determined in any of the usual ways. If the iron is to be determined, the ammonium chloride must be first washed out of the precipitate, and after ignition any silica present must be determined. The author considers the acetate method of separation preferable.—J. T. D.

*Silver in Blister Copper; Determination of* —. C. C. Sample. Eng. and Mining J., 1905, 80, 732.

THE process depends on the separation of the copper by oxidation and solution of the oxide in 10 per cent. sulphuric acid. About 5 grms. of very fine filings or borings are placed in a 20-grm. crucible or 2½ in. scorifier, and heated in a stream of air in the front of the muffle to as high a temperature as possible, short of fusing the particles together. After cooling, the contents are placed in a beaker, and hot, but not boiling, 10 per cent. sulphuric acid poured over, stirred, and kept hot (but not allowed to concentrate). The whole is poured on a filter and the residue washed with hot water. If much copper remains, the treatment must be repeated; but when practically the whole has been removed, lead is added, and fusion for a button and cupellation of the button carried out in the usual way.—J. T. D.

*Lead; Rapid Determination of* — in the Electrolytic Way. R. O. Smith. J. Amer. Chem. Soc., 1905, 27, 1287–1293.

THE author carried out some experiments on the rapid electrolytic determination of lead as dioxide, using a cathode rotating at a speed of about 450 revolutions per minute. It was found that the maximum time required for the deposition of 0.25 grm. of lead as dioxide was 15 mins., and for 0.5 grm. 25 mins. The results were nearly always slightly too high, the error increasing gradually with the weight of the deposit; with a deposit of about 0.58 grm. of lead dioxide, the amount of lead found was, on the average, 1.5 mgrms. too high (compare Holland, this J., 1903, 216). The deposits did not attain a constant composition until they had been dried at 200°–230° C., the time required varying with the weight of the deposit.—A. S.

*Titanium Chloride in Volumetric Analysis; Use of* —. E. Knecht and E. Hibbert. XXIII., page 1192.

## ORGANIC—QUALITATIVE.

*Maple Products, Detection of Gane Sugar in* —. A. G. Woodman. Technology Quarterly, 1905, 18, 146–152.

THE author has studied comparatively the value of three methods which have been proposed for testing the genuineness of maple syrups and sugars:—(1) Hortvet's method (this J., 1904, 1241), based on the measurement of the volume of the precipitate produced by basic lead acetate and alumina cream under standard conditions. (2) Hill and Mosher's method:—50 c.c. of syrup are diluted with 200 c.c. of water, and treated gradually with slight excess of a saturated solution of normal lead acetate. The precipitate is filtered off, washed until free from soluble lead salts and then decomposed by sulphuretted hydrogen and water; the organic acid present in the filtrate from the lead sulphide is then determined by titration. (3) In C. H. Jones' method for testing the purity of maple products, about 5 grms. of syrup or sugar are incinerated; the ash is weighed, extracted with boiling water, filtered and washed. The weight and alkalinity of the soluble and insoluble portions of the ash are determined separately. According to Hortvet's method the volumes of the precipitates with pure maple products vary from 0.94 to 1.82 c.c. for syrups,

and from 1.18 to 4.41 c.c. for sugars. According to Hill and Mosher's method, genuine maple syrup gives a nearly colourless filtrate from the lead sulphide, whilst other syrups give brown or black filtrates. The filtrates from maple syrups have an acidity equivalent to 30—35 c.c. of N/10 acid per 100 c.c. of syrup, whilst those which are not maple, or which are mixtures of maple and cane syrups have a very much lower acidity. According to Jones, the ash of a pure maple syrup is not lower than 0.5 per cent. on the basis of 11 lb. of syrup to the gallon.

The author regards the Hortvet method as an excellent process for rapidly sorting out the genuine from the suspected samples. The latter should then be tested by the other two processes before a conclusion is formulated. The Hill and Mosher method gives reliable results in the case of syrups, both as regards the colour and the acidity of the filtrate; with sugars the colour of the filtrate is not reliable, but the acidity is characteristic. The most conclusive data seem to be afforded by the determination of the ash, especially of the soluble and insoluble portions and their respective alkalinities.—J. F. B.

*Sugars; Some Colour and Spectral-Reactions of the Principal* —. E. Pinoff. Ber., 1905, 38, 3308—3318.

THE following reactions enable certain sugars to be identified either alone or in mixtures, provided the proportions and conditions of heating be observed. In all the tests the liquid is heated in test-tubes in the water-bath at 95°—98° C., and in all cases where alcohol is specified it is of 96 per cent. strength:—

(1) 0.05 gm. of sugar, 10 c.c. of alcohol-sulphuric acid mixture (750 c.c. of alcohol and 200 c.c. of concentrated sulphuric acid) and 0.2 c.c. of a 5 per cent. alcoholic solution of  $\alpha$ -naphthol:—Levulose, sorbose, cane sugar and raffinose give a coloration after heating for one minute, showing two absorption bands with mean wave lengths of 5736 and 5088  $\mu$  respectively. Dextrose, mannose, galactose, lactose and maltose give a coloration after 30—35 minutes, with one absorption band, 5325  $\mu$ ; rhamnose reacts in 20 minutes, absorption band, 5625  $\mu$ ; arabinose gives a dull greenish coloration with no absorption band.

(1A) Same reagent as (1), diluted with 10 c.c. of alcohol:—Levulose, cane sugar and raffinose react in 13—19 minutes, sorbose in 30 minutes, giving for each a coloration with only one absorption band, 5088  $\mu$ ; the other sugars show no reaction in 30 minutes.

(2) Same proportions as (1A), but the  $\alpha$ -naphthol is replaced by  $\beta$ -naphthol. Levulose reddish-brown, sorbose greenish-yellow after 25 minutes; other sugars *nil* after 45 minutes.

(2A) Same proportions as (1), but using  $\beta$ -naphthol instead of  $\alpha$ -naphthol:—Levulose, cane sugar and raffinose, reddish-brown after four minutes, absorption band 5050  $\mu$ ; sorbose, yellow after four minutes, no absorption band, other sugars *nil* after 15 minutes.

(3) 0.05 gm. of sugar, 5 c.c. of alcohol-sulphuric acid, 5 c.c. of alcohol, 0.2 c.c. of a 5 per cent. solution of resorcinol:—Levulose, sorbose, cane sugar and raffinose, after one minute, dextrose, lactose and maltose, after 32 minutes, absorption band in all cases 4875  $\mu$ . Arabinose, rhamnose, mannose and galactose, no reaction after 35 minutes.

(4) 0.1 gm. of sugar, 5 c.c. of a 5 per cent. solution of potassium bichromate and 5 c.c. of a 5 per cent. solution of ammonium chlorite, heated for 30 minutes. Sorbose gives a yellow precipitate after 12 minutes, levulose after 20 minutes, other sugars give no precipitate. This is a very reliable test for sorbose and levulose in mixtures.

(5) 0.1 gm. of sugar, 10 c.c. of a 4 per cent. solution of ammonium molybdate, 10 c.c. of water, 0.2 c.c. of glacial acetic acid; the total absence of free mineral acid must be ensured. Levulose, after three minutes' heating, gives a fine blue coloration; arabinose, rhamnose, galactose, mannose and sorbose give a faint greenish (not blue) coloration only after heating for 30 minutes. This is a characteristic test for levulose in mixtures; it is important that the total dilution of the test liquid should not be increased. With very small quantities of levulose in the mixture, 10—25 minutes

may be required to develop the coloration; this reaction may possibly form the basis of a colorimetric method for the quantitative determination of levulose.—J. F. B.

*Wood Spirit; Detection of — in Alcoholic Preparations.*  
R. Peters. Pharm. Centralh., 1905, 46, 521.

ACETONE being invariably present in wood spirit, Légal's reaction with sodium nitroprusside in the presence of alkali is employed for its detection. Ten c.c. of the alcoholic liquid are diluted with water and slowly distilled, until 20 c.c. of distillate have been obtained. Ten c.c. of this are then treated with 1 c.c. of freshly prepared 1 per cent. sodium nitroprusside solution, which has been protected from the light, and 2 c.c., or an excess, of 4 per cent. caustic soda solution. In the presence of acetone, a red colour is developed, becoming brown after a certain time. In its absence, the colour is merely yellow.

Since aldehyde and fusel oil give a similar reaction with the test, they must be destroyed, if present. The former is eliminated by heating 10 c.c. of the above distillate with 20 c.c. of 25 per cent. caustic soda solution and a little water on the water-bath (under the reflux condenser) for one hour. The liquid is then filtered through cotton wool and distilled, the distillate being then tested as above. To remove fusel oil, the first distillate is heated on the water-bath for one hour, under a reflux condenser, with granulated zinc and dilute sulphuric acid, with one drop of platonic chloride solution added. It is then distilled and tested.—J. O. B.

#### ORGANIC—QUANTITATIVE.

*Titanium Chloride in Volumetric Analysis; Use of —.*  
E. Knecht and E. Hibbert. Ber., 1905, 38, 3318—3326.

IN continuation of their previous work (see J. Soc. Dyers and Colourists, 1904, 3), the authors describe the volumetric estimation of indigo, and of basic dyestuffs such as Fosine A, Rhodamine B, Crystal Violet, Pararosaniline hydrochloride and Tolusafuranine, &c., which are reduced by titanium chloride. Two atoms of hydrogen are taken up as a rule, and the colourless leuco bodies formed. The dyestuffs thus act as their own indicator; the end of the reaction being shown by the solution becoming colourless. Owing to the tendency of the leuco bodies to oxidise, the titration is carried out in a current of carbon dioxide. The method adopted for the analysis of synthetic, and high grade natural indigos is as follows:—

1 gm. of indigotin is sulphonated with 5 c.c. of concentrated sulphuric acid at 90°—95° C. for one hour; the product is poured into water, and diluted to 500 c.c. 50 c.c. of this solution are poured into an Erlenmeyer flask closed with a perforated rubber stopper, and 25 c.c. of a 20 per cent. solution of Rochelle salt are added. Three glass tubes pass through the india-rubber stopper; one serves for the introduction of a regular stream of carbon dioxide, the second as an exit tube, and the third is connected with the titanium chloride burette. The indigo solution is first boiled, and, after the air has been expelled by carbon dioxide, is then titrated with the standard titanium solution, until the blue colour turns to yellow. Seignette salt is added because a sharp end reaction is only obtained in tartaric acid solution. With low grade indigos, such as Kurpah, the diluted solution in sulphuric acid must first be purified by the addition of chalk (see Grossmann, this J., 1905, 308) before titrating.

The above is stated to be quicker than the gravimetric method; and the end reaction sharper than in the permanganate method. The following table shows the comparative results obtained:—

Quality of Indigo.	TiCl <sub>3</sub> .	KMnO <sub>4</sub> (Rawson).	Gravimetric (Möhlau and Zimmermann).
Bengal I. ....	59.08	59.14	58.5
Bengal II. ....	55.97	56.00	57.0
Kurpah .....	35.32	—	36.0



The authors further describe the estimation of hydrogen peroxide, ammonium persulphate, metallic tin and tin salts by means of titanium chloride.—H. L.

*Rubber; New Method of Determining* — J. Torrey. India-Rubber J., 1905, 30, 417—418.

The method proposed, a colorimetric one, is founded on the fact that when rubber is heated with pure nitric acid of sp. gr. 1.42 under constant conditions, it is converted into a body which dissolves completely in caustic alkaline solutions with production of a deep red colour. The author states moreover that the same weight of pure rubber, when treated as described, and diluted with water to a definite volume, always gives the same tint. Certain of the organic substances used in compounding interfere, and must be removed before the test is made by means of such extracting agents as acetone, pyridine, and alcoholic caustic soda.

The colour standard is prepared as follows:—0.1 gm. of pure rubber is heated with 2 c.c. of pure nitric acid (1.42) in a test-tube immersed in a water-bath, first at 50° to 60° C. until action ceases, and then at 95° to 100° C. for 20 minutes. The liquid is diluted with 10 c.c. of water, 20 c.c. of caustic soda solution (1 in 4) are added, the liquid stirred, again diluted with 10 c.c. of water, filtered, and the filtrate and washings diluted to 250 c.c. Of this standard solution 100 c.c. are transferred to a test-tube for the purpose of comparison with the solution obtained from the sample under examination. This is prepared in the same manner, 0.1 gm. of the residue after extraction, being used. The filtrate and washings are transferred to a similar test-tube to that used for the standard, and the colour matched by dilution with water.

Then if  $P$  = required percentage of rubber in original mixing,  $V$  = volume of solution under test at standard tint, and  $a$  = percentage of extraction residue in original mixing, then  $P = aV/250$ .

Duplicate results agreed within 0.5 per cent.—E. W. L.

*Coca Leaves; Analysis of Javan* — M. Greshoff. Pharm. Weekblad, 1905 [13]; through Apoth. Zeit., 1905, 20, 291.

The total solid alkaloids, chiefly cinnamylecocaine, are first converted into ecgonine, which is then transformed into ordinary cocaine.

30.5 grms. of dried and powdered coca leaves are heated on the water-bath at about 80° C. for two hours, in a flask attached to an upright condenser, with 300 c.c. of 90 per cent. alcohol, the weight of the flask and its contents having been previously noted. After cooling, the flask and contents are again weighed, and any loss is made up by the addition of more alcohol. Exactly 150 c.c., equivalent to 15 grms. of leaves, are then filtered, and the spirit is distilled off. The residue is warmed on the water-bath with 20 c.c. of water, with frequent agitation. After cooling, the liquid is filtered, the insoluble waxy and other matter and chlorophyll being washed with tepid water until the total filtrate measures about 60 c.c. This aqueous filtrate is shaken with two successive washings each of 30 c.c. of ether which are rejected; it is then made alkaline with ammonia, and the liberated alkaloid is shaken with three successive quantities each of 30 c.c. of ether. The bulked ethereal extract is distilled in a small tared flask, and the residue dried in the water-oven, a rapid current of air previously dried over calcium chloride being aspirated through the flask during this drying, to remove traces of a volatile base, with a strong tobacco-like odour. The brown amorphous residue thus obtained is redissolved in a little 10 per cent. solution of sulphuric acid, again liberated with ammonia and shaken out, as before, with ether. After distilling off the solvent the residual alkaloid is dried for three hours at 95° C. and weighed.

Young Javan coca leaves, protected from the air while drying, gave 2.02 per cent. of alkaloid. Old leaves, similarly dried, gave only 0.78 per cent., thus confirming the observation that the younger leaves contain more than twice as much alkaloid as older ones do. It is further found that the leaves from the summits of young trees yield more alkaloid than those from the base, 2.1 per

cent. being obtained from the former and 1.2 per cent. from the latter. Although the method of drying and the period of storage adversely affect the alkaloidal value of the leaves, the commercial product should yield at least 0.6 to 0.7 per cent. of alkaloid.—J. O. B.

*Aldehydes and Ketones in Essential Oils; Fuller Study of the Neutral Sulphite Method for Determining some* — S. S. Sadtler. J. Amer. Chem. Soc., 1905, 27, 1321—1327.

The author describes some further work on his method for the determination of some aldehydes and ketones in essential oils, by titrating the alkali produced by the action on the oil, of normal sodium sulphite (this J., 1904, 303, 387). Reference is made to a paper by Burgess (this J., 1901, 1176; 1904, 387), and the author confirms most of the results obtained by that author, but finds that carvone reacts with 2 mols. of sulphite instead of with 1 mol., as stated by Burgess, whilst citronellal does not react at all, any slight action observed being probably due to the presence of small quantities of citral. Of the compounds examined, citral, cinnamic aldehyde, carvone, pulegone and formaldehyde each reacted with 2 mols. of sulphite, and benzaldehyde and vanillin each with 1 mol., whilst citronellal, camphor, menthone and fenchone did not react at all. In the determination of benzaldehyde, the reaction must be carried out entirely in the cold and with violent agitation. A relatively large quantity of rosolic acid or phenolphthalein must be added, and the titration with acid must be continued until the very faint pink colour completely disappears. The solution should be allowed to stand overnight to see if any additional alkali is formed.—A. S.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(Continued from page 1131.)

*Radio-active Element; New* —, *Emitting Thorium-Emanation*. O. Hahn. Ber., 1905, 38, 3371—3375.

This substance is separated from the barium-radium mixture by treating each radium fraction with a drop of ferric chloride and precipitating with ammonia. Repetition of this treatment effected a satisfactory separation of the new element from radium, and precipitation by ammonium carbonate in excess was resorted to in order to separate it from iron. The small quantity available prevented exact separation, and the final product was a dirty-brown, obviously not uniform, substance, yielding 700,000 times as much emanation as ordinary thorium. It is not thorium X, for its activity is not lessened even after six months; but thorium X seems to be the first product of its disintegration, and can be separated from the portion of constant activity by precipitation with ammonia. The emanation gave a value for  $\lambda$ , the disintegration-constant, of  $1.3 \times 10^{-2}$ , or falls to half value in 53.3 seconds. It gives very marked appearances in the dark room on a zinc sulphide screen; it rises in air, while the radium-emanation sinks. After igniting the substance no emanation is for the time being observed, but the total activity is increased; the same is the result of immersing the substance in liquid air. The substance is not self-luminous, but the glass vessel containing it fluoresces visibly in a dark room. Substances brought near to it become strongly radio-active by induction, and show the scintillation of the  $\alpha$ -rays brilliantly. The constant for the falling off of this induced activity is  $\lambda = 1.82 \times 10^{-5}$ ; the time of falling to half value is 10.6 hours. The chemical properties of the substance have been little investigated, owing to the small amount available, but it appears to belong to the rare earths. The author calls it "Radiothorium," and regards it as the cause of the activity of ordinary thorium compounds, thorium itself being inactive. (See also this J., 1905, 640.)—J. T. D.

*Phenolic Compounds Insoluble in Aqueous Alkalis; A Class of* — M. Rogow. J. prakt. Chem., 1905, 72, 315—322.

THE condensation of the three hydroxybenzaldehydes

and also of vanillin, with  $\beta$ -naphthol or  $\beta$ -naphthylamine produces a series of phenolic compounds, substituted dinaphthoxanthenes and dinaphthacridines, which are insoluble in cold solutions of alkali hydroxides, and only very sparingly soluble in hot solutions.—T. F. B.

*Esterification; Studies on* —. A. Bogojawlensky and J. Narbuntt. Ber., 1905, 38, 3344—3353.

THE authors have studied the influence of various water-absorbing salts on the limits of the esterification equilibria between a large number of organic acids and ethyl alcohol when boiled for several hours. The majority of the experiments were made with dehydrated copper sulphate and potassium pyrosulphate, but a few observations are recorded for the dehydrated sulphates of other metals. The heat necessary for the expulsion of the water of crystallisation, had also a tendency to liberate sulphuric anhydride from certain of these sulphates, the presence of which had an important effect in raising the limits of esterification. The influence of the dehydrated salt alone was determined in such cases by purifying the salt after heating, by extraction with alcohol. The investigations have shown that potassium pyrosulphate has a favourable influence in increasing the yields of esters both with aliphatic and aromatic acids, but that copper sulphate only affords good results in the case of acids of the aliphatic series. In nearly all cases the presence of a little free sulphuric acid in addition to the dehydrated salt raises the limit of esterification beyond that obtained with the acid or the salt alone, and this effect is so marked that a mixture of copper sulphate and free sulphuric acid gives good yields of esters even with acids of the aromatic series. The quantity of dehydrating agent employed was always rather more than was necessary to absorb the water liberated in the course of the reaction.—J. F. B.

## New Books.

**SOILS AND FERTILIZERS.** By HARRY SNYDER, Professor of Agricultural Chemistry, University of Minnesota, &c. Second Edition. The Chemical Publishing Co., Easton, Pa., 1905. Price \$1.50.

8vo volume, containing 287 pages of subject matter, and the alphabetical index. There are 40 illustrations. The entire subject is classified as follows:—I. Physical Properties of Soils. II. Geological Formation and Classification of Soils. III. Chemical Composition of Soils. IV. Nitrogen of the Soil and Air, Nitrification and Nitrogenous Manures. V. Farm Manures. VI. Fixation. VII. Phosphate Fertilizers. VIII. Potash Fertilizers. IX. Lime and Miscellaneous Fertilizers. X. Commercial Fertilizers. XI. Food Requirements of Crops. XII. Rotation of Crops. XIII. Preparation of Soils for Crops. XIV. Laboratory Practice.

**THE ELEMENTS OF PHYSICAL CHEMISTRY.** By J. LIVINGSTON R. MORGAN, Ph.D., Professor of Physical Chemistry, Columbia University. Third Edition. John Wiley and Sons, New York; Chapman and Hall, Ltd., London. 1905. Price 12s. 6d. nett.

12mo volume, containing 502 pages of matter and the alphabetical index. There are 21 illustrations. The text is subdivided as follows:—I. Introductory Remarks. II. The Gaseous State. III. The Liquid State. IV. The Solid State. V. The Phase Rule. VI. Solutions. VII. Thermo-chemistry. VIII. Chemical Change. IX. Electro-chemistry.

**TECHNICAL METHODS OF ORE ANALYSIS.** By ALBERT H. LOW, B.S. John Wiley and Sons, New York; Chapman and Hall, Ltd., London. 1905. Price 12s. 6d.

8vo volume, containing 264 pages of subject matter, with a Supplementary Note covering two additional pages. There is an alphabetical index of subjects, and in the text 14 illustrations. The subject matter is classified as follows:—I. Apparatus. II. Electrolysis. III. Logarithms. IV. Aluminium. V.—VIII. Antimony; Arsenic; Barium; and Bismuth. IX.—XIX. Cadmium; Calcium; Chlorine; Chromium; Copper; Iron; Lead; Magnesium; Manganese; Mercury; Molybdenum. XX.—XXIX. Nickel and Cobalt; Phosphorus; Potassium and Sodium; Silica; Sulphur; Tin; Titanium; Tungsten; Uranium and Vanadium; Zinc. XXX. Combining Determinations. XXXI. Boiler Water. XXXII. Coal and Coke. XXXIII. Testing Crude Petroleum. A series of tables is given on pages 249—259.

**DIE MIKROSKOPIE DER TECHNISCH VERWENDETEN FASERSTOFFE.** Ein Lehr- und Handbuch der Mikroskopischen Untersuchung der Faserstoffe, Gewebe und Papiere. Bearbeitet von Dr. FRANZ RITTER v. HÖHNEL, K.K. Professor an der technischen Hochschule in Wien. 2<sup>te</sup> Auflage. A. Hartleben's Verlag. Wien und Leipzig. 1905. Price M.6.

8vo volume, containing 234 pages of subject matter, 6 pages with references to literature, and the alphabetical index of names and subjects. There are 94 illustrations. The arrangement of the matter is as follows:—I. Vegetable Fibres. II. Animal Wools, Fur and Hairs. III. Fibres resembling Silk, Mineral Fibres, Artificial Silk. Finally, an Index to the Literature of the Subject.

**BIBLIOTHEK DES BETRIEBSLEITERS. ERSTER BAND.** Die Betriebsmittel der Chemischen Technik, von Dr. GUSTAV RAUTER. Dr. Max Jänecke's Verlagsbuchhandlung. Osterstrasse. Hannover. 1905. Price M.13, Bound M. 14.

THIS work forms the first volume of a series to be devoted to Chemical Engineering. It fills a large 8vo volume, occupying 537 pages, with 617 illustrations, and followed by an alphabetical index. The subject matter is subdivided and classified as follows:—A. General and Introductory. B. Building. C. Furnaces and Firing, Heating Arrangements, Regenerators and Gas Firing Apparatus, Boilers, &c. D. Power Machinery. E. Machinery to be worked by transmitted Power. Transmission Power Pumps, Compressors, &c. F. Materials and Appliances of various kinds for fitting up plant and machinery. G. Chemical Apparatus, in the more limited sense, such, e.g., as Filter-presses, Hydraulic Presses, Crystallisation Apparatus, Centrifugal Machines, &c.

## Trade Report.

(Continued from page 1135.)

### I.—GENERAL.

**IMPORT DUTIES; COLONIAL** —. 1905. [Cd. 2627].

This return relating to the rates of import duties levied upon various articles imported into the British Colonies, is sub-divided as follows:—Yarns and thread; woven manufactures; metals; earthenware and porcelain; bricks and tiles; glass and glassware; hides, skins and leather; indiarubber and guttapercha; paper, &c.; paints, colours and varnishes; chemicals; dyeing and tanning materials; oils, fats, resins, &c.; earth, stone, minerals, &c.; animals and other live stock; food; wood and timber; miscellaneous articles.

In the appendix are given rates of duty in the British Protectorates and in Cyprus.



## III.—TAR PRODUCTS, PETROLEUM, Etc.

## PETROLEUM INDUSTRY AT BAKU.

*Bd. of Trade J., Nov. 9, 1905.*

H.M. Consul at Batoum reports that the areas recently laid waste by fires are being rapidly built over, about 150 new derricks being already erected on the Balakhani field. At Romani and Sabunchi the work of restoration is being actively carried on. All oil and water pipe-lines, storage accommodation, engines, pumps and boiler houses, are being overhauled and repainted, and otherwise placed in a state of efficiency.

The Governor-General has promised to comply with certain suggestions made by the Council of Petroleum Producers for safeguarding the workers on the oil fields, and it has been decided to resume work.

## VII.—ACIDS, ALKALIS, Etc.

## SULPHUR IN JAPAN.

*Eng. and Mining J., Oct. 28, 1905.*

The sulphur output of Japan has grown from 10,000 tons in 1900 to above 20,000 tons in 1904, and is likely to grow still further. Domestic consumption takes only a quarter of the output, the consuming industries being the manufacture of matches, explosives and chemicals. As the price of native sulphur advances, pyrites is being imported, the supply coming mainly from Australia.

Exports amount to 14,000 or 15,000 tons per year, the western coast of the United States and Australia being the largest consumers; Hakodate is the usual shipping port, although Kobe and Nagasaki ship small quantities to China.

Recent quotations have been 3*l.* 10*s.* per ton for the best grades, and 3*l.* 2*s.* for inferior grades, with variation of 2*s.* per ton, according to method of packing.

In northern Japan, snow interrupts activities for five months in the year. The ore is put into iron receptacles and heated to 115° C. The Mitsui company, a few years ago, introduced modern Gill's furnaces such as are used in Sicily.

The yield of sulphur from Japanese ore is probably the highest in the world. It reaches 50 per cent. in the north, where ore of less than 38 per cent. is rejected. In Sicily, with modern furnaces, 20 per cent. ore is considered workable.

## X.—METALLURGY.

## INVAR: U.S. CUSTOMS DECISION.

*Oct. 27, 1905.*

The Board of General Appraisers overruled the assessment of duty at 45 per cent. *ad valorem* under paragraph 193 as "manufactures of metal" on certain *invar*, a newly introduced alloy of nickel and steel. The claim of the importers that it was dutiable at 6 cents per lb. as an "alloy in which nickel was the component material of chief value" under paragraph 185, was sustained.—R. W. M.

## FERRO ALLOYS: U.S. CUSTOMS DECISION.

Following a decision of the United States Circuit Court of Appeals which was acquiesced in by the Treasury Department, the Board of General Appraisers held that ferro chrome, ferro phosphate, ferro titanium, ferro tungsten, ferro vanadium and other similarly constituted materials, are dutiable by similitude to ferro manganese at 4 dols. per ton under paragraph 122 of the tariff. The Court overruled the assessment of duty at 20 per cent. *ad valorem* under paragraph 183 as "metals unwrought," on the ground that the articles were not capable of being wrought by themselves.—R. W. M.

## XII.—FATS, FATTY OILS, Etc.

## COCOANUT OIL: U.S. CUSTOMS DECISION.

*Oct. 17, 1905.*

The Treasury Department has decided not to appeal from the decision of the United States Circuit Court making refined cocoanut oil free of duty as "cocoanut oil" under paragraph 626 of the tariff. Duty had been assessed as "cocoa butterine," at 3½ cents per lb., under paragraph 282.—R. W. M.

## OLIVE OIL: U.S. CUSTOMS DECISION.

*Oct. 25, 1905.*

Olive oil, intended for use as a table oil after refining and blending with cottonseed oil, is free of duty as "olive oil for manufacturing or mechanical purposes, fit only for such use," under paragraph 626 of the tariff. The Board held that at the time of importation the oil was unfit for use as food and hence not subject to duty.

—R. W. M.

## CASTOR OIL PRODUCTION OF CAPE COLONY.

*Bd. of Trade J., Nov. 2, 1905.*

The "Agricultural Journal" of the Cape of Good Hope remarks that the constant appearance of the castor oil plant as a weed in the waste lands of the Colony, has more than once directed attention to the possibility of its profitable cultivation for commercial purposes, but nothing very definite ever seems to have been attempted. There are initial difficulties in the way, and an industrial problem has to be faced as well; but when it is considered that the Railway Department of the Colony alone spends some 8,000*l.* a year on castor oil for lubricating purposes, there should be some prospect of a fair return if the question were dealt with in a business-like manner. The Railway Department is prepared, if it could obtain a supply of suitable castor oil produced in the Colony, to give a small preference in point of price over the imported article in order to encourage the industry. An investigation as to the varieties most suitable is to be initiated next year.

## XIIIB.—RESINS, VARNISHES, Etc.

## SOAP VARNISH IN THE NETHERLANDS; EXEMPTION FROM IMPORT DUTY OF —.

*Bd. of Trade J., Nov. 2, 1905.*

A Dutch Royal Decree dated 11th September, 1905, exempts from import duty, subject to certain conditions, soap varnish imported for the exclusive purpose of varnishing metal objects in factories, &c.

## XVI.—SUGAR, STARCH, Etc.

STARCH; ARROWROOT —: U.S. CUSTOMS DECISION.  
*Oct. 25, 1905.*

The United States Circuit Court decided that ordinary arrowroot, chiefly used for infants' food and in the manufacture of medicinal preparations, is dutiable as "starch," at 1½ cents per lb., under paragraph 285 of the tariff. The claim of the importer for free entry under paragraph 478, as "arrowroot in its natural state and not manufactured" was overruled.—R. W. M.

## XVII.—BREWING, WINES, SPIRITS, Etc.

## ALCOHOLIC COMPOUND [FORTIFIED LEMON JUICE]: U.S. CUSTOMS DECISION.

On June 15th, 1892, the United States Circuit Court held that lemon juice fortified by the addition of 7-5 per cent. of alcohol was free of duty as "lemon juice," under

paragraph 543 of the tariff of 1883. The assessment of duty at 2 dols per gal. and 25 per cent. *ad valorem*, under paragraph 103 of the same tariff act was overruled on the ground that the addition of the alcohol did not destroy the identity of the article as lemon juice. The Treasury Department has acquiesced in this decision.—R. W. M.

### XVIII.—DISINFECTANTS.

#### SHEEP DIP: U.S. CUSTOMS DECISION. Oct. 18, 1905.

Little's Sheep Dip, a compound of coal tar distillates, rosin, rosin oil, soap and water, is dutiable at 20 per cent. *ad valorem*, as a "preparation of coal tar, not a colour or dye," under paragraph 15 of the tariff. The claim of the importer that it was free of duty as "sheep dip," under paragraph 657 was overruled on the ground that it was used for purposes other than dipping sheep and was recommended for internal use for horses. The assessment of duty at 25 per cent. *ad valorem*, as a "chemical compound" under paragraph 3, was also overruled and the duty fixed as above stated. Another importation of a similar article, known as *sulfo breol argentino* was the subject of another decision to the same effect.—R. W. M.

## Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

### I.—PLANT, APPARATUS, AND MACHINERY.

(Continued from page 1136.)

- [A.] 22,049. Foster. Structures for the cooling of liquids. Oct. 30.
- „ 22,063. Carmichael and Sharman. *See under II.*
- „ 22,106. Meyersberg. Process for compressing air or gases. Oct. 30.
- „ 22,125. Tejada. Developing power and heat from highly explosive substances and apparatus therefor.\* Oct. 30.
- „ 22,385. Cumming. Condensing plant. Nov. 2.
- „ 22,849. Hörig. Mechanical stirrers or agitators.\* Nov. 7.
- „ 22,878. Perkins and Kitchen. Coolers or condensers. Nov. 8.
- „ 22,914. Sulman and Picard. *See under X.*
- „ 22,933. Elmore. Separating certain constituents of finely divided material by causing them to rise or float in a liquid. Nov. 8.

- [A.] 22,965. Ramsden. Cooling and heating liquids. Nov. 9.
- „ 23,139. Howson. Muffle kilns and the like. Nov. 10.
- „ 23,185. Marsh and Parratt. Apparatus for evaporating liquids. Nov. 11.
- [C.S.] 24,785 (1904). Wilton and Wilton. Furnaces. Nov. 15.
- „ 25,611 (1904). Brooke. Apparatus for purifying liquids. Nov. 8.
- „ 28,396 (1904). Mathieson. Evaporators, feed heaters and condensers. Nov. 8.
- „ 28,951 (1904). Lennox. *See under XVII.*
- „ 29,217 (1904). Griffith. Apparatus for use in purifying water and other liquid. Nov. 15.
- „ 1138 (1905). Allen and Allen. Jet condensers. Nov. 8.
- „ 2653 (1905). Jones. Furnaces. Nov. 15.
- „ 5953 (1905). Elmore. Process for separating certain constituents of finely divided material by causing them to rise or float in a liquid. Nov. 8.
- „ 10,404 (1905). Hayes. Devices for vaporising liquids. Nov. 15.
- „ 14,854 (1905). Cooke and Kelly. Process and apparatus for dehydrating animal and vegetable substances. Nov. 15.
- „ 14,855 (1905). Cooke and Kelly. Process and apparatus for dehydrating animal and vegetable products. Nov. 15.
- „ 15,808 (1905). Wüstenhöfer. Disintegrating mills or machines. Nov. 8.
- „ 20,214 (1905). Haslam. Funnels. Nov. 8.

### II.—FUEL, GAS, AND LIGHT.

(Continued from page 1136.)

- [A.] 22,045. Cleland's Graving Dock and Slipway Co., Ltd., and Roxburgh. Gas producers. Oct. 30.
- „ 22,063. Carmichael and Sharman. Apparatus for drying peat and like substances. Oct. 30.
- „ 22,295. Gourlay. Incandescent gas mantles. Nov. 1.
- „ 22,382. Bowmer. Suction gas producers. Nov. 2.
- „ 22,512. Newton. Apparatus for the production and purification of gases. Nov. 3.
- „ 22,565. Wilkinson. Producing and utilising mixtures of coal gas and air for lighting, heating and power purposes. Nov. 4.
- „ 22,677. The International Patent Fuel Syndicate, Ltd., and Shedlock. Artificial fuel and the manufacture thereof.\* Nov. 6.
- „ 22,974. Hutchins and Wilkie. Producer gas generators. Nov. 9.
- „ 22,981. Wagner. Coking the binding material, soluble in water, used in the manufacture of briquettes, to enable the briquettes to resist the action of the weather. Nov. 9.
- „ 23,097. Siemens und Halske Akt.-Ges. Manufacture of incandescence bodies for electric light. [Ger. Appl., Nov. 15, 1904.]\* Nov. 10.
- „ 23,100. Bäcker. Gas generating furnaces.\* Nov. 10.
- [C.S.] 24,308 (1904). Redman and Redman. Inclined retorts. Nov. 8.
- „ 1843 (1905). Grice. Gas producing plant. Nov. 15.



[C.S.] 8918 (1905). Genty, and Soc. Nouv. des Etablissements de l'Horme et de la Buire. Gas producers. Nov. 15.

" 11,237 (1905). Baum. Washing of coal, ore, and the like. Nov. 8.

" 13,263 (1905). Harder. Furnaces for burning producer gas. Nov. 15.

" 14,061 (1905). Shrewsbury. Process for producing compressed non-porous bricks or briquettes of coke. Nov. 15.

" 17,871 (1905). Lake (Gasglühlicht Ges. Hamburg). Incandescing bodies for incandescent gas lighting. Nov. 15.

" 19,539 (1905). Van der Heyden. Manufacture of briquettes of coal dust or powdered peat. Nov. 15.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(Continued from page 1136.)

[A.] 22,759. Tatam and Bywater. Method of gasifying and destructively distilling carbonaceous materials by the aid of commercially pure oxygen in conjunction with steam or other gases. Nov. 7.

" 23,070. Beardmore and Co., Ltd., and Moore. Process for the purification of tars.\* Nov. 10.

[C.S.] 28,243 (1904). Macalpine. Refining mineral or petroleum oils. Nov. 15.

" 2840 (1905). Pettigrew. *See under VII.*

### IV.—COLOURING MATTERS AND DYESTUFFS.

(Continued from page 1136.)

[A.] 22,398. Holliday and Sons, Ltd., Turner and Dean. Manufacture of black colouring matters. Nov. 2.

" 22,412. Sachs. Manufacture of aminophenols. Nov. 2.

" 22,513. Holliday and Sons, Ltd., Turner and Dean. Manufacture of blue and black colouring matters. Nov. 3.

" 22,519. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing halogen. Nov. 3.

" 22,736. Johnson (Kalle und Co.). Manufacture of organic compounds containing sulphur and of red colouring matters therefrom. Nov. 6.

" 22,738. Ellis (Chem.-Fabr. vorm. Sandoz). Manufacture of new azo dyestuffs. Nov. 6.

" 23,034. Kalle and Kalle. Manufacture of o-oxy-monoazo dyes of the naphthalene series. [Ger. Appl. Nov. 28, 1904].\* Nov. 9.

" 23,122. Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable solid alkali salts of indigo white.\* Nov. 10.

[C.S.] 25,998 (1904). Ransford (Cassella und Co.). Nitroso compounds and blue dyestuffs therefrom. Nov. 8.

" 847 (1905). Newton (Bayer und Co.). Manufacture of new tetrazo dyestuffs. Nov. 8.

" 19,200 (1905). Badische Anilin und Soda Fabrik. Manufacture of anthraquinone derivatives. Nov. 15.

" 21,746 (1905). Johnson (Badische Anilin und Soda Fabrik). Production of halogenated indigo white. Nov. 15.

### V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

(Continued from page 1137.)

[A.] 22,101. Loring. Apparatus for producing and distributing a gaseous bleaching medium. Oct. 30.

" 22,301. The Calico Printers' Association, Ltd., and Warr. Treatment of certain seaweeds for the production of a thickening suitable for calico printing and other purposes. Nov. 1.

" 22,331. Johnson (Badische Anilin und Soda Fabrik). Production of stable dyeings. Nov. 1.

" 22,377. Shackleton. Treatment of wool washing and like refuse. Nov. 2.

" 22,756. Baker and Lockett. Wallpaper printing machines. Nov. 7.

" 22,827. Miller. Treatment of woven, knitted, and similar fabrics. Nov. 8.

" 22,870. Pickup and Knowles. Machines for printing fabrics. Nov. 8.

" 23,050. Klug. Dyeing apparatus. Nov. 10.

[C.S.] 28,733 (1904). Newton (Bayer und Co.). New artificial silk. Nov. 8.

" 28,951 (1904.) Lennox. *See under XVII.*

" 29,501 (1904). Johnson (Badische Anilin und Soda Fabrik). Dyeing and printing. Nov. 15.

" 1745 (1905). Bloxam (Verein. Glanzstoff-Fabr., A.-G.). Manufacture of films, threads, or other forms of cellulose. Nov. 15.

" 2460 (1905). Annand. Rotary web printing machines. Nov. 8.

" 8046 (1905). Atkinson, and Calico Printers' Association, Ltd. Production of photo-engraved surfaces for printing textile fabrics. Nov. 8.

" 16,453 (1905). Jeschke. Production of a yarn warp of several colours in one piece of work. Nov. 8.

" 21,538 (1905). Johnson (Badische Anilin und Soda Fabrik.). Manufacture of formaldehyde sulphoxylate. Nov. 15.

### VII.—ACIDS, ALKALIS, AND SALTS.

(Continued from page 1137.)

[A.] 28,992a (1904). Atkinson. *See under X.*

" 22,080. Cellarius. Manufacture of sulphuric acid. Oct. 30.

" 22,225. Feldkamp. *See under XX.*

" 22,570. Holden and Clayton. Purification of sulphur. Nov. 4.

" 22,755. Shaw. Lime kilns. Nov. 7.

[C.S.] 24,198 (1904). Howles. Utilisation of crude sulphides of arsenic. Nov. 8.

" 2840 (1905). Pettigrew. Self-discharging saturator for sulphate of ammonia and other salts. Nov. 15.

" 8642 (1905). Römer. Decomposition of chrome iron ore by alkaline carbonates. Nov. 15.

" 14,409 (1905). Biguet. Process and apparatus for the extraction of arsenious acid from ores. Nov. 15.

" 21,538 (1905). Johnson (Badische Anilin und Soda Fabrik). *See under V.*

## VIII.—GLASS, POTTERY, AND ENAMELS.

(Continued from page 1137.)

- [A.] 22,520. Pilkington. Manufacture of plate or sheet glass and apparatus therefor. Nov. 3.
- „ 23,086. Munford (Mount). Recuperative continuous glass melting furnace. Nov. 10.
- [C.S.] 28,930 (1904). Comings. Enamelling metal work. Nov. 15.
- „ 13,788 (1905). Marks (Colburn). Production of sheet glass. Nov. 15.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(Continued from page 1137.)

- [A.] 22,253. Geoffray, Jacquet and Guillermin. Process for the agglomeration of natural or artificial pumices. Oct. 31.
- „ 22,787. Watson. Manufacture of bricks from clinker and lime. Nov. 7.
- „ 23,183. Haskin. Curing or maturing and preserving wood. Nov. 11.
- [C.S.] 3669 (1905). Henke. Process of producing a heat insulating medium. Nov. 8.
- „ 16,744 (1905). Kochmann and Kaufmann. Manufacture of substances capable of resisting water and chemical and similar influences. Nov. 8.

## X.—METALLURGY.

(Continued from page 1137.)

- [A.] 28,992<sub>A</sub> (1904). Atkinson. Collection of arsenic in the treatment of refractory ores. Oct. 30.
- „ 22,130. Hadfield. Manufacture of magnetic materials. [U.S. Appl., June 8, 1905.]\* Oct. 30.
- „ 22,235. Baker and Smith. Treatment of sulphide ores. Oct. 31.
- „ 22,238. Wedge. Preparing iron pyrites for desulphurisation.\* Oct. 31.
- „ 22,415. Atkinson. Treatment of refractory ores containing iron. Nov. 2.
- „ 22,455. Wheatley. White metal alloy. Nov. 2.
- „ 22,456. Wheatley. Red coloured metallic alloy. Nov. 2.
- „ 22,537. White. Treatment of tin ores. Nov. 3.
- „ 22,825. Gardeur. Extraction of metals from their ores. Nov. 7.
- „ 22,843. Butterfield. Treatment of ores containing zinc and other metals as sulphides. Nov. 7.
- „ 22,900. Enke. Sulphatisation of ores and their by-products.\* Nov. 8.
- „ 22,914. Sulman and Picard. Dry crushing and treatment of ores and other granular or pulverulent materials. Nov. 8.
- „ 22,933. Elmore. *See under I.*
- „ 23,138. The Metals Corporation, Ltd., and Cowper-Coles. *See under XI.*
- [C.S.] 26,093 (1904). Lindermann. Crucible steel smelting furnaces and the like. Nov. 8.

- [C.S.] 4388 (1905). Denison. Ore washing machinery. Nov. 15.
- „ 5367 (1905). Hudson. Manufacture of charcoal iron and steel. Nov. 15.
- „ 5953 (1905). Elmore. *See under I.*
- „ 7698 (1905). Sandberg. Manufacture of steel for railway and tramway rails. Nov. 15.
- „ 11,237 (1905). Baum. *See under II.*
- „ 14,409 (1905). Biguet. *See under VII.*
- „ 16,643 (1905). Hernándthaler ung. Eisenind A.-G., and Primosigh. Treatment of iron ores. Nov. 15.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(Continued from page 1137.)

- [A.] 22,460. Yasuda. Electrodes. [U.S. Appl., Jan. 21, 1905.]\* Nov. 3.
- „ 22,740. Cowper-Coles. Electrolytic deposition of metals. Nov. 6.
- „ 22,901. Bagnall. Electroplating vats.\* Nov. 8.
- „ 23,138. The Metals Corporation, Ltd., and Cowper-Coles. Electrolytic refining of copper. Nov. 10.
- [C.S.] 12,105 (1905). Meyenberg. Insulating material and process of preparing the same. Nov. 15.
- „ 15,257 (1905). Gardiner and Stringfield. Storage battery electrode. Nov. 15.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

(Continued from page 1137.)

- [A.] 22,159. Paul and Seidler. Process for deodorising fish oils, train oils, and products of similar origin. Oct. 31.
- „ 22,241. Haddan (Edson Reduction Machinery Co.). Apparatus for rendering or reducing matter capable of yielding grease or oil.\* Oct. 31.
- „ 22,242. Haddan (Edson Reduction Machinery Co.). Process for reducing vegetable or animal matter.\* Oct. 31.
- „ 22,942. Macherski and Koperski. Preparation for uncolouring oils, fats, resins, syrups, varnishes, and the like. Nov. 8.
- [C.S.] 17,945 (1905). Bouit (Standard Oil Co.). Manufacture of composite paraffin wax candles. Nov. 8.

## XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(Continued from page 1138.)

(A.)—PIGMENTS, PAINTS.

- [A.] 22,252. Colignon. Manufacture of paint. [Fr. Appl., Nov. 26, 1904.]\* Oct. 31.
- „ 22,427. Brindley. Manufacture of ferric oxide pigments. Nov. 2.

(B.)—RESINS, VARNISHES.

- [A.] 22,942. Macherski and Koperski. *See under XII.*
- [C.S.] 23,679 (1904). Dunnett. Composition for preventing the incrustation and preserving the hulls of ships. Nov. 8.



## (C.)—INDIA-RUBBER.

- [A.] 22,504. Körner. Process for the devulcanisation of vulcanised india-rubber. Nov. 3.  
 „ 23,163. Gare. Process of reclaiming old or waste vulcanised india-rubber. Nov. 11.  
 [C.S.] 2575 (1905). Gubbins. Method of and apparatus for treating rubber waste and the like. Nov. 8.

## XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

(Continued from page 1138.)

- [A.] 22,525. Collardon. Manufacture of plastic masses from casein and the like.\* Nov. 3.  
 [C.S.] 2453 (1905). Hunter. Process of treating bone. Nov. 8.

## XV.—MANURES, Etc.

(Continued from page 1138.)

- [A.] 22,403. Günther. Process for manufacturing fertilisers from waste organic matter. [Ger. Appl., Dec. 28, 1904.]\* Nov. 2.

## XVI.—SUGAR, STARCH, GUM, Etc.

(Continued from page 1138.)

- [A.] 22,422. Nicolai. Extraction of fruit sugar or levulose from chicory roots. Nov. 2.  
 „ 22,709. Classen. Process for facilitating the fermentation of sugar solutions obtained from wood that contains tannin. [Ger. Appl., Nov. 21, 1904.]\* Nov. 6.

## XVII.—BREWING WINES, SPIRITS, Etc.

(Continued from page 1138.)

- [C.S.] 23,277 (1904). Schrottky. Manufacture of material for use in the production of fermented liquors. Nov. 8.  
 „ 1337 (1905). Adlam. Apparatus for chilling and carbonating beer. Nov. 8.  
 „ 14,103 (1905). Rice. Art of producing malt. Nov. 15.  
 „ 15,250 (1905). Schneible. Art of brewing. Nov. 15.

## XVIII.—FOODS; SANITATION, WATER PURIFICATION; &amp; DISINFECTANTS.

(Continued from page 1138.)

## (A.)—FOODS.

- [A.] 22,785. Feilmann. Manufacture of new casein preparations. Nov. 7.  
 „ 23,009. Eybert and Eybert. Method of and apparatus for treating flour. [Fr. Appl., April 10, 1905.]\* Nov. 9.  
 [C.S.] 24,288 (1904). Livingstone (Stein). Process for making a product for use as food for animals and other purposes. Nov. 8.  
 „ 6457 (1905). Fränkel. Manufacture of a malt food. Nov. 15.

## (B.)—SANITATION; WATER PURIFICATION.

- [A.] 22,726. Harris. Water softening plant. Nov. 6.  
 [C.S.] 25,611 (1904). Brooke. See under I.  
 „ 28,646 (1904). Spence, and Spence and Sons, Ltd. Treatment and utilisation of sewage. Nov. 8.  
 „ 28,951 (1904). Lennex. Evaporator for evaporating the liquid in brewers' wash, sewage, waste or spent dyes and the like. Nov. 8.  
 „ 29,217 (1904). Grilith. See under I.

## XIX.—PAPER, PASTEBOARD, Etc.

(Continued from page 1138.)

- [A.] 22,718. Parker. Pulp and paper machinery. [U.S. Appl., April 17, 1905.]\* Nov. 6.  
 [C.S.] 1745 (1905). Bloxam (Verein. Glanzstoff-Fabr., A.-G.). See under V.  
 „ 9832 (1905). Heyes (Gen.-Direction der Grafen, Hugo, Lazy, H. A. von Donnersmark-Beuthen). Process of manufacturing paper. Nov. 15.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

(Continued from page 1138.)

- [A.] 22,094. Lidholm. Manufacture of compounds of acetylene and chlorine. [Appl. in Sweden, April 28, 1905.]\* Oct. 30.  
 „ 22,225. Feldkamp. Process of making oxalates and oxalic acid.\* Oct. 31.  
 „ 22,533. Merck, Merck, Merck and Merck. Preparation of concentrated solutions of thiosinamine. [Ger. Appl., Dec. 12, 1904.]\* Nov. 3.  
 „ 22,697. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of disulphonic acids of dianisidine and diphenetidine. Nov. 6.  
 [C.S.] 2566 (1905). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of dialkylated barbituric acids. Nov. 8.  
 „ 4958 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of a double salt of 1,3-dimethylxanthine and of 1,3,7-trimethylxanthine. Nov. 8.  
 „ 5353 (1905). Ellis (Merck). Manufacture of dialkylbarbituric acids. Nov. 15.  
 „ 10,927 (1905). Augier. Process for the production of bisulphide of carbon. Nov. 15.  
 „ 19,375 (1905). Ellis (Chem. Fabr. von Heyden, A.-G.). Manufacture of a new salicylic acid compound. Nov. 15.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(Continued from page 1044.)

- [A.] 22,580. Browne. Process of reproducing photographs in natural colours. Nov. 4.  
 „ 22,723. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Process of producing coloured photographs. Nov. 6.  
 „ 22,735. Pifer. Process of making photographic pictures, and sensitive plates therefor.\* Nov. 6.

- [A.] 23,109. Rieder. Production of photographic and other prints.\* Nov. 10.  
[C.S.] 11,452 (1905). Mercier. Means for developing photographic images. Nov. 8.

## XXII.—EXPLOSIVES, MATCHES, ETC.

*(Continued from page 1138.)*

- [A.] 22,125. Tejada. *See under I.*  
[C.S.] 5687 (1905). Schultz and Gehre. Manufacture of a safety explosive. Nov. 8

- [C.S.] 18,275 (1905). Castropoer Sicherheitssprengstoff. A.-G. Process of manufacturing mine-gas-proof safety explosives. Nov. 15.

## XXIII.—GENERAL ANALYTICAL CHEMISTRY.

*(Continued from page 1138.)*

- [A.] 22,919. The Cambridge Scientific Instrument Co., Ltd., and Burton Method and apparatus for estimating and recording the quality of gases. Nov. 8.



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### SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

The Sixth International Congress of Applied Chemistry will be held in Rome in April, 1906, during Easter week. All communications should be addressed to the General Secretary, Prof. Vittorio Villavecchia, Via Panisperna, 89, Rome.

Members are reminded that the subscription of 25s. for 1906, payable on January 1st next, should be sent in good time to the Hon. Treasurer (Mr. Samuel Hall) in order to ensure continuity in the receipt of the Society's Journal. Any changes of address for the new List of Members now in course of preparation should reach the General Secretary not later than January 31st, 1906.

### DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882—1895), a volume of 550 pages, was published in 1899: a few copies of this are still left, price 10s. A second volume, embracing the period 1896—1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10s. each copy. A form of application for this purpose will shortly be issued.

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### London Section.

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### THE TEMPERATURE OF COMBUSTION OF METHANE IN THE PRESENCE OF PALLADIUMISED ASBESTOS.

BY H. G. DENHAM, M.A.

For the determination of the amount of hydrogen present in a gaseous mixture by passing it over palladiumised asbestos, most of the text books recommend the heating of the capillary tube with a naked flame, but state that a visible redness or softening of the glass must be avoided. The question immediately presents itself whether, even if these conditions are complied with, considerable quantities of methane may not be burnt, and the analysis vitiated. It was to determine to what extent methane is burnt when passed over palladium asbestos in presence of oxygen that the following experiments were carried out.

#### Literature.

In Winkler's "Handbook of Technical Gas Analysis," (2nd edition, translated by Lunge), it is stated that "methane is not burnt at all," when passed over palladium asbestos kept heated by a naked flame, and even in the presence of considerable excess of easily combustible gases, there is no methane, or at most, extremely slight traces of it burned along with them.

Hempel ("Gas Analytische Methoden" (1900) p. 160), mentions that methane, passed with oxygen through a capillary tube containing palladium asbestos does not burn at all up to 100° C. The combustion begins at about 200° C. A mixture of 29.3 c.c. of methane and 70.6 c.c. of oxygen at a temperature of 200°—220° C. gave a contraction of 3 c.c. Summing up, he says that "if the temperature be higher than 200° C., a portion of the methane is burnt as well as the hydrogen."

In a thesis by F. C. Phillips (Amer. Chem. Journ. 16, 163—187), the temperature of oxidation of methane by palladiumised asbestos is given as 404°—414° C. He also



states that, as the temperature rises, a point is reached at which a minute and scarcely recognisable trace of carbon dioxide appears. After this slow oxidation has continued for some time with a gradual increase of temperature of  $20^{\circ}$ – $30^{\circ}$ , a sudden and intense reaction occurs. A variation in the proportion of inflammable gas and air does not seem to affect the oxidation temperature.

Shortly before the completion of these investigations, a paper on the "Fractional Combustion of Gases containing Hydrogen by means of Heated Palladium Wire" was published by F. Richardt (J. f. Gasbeleucht., 47, 566–570 and 590–595, abstract in *Gas Lighting Journal*, July, 1904, p. 254). The author found that an appreciable amount of oxidation of the methane did not set in till a temperature of  $600^{\circ}$  was reached,  $150^{\circ}$  higher than that recorded by Phillips, when palladiumised asbestos was used. The proportion of methane made no difference. Mixtures of methane and hydrogen in the proportion of 2:3 were then tried, and it was found that the presence of hydrogen did not affect the oxidation temperature of the methane. Thus for fractional combustion of hydrogen, the temperature must not exceed  $500^{\circ}$ – $600^{\circ}$  C. He also studied the effect of passing the gas over a heated palladium wire at an increased rate, sufficient time, however, being allowed for heating. At  $600^{\circ}$ , 1.3 per cent. of methane had originally been burnt, but at the increased rate, this amount was not burnt till  $800^{\circ}$  was reached. At a lower speed the curves for the oxidation of methane and air, and methane, hydrogen and air were sensibly the same, but at a higher speed they were different. Richardt concludes that palladium wire exerts no catalytic influence on methane below  $450^{\circ}$ , but between  $450^{\circ}$  and a red heat sensible quantities are burnt if the contact is sufficiently prolonged. If the gaseous mixture is led over slowly, the combustion of methane is not affected by the presence of hydrogen, but at a higher rate the heat due to the hydrogen causes the natural retardation to disappear. He also condemns the use of palladium asbestos in favour of the wire, which he finds more amenable to control and more reliable.

#### Scope of Present Enquiry.

a. Temperature of combustion of methane and oxygen when in the proportion of 1 vol. of methane to 2 vols. of oxygen.

b. Influence of a change in the speed at which the gases are passed over the asbestos.

c. Influence of a change in the relative volumes of the gases.

d. Effect on the combustion temperature of methane when varying proportions of hydrogen are present.

e. A brief enquiry into the question as to how far the catalytic influence of the palladium is due to a superficial oxidation.

#### APPARATUS AND METHOD OF EXPERIMENT.

##### Preparation of Methane.

In the preliminary experiments, the methane was prepared from sodium acetate and caustic soda, but it was found that it was impossible to avoid the presence of traces of ethylene, a hydrocarbon which burns at a low temperature. Consequently this method was abandoned, and the gas prepared by the method of Parker and Tribe from pure methyl iodide. The apparatus was first well swept out with 12 litres of gas prepared by the previous method, and then by two litres of the gas prepared from methyl iodide. Analyses always gave a purity of 99 per cent.

The oxygen and hydrogen used were prepared electrolytically from pure dilute sulphuric acid, traces of hydrogen being removed from the oxygen by passage over heated palladium asbestos.

The heating bath consisted of a heavy iron vessel containing molten lead and shielded by asbestos walls, the hot gases rising up and circulating round the bath before their escape. The variation of temperature in the course of an experiment was very rarely  $3^{\circ}$ , often not  $0.5^{\circ}$ . A platinum resistance thermometer, on the model of Callendar's, was used for recording the temperature of the bath.

The method of experiment consisted in passing the gases through a tube containing palladium asbestos which was immersed in the lead bath. The burette work was carried

out over mercury. After the gases had been sent through the capillary four times each way, the burette was removed to a room, the temperature of which rarely varied  $2^{\circ}$  in a day, and the volume read after it had become constant. The carbon dioxide was then determined by absorption with potassium hydroxide. The method may be regarded as correct to 0.2 c.c.; consequently an absorption 0.1 c.c. has always been regarded as an experimental error.

The palladiumised asbestos was prepared from palladium foil according to the usual method.

#### Experimental Results.

a. Temperature of combustion of methane when in the proportion of one volume of methane to two volumes of oxygen.

The gas was generally passed four times each way over the asbestos. The third column denotes the number of minutes the gas took to complete these four passages.

Temp.	No. of Passages.	Minutes.	Volume before absorption of $\text{CO}_2$ .	Volume after absorption of $\text{CO}_2$ .	Result.
$^{\circ}\text{C}$ .			c.c.	c.c.	
390	4	18	32.7	32.7	No action
405	4	18	42.3	42.3	"
436	4	16	35.8	35.8	"
464	4	17	42.2	42.1	"
464	4	16	36.6	36.6	"
476	4	16	41.2	41.2	"
493	4	17	40.0	40.0	"
493	4	16	35.2	35.2	"
502	4	17	39.8	39.8	"
502	3	13	39.1	39.0	"
502	4	17	38.8	38.8	"
514	4	17	37.6	37.5	"
514	4	16	37.6	37.6	"
514	4	16	35.4	35.5	"
525	4	17	36.4	35.8	0.6 action
525	4	17	34.6	34.5	No action
525	4	16	34.6	34.4	0.2 action
535	4	16	32.2	32.2	No action
535	4	15	35.4	34.9	0.5 action
535	4	17	32.9	32.7	0.2 action
535	4	16	32.9	32.9	No action
544	4	15	31.45	31.3	0.15 action
547	4	17	38.4	38.0	0.4 action
547	4	17	37.6	36.7	0.9 action
547	4	17	35.9	35.2	0.7 action
553	3	11	38.5	37.8	0.7 action
558	4	16	33.4	33.0	0.4 action

All the experiments between  $490^{\circ}$ – $560^{\circ}$  are quoted. The temperature of initial oxidation is seen to lie between  $514^{\circ}$ – $546^{\circ}$ .

b. Influence of a change in the speed at which the gases are passed over the asbestos.

That the time of contact is an important factor in the reaction soon became evident, and hence a series of experiments at twice the previous speed, and one at half the previous speed was carried out. The previous speed was about 1 c.c. in  $3\frac{1}{2}$  seconds; hence the gas was in contact with the heated asbestos for a period of 2–4 seconds, quite sufficient for complete heating.

1. The proportions were as before, but the rate was doubled, 1 c.c. being sent over in  $1\frac{1}{2}$  seconds.

Temp.	No. of Passages.	Minutes.	Volume before absorption of $\text{CO}_2$ .	Volume after absorption of $\text{CO}_2$ .	Result.
$^{\circ}\text{C}$ .			c.c.	c.c.	
563	4	8	30.9	30.9	No action
563	4	$7\frac{1}{2}$	31.7	31.5	0.2 action
572	4	$8\frac{1}{2}$	35.3	35.3	No action
572	4	$8\frac{1}{2}$	37.3	37.1	0.2 action
578	4	8	33.2	33.3	No action
578	4	$8\frac{1}{2}$	35.3	35.0	0.3 action
579	4	$7\frac{1}{2}$	28.3	28.3	No action
579	4	$7\frac{1}{2}$	28.4	28.2	0.2 action
588	4	$8\frac{1}{2}$	30.5	30.5	No action
588	4	$8\frac{1}{2}$	33.3	33.2	"
588	4	8	28.6	28.6	"
611	4	8	28.8	28.8	"
611	4	8	31.8	31.4	0.4 action
611	4	$8\frac{1}{2}$	36.7	36.3	0.4 action
611	4	$8\frac{1}{2}$	33.6	32.9	0.7 action
611	4	$8\frac{1}{2}$	32.8	32.8	No action
611	4	$8\frac{1}{2}$	33.0	32.5	0.5 action
611	4	$8\frac{1}{2}$	38.2	37.6	0.6 action

The action appears to begin definitely a little above  $590^{\circ}$

2. Effect of decreasing the rate by one half, 1 c.c. being sent over in  $7\frac{1}{2}$  seconds.

Temp.	No. of Passages.	Minutes.	Volume before absorption of CO <sub>2</sub> .	Volume after absorption of CO <sub>2</sub> .	Result.
°C.			c.c.	c.c.	
515	4	16½	18.4	18.4	No action
515	4	17	18.8	18.8	"
515	4	16½	15.8	15.8	"
520	4	16½	18.7	18.7	"
520	4	15½	15.6	15.6	"
531	4	16½	15.5	15.5	"
531	4	15½	15.2	15.2	"
551	4	16	15.5	15.1	0.4 action
551	4	15½	16.6	16.5	No action
551	4	16½	17.9	17.6	0.3 action
562	4	16	16.7	16.7	No action
562	4	16½	15.7	15.3	0.4 action
562	4	16½	16.7	16.3	0.4 action

The temperature at which carbon dioxide is formed appears to be the same as in the first series of experiments, between 530—555°.

A distinct rise is to be noted in the temperature of oxidation, through decreasing the time during which the gas is in contact with the asbestos to  $1\frac{1}{2}$  seconds. This bears out the work of Richardt who observed a similar retardation.

The rise in temperature of oxidation amounts to 50°, and this can in no way be ascribed to improper heating of the gas.

With regard to the decreased rate, when the time of contact is greater, there appears to be no reduction of temperature. This points to the conclusion that the natural retardation noted by Mallard and Le Chatelier, and by Richardt is in no way overcome by giving the gas greater facilities for combustion.

Unfortunately, the tubes used would not stand a greater heat than 600°, and hence it was impossible to conduct experiments at a higher temperature.

c. Influence of a change in the relative volumes of the gases.

1. One volume of methane: three volumes of oxygen.

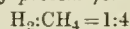
Temp.	No. of Passages.	Minutes.	Volume before absorption of CO <sub>2</sub> .	Volume after absorption of CO <sub>2</sub> .	Result.
°C.			c.c.	c.c.	
505	4	16½	37.0	37.0	No action
518	4	16½	35.4	35.4	"
518	4	18	39.6	39.6	"
531	4	17	36.4	36.4	"
546	4	16½	37.2	37.2	"
546	4	17	35.2	35.2	"
569	4	17½	36.8	36.5	0.3 action
569	4	17	37.7	37.6	No action
586	4	17	35.2	35.2	"
586	4	16½	33.1	33.1	"
605	4	16	32.4	32.4	"
605	4	16	31.5	31.5	"
622	4	17½	38.3	38.1	0.2 action
622	4	17	22.9	22.7	0.2 action
632	4	17	35.3	34.7	0.6 action
632	4	11	22.3	22.0	0.3 action
656	4	11	22.5	21.8	0.7 action
656	4	11	21.8	21.2	0.6 action

2. One volume of methane: one volume of oxygen.

Temp.	No. of Passages.	Minutes.	Volume before absorption of CO <sub>2</sub> .	Volume after absorption of CO <sub>2</sub> .	Result.
°C.			c.c.	c.c.	
545	4	10½	21.2	21.3	No action
545	4	10½	22.9	22.9	"
555	4	11½	23.4	23.4	"
565	4	11	22.8	22.6	0.2 action
565	4	11	23.9	23.8	No action
573	4	10½	21.8	21.8	"
573	4	10½	20.2	20.0	0.2 action
589	4	11	22.8	22.4	0.4 action
589	4	11	22.4	22.0	0.4 action
618	4	10	20.2	19.5	0.7 action
618	4	10	20.2	19.7	0.5 action

The temperature of combustion has in both cases risen considerably; when the ratio of CH<sub>4</sub>:O<sub>2</sub> is 1:3 the temperature is about 620°, when the ratio is 1:1, probably about 580°. In both cases the active mixture, consisting of 1 vol. of methane to 2 vols. of oxygen, is diluted to the extent of 33½ per cent., so that it is impossible to affirm that the temperature varies proportionally to the dilution. On plotting a curve for these temperatures, a well-defined minimum is obtained when the ratio is 1 vol. of methane to 2 vols. of oxygen.

d. Effect on the combustion temperature of methane when varying proportions of hydrogen are present; sufficient oxygen being present for complete combustion.



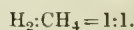
Temp.	No. of Passages.	Minutes.	Volume before absorption of CO <sub>2</sub> .	Volume after absorption of CO <sub>2</sub> .	Result.
°C.			c.c.	c.c.	
499	4	13	22.4	22.4	No action
499	4	17	32.1	32.1	"
514	4	14	26.1	26.0	"
514	4	14	25.9	25.7	0.2 action
530	4	14½	26.4	26.2	0.2 action
530	4	14	25.4	25.1	0.3 action
530	4	14	26.6	26.3	0.3 action

Temperature of combustion 510°—530°.



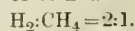
Temp.	No. of Passages.	Minutes.	Volume before absorption of CO <sub>2</sub> .	Volume after absorption of CO <sub>2</sub> .	Result.
°C.			c.c.	c.c.	
510	4	15	27.1	27.1	No action
610	4	15	26.9	26.9	"
503	4	14	28.6	28.4	0.2 action
503	4	14	27.7	27.6	No action
518	4	13½	28.3	28.1	0.2 action
618	4	14	27.65	27.7	No action
520	4	15	27.6	27.6	"
520	4	15	27.9	27.9	"
535	4	15	27.0	27.0	"
535	4	15	27.0	26.85	0.15 action
535	4	13	25.0	24.85	0.15 action
550	4	13	28.4	27.9	0.5 action
560	4	13	27.4	27.0	0.4 action
550	4	13	27.6	27.2	0.4 action

Temperature of Combustion 530°—550°.



Temp.	No. of Passages.	Minutes.	Volume before absorption of CO <sub>2</sub> .	Volume after absorption of CO <sub>2</sub> .	Result.
°C.			c.c.	c.c.	
505	4	12	18.0	17.9	No action
521	4	11½	17.3	17.2	"
521	4	12	17.8	17.8	"
528	4	12	16.5	16.5	"
528	4	12	16.4	16.4	"
528	4	11½	16.9	16.8	"
546	4	12	16.9	16.8	"
546	4	12	16.4	16.3	"
549	4	12	17.4	17.2	0.2 action
549	4	12	17.35	17.2	0.15 action
561	4	12	16.9	16.7	0.2 action
561	4	12	16.2	15.9	0.3 action

Temperature of combustion 545°—560°.



Temp.	No. of Passages.	Minutes.	Volume before absorption of CO <sub>2</sub> .	Volume after absorption of CO <sub>2</sub> .	Result.
°C.			c.c.	c.c.	
528	4	9	11.9	11.9	No action
558	4	10	11.8	11.8	"
558	4	9½	11.8	11.7	"
581	4	10	12.1	11.9	0.2 action
581	4	10	11.0	10.8	0.2 action
599	4	10	12.3	12.1	0.2 action

Temperature of combustion 570°—580°.



The temperature of combustion of methane and oxygen is  $514^{\circ}$ — $546^{\circ}$ ; on addition of 25 per cent. of hydrogen it is  $510^{\circ}$ — $530^{\circ}$ ; on addition of 50 per cent. of hydrogen it is  $530^{\circ}$ — $550^{\circ}$ ; on addition of 100 per cent. of hydrogen it is  $545^{\circ}$ — $560^{\circ}$ ; on addition of 200 per cent. of hydrogen it is  $570^{\circ}$ — $580^{\circ}$ . There is thus undoubted evidence that the addition of hydrogen in no way leads to a lowering of the temperature of oxidation of the methane. When 8 c.c. of hydrogen, 4 c.c. of methane, and 12 c.c. of oxygen are used, we have really 12 c.c. of a gaseous mixture which burns at  $50^{\circ}$  with the production of intense heat, intimately mixed with 12 c.c. of a gaseous mixture burning at a much higher temperature. It appeared reasonable to suppose that this would lead to a reduction of the temperature of combustion of the methane, and that the intense heat generated by the burning of the hydrogen would aid the action of the catalyser. But this is in no way the case, rather the reverse. Thus we have the phenomenon of an agent catalytically causing a combination at a certain temperature, and when another gas, to which the agent is catalytically more active, is passed over with the mixture, the heat generated by the secondary reaction does not aid the catalytic action of the agent towards the primary mixture. This appears to point to the conclusion that the palladium cannot act catalytically in the oxidation of the hydrogen and of the methane at the same time, but rather appears to confine its energy as a catalyser to the direction in which it is greater.

c. Enquiry as to how far the catalytic influence of the palladium is due to a superficial oxidation.

The catalytic behaviour of the palladium towards certain gases is of great interest, and an attempt was therefore made to find out to what extent the action is due to a superficial oxidation of the metal.

The procedure adopted was to sweep out the apparatus rapidly with oxygen, and then to pass oxygen slowly through. The oxygen left in the capillary was swept out by passing nitrogen through. Methane was then sent over the asbestos as usual.

Temp.	No. of Passages.	Minutes.	Volume before absorption of $\text{CO}_2$ .	Volume after absorption of $\text{CO}_2$ .	Result.
$^{\circ}\text{C}$ .			c.c.	c.c.	
550	4	12	11.8	11.9	No action
550	4	11½	12.4	12.4	"
600	4	11	18.2	18.2	"
600	4	14	16.2	16.2	"

It was anticipated that if an oxidation had taken place, sufficient oxygen would be retained to give traces of carbon dioxide. In no case was any of this gas found. So far as this method allows us to judge, the catalytic action is not due to a superficial oxidation of the palladium.

#### CONCLUSIONS.

1. The temperature of combustion of practically pure methane and oxygen lies between  $514^{\circ}$ — $546^{\circ}$ , a much higher temperature than that recorded by Hempel and Phillips, but in fair agreement with the statements of Winkler and Richardt.
2. An increase in the speed at which the gases are passed through the tube appears to cause a decided increase in the temperature of combustion.
3. A variation in the volumes of the gases exercises an influence on the temperature, tending to raise it above that recorded for a gaseous mixture in proper volumes for complete combustion.
4. The addition of hydrogen even in large quantities does not cause the methane to burn at a lower temperature, and hence the usual method of fractional combustion of hydrogen should give reliable results, if the temperature does not rise above  $500^{\circ}$ — $550^{\circ}$ .
5. The catalytic action of the metal does not appear to be due to a superficial oxidation.
6. Carefully prepared palladiumised asbestos gives consistent results in such combustion.
7. In no case has anything approaching complete com-

bustion been observed, although the gas was at times  $100^{\circ}$  above its temperature of combustion. This is directly contrary to the statement of Phillips, but in good accord with Richardt's work. The latter found 1.3 per cent. of methane burnt at  $600^{\circ}$ , whilst in a course of these experiments at from  $550^{\circ}$ — $595^{\circ}$ , about 4 per cent. was found to have been burnt.

## Manchester Section.

Meeting held at Manchester, on Friday, November 3rd, 1905.

### CHAIRMAN'S ADDRESS.

### HIGHER EDUCATION AND CHEMICAL INDUSTRY.

#### A PLEA FOR CO-OPERATION.

BY DR. G. H. BAILEY.

We, in this country, have too little respect for education, we do not regard it as essential to success in business, or necessary for the progress of our industries. This is not to be wondered at, for, during many years, what has passed muster for education, has, in a very large measure ignored those faculties which are essential to success in the affairs of life and mainly succeeded in reducing the normally healthy-minded pupil to the condition of a second-rate automaton. Whether under the Education Act of 1902, intended as it clearly is, to be a decentralising agency, the educator will get the opportunity he must so long have desired, remains to be seen. This, however, can only come about, if Education Committees will form such a conception of their duties as will prevent those well-meaning persons, the organisers of detail and the ubiquitous official, from dominating the situation. Meanwhile public interest has been aroused. Commissions of inquiry have travelled to and fro, the educational agencies at work in different countries have been reviewed, and it is, at all events, being now more generally appreciated, that the conditions which are to be satisfied in this country, in many respects, differ from those obtaining in other countries. It is also being recognised that the wholesale adoption by us of methods of education which prevail in France or Germany, or even in the United States, would be little short of a national disaster. It is, however not my intention to speak of education in general, nor would it be appropriate that I should occupy the time of the members of a Society of Chemical Industry in such a manner. Still, the fact must not be overlooked, that dullness and want of stimulus in the teaching of primary and secondary schools must seriously affect the progress of higher education. What I propose to do, is to ask your consideration in regard to higher education, of some points which are, in my opinion, of supreme importance to the Chemical Industries. The Society of Chemical Industry has on various occasions discussed the need for skilled assistants, intelligent foremen and reliable workmen, and I think it will now be generally acknowledged that the chief interest for us centres itself, as a matter of urgency, in the skilled assistant. At all events, beyond what general education will do for him, we are prepared to accept the conclusion that the workman may be eliminated from discussion. But when it comes to question of finding a young chemist, whose qualifications present anything like a sure prospect of success in directing the operations of a chemical works, the task is one which cannot be undertaken with any degree of confidence. Not only is this the case, but under existing conditions I cannot see that the situation is at all likely to improve. This is due, I believe, to the absence of a clear conception of the qualifications and abilities which are called for in such an occupation. If any improvement is to take place in

the supply of suitable men, the first step is indeed to realise what is the form of knowledge and the type of ability that is to be looked for. The next step is to examine how far the educational agencies in operation are providing the requisite training, or what modifications or additions should be made in their curricula if the demands for such knowledge are to be met. This is essentially the nature of the inquiry to which I desire to ask your attention. The general problem of the intelligence department in relation to a manufacturing industry may, however, be simplified by a preliminary examination of the duties which fall to the technical chemist; for the services, which are included under his direction in the works, are essentially two-fold in character. There is the analytical work of testing raw materials and products, work which calls for accuracy in manipulation and often for the exercise of considerable judgment. There is further the direction of the operations in the works, demanding knowledge and qualifications which must be placed on an altogether different horizon. In small concerns, the same chemist may have to be responsible for both these classes of work, and also in branches where well defined and long-established operations, of a simple character, form the basis of manufacture, the accuracy and expedition with which routine work is performed will be the predominant factor. It may be maintained, and I think with justice, that the curriculum in practical analysis at our places of higher instruction is not entirely satisfactory even as a preparation for the routine work of analysis. Yet the requisite efficiency might be secured by a moderate revision of the methods of teaching at present employed. I propose, therefore, to devote my attention chiefly to the higher qualifications of the Works Chemist, and in doing so, it must be understood that it is not because I underrate the importance of routine work, nor the vital necessity of such work in deciding the question of success or failure in many departments of chemical industry. I feel, however, that the part played by chemical technology, in its broadest sense, is not only of very much greater import, but is also very inadequately provided for in our present schemes of instruction. The pressing need for highly qualified chemists will appear, if the position of chemical industry is considered from a national point of view, and it is asked how far the permanence of that industry is secured; it must then be seen that security of tenure depends not merely, and not essentially, on routine processes, but on progress in the methods of production. It comes, indeed, to this, that the maintenance of our chemical industry, depends on the chemist who is able to modify existing processes so as to improve their efficiency, who is keen to determine the point at which old processes must be abandoned, old plant set aside, and who has the energy and the knowledge that will enable him to replace them by new processes and new products according to the varying demands of the time.

Progress in manufacture must, indeed, be regarded as a safeguard to stability, far more potent than any political or economic device for the protection of interests, and that nation must succeed in industry, which keeps this clearly in view and possesses the talent wherewith to meet the ever-changing demands made upon it. How many instances could be recalled of branches of industry which have lost ground in this country, or even succumbed, because this condition of success has not been realised? If, however, we are to appeal to the educational institutions for special assistance in the supply of such men, it may be asserted that the number of chemists required for work of the higher type is small, and must of necessity remain so, and that it could hardly be expected that the teaching institutions would offer special facilities for their training. Such an assertion would not be confirmed by the members of this Society, or by those who are familiar with the requirements of industry, nor, as we shall presently see, does it find any support from the experience of other countries. In a field so promising and so full of interest, it may be, indeed, considered strange that there should continue to be the great difficulty that there is, in obtaining men of the requisite talent and that the educational authorities should not long ago have taken independent action in the matter. The chief reasons for this hesitancy proceed, I believe, on the one hand from the inability of

the teaching institutions to realise the urgency of the demand for able men, and, on the other hand, from the failure on the part of the employer to indicate his wants with sufficient clearness or to offer sufficient inducements for their satisfactory fulfilment. The following statement by Mr. W. P. Groser, extracted from the Report of the Mosely Commission, if somewhat severe, is yet an expression of opinion that it is worthy of consideration: "In England, the man of commerce does not love the 'Varsity man. No, he owns that such have the right to try and prove that they have not succumbed to their education and are little the worse for it. Naturally he cannot afford to encourage their vagaries, but, now and again, personal reasons induce him to employ them, and he will be pleased as well as astounded, if they prove competent."

As matters stand, the chemical technologist has to pick up his knowledge of manufacturing operations after he becomes attached to the works. He knows usually little or nothing of these operations even in a general way, and what is worse, his acquaintance with science and mathematics is devoid of any idea of their application to engineering or other problems which are met with in even the most ordinary operations of a chemical works. He is, therefore, incapable of handling a practical problem in which chemical plant is concerned. He has devoted no attention to economic conditions, and would be unable to form even an approximate idea as to the practicability or cost of a chemical operation on the manufacturing scale. His progress is thus hampered, and the services he can render, unless he happens to be a man of unbounded energy, are of necessity restricted to routine work. If he is retained, the opportunity of advancing his knowledge of industrial problems becomes very remote, and, as a consequence, he will probably ultimately settle down to analytical routine. Naturally, the manufacturer finds that, for smaller works at any rate, the man who has grown up in the works, notwithstanding his lack of training in principles, is the better investment. And under the circumstances, who shall blame him for coming to such a conclusion? But it must be manifest that the interests of the chemical industries would be better served by the employment of men of ability who had already made some acquaintance with the principles of chemical technology. Yet, so far as I know, there is no educational institution in this country in which an adequate training in the general principles of technology is given. In addition, however, to a general acquaintance with chemical operations on the manufacturing scale, it is essential that the chemical technologist should possess experience in research. Now a few of our colleges do display considerable activity in research on pure science, but investigation on matters of technical interest and on technical lines is rarely undertaken. Nor is it realised that research on technical subjects is either desirable, or that it is a much more exacting task than that which ordinarily commands the attention of the student. There is no need for me to digress here in order to impress the fact on the members of this Society, for it is well-known to you that the investigation of a technical problem calls not only for sound preliminary knowledge, but also for abilities of the highest order, both in consideration of the limitations imposed, and the stringency of the conditions to be complied with. Yet the idea abroad is a very persistent one, that the second or third rate student, who gives no promise as a teacher, is the type of man to be turned over to the works, and little encouragement is given to the chemical student of high abilities to take up a definite course of preparation for industrial employment. Precisely the reverse of this order of things ought to be insisted upon.

An appropriate training for employment in the chemical industries should be afforded by a good degree course in chemistry, with facilities for obtaining special knowledge of technical matters, and for engaging in research preferably on a subject of technical interest. A period should also be spent in visiting other countries and acquiring a knowledge of the industrial and economic conditions obtaining there. Such an education might be completed in from five to six years, which is no longer than is now found to be necessary in medicine. Indeed, if we include



the further period of practice which the medical man requires before he can be regarded as fully qualified for his profession, the medical course is longer than that suggested for preparation for chemical industry. The college-trained man in the United States also spends much longer in his preparation; in the best colleges he takes an ordinary degree before proceeding to the special work more closely associated with industry.

Before we consider the means whereby the necessary instruction may be imparted, I should like to make some reference to the experience of other countries in regard to professional studies.

In the United States there are nearly 500 colleges and high schools with 135,000 students over 18 years of age. It is evident also that there, at all events, the university graduate is received by the employer with every confidence. He rises rapidly to positions of the highest eminence in works, the demand for him far exceeds the supply (large as this is), and there is an eagerness to secure the graduates of the best colleges which has no parallel in this country. We have records of large concerns employing almost wholly graduates and college-trained men, and of others who are so satisfied with the university men that they will take no other for responsible posts. We have also, in regard to such colleges as Cornell, the Johns Hopkins and the Massachusetts Institute, the remarkable statement, that, for many years past, 60 to 80 per cent. of their graduates have passed into works and occupy high positions therein. So great indeed is the desire to obtain the services of university graduates, that employers lodge their applications for them in advance, an instance being recorded where 160 such applications were booked for 35 graduates about to complete their course. Such figures are in strange contrast to anything that could be produced in this country. In our own university, situated as it is in the heart of the chemical industries, it appears from the Vice-Chancellor's Report that the number of appointments to posts in chemical works last year did not reach double figures, though some 160 appointments to professional and teaching posts are recorded. In Germany, a university training is a necessary preliminary to employment in all positions of responsibility under the State, and in the industries, in addition to this, it is well-known that whole battalions of graduates are engaged by the larger chemical firms in conducting special research. That the universities and colleges of this country attract men of the highest ability cannot be denied, but they have failed to command the confidence of the industries to an extent at all approaching that stated, and I fear they will fail to do so until they come more into touch with industry. In the United States, it has been fully realised that practice and theory must go hand in hand, and the professor who has had experience of manufacturing operations, and who keeps up his works practice, is regarded as the best guide for the student. Facilities are given which enable him to keep up his acquaintance with technical processes, and it is recognised that his services under such circumstances are of greater value to the university or college to which he is attached. Beyond the salutary effect which such associations have upon his teaching, his pupils are given the opportunity, not merely of visiting works, but even of engaging in operations going on there, for such periods that they gain a real insight into practical matters. The necessity of an intimate association of teaching with actual practice has been largely recognised in engineering, and universally in medicine, and its collateral branches, but in chemical industry, which is more complex than either of these, it is almost wanting. It is true that in some branches of chemical industry, endeavours are being made to give the student in training as nearly as possible the experience of appliances which he may be likely to find of service when he is brought under similar environments in the works. I refer to the establishment of plant on a working scale in the teaching institutions as well illustrated in the Manchester School of Technology, the Universities at Leeds and at Sheffield, and some other centres. How far such a method of providing for the need is the best that could be devised is open to question. At any rate, in the United States there is a definite form of co-operation and concerted action between

the industry and the higher teaching institutions, also we know that in Germany and countries where university education is more widely diffused than here, not only does the university professor frequently associate himself with technical inquiry, but relief is sought also in the employment of specialists. With this knowledge before us, let us now consider how the education of the chemical technologist may be secured, with due consideration of the conditions and state of education in this country. In the course of the remarks which I have already made, and those which I am about to make, it may be thought that I am giving a greater prominence to the claims of the university graduate than seems justified by his qualifications, for a high university degree in chemistry in itself affords no guarantee of fitness to occupy a post of responsibility in a chemical works. But I am convinced that it is in institutions of university rank, in this country, as it has been found to be elsewhere, that men of ability must be looked for, and that a liberal education is the surest foundation for ultimate success in industry. If success is to be achieved, however, a very different curriculum must be followed, and I am strongly of opinion that a satisfactory curriculum can only be assured by a more intimate association of the teaching authorities, whoever they may be, and the leaders of industry. That the supplementary training which is requisite depends largely upon the co-operation of the industry will appear from the succeeding paragraphs, in which the nature of the instruction is dealt with.

I. In the first place the course of laboratory teaching in chemistry at present too largely in vogue should be revised and extended, so that it may provide for the needs of industrial chemists. Opportunity should be given to practise the methods of examining fuel and flue gases, water for manufacturing purposes, raw materials and finished products. Simple experiments dealing with materials in bulk should also be made, and these should involve considerations bearing upon costs, yields, and methods of handling such as would arise on the large scale. A more practical acquaintance with electrolytic processes and the measurements associated with these processes is an important adjunct.

II. Secondly, the course of training should include a general acquaintance with chemical operations on the manufacturing scale and the plant in which such operations are carried out. Problems relating to furnace operations, to the solution of solids and gases, to crystallisation, distillation, condensation and the like, are met with in almost every manufacturing process, and should be considered by the student under the aspect which they present on the manufacturing scale. Courses of this character were given at the Owens College during the sessions 1888 to 1890. I can testify to the great interest shown by the students who attended, and it is to be regretted that the instruction was not continued.

The following copy of the syllabus will serve to indicate that the subjects dealt with in these courses are of general application. It is added here in order to show in somewhat greater detail the nature of the instruction embraced under this section:—

1. Conditions of combustion; fuels; testing of fuels.
2. Forms of heating appliances; regenerative furnaces; air supply and regulation; examination of chimney gases; regulation and measurement of temperature; pyrometers.
3. Physical properties of water and steam; testing of water for manufacturing purposes; boiler incrustation; types of steam boilers.
4. Physical properties of matter in the gaseous, liquid and solid condition; materials used in the construction of plant; transference of materials and products; pumps and elevators; appliances for grinding and mixing.
5. Chemical operations of the laboratory compared with those of the works; calcination, oxidation, and reduction in the furnace; electrometallurgy; oxidation and reduction by wet processes; bleaching.
6. Solution of gases and solids; lixiviation; digestion under pressure; testing of liquors; treatment of waste liquors.
7. Concentration and evaporation; desiccation; crystallisation; distillation and sublimation; con-

densation of gases and vapours—cooling and refrigeration.

8. The arrangement and laying down of plant; calculation of cost of production.

III. Under the third section I place research, such as would usually occupy the student after his graduation. The question that immediately arises is in regard to the nature of the research which should be undertaken. Provided there is a sound knowledge of the operations and conditions attaching to technical chemistry, such as should be afforded by the course of study already referred to, I do not consider it absolutely essential that the research shall be on a subject of technical interest. Research on pure science, if it is substantial, and if it calls upon the resourcefulness of the worker in opening up new ground and the faculty of accurate deduction and generalisation, will afford an excellent preparation. But the investigation of some question of technical importance, carried out with a view to its bearing on chemical industry, is in no sense inferior to this, and in many respects much more instructive. Moreover, it must be recognised that a very large proportion of the output of research in pure science, from laboratories in this and other countries, is of such a character as to afford no criterion of ability to conduct technical operations. The services which the methods of pure science can render is, perhaps, most pronounced in the colour industry, and yet this industry exemplifies in its most important product, indigo, how great is the necessity for a closer association of pure and applied science. From the point of view of pure science, the original synthesis of this body by Prof. Baeyer was entirely satisfactory, but it was not till after investigations extending over a quarter of a century that the method of producing indigo was placed on a basis which secured its application as a commercial product. Similar experiences will be found if we follow the steps taken in the utilisation of atmospheric oxygen, from the discovery of Boussingault to its ultimate achievement in the Brin process, or we might quote the realisation of the contact process for sulphuric acid, the ammonia-soda process and many others. It is interesting to note also that the researches which have been necessary for the fulfilment of commercial requirements, have greatly enriched chemical science; yet they could never have come under the purview of the student of pure science. Then, if we turn to the more physical aspect of research, we have again evidence of the vital importance of the attention being directed towards the study of physical phenomena in relation to operations on the large scale. The contributions of the late Dr. Hunter on the absorption and condensation of gases, and on the dynamic theory of the formation of sulphuric acid, afford admirable illustrations of this form of inquiry. The extent to which the course of chemical reaction may be modified under the influence of mass and temperature, or by the active movement of gases, or in association with liquid vesicles can nowhere be studied to greater advantage than in a chemical works. Then, again, every chemist who is accustomed to handle reagents by the ton is able to point to phenomena which pass unobserved in the chemical laboratory; also those branches of chemical industry which, like tanning, dyeing and papermaking, depend on the association of chemical substances with organised fibres, afford problems which would exercise the ability of the most skilful investigator. Less ambitious, but equally necessary to industry, is the general investigation of standard methods of analysis and of systems of sampling. These considerations will, I hope, serve to illustrate the interdependence of science and industry from the chemist's point of view, and the importance of greater attention being given to those aspects of chemical technology which alone can cope with the stagnation to which industry is liable. That there are limits to mutual co-operation is manifest, for it is evident that there are problems and details in manufacture which must be safeguarded, but these are of a nature which it is equally clear no teaching institution either should or could concern itself with. Some branches of industry are more affected in this respect than others, but even in those where such a form of protection seems most necessary I am of opinion that there would still be ample opportunity

for participating in such measures as are proposed. The greatest obstacles to be overcome are those which arise from prejudice and the arch-enemy to all progress, inertia, for manifestly, both in their initiation and in subsequent operation, any steps taken must be purely voluntary. Yet we may, I think, rest assured that if industry is to hold its own in this country, the closer association of science and technology must be accomplished. I have dealt with the necessity for co-operation on general principles, and the manifold avenues which will be opened up by the intercourse of specialists in science with specialists in industry must be apparent. But however desirable such a form of co-operation may appear in principle, it may be safely predicted that the magnitude of the advantages which must accrue will be still more fully realised when it comes to be put into practical operation.

## Newcastle Section.

*Meeting held at Armstrong College, on Thursday,  
November 9th, 1905.*

PROF. HENRY LOUIS IN THE CHAIR.

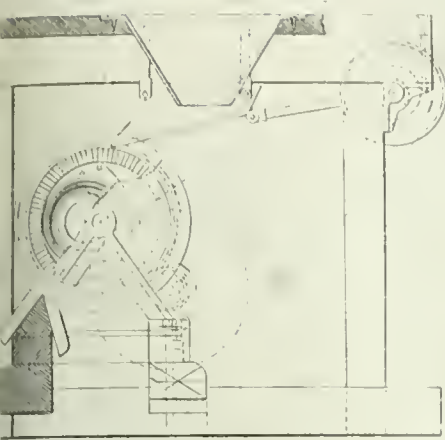
CHAIRMAN'S ADDRESS.

### THE DRESSING OF MINERALS.

BY HENRY LOUIS.

My first duty to-night is to express to you my sincere thanks for the honour you have done me in electing me to the Chairmanship of the Newcastle Branch of the Society of Chemical Industry, and to assure you that no efforts shall be wanting on my part to maintain to the full our ancient prestige during my tenure of the office to which you have appointed me. I am the more sensible of the honour you have conferred upon me, because the particular department of chemical technology with which I am most closely in touch is one that has received comparatively little—I might say even less than its due share of recognition in this Society. I am, of course, aware that the comparatively small attention devoted by this Society to the metallurgical industries may, in no small part, be fairly ascribed to the fact that these industries are already adequately represented by societies dealing especially with this branch of technology. At the same time I think that there is another and deeper-lying cause, which may be briefly expressed by saying that it is only comparatively recently that metallurgy has taken rank amongst the chemical industries. Although the science of chemistry necessarily underlies every portion of metallurgical practice, it is only within the last half century or so that the metallurgist has become aware of the fact. The origin of chemical science must, no doubt, be sought for to a great extent in mediæval experiments upon metals, but the alchemist of the middle ages had little in common with the metallurgical craftsman, who generally not only smelted the ore, but usually also collected or mined it himself. I may remind you that even etymologically the primitive metallurgist was a miner, the Greek "Metallon" meaning both a mine or shaft, and that which was extracted from it, namely, ore or metal. The early metallurgist was thus a rough prospector who extracted the metal from the ore he won by some simple smelting process, and the art of producing metals seems to have developed steadily along these same lines. Thus the well-known treatises of Agricola and Ercker, written for miners in the late middle ages, contain quite as much metallurgical as mining lore; even in the middle of the 18th century, we find the Swedish workman engaged alternately in extracting iron ore and in smelting it as occasion required, and the same is still true to-day of the Chinese tin-miner in the Far East. Metallurgy was thus in its origin a





VI.—WENSTRÖM ELECTRO-MAGNETIC SEPARATOR.

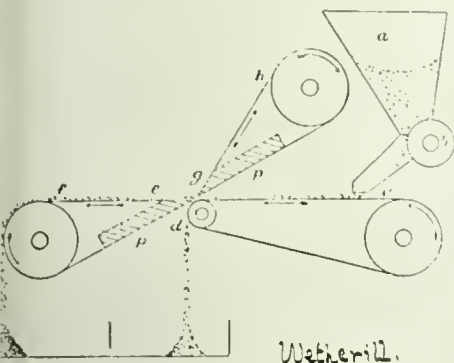
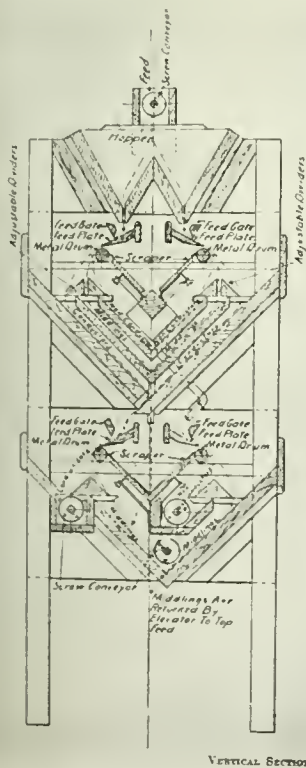


FIG. VII.—GRÖNDAL ELECTRO-MAGNETIC SEPARATOR.

II.—WETHERILL ELECTRO-MAGNETIC SEPARATOR.



VERTICAL SECTION.

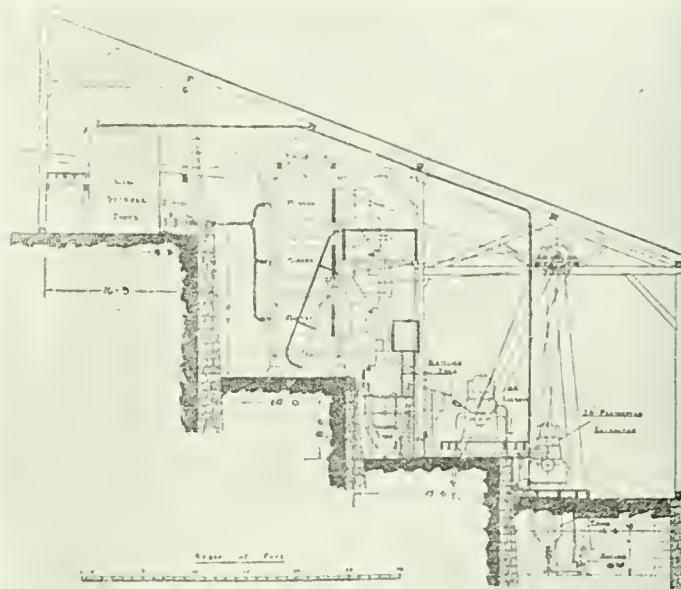
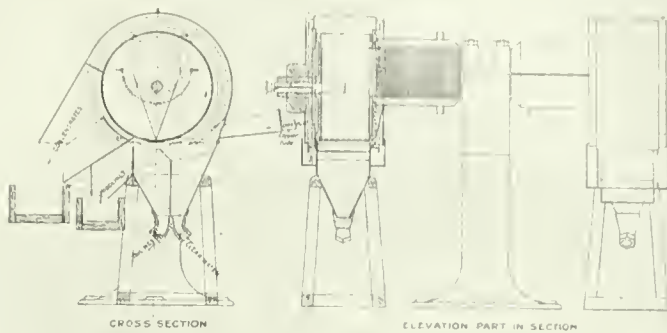


FIG. X.—ELMORE PLANT.





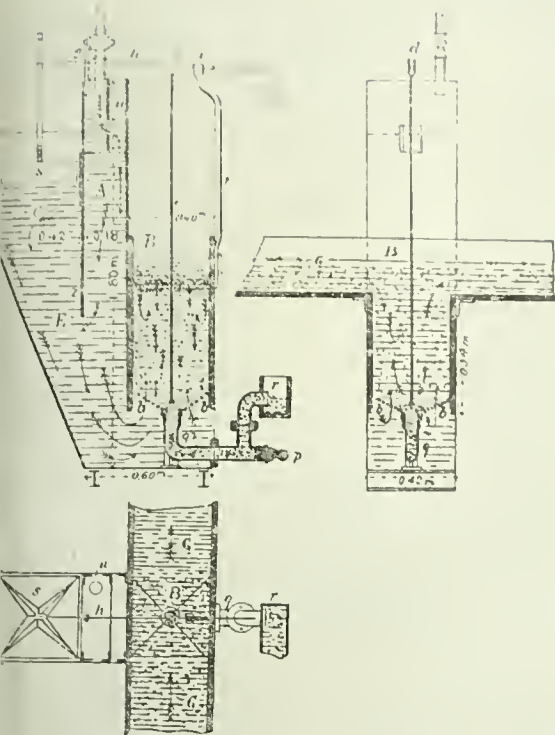


FIG. 1.—SYPHON WASHER.

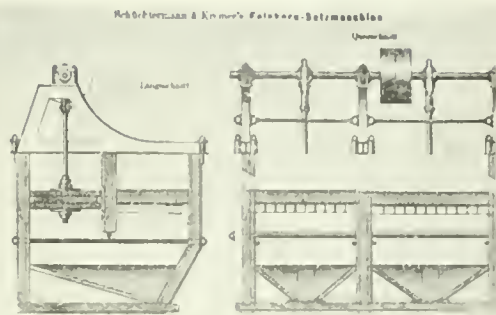


FIG. 111.—FELSPAR JIG.

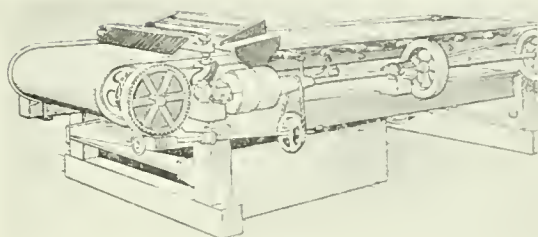


FIG. IV.—FREE VANNER.

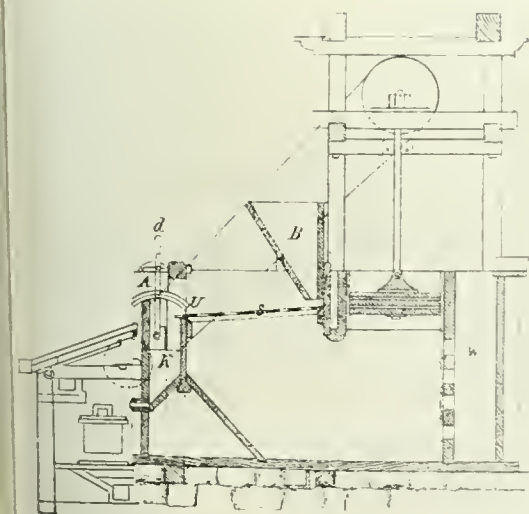


FIG. II.—COARSE COAL JIG.

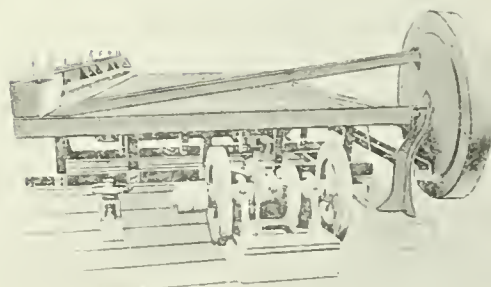


FIG. V.—WILFLEY TABLE.





purely empirical craft, and such it remained to a great extent up to very recent times. Thus even in so highly organised a manufacture as that of steel-making, we find that when the old-fashioned Sheffield steel meller found his metal teeming "too lively," he would physic it by throwing a bit of "glazed pig" into the pot, which experience had taught him would effect the desired object, although he had not the faintest idea that such pig-iron was rich in silicon, and was at least equally ignorant of the action of silicon upon molten steel.

Contrast now this state of affairs with the inception and development of the chemical industry, meaning by this phrase the "heavy" chemical trade, the manufacture of such articles as sulphuric acid, soda, &c. This trade never was a craft, it was never empiric at all; it grew from a purely scientific origin under the care of scientific chemists, and has been the development, along scientific lines, of the application of such chemicals as those mentioned to the everyday arts and industries. The contrast between the origin and the growth of the metallurgical crafts and the chemical industries is as sharp and as complete as possible, and yet it would be difficult to point out two industries in which the methods and appliances employed more closely resemble each other. In proportion as the refinements of chemical science have been applied to metallurgy on the one hand, and as the manufacture of chemicals on the other hand has become more of an ordinary industrial operation, so have the two arts approached each other, until it is difficult to draw any dividing line between them. The production of aluminium, of magnesium, and perhaps even more of sodium is, for example, looked upon as a purely chemical industry, although the product is a metal; the extraction of these metals from their ores is not, as a rule, included in metallurgical text-books, and most metallurgists would look upon it as outside their particular province; on the other hand, again, the extraction of gold, probably one of the most ancient of metallurgical operations, and until recently one of crudest conducted on purely empirical lines, has largely been carried on in recent times by the help of methods and appliances—such as leaching tanks and filter-presses—which may be looked upon as lying well within the especial domain of the manufacturing chemist.

In addition to the close alliance in methods and appliances now existing between these two arts which originated so far asunder, there is another most important point common to metallurgy and chemical manufacture, namely, that both utilise identically the same class of raw materials. Of all the raw materials available for the service of man, those of the organic world are procured by the agriculturist and the hunter—using these words in their widest sense, whilst those of the inorganic world are contributed by the miner. It is to these latter that the attention of the metallurgist and of the chemical manufacturer are in the main directed; both still use some organic products, but their place is being more and more occupied by mineral substances. Practically we look to the miner to-day to furnish us with all the raw materials which the metallurgist and the chemical manufacturer have to transform into products which can be utilised in our arts and manufactures.

I should like, therefore, to consider with you to-night the relation of the arts of metallurgy and chemical industry to the elaboration of the raw material produced by the miner in one particular aspect. Between the operations of mining, properly speaking, and those pertaining to the above-named industries, we find another group of somewhat nondescript operations, which belong to the province neither of the producer nor of the utiliser, but occupy ground common to both, and employ principles with which both are familiar. It is very rare, indeed, that mineral as mined happens to be in a condition suitable for the purposes of those who have to work it up: it usually has to undergo some process of preparation, some form of cleaning, in order to fit it for use, and it is to such preparatory processes as these that I desire to direct your attention. These are usually spoken of under the comprehensive but vague term of "dressing," which includes under one designation, a very large number of operations of very varying degrees of complexity according to circumstances. Thus, for

example, all that a coal may need may be merely picking out by hand the pieces of shale or dirt that may have become mixed with it in the course of mining; again, many deposits of iron pyrites yield a mineral so clean that it needs merely breaking up into lumps of suitable size, or perhaps sorting into various grades, by its approximate copper contents as judged by the eye. At the opposite end of the scale stands the dressing of such a material as tin ore, which contains as mined only 1 or 2 per cent. of "black tin" or tin oxide, contaminated with such impurities as copper ore, iron and arsenical pyrites, wolfram, &c. As oxide of tin forms fusible compounds with both siliceous and basic substances, tin silicate and a stannate being respectively produced, any form of impurity will cause loss of tin in the slags; the first condition of economic tin smelting is, therefore, to keep the proportion of slag formed down to the lowest possible limits, which can only be done by smelting nothing but rich ores. It is generally recognised that it does not, as a rule, pay to smelt ores containing less than 65 per cent. of metal, and as a rule the percentage is nearer to 70. Furthermore, tin has a great affinity for other metals, forming alloys most of which have a very injurious effect upon the working qualities of the tin, and most of which can only be eliminated with the greatest difficulty from the tin with which they have combined. The dressers' problem is, therefore, to produce a rich, pure ore from the poor and impure crude ore. This concentration and purification are effected by an elaborate series of crushing and washing operations, by which all the lighter earthy portions of the ore are ultimately removed, leaving the heavier metallic portions in a concentrated form; the latter may still contain such injurious impurities as arsenical pyrites and wolfram. The former can be got rid of by calcining the ore, thus decomposing the arsenical pyrites, driving off the arsenic as arsenious acid, and leaving behind oxide of iron in a light, spongy form, in which it is easily washed away from the tinstone. Wolfram can be got rid of by Oxland's process, which consists in fusing the ore with black ash, thus forming soluble tungstate of soda, which can be dissolved out, again leaving a light oxide of iron, which can be removed by washing. Here, then, we have an elaborate series of crushings, washings, calcinations and fusions, the sole object of which is to provide the metallurgist with an ore sufficiently rich and pure to admit of profitable smelting.

Between these two extremes, operations and groups of operations of all degrees of complexity are to be met with, the object being the preparation of the minerals in such a state of purity as will best fit them for the subsequent treatment that they will have to undergo at the hands of the smelter or the manufacturer—in other words, to render them marketable.

Sometimes the object is simple concentration or enriching, as when the earthy impurities are removed from a poor lead ore in order to get a rich galena suitable for smelting. Sometimes the object is the removal of injurious constituents, as, for instance, when shale or pyrites are separated from the coal with which they are intermixed, or when apatite is eliminated from an iron ore in order to obtain a Bessemer or practically non-phosphoric ore. It may happen, as in the latter case, that the injurious impurity got rid of may in its turn be converted into a marketable article, so that the production of commercially valuable bye-products may also have to be kept in view. Finally, we have the interesting case that sometimes presents itself, where a mixture of two valuable minerals may be practically worthless until the individual minerals have been separated. One of the best examples of this is to be found in those intimate mixtures of zinc blende and galena, that are met with in many mining districts, but notably in New South Wales. Such a mixture cannot be smelted direct: the readily fusible galena prevents the complete calcination of the blende, and even if satisfactory calcination were possible the refractory vessels needed for the distillation of the zinc would be rapidly destroyed by the lead silicate produced on heating. On the other hand, the excessively refractory zinc compounds prevent the lead from being smelted by any of the methods known to lead smelters.

The mixed ore is thus equally worthless to the zinc smelter and to the lead smelter; yet if the blende and the galena can be separated, both are readily marketable.

It is an obvious truism that the processes to be adopted in each particular case must depend upon the differences in the properties of the minerals that it is desired to separate; accordingly we find that these processes are mechanical, physical or chemical. For a period covering many centuries only mechanical means were employed, all the others having sprung up within the last half century and many within the last decade. The most striking characteristic of many valuable minerals, notably of metallic minerals, is their relatively high specific gravity. This appears to have been the property that first attracted the notice of primitive man, and which probably led to the recognition of ores of the metals in the first instance. It is, therefore, only natural that the earliest methods of dressing minerals for the purpose of obtaining such ores in a concentrated form should have been based upon their superior density and it is impossible to say at how early a date the simple method originated of washing an aggregate of mineral particles in a stream of water which would carry off the lighter particles and leave the heavier. The very earliest treatises on mining already show different and comparatively elaborate forms of appliances making use of this principle: in its simpler type it is still found amongst semi-civilised races all over the earth under forms which, although very similar, are evidently the result of independent invention. These ancient devices have continued in use down to the present day, and their design was purely empirical until comparatively recent times. The first systematic investigation of the underlying principles was due to Bergrath Peter von Rittinger, whose classical treatise, published in 1867, defined the laws governing the motion of particles of mineral in water, and the effect upon them of water currents. Rittinger did not merely develop the theory of the subject; he also invented and improved numerous appliances for the effective separation of minerals of different specific gravity, and appears to have been the first to appreciate the economic importance of making the operation continuous, and of discharging the concentrates and the tailings automatically; the replacement of intermittent hand-worked appliances by continuous self-acting ones was the first real step in the evolution of modern dressing machinery.

Obviously, before it is possible to separate the individual minerals composing a massive aggregate, it is indispensable to break down the mass into fragments of such size as to release the individual minerals, and crushing machinery, therefore, plays a very important part amongst dressing appliances. Such machinery dates back to very ancient times; of the three principles upon which it may act, namely, by percussion, by attrition, or by pressure, the very earliest machines seem to have used the first named, and then came those depending upon attrition. Rolls, which act mainly by pressure, seem to have been devised first in Cornwall about the year 1800, and the well-known Blake rockbreaker was invented by E. W. Blake, at New Haven, U.S.A., in the year 1858. Although many new machines have been devised since then, the principal modern improvements have been in the direction of better engineering design, and the use of superior materials of construction.

Amongst the great advances due to Rittinger was the recognition of the importance of sizing, and the demonstration of the fact that it is much easier to effect a separation amongst mineral particles of different density when they are all of approximately the same size; his theory also indicated the degree of accuracy to which sizing should be carried. This is now looked upon as one of the fundamental principles of modern dressing, and the grading of the crushed mineral according to the size of the particles is a portion of the work of every dressing plant; it is performed by means of a large variety of screening and classifying appliances, none of which need any special reference here.

In every system of comminution, it is impossible to prevent a certain portion of the material from being

crushed much finer than is absolutely required; such very fine particles, which, when suspended in water, as is usually the case, are known as slimes, have always been the great difficulty in every system of dressing minerals. Here, again, Rittinger did much useful pioneer work: he showed that slimes could not be successfully treated in appliances in which water currents alone were employed, but that external impulses must be superadded, and he designed or improved what may generically be spoken of as shaking tables, that is to say, inclined surfaces over which the pulp of slimes is allowed to flow in a gentle stream whilst the surface is subjected to a series of shakes, jerks, or impulses, which promote the separation of the specifically heavier from the lighter materials. Modern invention has been busy chiefly with appliances for treating these finer portions of the crushed mineral, those for treating the coarser particles being already tolerably effective.

Most of the appliances now used for the dressing of the coarser fragments depend upon the action either of continuous upward currents of water, or upon the action of alternate upward and downward currents of short duration. No better example of the former can be quoted than the well-known syphon washer (Heberwäsche) used at the lead mines of Mechernich, near Commern, Rhenish Prussia. The ore to be treated consists of a very soft sandstone with small concretionary nodules of galena, which needs very little crushing. The crushed stuff is carried by a stream of water along a trough G (Fig. I.) to a vertical chamber B, up which a current of water rises that carries the lighter sandstone particles up and away through a continuation of the trough, whilst the heavier galena settles down to the bottom. The bottom of the chamber consists of a perforated plate, upon which the galena drops, the perforations being small enough not to let the ore drop through, whilst allowing the water to flow upwards. In the middle of this perforated funnel-shaped bottom there is an escape pipe, which is normally closed by a plug attached to a long rod. This rod is connected to a float S in a tank C, from which the water supply is furnished that ascends through the perforated bottom of B. When a certain amount of washed ore has accumulated on this perforated bottom, it checks the upward flow of the water, thus banking the water back in C, and lifting the float S, which in its turn raises the plug and opens the escape pipe. The ore runs through it into a suitable receiver, thus freeing the water in C, which resumes its previous level, allowing the float S to descend and forcing the plug down again into the escape pipe. The whole operation is thus continuous and automatic.

The other type of appliances, known generically as jigs, may be illustrated by the machines used largely for washing small coal. These (Fig. II.) consist essentially of a box divided into two communicating compartments; in one of these a piston reciprocates, whilst a screen of stout wire gauze is fixed more or less horizontally across the other. A supply of water is admitted into the box, and the dirty small coal is delivered on to the screen at one edge of it, usually in a stream of water; it is thus carried across the screen and in its passage is submitted to a series of upward pulsions and downward suction due to the alternate ascent and descent of water through the screen caused by the downward and upward motion of the piston in the adjoining compartment. Under the influence of these impulses the coal is separated into two layers—the upper of the lighter clean coal, and the lower of the heavier materials, such as stone, shale, pyrites, &c. The former flows over a suitably arranged gate into a receiver. The latter is either discharged at a lower gate, close to the level of the upper surface of the screen, when the pieces washed are larger than the mesh of the screen, or else (Fig. III.) they pass through the screen into the box, whence they are removed by suitable devices. The latter method is usually applied to washing small coal that has passed about a 3/8 in. mesh, the former to the larger sizes. When the latter plan is employed a bed of pieces of felpar, just large enough not to go through the meshes, is placed upon the screen to prevent any small pieces of clean coal being accidentally drawn through; this form of jig is generally spoken of as a felpar washer.



There are many modifications of this type of appliance, and it has a wide range of usefulness.

Of the numerous machines devised for treating the more finely divided minerals and shales I will mention only two, typical of modern practice, namely, the Fyee Vanner and the Witley table. The former (Fig. IV.) consists of an endless indiarubber belt, supported on rollers carried by a frame having a slight slope in the direction of its length. The belt is given a slow movement up the slope, the frame receiving at the same time a rapid transverse vibrating motion. The pulp to be dressed is allowed to flow down the belt, when the heavier material tends to settle upon its surface, whilst the lighter materials flow over it in the stream of water. The heavier particles adhere to the belt, and are thus carried upwards and discharged at the top end, whilst the lighter particles are discharged at the lower end, the separation being assisted by the rapid shaking motion. A very complete separation is thus produced, even when working upon extremely finely-divided material.

The Witley table (Fig. V.), invented about 10 years ago, is a type of the most modern machine for separating finely-crushed mineral. It consists of a nearly rectangular (trapezoidal) table, sloping downwards in the direction of its shorter sides; by means of a peculiarly-arranged toggle mechanism it receives a rapid forward and slow backward movement; the surface of the table is covered with grooves parallel to its longer side, deepest at the motion end, and running out to nothing as they approach the further end. The pulp is fed on to the upper edge close to the motion end; the lighter particles flow down successively into groove after groove, and escape at the lower edge almost opposite the point where the pulp is admitted, whilst the heavier portions, working their way to the bottom of the grooves, flow along these and thus travel parallel to the length of the table for a greater or lesser distance according to their specific gravities, before they are finally discharged. A pulp containing various minerals of different densities can thus be separated into its constituent minerals with great accuracy, this power of making several different grades being one of the most valuable characters of the Witley table.

These examples will suffice to illustrate the methods employed in modern dressing practice, in order to separate minerals of different specific gravities. With the advance of the subject, however, the need of being able to separate at times minerals of practically the same specific gravity often makes itself felt, and at the present day a large range of the other properties of minerals has been pressed into service; prominent amongst these I may mention differences in magnetic permeability, in electric conductivity, in surface attraction for liquids, and in chemical reactions.

It is obvious enough that two minerals of very different magnetic susceptibilities can be readily separated by the magnet; unfortunately the great majority of minerals are very feebly magnetic, the only ones that are at all readily attracted by the magnet being magnetite, magnetic pyrites (pyrrhotite), and some varieties of ilmenite and franklinite. There has not been much work done upon the determination of the magnetic susceptibilities of minerals; some of the most recent is that published by Mr. W. R. Crane,\* from which it appears that the pull exerted in attracting certain minerals, expressed in percentages of their weight, is as follows (neglecting decimals):—

Iron, 72,606 (taken as a standard for comparison).  
Magnetite, 29,140.  
Franklinite, 23,942.  
Ilmenite, 18,500.  
Pyrrhotite, 1359—4898.  
Haematite, 150—424.  
Spathic ore, 373—453.  
Iron pyrites, 12—113.

The great majority of other minerals being below 100. It appears to me that the tractive power of pyrrhotite here given is too low, and that of franklinite too high,

but these figures illustrate well the great difference between the magnetic susceptibility of the first four minerals on the list and all others.

A few ores of iron can be rendered magnetic by simple treatment; thus spathic ore and iron pyrites can be rendered strongly magnetic by simply heating to a low red heat out of contact with air, and red and brown haematite can be rendered similarly magnetic by heating in a reducing atmosphere. As might be expected the first attempts at magnetic separation were confined to magnetite, and had for their object the production of a rich, pure iron ore from low-grade ores rendered impure by the presence of phosphates or sulphides. As deposits of magnetite occur chiefly in regions where the older crystalline rocks are extensively developed, such as Scandinavia and the North-east portion of North America, it is only natural that the first magnetic separating machines should have originated in Sweden and in the United States. Such machines seem to have been built experimentally as far back as 1870, but it was fully 10 years later before they came into anything like general use. One of the earliest machines to achieve practical success was the Swedish Wenström machine, which is still doing good work, and the construction of which is typical of many others. It consists (Fig. VI.) of a drum built up of alternate narrow segments of iron and some non-magnetic material, which is rotated about an eccentrically-placed electro-magnet. The material to be separated is delivered on to the drum and carried round with it; on entering the magnetic field the magnetic portions adhere and are carried further round, whilst the non-magnetic portions at once drop off; the magnetic fragments drop off in their turn as soon as the rotation of the drum has carried them past the magnetic field, and the magnetic and non-magnetic particles are thus effectually separated. Other machines use travelling belts to carry the material to be treated through the magnetic field, whilst Edison simply allows the crushed mineral to fall past the pole of a magnet, the magnetic portion being sufficiently deflected in passing the field to effect a separation. All these machines work upon dry material, and when this is finely ground, it is obvious that perfect dryness is a necessary condition to enable complete separation to be brought about. This fact necessitates artificial drying as a general rule, which not only adds to the expense, but may sometimes interfere with the process, more especially when it is desired to free magnetite from iron pyrites. On drying such an ore it is almost impossible to regulate the temperature so accurately as not to convert a certain portion of the iron pyrites into magnetic pyrites, which is then taken up with the magnetite. To get over this difficulty, as well as that caused by fine, dry dust clinging to the magnetite, wet magnetic concentration has been introduced; in some of the best modern machines of this type, a revolving drum, somewhat like that used in the Wenström machine, picks out the magnetic particles from a pulp of crushed ore suspended in a stream of water flowing past the drum. The Gröndal machine (Fig. VII.), which has been very successful in practice, is of this type. Wet magnetic concentration can be made to give exceedingly good results, it being quite possible to produce in regular work concentrates with 70 per cent. of metallic iron. Dry concentration is usually preferred when a feebly magnetic mineral has been rendered strongly magnetic by heating, as has been done, for instance, in order to separate spathic ore from zinc blende; this separation is impossible by the methods of ordinary dressing, because the two minerals have practically the same specific gravity, but its attainment is important, because any iron ore left in the blende will rapidly destroy the retorts or other vessels used for distilling off the zinc. As a simple heating converts spathic ore into magnetic oxide of iron, magnetic separation affords a simple solution of the problem.

An important advance was made in this branch of the subject by Mr. Wetherill in 1896, when he showed that minerals of low magnetic susceptibility, or what, in ordinary language, would be called non-magnetic minerals, could be separated from minerals still lower in the magnetic scale, provided they were introduced into a sufficiently powerful magnetic field such as is produced between the

\* Investigations of Magnetic Fields with reference to Ore-Concentration. By Walter R. Crane. Trans. Amer. Inst. Min. Eng., Vol. XXXI., p. 405.

wedge-shaped pole-pieces of strong electro-magnets. The Wetherill machine (Fig. VIII.) consists of magnets provided with such pole-pieces, to which the crushed ore is to be treated is conveyed on belts, other belts carrying away those portions of the ore that are magnetically attracted; the process has been used for many different minerals, and is especially applicable to zinc ores, from which ferrous minerals, like franklinite, sphathic ore, &c., can be removed, no calcination being needed in this case; some black blendes also contain enough iron to enable them to be attracted by the magnet in these machines. The Wetherill machine has also been used successfully for separating wolfram from tin-stone. The Edison machine, for the separation of feebly magnetic minerals, such as specular haematite, from less magnetic ones, operates by allowing the crushed ore to fall past magnets furnished with pole-pieces so shaped as to produce a very powerful field, when the feebly-magnetic minerals are sufficiently deflected to effect a separation.

There is only one process in use depending upon differences in electric conductivity, which is known as the Blake-Morscher process, first brought out in the year 1901. It consists in allowing the finely crushed and perfectly dry ore to fall in a thin stream past a pole charged with high-tension static electricity. Any particles which consist of good conductors of electricity are immediately electrified similarly to the pole, and are hence repelled by it, whilst the direction of fall of bad conductors is unaffected. The machine (Fig. IX.) merely consists of a series of suitable poles arranged below each other, past which the stream of ore flows successively. Graphite and most of the metallic minerals have been found to be good conductors with the exception of compounds of zinc, some forms of blende being especially bad conductors. Practically all the plants now at work are employed for freeing zinc blende from iron pyrites, the economic importance of which separation I have already referred to; the specific gravities of these two minerals are nearly the same, and magnetic separation by the Wetherill process can only be carried out when the blende is high in iron. For cleaning the purer varieties of blende this process has therefore a definite field of usefulness. The method is still so new that it is impossible to predict what its future is likely to be.

The principle of the differential surface attraction of minerals for liquids has been utilised in the Elmore oil process, introduced about the year 1899. It depends upon the following fact:—If a mixture of finely-crushed minerals, some of which are sulphides of the heavy metals, whilst others are such oxides as quartz or alumina, or such silicates as clay, is formed into a pulp with water, and the pulp mixed with a heavy oil, such as petroleum residues, it will be found that the oil will wet and adhere to the metallic sulphides, but will not touch the other minerals; as the oil then floats up to the surface of the pulp, it will carry the metallic minerals up with it, thus separating these from the gangue with which they were intermixed. This process is particularly applicable to copper and silver ores which have to be crushed fine for treatment by the ordinary methods of dressing according to specific gravity; some of the minerals richest in these metals are very brittle, and in the process of crushing yield a powder so fine that it floats on water. To such a powder the ordinary methods of dressing are obviously inapplicable, but it can readily be concentrated by the Elmore process. This is carried out by mixing the pulp of crushed mineral with oil in horizontal revolving iron cylinders (Fig. X.) fitted with an internal spiral; there are three such cylinders placed one below the other; from the lowest the mixture flows into a funnel-shaped iron vessel, from the bottom of which the pulp, carrying the non-metallic material, flows off to waste, whilst the oil carrying the metallic particles overflows at the top into a suitable receiver. The oil is separated from the mineral particles in a special form of centrifugal pan with solid walls and a projecting flange round the top. Hot water is first run in until it forms a wall round the pan equal in thickness to the depth of the flange. On now running the charged oil into the centre of the rotating pan, the mineral is driven through the wall of water against the iron wall of the pan, whilst the oil remains inside the water and

flows up over the edge of the flange. By these means the metallic minerals are obtained in a high state of concentration. The process is in use in several places, and is giving satisfactory results, especially in saving very fine particles of rich ores that have escaped collection by any form of ordinary dressing appliances.

Another process, which appears to depend on an application of the same principle, is one used to recover small diamonds from the tailings escaping from the pans in which diamondiferous blue-ground is washed. These tailings are streamed over shaking tables with grooved surfaces, covered with a layer of thick grease. The diamonds adhere to the grease, and are caught, whilst the other minerals flow off freely.

Finally, I may refer to a very novel process, which effects the separation of certain minerals by chemical means, which is generally spoken of as the "flotation" process. This was first devised by C. V. Potter in 1901, and depends upon the fact that when zinc blende in a state of fine division is thrown into hot, very dilute sulphuric acid, sulphuretted hydrogen is formed, which adheres to the blende in the form of a bubble and floats the mineral to the surface.

The Delprat process, patented in 1902, is similar, but uses a hot acid solution of salt-cake. These processes are being applied to the mixed ores of the Broken Hill district, New South Wales, which contain a great deal of zinc blende in a state of such intimate admixture that none of the ordinary methods of dressing can be employed to separate it. The finely-ground ore is fed into a tank containing the above solutions, when the blende rises to the surface and can be skimmed off, the other minerals being drawn off from the bottom of the tank. It has also been proposed to use dilute nitric acid and chlorine water for the same purposes. This principle appears to be susceptible of much further development, and a good deal of attention is now being paid to it. It is interesting to note how we have here chemical methods being employed to solve a problem that was for so many years attempted by purely mechanical means.

I have now, gentlemen, attempted to lay before you a brief review of the more important methods in use to-day for preparing crude mineral products for treatment by the metallurgist or the industrial chemist. I have, of course, only attempted the barest outline of this very large subject, so as to indicate the degree of development to which it has by now attained, and to show how rapidly the old mechanical methods are being reinforced from the domains of physics and chemistry. I have been anxious to impress upon you its importance in the utilisation of the world's mineral wealth, which is all the greater because mineral products, unlike those of the animate kingdom, are incapable of reproduction. A bad harvest in one year may be compensated by a good one in the next, but a mineral deposit, once worked out, is exhausted for ever. It is accordingly the duty of all who have to treat minerals to study with special attention all methods and processes that tend to the more complete utilisation of the world's mineral output. I trust that this consideration may be deemed sufficient excuse for my having occupied your time this evening with a review of a subject somewhat different from those usually submitted to the meetings of this Society, but which I have endeavoured to show nevertheless possesses for all of us a very real importance.

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*Meeting held at Armstrong College on Thursday, November 9th, 1905.*

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PROF. HENRY LOUIS IN THE CHAIR.

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#### DETERMINATION OF SULPHUR IN PETROLEUM AND BITUMINOUS MINERALS.

BY F. C. GARRETT, D.S.C., AND E. L. LOMAX, B.S.C.

Many methods for the estimation of sulphur in bituminous minerals have been suggested, but Hodgson



(*J. Amer. Chem. Soc.*, 1898, 20, 882; this *J.*, 1899, 77) has shown that none could be trusted except that of Carius, and this method, though accurate, is very tedious. We have found that, by some modification in the details, the familiar method of heating with a mixture of sodium carbonate and lime or magnesia can be used even in the analysis of petroleum. A convenient quantity (*i.e.*, from 0.7 to 1.5 gm.) of the substance is placed in a small platinum crucible, intimately mixed with 3 or 4 grms. of a mixture of four parts of pure lime to one of anhydrous sodium carbonate, and the crucible completely filled with the lime-soda mixture. A larger platinum crucible is placed over the small one (mouth downward), the whole inverted, and the space between the two crucibles filled with the lime-soda mixture. The mouth of the crucible is covered by a thick pad of asbestos board, and the apparatus placed in a muffle furnace heated to bright redness; the object of the asbestos pad is to protect the inner crucible from radiation from the roof of the muffle, and so to ensure that distillation shall not commence before the mixture in the outer crucible has had time to heat up. Distillation commences in about two minutes, and as soon as a flame appears the asbestos may be removed. To ensure complete oxidation of carbon the roasting should be continued for two hours. The mixture is then brought into water, sulphides, &c., oxidised by bromine, and the solution acidified, filtered, and precipitated by barium chloride as usual. If the amount of sulphur be small it is advisable to allow the solution to stand on the water bath for 24 hours before filtering off the barium sulphate.

The following experiments show that the method is trustworthy:—

(I) 0.2340 gm. of dibenzyl disulphide gave 0.4460 gm.  $\text{BaSO}_4$ . S=26.18 per cent.

0.1258 gm. gave 0.2386 gm.  $\text{BaSO}_4$ . S=26.04 per cent. The formula requires 26.01 per cent.

(II) Trinidad petroleum, by Carius' method:—

0.9270 gm. gave 0.0940 gm.  $\text{BaSO}_4$ . S=1.39 per cent.  
0.8668 " 0.0910 " S=1.41 "

Five consecutive analyses of the same petroleum by the lime-soda method resulted as follows:—

1.4890 gm. gave 0.1386 gm.  $\text{BaSO}_4$ . S=1.28 per cent.  
1.4140 " 0.1434 " S=1.39 "  
1.2980 " 0.1350 " S=1.42 "  
1.4690 " 0.1386 " S=1.29 "  
1.3740 " 0.1394 " S=1.39 "

Mean=1.35 "

(III) Examination of a sample of Trinidad Manjak:—  
0.7946 gm. gave 0.1720 gm.  $\text{BaSO}_4$ . S=2.97 per cent.  
0.8666 " 0.1862 " S=2.95 per cent.

(IV) It was suggested that as about 22 grms. of the lime-soda mixture was used, the large amount of calcium and

sodium chlorides in the solution might affect the result. A solution of pure sulphuric acid was therefore prepared of such a strength that 25 c.c. contained 58.8 mgrms. of  $\text{H}_2\text{SO}_4$  or 18.4 mgrms. of sulphur; 25 c.c. of this solution was added to 20 grms. of the mixture, and worked up as usual, when 0.1428 gm. of  $\text{BaSO}_4$  was obtained, corresponding to 60.0 mgrms.  $\text{H}_2\text{SO}_4$  or 18.8 mgrms. S.

*Postscript.*—Since the foregoing was written, Sadtler (*J. Amer. Chem. Soc.*, 1905, 27, 1188; this *J.*, 1905, 1038) has described a method differing from this only in certain details; he uses a platinum crucible of special design, a mixture of equal quantities of sodium carbonate and magnesia, heats over the blow-pipe, and does not fill the outer crucible. We adopted lime because we found it easier to obtain free from sulphur than magnesia; we also find that if the percentage of sodium carbonate be increased, the mixture cakes, and is difficult to remove from the crucible. The filling of the outer crucible is important, as is shown by an examination of dibenzyl disulphide, made with the outer crucible filled only to the depth of about a quarter of an inch, when

0.1210 gm. gave 0.1436 gm.  $\text{BaSO}_4$ . S=16.4 per cent. (Theory requires 26.01 per cent.)

Possibly the use which Sadtler makes of asbestos gives a better absorption in the inner crucible, and so enables him to work with less of the mixture.

## Sydney Section.

Meeting held at Sydney on Wednesday, September 13th, 1905.

PROF. LIVERSIDGE, F.R.S., IN THE CHAIR.

### ANALYSES OF SOME NEW ZEALAND COALS.

BY A. M. WRIGHT.

The coals of New Zealand are of varying quality, some of them being equal to the best found in other parts of the world, while others are inferior, and of merely local value.

The following analyses were made, in most cases, from consignments of from 40 to 100 tons. The calorific value was determined with Rosenhain's modification of the Thomsen coal calorimeter:—

#### A.—Anthracite Coals.

	Moisture.	Ash.	Volatile combustible matter.	Fixed Carbon.	Sulphur.	Calories.
1. Acheron .....	1.80	12.12	1.96	84.12	—	—
2. Paparoa .....	5.11	2.55	15.89	76.45	0.15	7598

1. This analysis is taken from the reports of the Colonial Laboratory.

2. It is claimed for this coal, that it is identical with the best Welsh. It is estimated that about sixty-five million tons of it are available.

*B.—Semi-Bituminous and Bituminous Coals.*

	Moisture.	Ash.	Volatile combustible matter.	Fixed carbon.	Sulphur.	Calories.
1. Coalbrookdale .....	1.84	4.82	22.68	70.66	0.49	7508
2. Grey River .....	2.07	6.44	28.32	63.17	0.64	7233
3. Mokihinui .....	3.65	3.30	36.36	56.69	0.72	7482
4. Brunner .....	1.58	5.30	35.70	57.42	1.03	7389
5. Puponga .....	6.78	8.90	33.16	51.16	0.61	6895
6. Westport (good) .....	2.10	2.27	30.42	65.21	1.24	7698
7. Westport (average) .....	3.63	2.75	36.39	57.23	1.58	7473
8. Co-operative mine .....	5.81	1.12	34.72	58.35	1.35	7381
9. State coal mine (Port Elizabeth) .....	9.88	0.88	35.95	53.29	1.45	7063
10. State coal mine (Port Elizabeth) .....	10.48	1.63	31.87	56.02	0.97	7003
11. Westport Cardiff .....	3.33	1.55	38.28	56.84	1.02	7651
12. Blackball .....	8.25	1.72	27.98	62.05	0.62	7204
13. Kawa-Kawa .....	3.32	3.62	43.60	49.47	1.22	7328
14. Hikurangi .....	6.89	2.50	45.06	45.55	0.88	7245

1. A bright hard coal, yielding a strong lustrous coke and grey ash.
2. Almost lustrous, of very compact structure; the coke is highly vesicular, and ash light brown.
3. Bright and compact, yielding a hard coherent coke.
4. Bright and hard, yielding a vesicular coke, and grey ash.
5. Burns slowly without coking. The ash is red, containing much ferric oxide.
6. Bright and hard, burns fiercely, giving a lustrous, highly vesicular coke. Is well known in Australasia and extensively used in New Zealand.
7. Lustrous and hard, burns freely, giving a fairly compact coke and grey ash.
8. Lustrous and compact, burning freely. Yields a compact coke and grey ash.
9. Somewhat friable, lustrous and homogeneous. The coke is highly vesicular and burns to a grey ash.
- 11 and 12. Frequently contain quantities of fossil resin allied closely to the kauri gum.
12. Hard and lustrous, yielding a coke which frits well at high temperatures, burning to a brown ash.

*C.—Brown Coals.*

	Moisture.	Ash.	Volatile combustible matter.	Fixed carbon.	Sulphur.	Calories.
1. Malvern Hills .....	25.83	3.96	36.85	33.36	0.68	5388
2. Woolshed Creek .....	26.80	5.45	29.42	38.33	1.63	5102
3. Kaitangata .....	15.86	6.44	35.96	41.74	1.07	6100
4. Homebush .....	15.68	3.30	35.20	45.82	0.95	6215

1. Friable, burns slowly without coking to a bulky grey ash.
2. Fairly compact, burns without coking to a grey ash.
3. Fairly compact, gives a very friable coke and a grey ash, mostly calcium carbonate.

For permission to submit this paper, I have to express my thanks to Mr. Gilbert Anderson, Managing Director of the Christchurch Meat Co., Ltd., in whose laboratory most of the work has been carried out.

## DISCUSSION.

Mr. T. U. WALTON said that, except in certain Government reports, very few analyses of New Zealand coals seemed to have been published, and the paper was of value in supplying information as to the different kinds of coal obtainable, an interesting feature in most of which was the small proportion of ash. He had seen many analyses of similar coals, the results of which were in close agreement with those now published, except in respect to sulphur, the determination of which struck him as being generally too low. Thus Hickurangi coal was said to contain 0.88 per cent., while he had seen samples with only  $4\frac{1}{2}$  per cent. ash, containing about 5 per cent. sulphur, most of it in the free state, though the usual quantity was about 2½ per cent. Roasting with sodium carbonate was one of the best methods for complete oxidation of the sulphur, and he would like to know what method the author had used.

Mr. T. STEEL said that in the "Transactions of the New Zealand Institute," 31, 34, Evans gave a number of analyses of these coals, which agreed well with the present analyses; even the calorific values, which had been calculated by the formula of the American Coal Analysis Committee, were in close agreement. But the sulphur, determined by Eschka's method (*Chem. News*, 40, 237) was strikingly higher in many cases. Thus Coalbrookdale was 2.04, against 0.49; Brunner 2.35, against 1.03; Blackball 4.74, against 0.62; Kawa Kawa 4.92, against 1.22; Hickurangi 3.80, against 0.88; and Homebush 3.59, against 0.95. These coals were of lower cretaceous age, and the fossil resin was known as retinite, which was in no way related to the well-known kauri gym.

Mr. W. A. DIXON also thought the sulphur too low.

Mr. H. G. SMITH said that in the Sydney Technological Museum there were some good specimens of New Zealand coals showing the retinite mixed with them.

The AUTHOR, who was unable to be present, sent the following reply:—

"In the sulphur determinations, Eschka's method, igniting with magnesia and soda, was used, checked where the results seemed low by fusion with sodium carbonate and potassium nitrate."



# Journal and Patent Literature.

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## I.—PLANT, APPARATUS & MACHINERY

(Continued from page 1163.)

*Heat Engine; A New* — M. Cantor. *Physik. Zeits.*, Nov. 9, 1905; through *Electrician*, 1905, 56, 225.

SINCE the efficiency of a heat engine depends upon the amount of expansion of the gases employed, that is to say, upon the ratio of the final to the initial volume, much better results would be obtained if an initial pressure capable of solidifying the gas, and thus reducing it to the smallest possible initial volume, were employed.

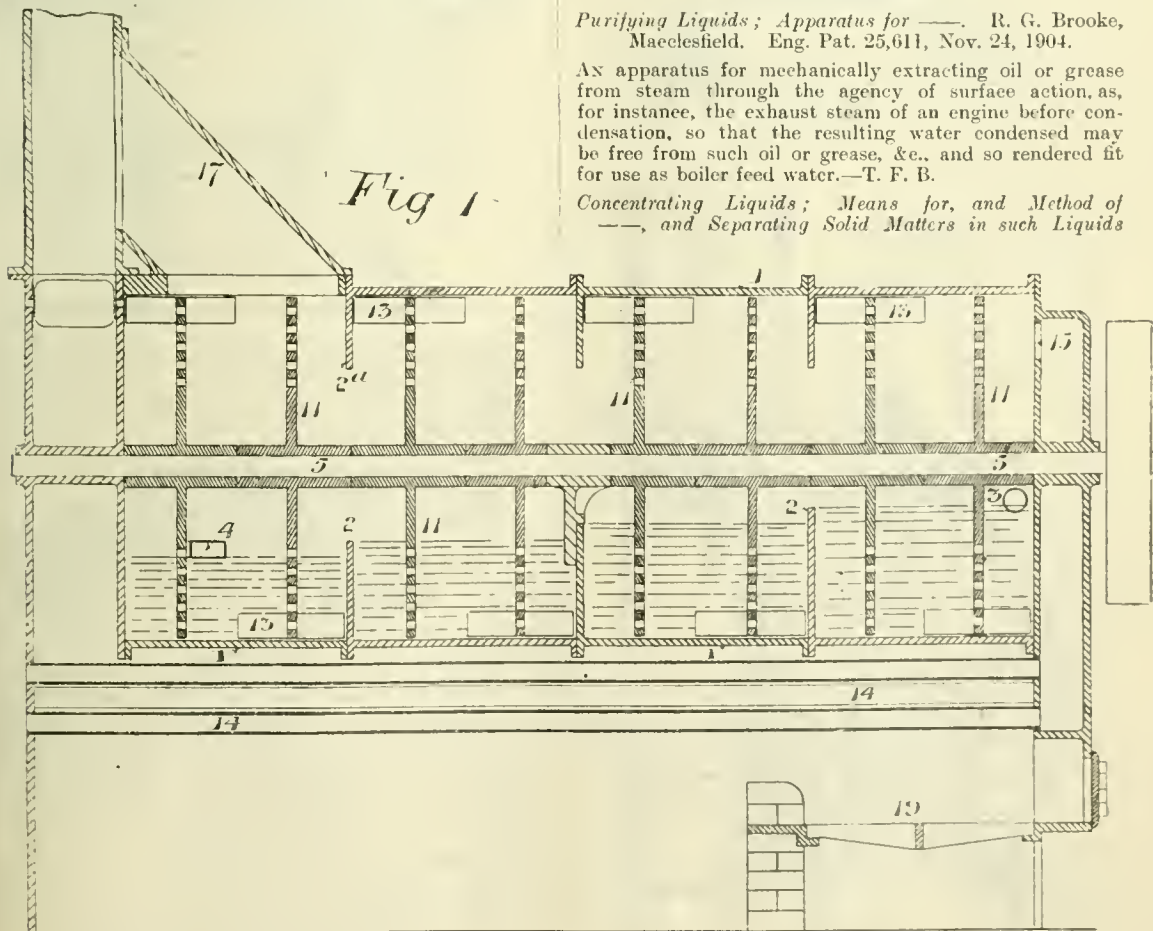
The following is suggested as a method of effecting this:—The engine is charged with copper oxide heated to incandescence, and is worked by blowing liquid fuel, e.g., petroleum, through the incandescent mass. The metallic copper produced is re-oxidised by a current of oxygen, the heat evolved being also utilised. The liquid fuel and the solid oxygen (contained in the copper oxide) have a very small initial volume, that of the oxygen being, in fact, only 1/7000 of its ordinary volume when in the gaseous state.—A. S.

### ENGLISH PATENTS.

*Purifying Liquids; Apparatus for* — R. G. Brooke, Macclesfield. Eng. Pat. 25,611, Nov. 24, 1904.

AN apparatus for mechanically extracting oil or grease from steam through the agency of surface action, as, for instance, the exhaust steam of an engine before condensation, so that the resulting water condensed may be free from such oil or grease, &c., and so rendered fit for use as boiler feed water.—T. F. B.

*Concentrating Liquids; Means for, and Method of* —, and *Separating Solid Matters in such Liquids*



by *Evaporation of the Liquid*. F. Wertenbruch, Glasgow. Eng. Pat. 27,579, Dec. 17, 1904.

THE invention relates to an improved apparatus for concentrating liquids, where it is required to separate solid material without detriment. The liquor passes through an opening 3 (Fig. 1), into a horizontal drum 1

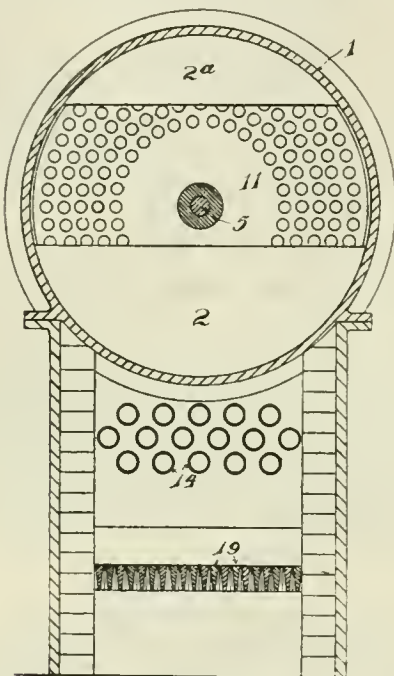


Fig 2

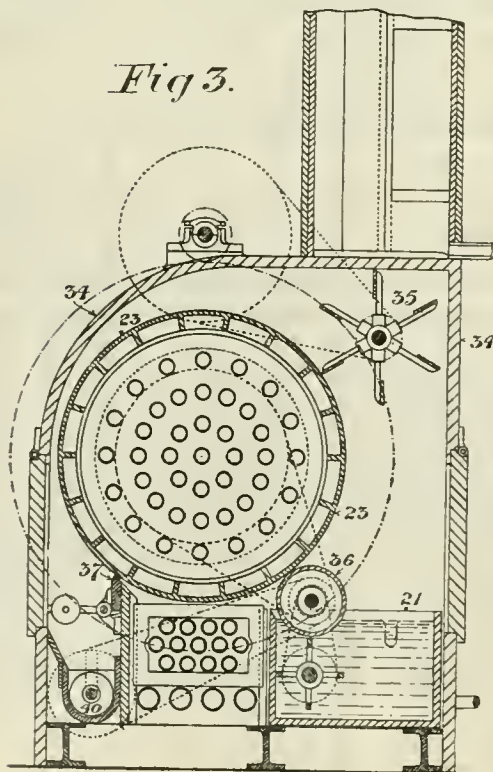
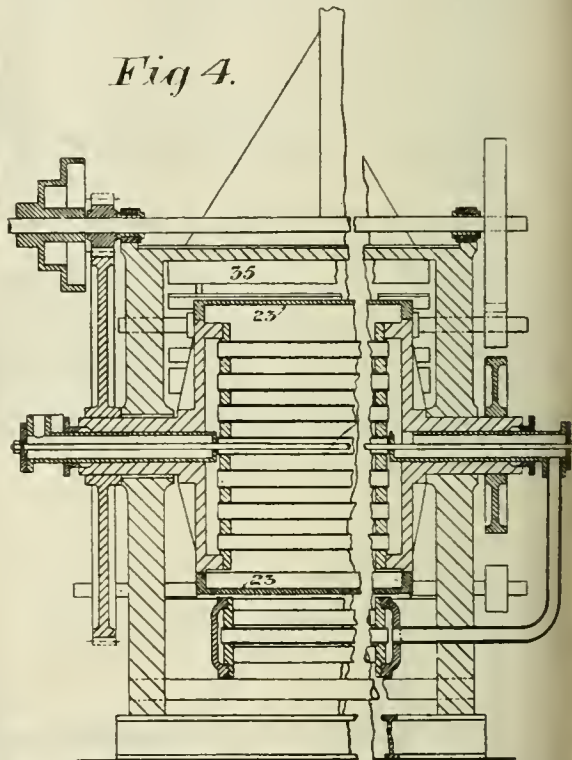


Fig 3.

(Figs. 1 and 2), with division plates 2 of varying height at the bottom and baffle-plates 2a, at the top. A shaft 5, carrying perforated discs 11, and paddles 13, traverses the centre of the drum, and on rotation churns up the liquid, thereby causing it to evaporate rapidly in a current of heated air which passes in through the pipes 14 and the inlet 15, and leaves the drum by the flue 17.

The air may be heated either by furnace gases or by a fire, 19, placed underneath the drum. The partially concentrated liquor runs out through the outlet 4, into a trough 21 (Fig. 3). It is then applied in a thin layer to the outer surface of an internally-heated revolving drum 23, by means of the roller 36, and the solid material which separates on the surface of the drum is removed

Fig 4.



by means of a scraper 37, and a conveyor 40. The whole is enclosed in an outer case 34, and frothing is prevented by the rotating fan 35. The speeds of the various parts of the apparatus are regulated according to the nature of the liquids.—B. J. S.

*Evaporators, Feed Heaters and Condensers; Impts. in* — D. Mathieson, Newcastle-on-Tyne. Eng. Pat. 28,396, Dec. 27, 1904.

THE claim is for causing the liquid to be heated or cooled and the heating or cooling agent to take opposite helical or spiral paths in separate adjoining conduits within a casing. The conduits may be formed by helical partitions, or by coils of piping, or by a combination of both within the casing.—W. H. C.

*Evaporating Pans; Method of and Apparatus for Discharging Vacuum* — H. A. Gill, London. From L. Tailfer, Paris. Eng. Pat. 29,392, Dec. 31, 1904.

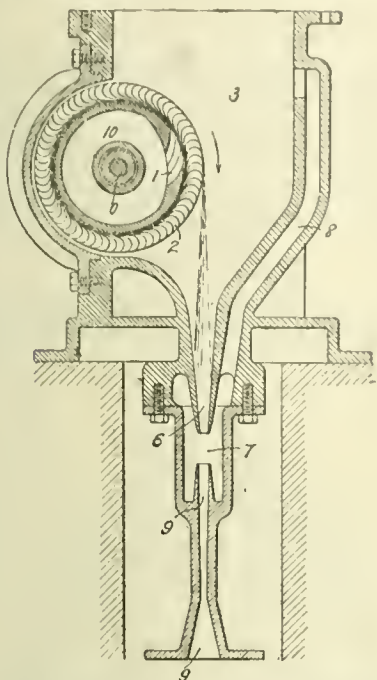
THE solids separated during evaporation are discharged from the bottom of the pan, through a rotating plug-valve, into a vessel containing a similar liquid to that which is being evaporated. All joints and openings through which air might leak into the apparatus are kept luted by the liquid.—W. H. C.

*Separators; Centrifugal* — N. S. Bök, Stockholm. Eng. Pat. 8256, April 18, 1905. Under Int. Conv., April 26, 1904.

SEE Fr. Pat. 355,062 of 1905; this J., 1905, 1162.—T.F.B.



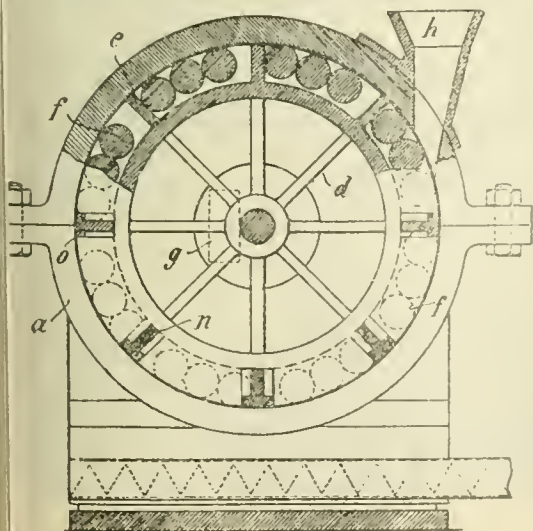
*Condensing and like Apparatus; Impts. in —.* La Soc. Anon. Westinghouse and M. Leblanc, Paris. Eng. Pat. 8452, April 20, 1905. Under Int. Conv., April 23, 1904.



A TURBINE 2, rotated in the reversed direction by the shaft 0, and supplied with water through the space 10 and the stationary jets 1, delivers the water in the form of spray into the chamber 3, into which the vapour to be condensed is led. The particles of water condense the vapour and pass out of the chamber through the passage 6, into the space 7, in which the pressure is equalised by the connecting channel 8. The spray then passes out through the ejector 9, at a high velocity, and draws with it any air that may have found its way into the chamber 3.—W. H. C.

*Washing of Coal, Ore, and the like; Impts. in the —.* F. Baum, Herne, Germany. Eng. Pat. 11,237, May 29, 1905.

SEE Fr. Pat. 355,097 of 1905; this J., 1905, 1162.—T.F.B.  
*Disintegrating Mills or Machines for Reducing Materials.* J. Wüstenhöfer, Dortmund, Germany. Eng. Pat. 15,808, Aug. 2, 1905.

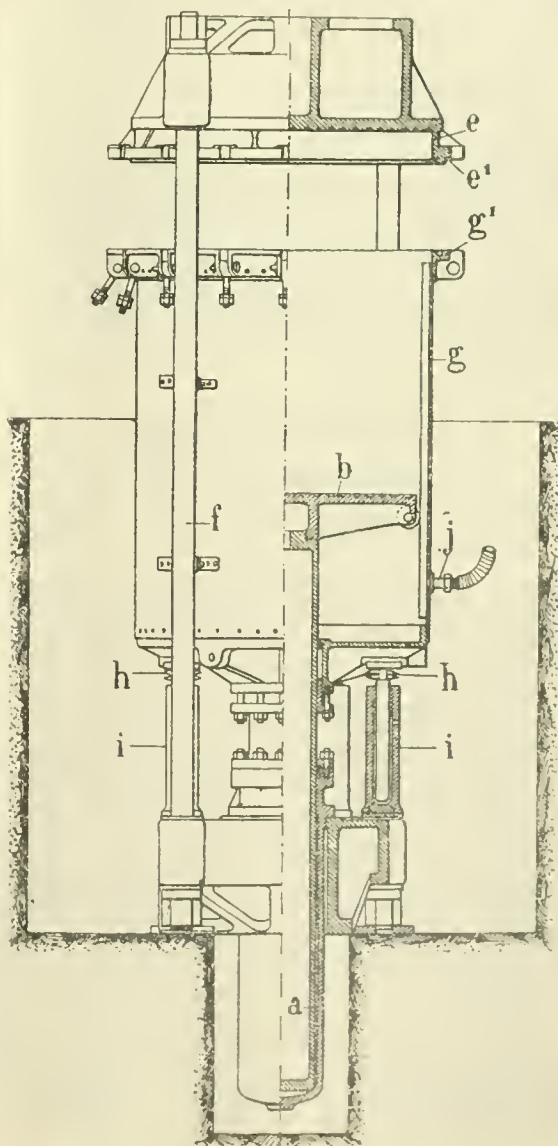


THE mill consists of a casing *a*, within which a series of drivers *d*, having "angle-shaped" end pieces *e*, are rotated by a central shaft. The interior of the mill is thus divided into a number of chambers, in each of which several rollers or balls *f*, are arranged. The material, which is introduced either by the hopper *h*, into the periphery, or into the interior by another hopper indicated by the dotted outline *g*, is ground between the balls or rollers *f*, and between them and the casing *a*. The ground material is thrown out through sieves placed at the end of the casing *a*, whilst any unground pieces are returned to the grinding zone by the wings *n*, and the projections *o*. The whole is enclosed in an outer casing provided with a conveyor to remove the ground material.—W. H. C.

#### FRENCH PATENTS.

*Press; Autoclave —.* E. Decauville.  
Fr. Pat. 350,167, Sept. 10, 1904.

THE press consists of a press-plate *b*, which is surrounded by a cylindrical casing *g*, the ram *a* of the press passing through a stuffing-box in the bottom of the casing, which rests on the elastic rings *h* placed on the hydraulic jacks *i*, and is provided with guides working on the



pillars *f* of the press. When the press has been charged, the casing *g* is raised by the jacks *i* until the top *g*<sup>1</sup> of the casing makes a tight joint with the rib *e*<sup>1</sup> of the border *e* of the top piece of the press. The bolts are then screwed up and the ram *a* set to work until sufficient pressure has been applied. Steam or vapour can be introduced into the casing through the pipe *j*. The casing is free to expand in a vertical direction owing to the elasticity of the rings *h*, and should this be insufficient, further expansion is allowed by some of the liquid in the hydraulic jacks being forced back into the accumulator. The arrangement allows both mechanical and steam pressure to be applied simultaneously.—W. H. C.

*Gases, Air Laden with Dust, &c.; Process and Apparatus for Purifying Blast-Furnace —, and for Dissolving Gases, &c., in Liquids.* E. Barthelmess. Fr. Pat. 355,562, June 21, 1905.

SEE Eng. Pat. 12,533 of 1905; this J., 1905, 1055.—T. F. B.

*Separator; Continuous —.* E. Wattier. Fr. Pat. 355,820, July 3, 1905.

A HORIZONTAL circular filtering surface, to the under side of which vacuum can be applied, is rotated below a feeding tank from which the material to be treated is fed regularly upon the upper surface of the filter. The liquid is drawn through, and the residue is removed from the surface of the filter by a worm conveyor.—W. H. C.

*Heat-Insulating Material; Process for Manufacturing a —.* G. G. Thomain and J. A. Gohier. Fr. Pat. 356,026, July 10, 1905.

STRONG glue (2 kilos.), resin (1 kilo.), alum (1 kilo.), and yellow gum-lac (50 grms.) are separately dissolved, and the hot solution mixed with 50 kilos. of cork and 18 litres of water. The mixture is next moulded under a pressure of about 200 kilos. per sq. cm., and then heated for three hours at a temperature of about 120° C., after which it is cooled and again heated for some time at about 50° C. For coverings for steam-pipes, the quantity of cork used is somewhat less, the quantities of adhesive ingredients being increased by about one-tenth.

The moulds used for making various forms of casings are also claimed.—A. G. L.

## II.—FUEL, GAS, AND LIGHT.

(Continued from page 1164.)

*Alcohol; Methods of Denaturing — employed in Different Countries.* A. Lecomte. Bull. Assoc. Chim. Sucr. Dist., 1905, 23, 386—390.

TRIALS in a spirit motor of denatured alcohol from various countries showed the following classification in order of efficiency: Austrian, German, Italian, Russian, Swiss, French, the values being the means of tests for maximum power developed, power developed at half-charge and alcohol consumed per horse power.

The conclusion drawn is that the presence of wood-spirit lowers the calorific value of the alcohol. German spirit for motors contains only 0.5 per cent. of wood-spirit and 0.25 per cent. of acetone, Austrian contains no acetone, Russian contains 10 per cent. of wood-spirit and 5 per cent. of acetone, Swiss contains 5 per cent. of wood spirit and 2.2 per cent. of acetone, whilst French contains 7.5 per cent. of wood spirit and 2.5 per cent. of acetone. The formula recommended for use in Belgium for motor and lighting purposes is: 100 litres of 90 per cent. alcohol, 2.5 litres of methyl ethyl ketone containing about 0.2 litre of higher ketones, 1 litre of benzene.—J. F. B.

*Fuels; Calorific Values of Motor —.* Levi. Revue Technique; through Brewers' J., 1905, 41, 681.

THE following comparison between the calorific values of different fuels used in combustion engines is given:

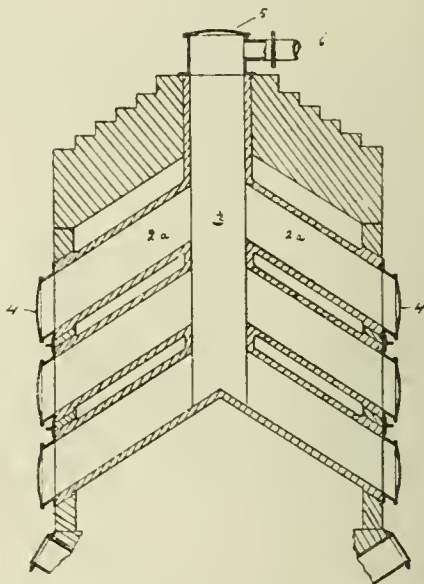
	B.T.U. per lb
Methylated alcohol.....	10630
Methylated alcohol with 50 per cent. of petrol.....	14200
Crude American oil.....	19630
Refined American oil.....	19880

The mixture of alcohol and petrol can be used as easily as petrol, but with alcohol alone, it is necessary to warm up the carburettor before starting, since the alcohol is not sufficiently volatile at ordinary temperatures. The small quantity of acetic acid produced when alcohol is used, is not sufficient to cause any damage. If a deposit of soot occurs in the admission valves, the fault is generally due to the carburettor which should be of such a type as will deal with a measured quantity of the spirit at each suction stroke. The use of alcohol for motors is spreading in Germany, where the cost of this spirit is only 8d. per gallon; one great advantage is said to be the absence of smell.—J. F. B.

*Coke; Properties of Good Blast-Furnace —.* Weill. X., page 1234.

### ENGLISH PATENTS.

[Gas] *Retorts and the Charging of same; Impts. in Inclined —.* T. and R. Redman, Bradford. Eng. Pat. 24,308, Nov. 10, 1904.



A NUMBER of inclined retorts *2a* set in a suitable furnace communicate at their upper ends with a central shaft *3*, through which they are charged after removing the cover *5*, and through which the gas escapes to the hydraulic main by the connection *6*. The lower ends of the retorts have mouth-pieces and doors *4*, through which the coke is discharged. The retorts are charged by a special feeding apparatus, having as many compartments as there are retorts, and doors opposite the retort ends. This is filled with coal, lowered into the central shaft *3* and the doors opened, when the coal slides down into all the retorts simultaneously. The retorts may also be set parallel instead of in vertical tiers, in which case a pyramid is formed at the bottom of the central shaft to direct the coal into the retorts.—W. H. C.

*Incandescent Bodies (Mantles); Impts. in —, and Method of making the Same.* H. Reeser, Berlin. Eng. Pat. 16,018, Aug. 4, 1905.

CLAIM is made for the employment, in the manufacture of incandescent mantles, of a metal obtained from platinum ore, after separation of platinum, iron, osmium, iridium, palladium, ruthenium, rhodium, and all other known metals contained in the ore. The known metals in the ore are separated by treatment with acids and repeated evaporation and calcination of the dissolved ore, the metal for use in the mantle being obtained from the remaining



solution after evaporation and calcination. The mantle is constructed of this metal, or the metal may be deposited on a mantle constructed of nickel, nickel alloy, or other suitable material.—B. N.

## UNITED STATES PATENTS.

[*Fuel Briquettes; Process of Manufacturing* — G. Höpfner, Berlin, Assignor to W. von Lewinski, Breslau, Germany. U.S. Pat. 804,193, Nov. 7, 1905.

SEE Fr. Pat. 344,926 of 1904; this J., 1904, 1205.—T. F. B.

[*Fuel Briquettes; Machine for Manufacturing* — G. Höpfner, Bleekendorf, Assignor to W. von Lewinski, Breslau, Germany. U.S. Pat. 804,402, Nov. 14, 1905.

SEE Fr. Pat. 344,926 of 1904; this J., 1904, 1205.—T. F. B.

[*Peat; Apparatus for Carbonising* — T. Ledermüller, Lemberg, Austria. U.S. Pat. 804,239, Nov. 14, 1905.

SEE Eng. Pat. 21,587 of 1902; this J., 1903, 989.—T. F. B.

[*Gas-Generator*. B. A. Sinn and F. H. Wagner, Baltimore, Md. U. S. Pat. 803,444, Oct. 31, 1905.

THE generator consists of an outer shell, below which is a sealed ash-pit. Above the ash-pit is the generator chamber proper, and above it a long filling hopper. Immediately above the generator chamber is an annular heating chamber, and above this a steam generator, provided with a number of flues, through which heated gases pass to the gas chamber which forms the top division of the apparatus. On the same level as the heating chamber, but outside the shell, is an air-heating chamber, provided with a conduit for conveying the heated air to the base of the generator. The hopper is extended down through the gas space, steam generator and the heating chamber to the dome of the gas generator. Means are also provided for conveying steam and water-overflow from the steam generator to the ash-pit.—W. C. H.

[*Gas; Process of Generating* — C. H. Claudel, Argenteuil, Assignor to Cie. du Carburateur Claudel, Paris. U.S. Pat. 803,557, Nov. 7, 1905.

SEE Fr. Pat. 331,372 of 1903; this J., 1903, 1122.—T. F. B.

[*Gas; Apparatus for the Manufacture of Generator* — P. Stiens, Rotterdam, Holland. U.S. Pat. 804,441, Nov. 14, 1905.

SEE Eng. Pat. 14,971 of 1904; this J., 1904, 977.—T. F. B.

[*Gas; Process of Generating* — E. Krenz, St. Louis, Mo. U.S. Pat. 804,737, Nov. 14, 1905.

THIS is a process for generating gas from bituminous fuel. Bituminous fuel is ignited within a "fire-pot," and reduced to a red-hot mass, on which fresh fuel is piled, within a fuel chamber at the top of the fire-pot. At the same time the "inherent" smoke from the fuel chamber is withdrawn at a point above the flame and above the openings through which the gas makes its exit. Steam and air are injected into the red-hot mass above the grate, and simultaneously the gas is sucked out at a point below the top plane of the red-hot mass, and at a point below the new fuel contained within the fuel chamber, and below the plane of the smoke-exit opening.—W. C. H.

[*Gas Purifying Apparatus*. P. Plantinga, Cleveland, Ohio. U.S. Pat. 803,068, Oct. 31, 1905.

THE apparatus consists of a purifying chamber containing a series of adjacent, disconnected gas ducts. Each of these consists of a horizontal tube, composed of a solid circumference, except along the lower portion, where it is formed into a narrow channel which is expanded into a wider perforated portion, open at the bottom. Thus between two contiguous ducts there is an entirely free space, the upper and lower portions of which are contracted, and the middle portion, between two of the narrow channels, is enlarged.—W. C. H.

[*Gas-Purifier*. B. A. Sinn and F. H. Wagner, Baltimore, Md. U.S. Pat. 803,139, Oct. 31, 1905.

THE purifier consists of a shell, the bottom portion of which forms a water chamber. Above the water is a ring-plate having a central perforated depression, on the under side of which is an annular flange which projects into the water. A gas-inlet pipe enters the shell below the ring-plate, and is confronted by the downturned flange. At the side of the shell, and communicating with the water-chamber, is a water-trap. In the shell, above the ring-plate, is a number of grids or crossed bars, over which water is sprayed from above. Over the sprays is a partition, forming an upper chamber in the shell, and a receptacle in this chamber. A pipe is arranged so that one end opens into this receptacle and the other end into the shell above the grids, whilst a gas-discharge pipe is connected with the shell above the partition, and between it and the perforated bottom of the upper chamber.—W. C. H.

[*Gas-Purifier*. A. Sahlin, London. U.S. Pat. 804,677, Nov. 14, 1905.

THIS apparatus for cleaning blast-furnace and other gases consists of an outer stationary shell provided with gas-inlets and outlets. Within the shell, and slightly eccentric to its axis, is a perforated drum, which is made to rotate by suitable means, and within which is a series of discs, arranged transversely to the axis, dividing the drum into compartments. In the space between the top of the drum and the outer shell are arranged, over alternate discs of the drum, diaphragms, by which the direction of the gases is changed so that they pass up out of one compartment and down the next. Above each compartment means are arranged for subjecting the perforated surface of the drum to the action of water. On the outer surface of the drum blades are arranged spirally to convey the used water and dust to the discharge exit. (See also this J., 1905, 610.)—W. C. H.

[*Mantles; Method of Preparing Incandescent Gas-* — C. M. Lungren, Bayonne, N.J., Assignor to The Safety Car Heating and Lighting Co., New York. U.S. Pat. 803,915, Nov. 7, 1905.

THE process consists in heating a mantle of varying thickness until the carbonaceous matter in the thinner portions is burned out, removing the mantle from the source of heat, in a glowing condition, and allowing the remaining carbonaceous matter to burn out. The entire mantle is then exposed to the direct action of a jet of flame, and the end by which it is secured to the member upon which it is mounted, is hardened by being independently heated.—W. C. H.

## FRENCH PATENTS.

[*Carburetted Air Generator*. E. Chazet. First Addition, dated June 24, 1905, to Fr. Pat. 338,883, June 22, 1903.

A VERTICAL cylindrical casing is divided, by means of a conical partition, into two compartments, each of which contains a bell floating in water. The bell in the lower compartment serves as the air-pumping device, and supplies air as required to the bell in the upper compartment; from the latter the air is led to a carburetter, which is attached to the side of the casing. The lower bell is caused to move up and down by means of a rod, which is attached to the under side of the bell and is provided at its lower end with a piston which moves vertically in a cylinder, to the bottom and top of which water is admitted alternately, under pressure. Externally, three four-way cocks, for the water, air and hydrocarbon supplies respectively, are connected by means of linked levers, and are controlled by means of a weighted chain, attached to the top of the lower bell and bearing upon a toothed sector which is fixed to the air cock. When the bells have reached a predetermined position, a tube, partly filled with mercury, tips over suddenly, and at once reverses the cocks. The main water-cock, which determines the movement of the whole apparatus, is connected by a rod with the upper bell, and is shut off automatically when the bell becomes full of air.—H. B.

*Gaseous Mixture containing Hydrogen and Methane; Manufacture of a —.* P. Sabatier. Fr. Pat. 355,900, July 5, 1905.

WATER gas, Dowson gas, or any other gaseous mixture containing carbon monoxide and hydrogen, is passed, at a temperature of 300°–500° C., over nickel, cobalt, or iron (or a mixture of these), obtained by the reduction of their oxides. A mixture of carbon dioxide, methane and hydrogen is produced, and carbon is deposited on the metal. The carbon dioxide is removed from the gas by washing with caustic alkali or the like. The metal, with its deposit of carbon, is now heated to 400°–500° C., and steam is passed over it. The carbon is oxidised, with production of carbon dioxide and hydrogen, and these two gases react partially upon each other, forming methane and water; the resulting gas, consisting of methane, hydrogen and carbon dioxide, is then washed with caustic alkali, to eliminate the carbon dioxide. Gases containing carbon monoxide, but no hydrogen, may be utilised as above, the first phase of the process serving merely to produce a deposit of carbon, which is then treated with steam for the production of methane and hydrogen.—H. B.

*Gas Purifier.* W. Towns. Fr. Pat. 355,583, June 24, 1905.

SEE Eng. Pat. 10,993 of 1905; this J., 1905, 1164.—T.F.B.

*Electrodes for Arc Lamps.* E. Mendoza and R. Bueno. Fr. Pat. 350,186, Sept. 23, 1904.

ELECTRODES are moulded in the desired form, from a paste consisting of retort carbon, 400 grms.; coke, 400 grms.; graphite, 100; tar, 150; sugar syrup, 100; copper oxide, about 10; zinc oxide, about 10; and ferric oxide, about 10 grms. After baking the electrodes at a bright red heat, they are covered electrolytically with a metallic deposit in a bath composed of water, 1 litre; copper sulphate, 100 grms.; sulphuric acid, 50 grms.; "platinum chloride, 2 grms.; potassium chloride, 5 grms."; and ferric chloride, 75 grms.—H.B.

*Filaments for Incandescent [Electric] Lamps.* A. Just and F. Hanaman. First Addition, dated June 10, 1905, to Fr. Pat. 347,661, Nov. 4, 1904. (See this J., 1905, 431.)

VERY thin filaments of carbon (0.02–0.06 mm.) are heated in an atmosphere containing tungsten hexachloride, molybdenum pentachloride, or a mixture of these, and a reducing gas such as hydrogen, whereby a metallic deposit is formed upon the carbon core. The filaments are then heated to a white heat for a short time in a reducing atmosphere at very low pressure, to convert all the carbon into carbide or other combined form. The carbon is finally removed by packing the filaments in the midst of finely powdered oxide of tungsten or molybdenum, and submitting them to a high temperature, whereby the carbon is oxidised.—H. B.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(Continued from page 1166.)

ENGLISH PATENT.

*Candles; Manufacture of Composite Paraffin Wax —.* A. J. Boulton, London. From The Standard Oil Co., Whiting, U.S.A. Eng. Pat. 17,945, Sept. 5, 1905.

SEE U.S. Pat. 802,100 of 1905; this J., 1905, 1166.—T.F.B.

UNITED STATES PATENTS.

*Coke Oven.* M. E. Rothberg, Cleveland, Ohio. U.S. Pat. 804,053, Nov. 7, 1905.

THE coking-oven consists of a series of adjacent coking chambers, in the side walls of which is a number of horizontal reverting heating flues, which at one end are

connected, by vertical "off-gas" flues, with a transverse stack-draught flue in the foundation. Also in the foundation, and at the other end of the heating flues, is a transverse air-supply flue, parallel to the stack-draught flue. The air-supply flue is connected with combustion chambers under the ovens, and in the floor of the ovens are cooling flues, open at one end to the atmosphere, and means are provided for establishing a circulation of air through the cooling-flues, and air-supply flue in communication with the combustion chamber. Dampers are arranged for regulating the flow of air and gases. There is also an air-inlet chamber, connected with the air-supply flue, arranged under the ovens, which may be of a double-fronted arrangement. (See also U.S. Pat. 705,446 of 1902; this J., 1902, 1067.)—W. C. H.

*Coke Oven.* M. E. Rothberg, Cleveland, Ohio. U.S. Pat. 804,054, Nov. 7, 1905.

THE invention relates to a double-fronted coke oven, the longitudinal walls of which are hollow, and provided with a median transverse partition. On each side of the partition, and extending from the front to the middle of the ovens, is a set of vertical up-draught heating flues, and a set of vertical down-draught heating flues. Above each double set of heating flues, and extending from the front to the middle of the ovens, is a chamber into which they open. Under the ovens are combustion chambers having perforated walls dividing them from the chambers below the up-draught heating flues. The down-draught heating flues are connected with a central transverse "off-gas" flue in the foundation. Also in the foundation, at the fronts of the ovens and parallel to this flue, are air flues communicating with the air-distributing chambers below the combustion chambers. In the tops of the ovens are reverting air-flues, connected with the chambers over the heating flues, at the rear of the ovens, and burner openings are provided to these reverting air-flues. The central off-gas flue in the foundation has upwardly extending branches opening into chambers at the side of the chambers below the down-draught heating flues, and separated from them by perforated walls. In the floors of the ovens are cooling flues open at one end to the atmosphere, and at the other end connected to a yoke-flue and a fan and piping connections for drawing air through the cooling flues and discharging it through the air flues in the foundation. (See also U.S. Pat. 720,971 of 1902; this J., 1903, 357.)—W. C. H.

*Wood; Process of Obtaining Terpenes and other Products from —.* E. B. Weed, Cleveland, Assignor to Weed Distilling and Manufacturing Co., New York. U.S. Pat. 804,358, Nov. 14, 1905.

SEE Eng. Pat. 4355 of 1903; this J., 1903, 692.—T. F. B.

FRENCH PATENTS.

*Bricks from Pitch and Coal-tar.* A. Monicole and M. Dupont. Fr. Pat. 355,901, Jan. 10, 1905. IX., page 1233.

*Ammoniacal Liquors resulting from the Manufacture of Lighting Gas; Apparatus for the Distillation of —.* J. Adriaanse. Fr. Pat. 355,971, July 7, 1905.

THE gas-liquor, after treatment with sodium carbonate to liberate the fixed ammonia, is passed through a reheater receiving its heat chiefly from a current of hot vapour arising from the vessel in which the ammoniacal vapours from the distilling column are saturated with sulphuric acid; but also in part from the residual liquor derived from the said column. The distilling column is constituted of successive superposed tiers of vessels to contain the liquid, which overflows from above to the vessels below, each of which is provided with an inverted immersed cap, enlarged at the bottom, for bubbling the gas set free through the liquor, in the usual manner. Some of these vessels are furnished with agitators; and, in case the liquor has not been treated with sodium carbonate, as described above, milk of lime is led into the two lower tiers of the column. The distillation may be promoted by circulating through the column the waste or exhaust



steam from the motor which serves to actuate parts of the apparatus. The process and apparatus may be modified in certain described ways.—E. S.

*Wood Tar ; Process for Separation of — in the Distillation of Wood for Pyroligneous Acid.* L. Meyer. Fr. Pat. 355,592, June 24, 1905.

By the neutralisation of crude pyroligneous acid with slaked lime, brown acetate of lime (68 per cent.) is produced. This is not such an important commercial product as the grey acetate of lime (80–82 per cent.), which can be obtained after a redistillation of the crude pyroligneous acid. This invention is an attempt to provide an economical method of completely purifying the distillation products of wood from the accompanying wood tar by a process of continuous fractional distillation. Instead of passing the products from the distillation of wood directly into a condenser, as is now commonly done, the volatile matter is made to circulate through several chambers, arranged either alongside one another or one above the other. The vapours are made to pass through these chambers in a finely divided condition, the chambers being kept at a convenient temperature. In this way the whole of the tar can be removed and chamber liquids of different boiling point obtained. In starting a distillation, the vapours may be washed by introducing into the chambers liquids of similar composition to those afterwards condensed there. The pyroligneous acid, which is condensed after removal of the tar, gives an acetate of lime containing 80–82 per cent. without further distillation.—C. E. F.

*Petroleum and Analogous Substances ; Rectifying —.* A. Pollet. Addition, dated June 15, 1905, to Fr. Pat. 351,519, Feb. 15, 1905 (this J., 1905, 885).

An improved arrangement of baffles is provided, so as to prevent the vapours ascending the sides of the vessel without encountering the screens designed to hinder the escape of the volatile particles.—C. S.

#### IV.—COLOURING MATTERS AND DYE STUFFS.

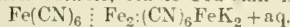
(Continued from page 1168.)

*Iron-Cyanogen Compounds ; Blue —.* K. A. Hofmann and F. Resenschek. *II.* *Annalen*, 1905, **340**, 267–275. (See also this J. 1904, 1209.)

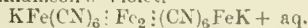
ALL the blue iron cyanides contain the tetravalent ferrocyanide group, more or less completely combined with ferric iron. The simplest member of the group, water-soluble Prussian Blue, is obtained by the action of 1 mol. of potassium ferrocyanide on 1 mol. of a ferric salt, or of 1 mol. of potassium ferricyanide on 1 mol. of a ferrous salt, in the absence of acid in aqueous solution, and corresponds to the formula  $KFe'''[Fe(CN)_6] + aq$ . By complete displacement of the potassium in this compound by ferric iron, insoluble Prussian Blue, or Turnbull's Blue is obtained, the two products being identical. Williamson's Violet, which is formed by the oxidation of the residue obtained in the preparation of hydrocyanic acid, has the same empirical formula as water-soluble Prussian Blue, with the exception of a slight difference in the quantity of water. The two substances are, however, undoubtedly different, as apart from the difference in colour, Williamson's Violet is insoluble in water and in oxalic acid, does not part with alkali under the influence of dilute mineral acids, and is only very slowly decomposed by ammonia solution. It has probably the constitutional formula  $KFe(CN)_6 : Fe'''_2(CN)_6 FeK + aq$ . When equimolecular amounts of ferrous sulphate and potassium ferrocyanide react in aqueous solution in the absence of free acid, a white precipitate is obtained, which rapidly oxidises in the air, forming a blue which resembles ordinary soluble Prussian Blue in being soluble in water and also in being rapidly decomposed by ammonia. Its behaviour towards oxalic acid is, however, characteristically different, and will be further discussed in a later communication (see below). If the reaction between ferrous sulphate and

potassium ferrocyanide take place in presence of about 1 per cent. of free sulphuric acid, the white precipitate formed is much more stable towards atmospheric oxygen, and when oxidised, forms a blue which behaves in a completely different manner to ordinary soluble Prussian Blue or Williamson's Violet. This blue has not been previously studied, and is called by the authors "Water-soluble, stable Blue," as it is much more resistant to ammonia or acids. It is prepared as follows:—To a solution of 21 grms. of potassium ferrocyanide ( $\frac{1}{2}$  mol.) in 500 c.c. of water, a solution of 13 grms. of pure ferrous sulphate ( $\frac{1}{2}$  mol) in 400 c.c. of water and 50 c.c. of 20 per cent. sulphuric acid is gradually added with continuous stirring. Oxidation is then effected by stirring for some days in the air in a shallow vessel. The substance is washed, and if necessary precipitated, by means of a mixture of equal volumes of alcohol and  $\frac{1}{2}$  per cent. aqueous sulphuric acid. It is dried over sulphuric acid, powdered, and further dried *in vacuo* over phosphorus pentoxide until its weight is constant. The empirical formula of the product is  $KFe[Fe(CN)_6] + H_2O$ . It is soluble in water and in 10 per cent. oxalic acid with a bright blue colour. On adding excess of 4 per cent. ammonia solution at 10° C., a blue precipitate forms after a few minutes only, and then gradually changes to olive-green, and in 6–7 minutes to reddish-brown ferric hydroxide. The filtrate contains ferrocyanide, but no ferricyanide. On treatment of the dissolved blue with 10 per cent. hydrochloric acid for several hours at the ordinary temperature, blue flocks are formed, which are insoluble in pure water after washing, but still behave towards ammonia or oxalic acid in the same manner as the original substance. This process is due to a removal of alkali which is not effected by very dilute ( $\frac{1}{2}$  per cent.) acid. The new blue is gradually precipitated in an apparently unchanged condition by ferric chloride, which converts ordinary soluble Prussian Blue into Insoluble Blue. Aqueous solutions of the new blue show no apparent depression of the freezing point, indicating that they are colloidal, a supposition borne out by their behaviour in an electrical field, the blue substance travelling to the anode, and being there precipitated. This view is also confirmed by the optical properties of the liquid, but no granular structure could be detected microscopically and nothing was retained on passing through a hardened filter. The new blue can also be prepared by completely precipitating potassium ferrocyanide with a ferrous salt, adding another molecule of potassium ferrocyanide in presence of free acid, and then oxidising with hydrogen peroxide. From this fact, together with its considerable resemblance in behaviour to Williamson's Violet, the authors deduce the following formulæ:

Water soluble, stable Prussian Blue,



Williamson's Violet,



By the action of potassium ferricyanide on ferric-ammonium-alum in presence of hydrogen peroxide, precipitates are obtained, identical with those obtained from ferric salts and potassium ferrocyanide, the ferricyanide being reduced. If, however, 5 per cent. of free hydrochloric acid is added to the brown mixture of potassium ferrocyanide solution and excess of ferric-ammonium-alum (3 mols.), then, on adding hydrogen peroxide, the reduction takes place much more slowly, and a copious precipitate is only formed in about 24 hours. This precipitate has a purple lustre, is insoluble in water and in oxalic acid, and only differs from Williamson's Violet in properties by being less stable towards 4 per cent. ammonia solution. On analysis, however, it is found to be an isomeride of insoluble Prussian Blue, of the formula  $Fe_7C_{18}N_{18} + 10H_2O$ .—E. F.

*Iron-Cyanogen Compounds ; Blue — and the Cause of their Colour. III.* K. A. Hofmann and F. Resenschek. *Annalen*, 1905, **342**, 364–374.

WHEN 1 mol. of potassium ferrocyanide reacts with 1 mol. of a ferrous salt in hot, mineral acid solution, Williamson's Violet is obtained on subsequent oxidation. If

the above-mentioned substances react in the cold, a blue compound of identical composition, excepting a difference in the percentage of water, is obtained on oxidation, as was described in the last communication, and was named by the authors "Water-soluble, stable Prussian Blue." (See preceding abstract.) When 1 mol. of a ferrous salt reacts with 1 mol. of potassium ferrocyanide in the absence of acid, another water-soluble blue is obtained on oxidation. This blue, which has not hitherto been distinguished from ordinary soluble Prussian Blue is of technical importance, as its formation explains the use of an admixture of a ferrous salt in preparing technical Prussian Blue. It is prepared as follows: 24 grms. of ferrous sulphate are dissolved in 1 litre of water, filtered and gradually added with stirring to a filtered solution of 42 grms. of potassium ferrocyanide in 1.5 litres of water. The white precipitate oxidises gradually in the air, or more quickly after adding neutral hydrogen peroxide solution, to the new blue, which is washed with a 1 per cent. potassium chloride solution, and finally with 50 per cent. alcohol. It is then dried *in vacuo*. The product is soluble in water with a greenish-blue colour, but insoluble in oxalic acid solution. On adding 1 per cent. of sulphuric acid to its aqueous solutions, the blue is precipitated and becomes insoluble in water owing to loss of alkali, whereas ordinary soluble Prussian Blue, though it loses alkali under the same treatment, is only precipitated very slowly and does not become insoluble in water, unless dried. The new blue is decomposed by 4 per cent. ammonia solution in a few seconds, forming ferric hydroxide and a ferrocyanide. On analysis, it yields figures corresponding to the formula,  $\text{FeKFe}(\text{CN})_6 \cdot \text{H}_2\text{O}$ . The authors consider it to be probably  $(\text{Fe}^{++}\text{OH})(\text{K})\text{Fe}(\text{CN})_6$ , whilst to ordinary soluble Prussian Blue they assign the formula  $\text{Fe}^{+++}(\text{OH})_2 \cdot \text{K}_2\text{Fe}(\text{CN})_6$ . Various experiments are cited in support of this view. The blue colour of the iron-cyanogen pigments is probably due to the simultaneous presence of iron of two different degrees of valency in the same molecule, and it is pointed out that the presence of atoms of the same element of various degrees of valency in the same molecule usually leads to strong light absorption. *Aethiops martialis* (containing ferric and ferrous hydroxides), red lead, sulphur sesquioxide, various complicated platinum compounds and tungsten compounds,  $\text{U}_3\text{O}_8$ ,  $\text{Mo}_3\text{O}_8$  and  $\text{Bi}_2\text{O}_4$  are cases in point.—E. F.

*Eosine; Products Obtained by the Autoxidation of* —. A. Hefft r. Ber., 1905, 33, 3633—3634.

Eosine solutions bleach slowly in the dark, much more quickly in direct sunlight. The action is accelerated by the presence of alkali. In absence of alkali strong eosine solutions deposit tetrabromofluorescein in sunlight, showing the formation of acids which decompose the potassium salt of eosine. A  $\frac{1}{2}$  per cent. eosine solution, containing 1 per cent. of sodium hydroxide, was exposed to sunlight whilst a current of air was passed through until the red colour changed to pale yellow. The liquid gave no peroxide reaction, but contained large quantities of bromides. On acidifying with hydrochloric acid, much carbon dioxide was evolved. The liquid was then extracted with ether, which, on evaporation, left a residue consisting of oxalic and phthalic acids and small quantities of a reddish-brown oil. Thus the main products are hydrobromic, carbonic, oxalic and phthalic acids. The latter was only isolated in much less than the theoretical quantity.—E. F.

#### ENGLISH PATENTS.

*Lakes [from Azo Dyestuffs]; Manufacture of Colour* —. C. D. Abel. From Act.-Ges. f. Anilinfabr. Eng. Pat. 27,496, Dec. 16, 1904. XIII.A., page 1243

*Indophenols; Manufacture of* —. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 27,499, Dec. 16, 1904.

SEE Fr. Pat. 353,866 of 1905; this J., 1905, 1062.—T. F. B.

*Pigment Colours [from Azo Dyestuffs]; Manufacture of Yellow and Orange* —. O. Imray. From Farb. vorm. Meister, Lucius und Brünig. Eng. Pat. 28,259, Dec. 23, 1904. XIII.A., page 1243.

*Dyestuff; Manufacture of a Bisulphite Compound of a Certain [Azo]* —. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brünig, Höchst a/Main, Germany. Eng. Pat. 7002, April 3, 1905.

SEE U.S. Pat. 795,058 of 1905; this J., 1905, 885.—T. F. B.

*Dyestuffs; Manufacture of new Tetrazo [Azo]* —. H. E. Newton, London. From Farbenhfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 847, Jan. 16, 1905.

SEE Fr. Pat. 347,376 of 1904 and additions thereto; this J., 1905, 329 and following these.—T. F. B.

#### UNITED STATES PATENT.

*Dye and Process of Making same; Monoazo* —. W. Herzberg and O. Siebert, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 803,592, Nov. 7, 1905.

SEE addition of Dec. 12, 1903, to Fr. Pat. 331,121 of 1903; this J., 1904, 657.—T. F. B.

#### FRENCH PATENTS.

*Dyestuffs Susceptible to Chroming on the Fibre; Process of Preparing Red to Bluish-red [Azo]* —. Fabr. Coul. d'Aniline et d'Extraits, ci-dev. J. R. Geigy. Fr. Pat. 350,161, Sept. 7, 1904.

SEE Eng. Pat. 17,274 of 1904; this J., 1905, 725.—T. F. B.

*Azo Dyestuffs; Preparation of New* —. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Jan. 9, 1905, to Fr. Pat. 347,376, Oct. 24, 1904 (this J., 1905, 329). Under Int. Conv., Oct. 31, 1904.

TETRAZOTISED benzidine- or toluidine-*m*-disulphonic acid is combined with 1 mol. of 1-phenyl-3-methyl-5-pyrazolone or  $\alpha$ -methylindole, and 1 mol. of  $\beta$ -naphthol, instead of with 2 mols. of either 1-phenyl-3-methyl-5-pyrazolone or  $\alpha$ -methylindole as described in the main patent. The new products are stated to dye wool from an acid bath in orange shades fast to milling, which do not bleed into the white when washed.—H. L.

*Azo Dyestuffs; Preparation of New* —. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated Jan. 12, 1905, to Fr. Pat. 347,376, Oct. 24, 1904 (this J., 1905, 329). Under Int. Conv., Nov. 18, 1904.

TETRAZOTISED benzidine- or toluidine-*m*-disulphonic acid is combined with 2 mols. of nitro-*m*-phenylenediamine, or with 1 mol. of this substance and 1 mol. of either  $\alpha$ -methylindole or 1-phenyl-3-methyl-5-pyrazolone or  $\beta$ -naphthol. Wool is dyed by the products from an acid bath in greenish-yellow to orange shades of similar fastness to those produced by the dyestuffs of the main patent. (Compare preceding abstract.)—H. L.

*Dyestuffs [Monoazo]; Production of New* —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 355,046, March 21, 1905. Under Int. Conv., June 1, 1904.

THE new dyestuffs are prepared by combining diazo compounds with the thiazolsulphonic acids claimed in Fr. Pat. 353,928 of 1905 (see this J., 1905, 1041) and its First Addition also of 1905 (see this J., 1905, 1168).

Example 1.—The thiazolsulphonic acid prepared from 2-benzylidene-amino-5-hydroxynaphthalene-7-sulphonic acid is combined with diazobenzene in sodium carbonate solution. The product dyes cotton directly in scarlet shades, fast to acids.

Example 2.—The thiazolsulphonic acid derived from 2-*m*-nitro-benzylideneamino-5-hydroxynaphthalene-7-sulphonic acid is combined with diazotised *o*-anisidine. The product dyes cotton in bluish-red shades, which may be diazotised on the fibre and developed with  $\beta$ -naphthol. A red, of yellower shade, fast to washing, is thus obtained.

The shade of a number of analogous dyestuffs, prepared by the combination of diazo compounds such as those of aniline, *o*-toluidine, xylidine, *o*-anisidine and  $\beta$ -naphthylamine on various thiazolsulphonic acids is shown in a table. In all cases cotton dyestuffs of yellowish to bluish-



red or scarlet shade are obtained. The thiazolsulphonic acids prepared from nitrobenzylidene derivatives yield dyestuffs which may be diazotised on the fibre and developed with  $\beta$ -naphthol.—H. L.

*Dyestuffs of the Anthracene Series; Production of* —. Soc. Anon. Prod. F. Bayer et Cie. First Addition, dated June 16, 1905, to Fr. Pat. 343,608, March 29, 1904.

SEE U.S. Pat. 775,369 of 1904; this J., 1904, 1210.—T. F. B.

*Dyestuffs of the Anthraquinone Series, and Intermediate Products for their Manufacture; Production of* —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 355,326, June 17, 1905.

By nitrating urethanes of the anthraquinone series new nitro derivatives are obtained, containing the nitro group in the ortho-position to the  $-\text{NH}\cdot\text{COOR}$  group. These are converted into new *o*-nitroaminoanthraquinones by hydrolysis, and thence by reduction to *o*-diaminoanthraquinones. These *o*-diaminoanthraquinones are condensed with *o*-diketones and yield new dyestuffs, probably azines, which dye cotton, after the fashion of indigo, from an alkaline reducing vat.

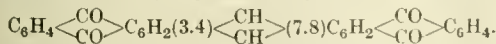
Thus, by nitrating the urethane of  $\beta$ -aminoanthraquinone (prepared by boiling  $\beta$ -aminoanthraquinone with ethyl chlorocarbonic acid,  $(\text{ClCOOC}_2\text{H}_5)$ , a mixture of the urethanes of 1,2- and 3,2-nitroaminoanthraquinone is obtained. These may be separated by crystallisation from nitrobenzene or glacial acetic acid and are then saponified by concentrated sulphuric acid, and purified by recrystallisation from pyridine. On reduction 1,2- and 2,3-diaminoanthraquinone are obtained respectively. The condensation with *o*-diketones is carried out in hot glacial acetic acid solution. The azine from 2,3-diaminoanthraquinone and  $\beta$ -naphthoquinone dyes cotton in orange shades from an alkaline hydrosulphite vat; the corresponding dyestuff from  $\beta$ -anthraquinone dyes cotton in blue shades. A green "vat" dyestuff is obtained by condensing 2,3-diaminoanthraquinone with an oxidation product of Alizarin Blue. This oxidation product is prepared by treating Alizarin Blue with nitric acid ( $42^\circ\text{B.}$ ) at  $10^\circ$ – $20^\circ\text{C.}$  in glacial acetic acid suspension. It crystallises out in yellow prisms, which are reconverted into Alizarin Blue by reduction, and dissolve with a yellow colour in sulphuric acid and organic solvents.

Similar dyestuffs derived from 1,2-diaminoanthraquinone are also described.—H. L.

*Anthracene; Production of New Derivatives of* —. Badische Anilin und Soda Fabr. Fr. Pat. 355,100, June 8, 1905. Under Int. Conv., March 24 and 25, 1905.

A YELLOW dyestuff, producing greener and brighter shades than Flavanthrone, is prepared by heating  $\beta$ -methylantraquinone with condensing agents such as caustic alkalis, alcoholic potash or caustic soda, &c. It may be dyed on cotton from a hydrosulphite or other alkaline "vat," and printed on fabrics either (1) in the presence of an alkali, with or without a reducing agent, or (2) in the presence of a reducing agent only. In the former case the goods are steamed; in the latter case, passed through an alkaline bath after printing. Two detailed recipes for dyeing cotton from a hydrosulphite vat and two recipes for printing on fabrics are given. The fastness of the shades thus obtained to light, chlorine, acids, washing and boiling is stated to be excellent.

The substance is insoluble in alkali and dissolves in concentrated sulphuric acid with a bright bluish-red coloration. The molecular composition is given as  $\text{C}_{30}\text{H}_{14}\text{O}_4$ , probably represented by the formula:—



Two mols. of  $\beta$ -methylantraquinone are probably condensed together in the methyl groups. Halogen derivatives of  $\omega$ -methylantraquinone substituted in the side chain, such as  $\omega$ -chloro- or bromo- $\beta$ -methylantraquinone,  $\beta$ -dichloro- or dibromo- $\beta$ -methylantraquinone show the same reaction.—H. L.

*Anthracene; Production of New Derivatives of* —. Badische Anilin und Soda Fabrik. Fr. Pat. 355,029, July 5, 1905. Under Int. Conv., Aug. 22, 1904.

SEE Eng. Pat. 1817 of 1905; this J., 1905, 919.—T. F. B.

*Indigo and its Homologues and Derivatives; Process of Reducing* —. Badische Anilin und Soda Fabrik. First Addition, dated July 5, 1905, to Fr. Pat. 348,360, Nov. 29, 1904. Under Int. Conv., May 13, 1905. (See this J., 1905, 495.)

INDIGO may be reduced by means of iron by the use of concentrated solutions of alkali carbonates, sulphates, or phosphates. Also the alkali hydroxide used in the process described in the principal patent, may be replaced wholly or partially by the disodium salt of indigo white; the indigo dissolves as it is reduced, and the monosodium salt of the indigo white remains in solution until it is converted into indigo white by fresh addition of indigo. At that juncture, the addition of alkali hydroxide is necessary to form the disodium salt. For example, 100 kilos. of the disodium salt of indigo white, in 30 per cent. solution, are heated with 20 kilos. of indigo and 20 kilos. of finely divided iron to about  $75^\circ\text{C.}$  The filtered liquid is stated to contain 40 per cent. of indigo white.—T. F. B.

*Dyestuffs; Process for the Production of Brown Sulphide* —. K. Oehler. Fr. Pat. 355,783, June 30, 1905.

SEE U.S. Pat. 801,598 of 1905; this J., 1905, 1167.—T. F. B.

#### GERMAN PATENTS.

*Dyestuff which Dyes Clear Yellow Shades on Unmordanted Cotton; Process of Preparing a Sulphide* —. Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 161,515, Feb. 25, 1903.

ONE part of monoacetyl-1,2,4-triaminobenzene is melted with 2 parts of sulphur, and the melt maintained at a temperature of  $250^\circ\text{C.}$  The resulting dyestuffs give clear fast yellow shades on unmordanted cotton from sodium sulphide baths.—T. F. B.

*Lakes [from Azo Dyestuffs] Fast to Light; Process of Preparing Red* —. Farb. vorm. Meister, Lucius und Brüning. Ger. Pat. 161,424, March 30, 1904. XIX.4., page 1244.

*Dyestuffs; Process of Preparing Red [Sulphide]* —. Anilin-farben- und Extrakt-Fabr. vorm. J. R. Geigy. Ger. Pat. 161,516, May 5, 1903.

By heating resorcinol and dimethylaniline or dimethyl-o-toluidine with sulphur at a high temperature, dyestuffs are obtained which, though of no value alone for dyeing purposes, are useful for imparting a red shade to dyeings with other sulphide dyestuffs. Red dyestuffs are formed at first (or if too little sulphur be used), and are converted into Corinth-red dyestuffs on further heating.—T. F. B.

*Dyestuffs; Process of Preparing Orange-Yellow to Orange-Red Basic* —. Anilin-farben- und Extrakt-Fabr. vorm. J. R. Geigy. Ger. Pat. 161,699, Sept. 4, 1904. Addition to Ger. Pat. 149,409, March 10, 1903.

THIS patent constitutes an addition to Fr. Pat. 330,487 of 1903, and its addition (this J., 1903, 1082 and 1241). Formylated aromatic *m*-diamines are heated either alone or with primary or alkylated *m*-diamines or with alkylated *m*-aminophenols, in presence of ammonium salts or amino bases. The best proportions to use are 1 mol. of the formyl compound to 1–2 mols. of the second component. With ammonium salts the temperature of reaction is  $200^\circ$ – $250^\circ\text{C.}$ , with amino bases from  $150^\circ$ – $200^\circ\text{C.}$  The dyestuffs dye tanned cotton and leather in various shades of orange.—T. F. B.

*Dyestuffs from Aminoanthraquinonesulphonic Acids; Process of Preparing Azo* —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 161,151, May 30, 1903.

AMINOANTHRAQUINONESULPHONIC acids are diazotised and combined with naphtholsulphonic acids. The dye-

stuffs prepared from the following are described:—1.2-aminoanthraquinonesulphonic acid and 1.5.2.6-diaminoanthraquinonedisulphonic acid with 2.3.6-naphtholdisulphonic acid; 1.6-aminoanthraquinonesulphonic acid with 1.3.6-naphtholdisulphonic acid. These dyestuffs dye wool yellowish-red to bluish-red shades, and are stated to produce fast lakes of fine colour by the usual methods.—T. F. B.

*Dyestuffs; Process of Preparing Polyazo* —. Kalle und Co., A.-G. Ger. Pat. 161,720, Nov. 29, 1903.

DIAZOTISED acet-*p*-phenylenediamine is combined with a phenol or amine, the acetyl group is removed, and the dyestuff is diazotised and combined in alkaline solution with 1-*p*-aminobenzeneazo-2.5.7-aminonaphtholdisulphonic acid. The dyestuffs give black shades when dyed directly, and various shades of blue when developed with  $\beta$ -naphthol. The dyeings are stated to be very fast.—T. F. B.

*Dyestuffs suitable for Preparing Lakes; Process of Producing Monoazo* —. Kalle und Co., A.-G. Ger. Pat. 162,180, Aug. 30, 1904.

THE diazo compounds of 2.6.8- or 2.5.7-naphthylamine-disulphonic acids, or of 2.3.6.8-naphthylaminetrisulphonic acid are combined with  $\beta$ -naphtholdisulphonic acid R. The lakes, prepared in the usual manner from these dyestuffs, are very fast to light and water, and are bluish-red in colour.—T. F. B.

*Indigo; Process of Preparing Stable Chloro-derivatives of* —. Badische Anilin und Soda Fabrik. Ger. Pat. 160,817, Feb. 24, 1904.

STABLE chloro-derivatives of indigo or its homologues are obtained by the action of chlorine on indigo in absence of water, and in presence of a halogen compound of phosphorus or sulphur. The action of dry chlorine on dry indigo, and the chlorination in presence of indifferent solvents, give rise to products from which the chlorine is split off by caustic alkali.—T. F. B.

*Dyestuffs; Process for Preparing o-Hydroxyazo [Azo]* —. Badische Anilin und Soda Fabrik. Ger. Pat. 162,009, March 27, 1904. Addition to Ger. Pat. 160,536, Jan. 8, 1904.

THE diazo compounds of mono- or polysulphonic acids or chloro derivatives of 1.2- or 2.1-naphthylaminesulphonic acids are converted into the corresponding o-hydroxy-diazo compounds by treating them in acid solutions, with hydrogen peroxide or an alkali or alkaline earth peroxide or persulphate; by this means the o-sulphonic group is replaced by a hydroxyl group. (Compare Eng. Pat. 15,025 of 1904; this J., 1905, 668.)—T. F. B.

*Dyestuffs suitable for Preparing Lakes; Process for Producing Yellow to Orange-yellow Monoazo [Azo]* —. Badische Anilin und Soda Fabrik. Ger. Pat. 161,277, July 27, 1904. Addition to Ger. Pat. 156,352, Sept. 10, 1903.

THE nitro-*m*-phenylenediamine or nitro-*m*-toluylenediamine in the principal patent (this J., 1905, 434) are replaced by nitro-*m*-phenylenediaminesulphonic acids. The presence of the sulphonic group makes the dyestuffs suitable for lake manufacture; the dyestuffs are also stated to be faster to light than those formerly described.—T. F. B.

*Dyestuffs; Process for Preparing Green Sulphide* —. Chem. Fabr. vorm. Sandoz. Ger. Pat. 162,156, May 25, 1904.

1-PHENYL- or tolylamino-4-*p*-hydroxyphenylaminonaphthalenemonosulphonic acids are heated with alkali polysulphides, with or without a copper salt. In the former case green, and in the latter yellowish-green, dyestuffs are obtained, which yield shades fast to light and washing. (Compare Fr. Pat. 343,377 of 1903; this J., 1904, 1026.)—T. F. B.

## V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(Continued from page 1170.)

*Dyeing [Silk Weighting] Process; The* —. IX. *The Tin Phosphate Process*. P. Heermann. Färber-Zeit., 1905, 16, 323–326, 340–343.

SILK was treated first with tin chloride solution (30° B.) and then with disodium phosphate solutions of various strengths and at different temperatures. It was found that the maximum amount of phosphoric acid was taken up when a 10° B. phosphate solution was used at a temperature of 75° to 100° C. Under these conditions the ratio of tin to phosphorus on the fibre agrees with the formula  $P_2O_5 \cdot 3SnO_2$ ; it was found, however, that this compound was not actually present, but that a mixture of a compound  $P_2O_5 \cdot 2SnO_2$  and a basic tin phosphate was formed. Experiments performed by the author indicated that the tin hydroxide first combined with a molecule of the phosphate, forming a compound  $Sn(ONa)_2H_2PO_4$  (the tin acting at the same time as an acid and a base), which is decomposed in the subsequent washing, with liberation of sodium hydroxide (which combines with the excess of phosphate, forming the normal phosphate), the basic phosphate being produced. This is in part decomposed in drying, with loss of water, to form the phosphate  $P_2O_5 \cdot 2SnO_2$ .—T. F. B.

*Cotton Colours Fast to Cross Dyeing*. G. Richter. J. Soc. Dyers and Colourists, 1905, 21, 306–307.

COTTON is cheaper than wool for obtaining coloured thread effects on dress goods, &c., as the goods can be dyed in the piece, and a large number of different effects can be produced by cross-dyeing. For obtaining "mélange" effects the loose cotton is dyed with colours fast to cross-dyeing, mixed with white wool, and the whole dyed in the piece. Ramie may also be used for this purpose. For other purposes the ground colour is dyed on the yarn or loose wool. Many basic colours are fast to cross-dyeing if subjected to after-treatment with tannin and tartar emetic or antimony salt. The cotton yarn is entered into a 2–6 per cent. tannin bath at 60° C. and left in the slowly cooling bath for three to four hours. The tannin, which may be replaced by sumach for dark shades, is fixed with half its weight of tartar emetic or antimony salt in a cold bath for half an hour. The goods are dyed in presence of acetic acid or alum, and are entered into a lukewarm bath, which is finally heated to 80° C. The after-treatment with tannin is performed in one hour in the cold, and is followed by treatment with tartar emetic for 10 to 15 minutes.—E. F.

*Mixed Cotton and Wool Tissues; Printing* —. E. Justin-Müller. Rev. Gén. des Mat. Col. 1905, 9, 313–315.

To produce printed tissues, consisting of about equal parts of cotton and wool, which, in feel and appearance, bear greater resemblance to wool than to cotton tissues, it is essential that the tissues in question shall not be woven from cotton warp- and woollen weft-yarns, as is frequently the case, but that they shall be composed of yarns in which the cotton and wool fibres have been carded and spun together.

*Operations Preparatory to Printing*.—The tissues, before printing, should be "crabbed," i.e., repeatedly passed through boiling water and pressed, or "decatized" by wrapping them upon a perforated pipe through which steam is thereupon passed. They may with advantage undergo both of these operations. The object of this preliminary treatment is to give the tissues greater firmness and tenacity and to enable them to withstand the subsequent operations without becoming crinkled or deformed. The usual practice of chlorinating the tissues to give the wool greater capacity for absorbing the dyestuff-mixtures which are printed upon them, is not to be recommended, as the wool is not only rendered yellowish in colour but harsh to the touch and the mixed tissues then appear too much like cotton tissues. It is found that by adding phenol to the printing-mixtures, the same



full shades may be produced upon unprepared tissues, as are obtained upon chlorinated tissues from the ordinary printing mixtures.

**Printing.**—The direct cotton dyestuffs are the most suitable dyestuffs for printing mixed cotton and wool tissues. Some of these yield identical shades on the wool and the cotton. Most of them, however, give on the two fibres colours which differ from each other. To produce the same shades, it is often necessary to add to the printing-mixtures small proportions of "complementary" dyestuffs, which colour the wool only, such as Formyl Violet S4B, Formyl Blue B, Lanacyl Blue BB, Lanacyl Violet B, Thioeosin R, Indian Yellow G, Naphthol Black 12B and similar acid dyestuffs. The following recipe represents the general composition of the printing-mixtures employed:—5–50 grms. of a direct cotton ("diamine") dyestuff, 0.5–5 gm. of a "complementary" dyestuff, 300 c.c. of boiling water, 70–100 c.c. of a dilute solution of ammonium citrate (added only when the water used is calcareous), 500 grms. of a neutral or slightly alkaline thickening-mixture, 90–100 c.c. of glycerin, and 35 grms. of phenol.

**Steaming.**—Before being submitted to this operation, the tissues are "damped" in the same manner as printed woollen tissues. They are then wrapped in dry steaming cloths and steamed for an hour without pressure. After this, they are washed in a plentiful supply of water.

**Finishing.**—Finishing is a very important operation in the case of mixed cotton and wool tissues. The use of all materials which are likely to impart stiffness to the tissues, is to be rigorously avoided. When it is necessary to "fill" the tissues, only such thickening materials, as gum tragacanth and Irish moss, which give a pliant finish, may be used, along with softening agents, namely, fatty matters, &c. The object of finishing is to render the cotton in the tissues as soft and supple as possible.

—E. B. .

**Discharging Dyed Textiles; Application of Bromine Salts for** — F. Erban. *Färber-Zeit.*, 1905, 16, 337–340.

A MIXTURE of sodium bromide and bromate, previously used by Koppeschaar for brominating phenol (for its determination) is suggested as a suitable source of bromine for use in discharging dyeings. This mixture is made by slowly adding 5 kilos. of bromine to 6.25 litres of caustic soda liquor (36° B.), keeping the temperature below 35° C., allowing to stand for two hours, and then evaporating to dryness. The product contains about 70 per cent. of bromine, which is liberated by acids. In many cases, acetic acid may be used in conjunction with the bromate mixture, but in certain cases bromination occurs, whilst in others, the acetic acid is set free by steaming, and the bromine is partially used up in oxidising the glycerin: the discharge of Alizarin dyeings with the use of acetic acid was unsatisfactory, owing to the partial re-formation of lakes after discharging. The dialkyl esters of oxalic acid, especially dimethyl oxalate, are, however, very suitable for the purpose, since the oxalic acid prevents any re-formation of lakes (*e.g.*, in working with Alizarin), and the alkali oxalate which is produced is oxidised by any excess of bromine. A suitable discharging mixture consists of 100 grms. of gum solution or other suitable thickening: 40–50 grms. of the bromate mixture, and 21–26 grms. of dimethyl oxalate (in alcoholic solution). An ammonium salt may be used instead of dimethyl oxalate, but there is more danger in this case of the fibre being attacked by the bromine.—T. F. B.

**Paper as a Material for Textiles.** H. P. Stevens. XIX., page 1250.

**Wool-Fat; Water-absorbing Power of** — J. Lifschütz. XII., page 1242.

**Paranitraniline Red; A Simple Test for** — E. Knecht. XXIII., page 1258.

#### ENGLISH PATENTS.

**Rhea Grass, Wood Fibre and the like: Treatment of** — for Spinning and other Purposes. J. Harris, London. Eng. Pat. 29,137, Dec. 30, 1904.

SEE FR. Pat. 354,599 of 1905; this J., 1905, 1169.—T. F. B.

**Silk: Process and Apparatus for Ungumming** — J. P. and J. Schmid, Basle, Switzerland. Eng. Pat. 13,952, July 6, 1905. Under Int. Conv., July 27, 1904. SEE FR. Pat. 345,173 of 1904; this J., 1905, 24. T. F. B.

**Carbonising Wool, Rags, Silks and other Fibres.** S. Roberts, Liversedge, Yorks. Eng. Pat. 4593, Mar. 6, 1905.

Wool and other animal fibres are freed from vegetable matter by immersing them in a bath of dilute acid through which an electric current is passed. Sulphuric acid of 5–7° Tw., or hydrochloric acid of 3–5° Tw. is used in an insulated bath. The bath is electrolysed and the material placed in a cage and immersed. A current of 500–600 amperes at 20–25 volts will complete the operation in ten to fifteen minutes.—E. F.

**Mercerising and Apparatus therefor: Impts. in** — Sir W. Mather, Salford, and J. Hübner and W. J. Pope, Manchester. Eng. Pat. 2993, Feb. 14, 1905.

THE invention is specially applicable to the mercerisation of loose cotton, but may also be used for muslins, lace, yarns, &c. After washing, the cotton is passed in a continuous manner between an upper pervious endless band and a lower travelling bed. The mercerising liquid is forced through the cotton, the latter being stretched between the band and the travelling bed, and thus prevented from contracting. The band and the travelling bed may, one or both, be constructed of wire gauze or of a series of metal bands, and are so devised that a constructive pressure is exerted on the material under treatment. (See also this J., 1905, 272.)—E. F.

**Dyestuffs; Manufacture of Blue and Violet to Black** — by Oxidation on the Fibre. O. Imray, London. From Farbwerke vorm. Meister, Lucius and Brüning, Höchst a/Maine, Germany. Eng. Pat. 2933, Feb. 14, 1905.

IN addition to the compounds enumerated in U.S. Pat. 796,715 of 1905 (this J., 1905, 967), *p*-aminohydroxydiphenylamine and *p*-*p*-diaminodiphenylamine may be used on the one hand, and phenol ethers, hydroxycarboxylic acids and their esters, *o*-aminophenol ethers, primary, secondary or tertiary *m*-aminophenols, alkylated or aliphylated *m*-phenylenediamines, naphthylamines, or thioaniline, on the other hand, with or without the addition of tannin or metallic salts.—T. F. B.

**Engraving and (or) Etching of Copper Rolls for Calico Printing: Impts. in** — D. C. Paterson, Glasgow. Eng. Pat. 27,222, Dec. 14, 1904.

A HALF-TONE photographic negative is first obtained from the original design. A print is then prepared from this by the bichromate process and is charged with greasy lithographic ink with a roller as used by lithographers. Sufficient ink is taken up by the design to permit of its transference to a lithographic stone. A transfer is then taken off the stone with paper and greasy lithographic ink, and is applied to the surface of a copper roller, which has been previously prepared by coating it with bitumen or some other acid-resisting compound. The greasy ink removes the bituminous coating where it is applied, and the roller is then etched and engraved by the usual methods. The transfer of the design to a lithographic stone may be omitted. In this case a print is prepared from the photographic negative directly on to paper, thin metallic sheeting, or some other flexible support by the bichromate process. The print is then prepared with lithographic ink and applied to the prepared surface of the roller. The same process may also be applied to produce a design on a steel mill, by means of which the copper roller is impressed.—E. F.

**Liquids as Brewers' Wash, Sewage, Waste or Spent Dyes and the like; Evaporating** — the Evaporator being also applicable as a Smoke Washer. A. B. Lennox. Eng. Pat. 28,951, Dec. 30, 1904. XVIIIIB., page 1250.

**Substances Capable of Resisting Water and Chemical and Similar Influences: Manufacture of** — [for Impregnating Textiles, Paper, &c.] C. Kochmann and J. Kaufmann, both of Berlin, Germany. Eng. Pat. 16,744, Aug. 18, 1905.

CARNAUBA wax is heated to a little above its melting

point, and powdered alum is stirred into it, and dissolves in the melted wax "to a fairly considerable extent." The quantity of alum added may vary from 5 per cent. to that necessary for complete saturation of the wax. The mass so obtained may either be cast or moulded, with or without pressure, or else it may be used in the melted state for the impregnation of porous materials, such as paper, textiles, &c. Other substances may be added to the mixture, such as cement, &c., as fillers, or oils to render it soft and flexible. Thus a material, closely resembling vulcanite, is obtained by impregnating a strong cotton or hemp fabric with a mixture of one kilo. of carnauba wax, 300 grms. of calcined alum, 300 grms. of plaster of Paris, and 300 grms. of kieselguhr. A flexible material may be obtained by impregnating with a mixture of 10 parts of carnauba wax, one of "residue of oil of amber," and one of alum. Materials may also be first of all saturated with a concentrated solution of alum, and then treated with the melted wax.—A. G. L.

#### UNITED STATES PATENTS.

*Cellulose; Process of Manufacturing Films or Threads of* —. M. Fremery, E. Bronnert and J. Urban. U.S. Pat. 804,191, Nov. 7, 1905. XIX., page 1251.

*Fibres; Process of Liberating and Separating* —. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 803,391, Oct. 31, 1905.

THE binding constituents of the fibres are converted into soluble compounds by suitable reagents, and the fibres are then submitted alternately to the action of alkalis and acids, whereby salts are formed within the pores of the fibres, causing their separation. Ammonia solution and an acid anhydride (e.g., carbon dioxide) are specified for the above purpose. The soluble salts are subsequently removed by washing.—T. F. B.

*Fibres; Process of Liberating, Separating and Bleaching* —. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 803,292, Oct. 31, 1905.

THE fibres are digested with some substance which is capable of rendering the binding constituents soluble, and of increasing in bulk when treated with sulphur dioxide. Sodium aluminate is claimed to fulfil these conditions. The fibres, saturated with sodium aluminate solution, are treated with sulphur dioxide, whereby compounds of increased bulk are formed within the pores of the fibres, causing them to be segregated, and bleaching them at the same time.—T. F. B.

*Mordanting with Magnesium Compounds; Process of* —. W. Warr, Stalybridge, Assignor to The Calico Printers' Association, Ltd., Manchester. U.S. Pat. 803,647, Nov. 7, 1905.

SEE Eng. Pat. 25,165 of 1904; this J., 1905, 194.—T. F. B.

*Dyeing; Process of* —. C. F. Kübler, Elmshorn, Germany. U.S. Pat. 803,421, Oct. 31, 1905.

SEE Fr. Pat. 348,398 of 1904; this J., 1905, 495.—T. F. B.

*Dyeing Indigo Resists; Process of* —. J. Ribbert, Hagen, Germany. U.S. Pat. 803,855, Nov. 7, 1905.

SEE Fr. Pat. 327,763 of 1902; this J., 1903, 948.—T. F. B.

*Hydrosulphite Preparations; Process of Making* —. R. Müller, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Höchst on the Maine, Germany. U.S. Pat. 804,157, Nov. 7, 1905.

SEE Eng. Pat. 6216 of 1904; this J., 1905, 194.—T. F. B.

#### FRENCH PATENTS.

*Cellulose and Copper Compounds; Manufacture of Artificial Threads composed of* —. A. W. Kracht. Fr. Pat. 355,064, May 1, 1905. Under Int. Conv., March 31, 1905.

A 5–10 PER CENT. cupro-ammoniacal solution of cellulose, containing as little ammonia as possible, is forced, through

apertures of greater diameter than the threads to be produced, into a concentrated solution of sodium carbonate. In this bath, which has a slightly coagulating or conglutinant action, the filaments are drawn out to a great degree of fineness. When sufficiently attenuated and firm, they are passed through a second bath, composed of a 35 per cent. solution of caustic soda or caustic potash, which causes the ammonia in the cellulose-compound to be replaced by soda or potash and renders the filaments considerably more tenacious. The filaments may now be washed with water, treated with acids, &c. and again washed with water, and dried. It is stated that filaments of extreme fineness and great strength are thus obtained.—E. B.

*Fibres, Films, Blocks or Plates; Transparent Plastic Product for the Manufacture of* —. H. C. M. L. Cathelineau and A. A. R. Fleury. First Addition, dated June 8, 1905, to Fr. Pat. 354,942, June 5, 1903 (this J., 1905, 1169).

A PLASTIC substance, which can be cut into sheets, strips or any other shape and used for various purposes, is made by treating casein with a phenol (as carbolic acid and thymol) in which is dissolved camphor and cellulose. The carbolic acid may be partially replaced by acetic acid.—W. B. H.

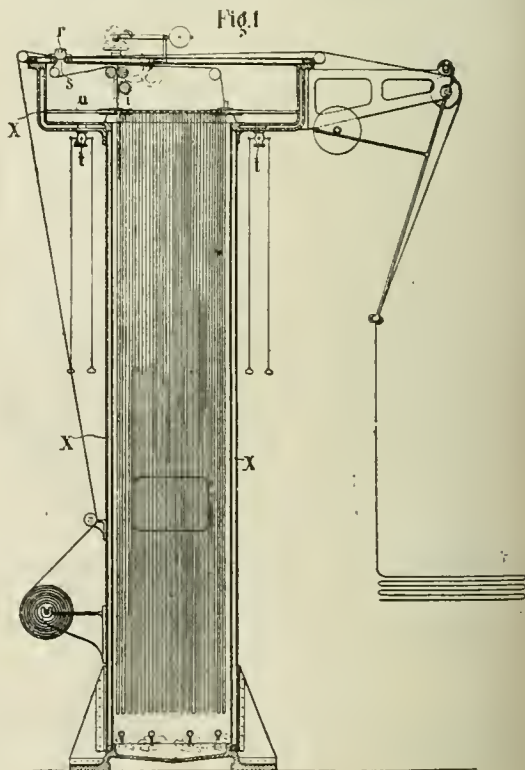
*Peptone from Silk Fibrom; Manufacture of* —. Act.-Ges. f. Anilinfabr. Fr. Pat. 355,805, July 1, 1905. XVIII., page 1249.

*Dyeing Skeins; Machine for* —. W. H. Fletcher. Fr. Pat. 356,133, March 14, 1905.

SEE U.S. Pat. 787,285 of 1905; this J., 1905, 544.—T. F. B.

*Steaming at High Temperatures [above 110° C.] and with Reduced Volumes of Steam; Process and Apparatus for Continuous* —. E. Simon and J. B. Weckerlin. Fr. Pat. 355,081, May 22, 1905.

THE process of steaming, in a continuous manner, printed, padded, or dyed textile materials, at temperatures exceed-





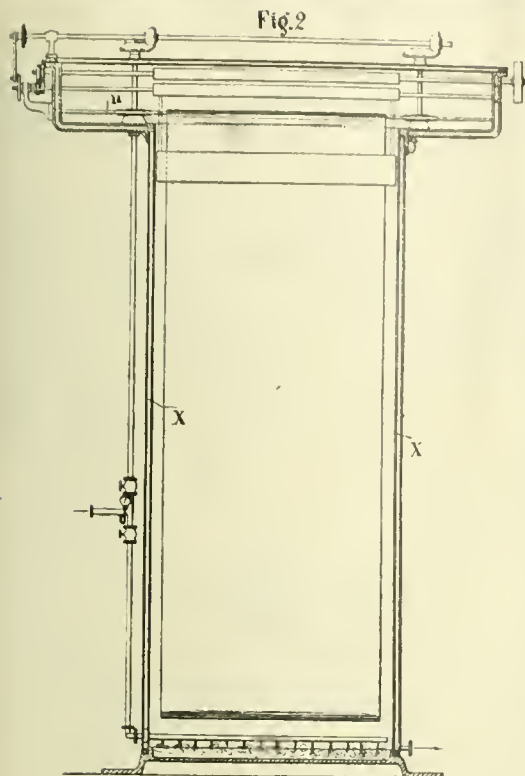
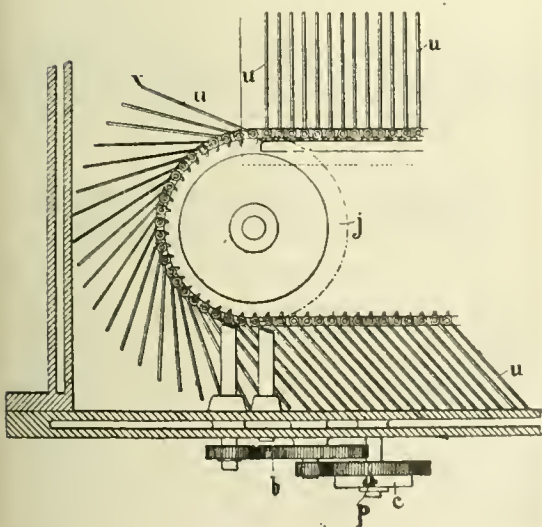


Fig. 3



ing  $110^{\circ}\text{C}$ ., is claimed. This method has the advantages, it is stated, (a) of effecting more perfect discharges upon cotton, wool, silk and other tissues than are obtained with the same dyestuffs and discharging agents by the usual methods of steaming, and (b) of producing "important" results, possibly with some economy, in the fixation of basic and Alizarin dyestuffs. The azo-Bordeaux colour from  $\alpha$ -naphthylamine and  $\beta$ -naphthol, for example, is discharged to a pure white by sodium hydro-sulphite-formaldehyde, when tissues dyed with it are steamed for three minutes at a temperature of  $130^{\circ}$ – $140^{\circ}\text{C}$ ., a result which is not attained by steaming for 20 minutes, at

$100^{\circ}\text{C}$ . or a little above this, in the ordinary continuous steaming apparatus.

A form of apparatus, suitable for accomplishing the operation of steaming at temperatures higher than  $110^{\circ}\text{C}$ ., which is the subject of a second claim, consists of a heat-insulated double-jacketed vessel (see Figs.), fitted with a system of rollers, over which the tissues are drawn in the ordinary manner, or, alternatively, and preferably, provided with two sets of rods  $u$ , on opposite sides of the vessel, upon which the tissues, &c., are suspended in folds. The tissues, &c., enter and leave the apparatus at its top through a slit  $s$ , above which a roller  $r$  is mounted. Before beginning the operation of steaming, steam under a pressure of six atmospheres is introduced into the walls  $X$  and top of the apparatus, and allowed to circulate therein for 30–35 minutes, or the jacket may be directly heated by means of a fire. The steam is then admitted into the interior of the vessel, the air displaced being allowed to escape through valves  $t$ . At the end of a minute, the temperature of the interior will have reached  $110^{\circ}$ – $140^{\circ}\text{C}$ ., whereupon the tissues, &c., to be steamed are passed into the apparatus, and the steaming operation is begun and accomplished in a continuous manner. The comparative rapidity with which the high temperature is attained is to be ascribed to the fact that, owing to the top and walls of the vessel being highly heated, no condensation of steam takes place in the inner space. The steam may now be almost entirely shut off from the outer spaces, being admitted in the necessary quantity to the steaming space, as long as the apparatus is in operation. The excess of steam escapes through the slit  $s$ . The dimensions (capacity) of the apparatus described, necessarily small, are considerably less than those of the ordinary small-sized Mather-Platt steaming apparatus. It has not been found possible to obtain high temperatures (of  $130^{\circ}$ – $140^{\circ}\text{C}$ .) with apparatus of large size.

The rods  $u$  (Fig. 3), from which the tissues hang down in folds, are actuated from one of the draw-rollers by means of a train of gear-wheels  $b$ , upon the last of which a disc  $c$  is keyed. The latter bears a pawl  $p$ , which, at each revolution of the disc, moves a tappet which actuates a lever and, through it, a ratchet-wheel. The motion of this is communicated by means of cone-gearing to two shafts which turn chain-wheels  $j$ , round which pass the chains bearing the rods  $u$ . The rods are thus intermittently moved at intervals which are automatically regulated and which correspond with the speed of motion of the draw-rollers, the mechanism being such that the disc completes a revolution whenever a length of tissue sufficient to form a fold, has been fed into the apparatus.—E. B.

*Dyeing and Finishing: Method of —. [Action of Chlorine upon Dyestuffs.]* C. Henry. Fr. Pat. 355,391., June 20, 1905.

TEXTILE and other materials are simultaneously dyed and finished by the application to them, at the ordinary temperature, of dyestuffs dissolved in varnishes composed of mixtures of (a) gum-lac, colophony, ammonia, and methylated spirit, and (b) an aqueous solution of borax and glue, which may be treated with chlorine or other halogens, introduced into them either in the form of gas or in aqueous solution.—E. B.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(Continued from page 1170.)

### FRENCH PATENTS.

*Leather: Process of Making — by means of Colouring Matters.* P. D. Zacharias. First Addition, dated June 29, 1905, to Fr. Pat. 329 708, Feb. 25, 1903. XIV., page 1245.

*Dyeing and Seerlage of Skins and Hair by Spraying.* C. Pichard and E. Pichard. Fr. Pat. 355,121, June 9, 1905.

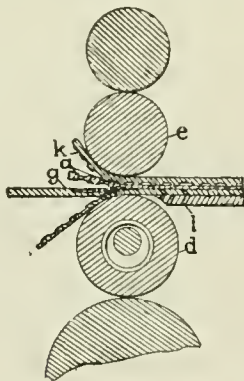
CLAIM is made for a machine for the dyeing and seerlage of

skins. [Secrétagé is a treatment with mercuric nitrate solution, for improving the felting properties of the fur or hair.] Above is placed a tank for holding the dye-liquor, &c., which is led to the machine through a small pipe close to the lower end of which is a pipe conveying compressed air. The skins enter and leave the machine by means of rollers. The machine has a perforated bottom for the excess of dye-liquor, &c., to run through, and so be collected. The apparatus is also provided with a draught chimney to carry away obnoxious fumes evolved in the secrétagé process.—W. B. H.

*Sponges; Process of Dyeing* — T. Asher.  
Fr. Pat. 356,176, July 17, 1905.

THE sponges are mordanted, dried at about 50° C., and then dyed in a solution of a suitable dyestuff at about 70° or 80° C. They are finally treated with a hot soap solution, and dried at below 80° C. By using temperatures up to and not exceeding 80° C., it is stated that no contraction of the sponges occurs.—T. F. B.

*Fibrous Materials [Leather, &c.]; Producing Designs upon Both Sides of Sheets of* — F. W. Moore,  
Fr. Pat. 355,265, June 15, 1905. Under Int. Conv.,  
Feb. 25, 1905.



SHEETS of leather *a* (see Fig.), or of other suitable, flexible fibrous materials, are ornamented in pattern by passing them over a stationary table *l*, between a guide-roller *e* and a roller *d*, composed of rings or sections, in contact with a matrix-band *k*, of hard material, such as celluloid or metal, against a revolving knife *g*. The band *k*, bears upon it a design in relief and intaglio, or has portions cut out of it, leaving openings in it. As the band *k*, and sheet *a* emerge from between the rollers *e* and *d*, the pressure exerted by the projecting portions of the band upon the upper surface of the flexible sheet, causes parts of the latter to protrude from the lower surface beyond other parts. These protruding parts are cut away by the knife *g*. After the sheet has left the matrix-band, the parts, from which portions have thus been removed, spring back, leaving depressions corresponding with those impressed upon the upper surface. The design is thus simultaneously produced upon both sides of the material.—E. B.

*Printing-Machine [for Wall-Papers, &c.]; An Intermittent, Rotary* — J. P. Bertrand. Fr. Pat. 350,159, Sept. 5, 1904.

THE object of this invention is to enable sheets of paper to be printed at regular intervals by certain rollers, while they are being, if desired, continuously printed by other rollers. A segment B C (see Figs.) of a crown-wheel of the same length as the circumference of the printing-rollers, is attached to one side of the main crown-wheel A, of a rotary printing-machine. As the wheel A revolves, the segment comes into gear with a crown-wheel or wheels O mounted, in the same plane as it, at the end of the mandrel carrying the intermittent printing-roller or rollers P. A portion, E D (Fig. 3) of the surface of the latter which remains in contact with the paper

Fig 1

Fig 2

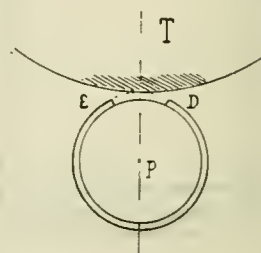
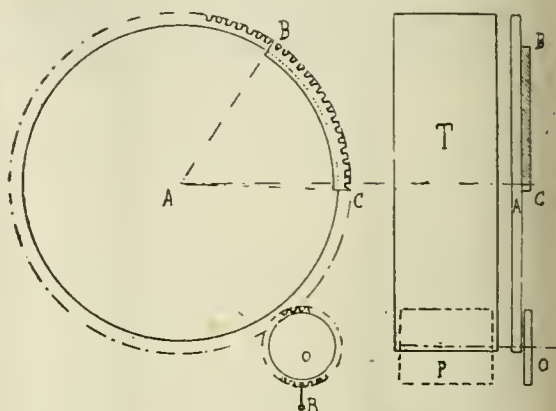


Fig 3

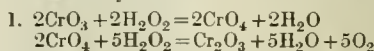
as it passes round with the bowl T (Figs. 2 and 3), when the roller or rollers P are not in operation, is left unengraved. Springs R engage with the wheels O, to prevent the rollers from being moved out of position by the bowl.—E. B.

## VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

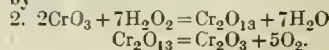
(Continued from page 1172.)

*Chromic Acid; Decomposition of* — by Hydrogen Peroxide. E. H. Riesenfeld. Ber., 1905, 38, 3578—3586.

A KNOWN volume of hydrogen peroxide was slowly run into a large excess of chromic acid (potassium bichromate and sulphuric acid) at the ordinary temperature, the reaction-flask being constantly shaken to avoid local excess of peroxide, and the oxygen evolved was measured. The results showed that the equation  $2\text{CrO}_3 + 3\text{H}_2\text{O}_2 = \text{Cr}_2\text{O}_3 + 3\text{H}_2\text{O} + 3\text{O}_2$  represents the reaction. The amount of oxygen actually evolved varied from 2.79 to 2.93 atoms per atom of chromium, the deficiency being, no doubt, due to supersaturation of the liquid. On reversing the conditions of the experiment, and running a known amount of chromic acid solution into an excess (8 to 600 times the theoretical amount) of hydrogen peroxide, the amount of oxygen liberated corresponded to nearly five atoms per atom of chromium, a result which can be represented either by—



or by





To decide which of these reactions really occurs, derivatives of the two perchromic acids, namely  $K_2CrO_8$  and  $CrO_4.3H_2O$ , were decomposed by acids, in aqueous solution alone and in presence of varying amounts of hydrogen peroxide. In the case of each substance, the amount of oxygen evolved was independent of the presence of hydrogen peroxide. Hence the second set of equations represents the reaction, and chromic acid, in presence of excess of hydrogen peroxide, is converted, chiefly, at least, into a perchromic acid of the formula  $H_3CrO_8$ . The amount of evolved oxygen being always somewhat less than that required by this, it is possible that a less highly oxidised perchromic compound is also formed to some extent. The same reaction occurs in alkaline solution, but if the temperature rises, the alkali salt, when a certain concentration is reached, decomposes according to the equation  $2K_2CrO_8 + H_2O = 2K_2CrO_4 + 2KOH + O_2$ , regenerating chromate and hydroxide. In this way a given quantity of chromate can decompose an indefinitely large amount of hydrogen peroxide.—J. T. D.

*Phosphoric Acid; Equilibrium between some Bases when they are Present Simultaneously with —.* A. Quartaroli. *Gaz. chim. ital.*, 1905, 35 [2], 290—304.

THE author states that Berthelot (this J., 1901, 806), probably owing to an error of calculation, wrongly interpreted the results of his experiments on the equilibrium between phosphoric acid, sodium hydroxide and lime or baryta. He has, therefore, determined the conditions of equilibrium in the following systems:—(1)  $1H_3PO_4 + \frac{1}{2}CaO$  (or  $BaO$ ) +  $2KOH$  (or  $NaOH$ ); (2)  $1H_3PO_4 + \frac{1}{2}CaO$  (or  $BaO$ ) +  $1NaOH$ ; (3)  $1H_3PO_4 + \frac{1}{2}MgO + 2NaOH$  (or  $KOH$ ); (4)  $1H_3PO_4 + \frac{1}{2}MgO + 1NaOH$  (or  $KOH$ ). 25 c.c. of a N/1 solution of phosphoric acid were mixed with corresponding quantities of the alkaline solutions, and the whole made up to 500 c.c. A portion of the solution was filtered immediately, and the filtrate titrated with N/2 hydrochloric acid in presence of methyl orange and of phenolphthalein. After standing for two days, another portion of the solution was filtered and titrated. In system (1) barely one-third of the phosphoric acid present is precipitated, in the form of tri- and tetrabasic salts, and not two-thirds in the form of a double salt  $Ca_2(Ba_2)Na_6(PO_4)_4$  as Berthelot stated. Two-thirds of the phosphoric acid remains in solution in the form of tri- and dibasic salts. The bases are distributed irregularly between the precipitate and the solution. If the system  $1H_3PO_4 + \frac{1}{2}BaO + 2NaOH$  be allowed to stand for a long time, the precipitate ultimately contains one atomic proportion each of sodium and barium, and nearly one-half of the acid is precipitated. In system (2) also, the bases are distributed irregularly between the precipitate and the solution. The latter contains mono- and dibasic phosphates, whilst the precipitate contains di-, tri- and, occasionally, tetrabasic salts. Less than two-thirds of the phosphoric acid is precipitated. Magnesia behaves differently from lime and baryta, and its behaviour depends also on the kind of alkali present. For example, in system (3) when the alkali employed is sodium hydroxide, the precipitate consists solely of magnesium compounds, whilst when potassium hydroxide is used, some alkali is carried down by the precipitate. In system (4), much less phosphoric acid is precipitated (only about one-sixth of the total quantity); apparently a soluble double phosphate is formed, as dimagnesium phosphate is insoluble, and the amount of alkali present would be sufficient for the precipitation of the remaining dissolved magnesium under ordinary conditions.—A. S.

*Barium Oxide; A New Hydrate of — [and Presence of Barium Ferrocyanide in the "pure" Hydroxide].* O. Bauer. *Z. anorg. Chem.*, 1905, 47, 401—420.

THE hydrate  $Ba(OH)_2.3H_2O$  has been prepared from  $Ba(OH)_2.8H_2O$  by melting in an iron crucible and driving off the necessary quantity of water. The boiling temperature slowly rises and finally reaches 108.5 C. as the concentration increases, and at this point heating is discontinued. The cooling process is made to occupy some hours by packing the hot crucible in sawdust, and when some of the product has solidified, the surface crust is

pierced and the rest poured out. When cold the interior is found to contain brilliant rhombic crystals of the new hydrate, which readily absorb carbon dioxide from the air and lose their lustre and transparency. In dry air the trihydrate slowly changes to the monohydrate. The corresponding hydrate of strontium cannot be obtained by a similar method. It is noted that strongly heated barium hydroxide attacks platinum.

When barium hydroxide is obtained by heating the carbonate with charcoal, it is found to contain ferrocyanide. In the heating process barium cyanide is first formed, and this combines with small quantities of iron present to yield Prussian Blue. On solution, barium ferrocyanide results and cannot be removed by recrystallisation, but only by heating in steam at 300° C., which decomposes it with the liberation of ammonia and carbon monoxide. Barium oxide prepared by heating the nitrate is not liable to contain this impurity.—F. Spx.

*Hypochlorite Production; Relation of Stability to Electro-Chemical Efficiency in —.* W. P. Digby. Paper read before Faraday Soc., Oct. 31, 1905. [Advance Proof.]

IN electrolytic hypochlorite manufacture rarely more than 18 per cent. of the chlorine present in the form of chloride is converted into hypochlorite. The author states that the amount of available chlorine produced from a solution of sodium chloride probably depends upon the relation of the current density to the quantity of unconverted sodium chloride actually present between the electrodes. Consideration is also given to the question of the instability of the electrolytic hypochlorite solutions, and it is shown how important this is in all cases except those in which the sodium chloride solution is fed into the electrolyser at one end and drawn off at the other end for continuous use. It is suggested that the presence of minute quantities of iron in the solution materially affects the instability.—R. S. II.

*Nitrous Oxide; Rate of Decomposition of —.* M. A. Hunter. *Z. physik. Chem.*, 1905, 53, 441—448.

THE author's experiments were carried out at 700°—900° C., the dried gas being passed through a porcelain bulb, heated in a small electric tube furnace to the desired temperature, which was measured by means of a platinum-rhodium thermo-element. The amount of decomposition was ascertained by determining the density of the effluent gas, after cooling to a definite temperature. The density of the gas was determined in a micro-balance consisting of an ebonite box, in which was mounted a stretched quartz fibre. Mounted across the quartz fibre was a long thread of glass carrying a bulb at one end, whilst the other end travelled over a graduated scale. The results of the experiments show that the reaction is bimolecular, in accordance with the equation:  $-2N_2O = 2N_2 + O_2$ . Small quantities of the higher oxides of nitrogen are, however, always formed, their amount being greater the higher the temperature. Moisture has little influence on the rate of decomposition.—A. S.

*Nitrosyl Fluoride.* O. Ruff and K. Stäuber. *Z. anorg. Chem.*, 1905, 47, 190—202.

THE authors repeat the experiments of Gore (*J. Chem. Soc.*, 1869, 22, 391, 393) on the action of concentrated nitric acid on anhydrous hydrofluoric acid, and on the action of potassium nitrate and sulphuric acid on sodium fluoride, but were unable to obtain a compound of nitrogen, oxygen and fluorine. Nitrosyl fluoride, NOF, was obtained, however, by the action of nitrosyl chloride on oilier fluoride. A glass flask containing nitrosyl chloride was connected by means of a glass tube bent at right angles, and by stoppers of paraffin wax with a platinum tube 60 cm. long, and 1 cm. wide, containing dry silver fluoride, and heated to 200—250° C. This tube was connected by means of a stopper of paraffin wax to a platinum bottle or flask provided with two tap-tubes, and connected to a calcium chloride tube. The paraffin wax stoppers in the ends of the platinum tube were protected from the action of heat by means of leaden cooling worms. The flask containing the nitrosyl chloride

was cooled to  $-5^{\circ}\text{C}.$ ; at this temperature, a slow stream of nitrosyl chloride distilled off, and passed over the heated silver fluoride in the platinum tube. The effluent gas was condensed in the platinum bottle by means of liquid air, and was afterwards freed from nitrosyl chloride by repeated fractional distillation. In the pure state in a strongly cooled vessel, it formed a nearly colourless mass, which liquefied at  $-134^{\circ}\text{C}.$  and boiled at  $-56^{\circ}\text{C}.$  The gas was colourless and had little action on dry glass, but attacked the latter vigorously in presence of moisture. The moist gas also acted strongly on phosphorus pentoxide. Nitrosyl fluoride is decomposed by silicon, boron, phosphorus, antimony and arsenic, and by sodium with formation of sodium fluoride. Tin reacts on warming, and organic substances (starch, caoutchouc, filter-paper) are decomposed with formation of hydrofluoric acid. Nitrosyl fluoride dissolves in water to a blue solution, which decomposes with formation of nitric oxide and nitric acid.—A. S.

*Ammonium Salts; Volumetric Determination of — by means of Alkali Hypobromite.* E. Rupp and E. Roessler. XXIII., page 1256.

*Iron-Cyanogen Compounds; Blue — and the Cause of their Colour. II, and III.* K. A. Hofmann and F. Resenschek. IV., page 1221.

*Silicate Analysis.* E. Jordis and W. Ludewig. XXIII., page 1256.

#### ENGLISH PATENTS.

*Sulphides of Arsenic; Utilisation of Crude —.* F. Howles. London. Eng. Pat. 24,198, Nov. 8, 1904.

CRUDE arsenic sulphides, such, for instance, as result from the de-arsenication of sulphuric acid, are treated with a solution of soda ash (sodium carbonate) or other suitable alkali, and the solution thus obtained is decomposed, preferably hot, by hydrated oxides of iron or manganese, or of other suitable metals. The solution of arsenites thus produced, after filtration from the precipitated sulphides, is evaporated to obtain solid arsenites. —E. S.

*Electrolytic Cells; Treating the Contents of —.* J. Hargreaves. Eng. Pat. 25,331, Nov. 22, 1904. XI., page 1240.

*Nickel and Cobalt; Eliminating Iron from Solutions of —.* H. Hirtz, London. Eng. Pat. 28,128, Dec. 22, 1904.

A NEUTRAL or nearly neutral solution of nickel or cobalt, containing iron, is treated with the hydrated peroxide of nickel or of cobalt, as the case may be, added in such proportion that the available oxygen introduced is approximately equivalent to the amount of iron to be oxidised.—E. S.

*Carbon; Impts. in Treated —, and Method of Producing same.* The British Thomson-Houston Co., London. From General Electric Co., Schenectady, N.Y. Eng. Pat. 28,062, Dec. 21, 1904.

ORDINARY untreated carbon, either moulded into the form of the article to be made or else in block form, is immersed for some time in a bath of melted petroleum jelly, melted paraffin or similar oily substance, or in a heated solution of vaseline, petroleum jelly, lard, oil, &c., in a volatile solvent, e.g., benzene, coal-tar naphtha, or turpentine. No substance which dries or hardens by oxidation should be used, however. In the case of petroleum jelly a temperature of  $100^{\circ}\text{C}.$  is used, the carbon being immersed for several hours. The carbon is next usually allowed to drain and dry in the air for several hours. This treatment may, however, be omitted, and the carbon at once baked for several hours in an oven at a temperature at least as high as that at which they are to be used subsequently. Thus dynamo brushes are heated for 12 hours to from  $120^{\circ}$  to  $200^{\circ}\text{C}.$ ; carbon packing rings for steam turbines are heated for several hours to from  $260^{\circ}$  to  $270^{\circ}\text{C}.$  During this baking a large part of the lubricating material drains out of the carbon. —A. G. L.

#### UNITED STATES PATENTS.

*Hydrochloric and Sulphuric Acids; Process of Making and Separating —.* P. Askenasy and M. Mugdan, Nuremberg, Germany. U.S. Pat. 804,515, Nov. 14, 1905.

SEE Eng. Pat. 14,342 of 1903; this J., 1903, 1085.—T.F.B.

*Lime; Process of Hydrating —.* J. Reaney, jun., Sherwood, Md. U.S. Pat. 803,506, Oct. 31, 1905.

THE process, which is conducted in a closed receptacle, in the presence of steam, consists in agitating the moistened lime to cause the heavier, unhydrated particles to settle to the bottom of the mass, and the lighter, hydrated particles, to rise to the surface and pass off while the heavier particles are held in check. The separated hydrated particles are passed over a screen, and the coarser particles thus separated are retained in an atmosphere of steam until completely hydrated. (See also U.S. Pat. 773,029 and 773,030, of 1904; this J., 1904, 1088 and 1089.)—E. S.

*Ammonia; Process of Making — by Synthesis.* H. C. Woltereck, Assignor to the Eschweiler-Woltereck Process Synd., Ltd., London. U.S. Pat. 803,651, Nov. 7, 1905.

SEE Eng. Pat. 2461 of 1902; this J., 1903, 695.—T.F.B.

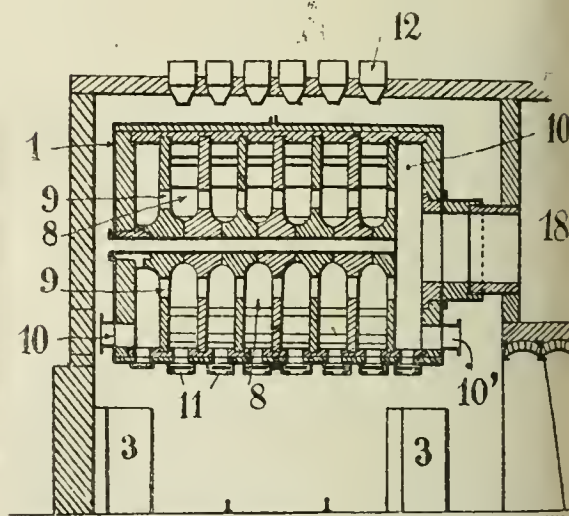
*Ammonia; Process of Making — by Synthesis.* H. C. Woltereck, Assignor to the Chemicals Proprietary Co., Ltd., London. U.S. Pat. 803,652 and 803,653, Nov. 7, 1905.

SEE Fr. Pat. 332,591 of 1903; this J., 1903, 1243.—T.F.B.

#### FRENCH PATENTS.

*Kiln for Roasting Fine and Granulated Pyrites; Rotating —.* V. Brulfer. Fr. Pat. 355,581, June 24, 1905.

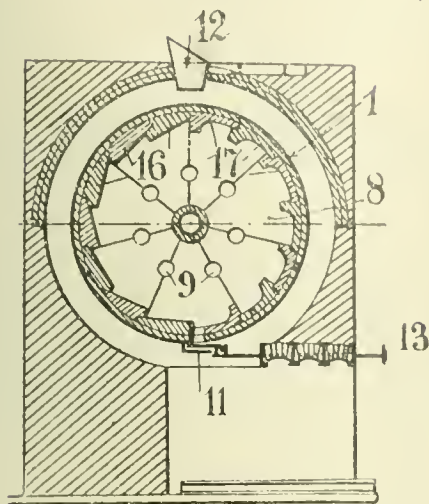
Fig 1



THE kiln or furnace consists of a large cylinder 1 lined with brickwork and refractory material, and rotated by means of a toothed flange on its exterior, gearing with a pinion mounted between rollers (not shown) resting on the blocks 3. The furnace is divided longitudinally into a number of compartments 8, communicating with each other by the passages 9. The two dust-chambers 10 at the ends of the furnace are provided with doors 10' through which they can be cleaned. The pyrites is introduced into chambers 8 through ports 11 from hoppers 12, and the furnace is then set in rotation and heated to bright redness, the pyrites being kept in continual agitation and subjected to a rubbing action by the projections 16 and 17



Fig. 2



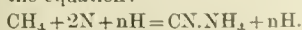
(Fig. 2) of refractory material, whereby fresh surfaces are exposed to the air which is admitted in regulated quantities through openings in the wall of the furnace registering with openings in the outer casing, and which passes into chambers 8 through passages 9. The gases produced by the roasting are drawn through the dust-chambers 10 and 18, and led to the Glover tower. The roasted material is withdrawn through ports 11 by means of the draw-plate 13 (Fig. 2).—A. S.

**Carbonic Acid ; Process and Apparatus for the Solidification of —.** H. S. Elworthy. Fr. Pat. 355,503. Jan. 31, 1905.

LIQUEFIED carbon dioxide is solidified in jacketed vessels, which serve as moulds, by the aid of the evaporation and expansion of a part of the liquid, conducted in two phases. The first phase occurs in the outer of two concentric coils, by liberating a portion of the liquid, so as to partially cool the remaining liquid in the inner coil; and the second phase consists in the partial liberation and evaporation of liquid in the jackets to the moulds, whereby the liquid contents of these, already strongly cooled, are solidified. When moulds without jackets are used, they are immersed in a bath of a liquid of very low freezing point, such as alcohol, in which bath a coil receives a current of liquefied ethylene (or of other gas, or of air) cooled by the same means as are applied in the previous cases. The apparatus employed includes a compressor, immersed coils, concentric coils (enclosed in outer coils) for cooling by the system of counter currents, and arrangements for return to the compressor of the gas which is allowed to expand to obtain the cooling effect in the several stages of the process. (Reference is made to Eng. Pat. 25,007, of 1897; this J., 1898, 908).—E. S.

**Ammonia, Cyanogen, and in general, Nitrogenous Compounds ; Synthetic Production of — as well as of the simple or complex "Elements" which enter into the Manufacture [of such Compounds].** D. Lance and H. S. Elworthy. Fr. Pat. 355,504, Feb. 22, 1905.

A MIXTURE of methane (marsh gas) and nitrogen, with addition of a considerable proportion of hydrogen, in order to avoid reversal of reaction, is passed over a highly heated inactive porous body, such as pumice, for instance, or over metallic nickel; or the mixture is subjected to electrical energy, in order to produce ammonium cyanide, according to the equation:



This ammonium cyanide then becomes the source of other

nitrogenous compounds. Heated at 80° C. in a closed vessel with sulphuric acid, it gives ammonium sulphate and hydrocyanic acid gas, which gas, mixed with hydrogen, and passed over finely-divided nickel at a suitable temperature, yields ammonia, with recovery of methane, again available for the first-mentioned reaction, thus:  $\text{CNH} + 6\text{H} = \text{CH}_4 + \text{NH}_3$ .

To form an alkali cyanide, potassium cyanide, for instance, hydrocyanic acid gas, dried by passage over calcium chloride, is led into a hydrocarbon liquid, only slightly volatile at ordinary temperatures, in a closed vessel in which fused potassium hydroxide is being mechanically crushed and powdered. Potassium cyanide thus formed is freed from the hydrocarbon in a filter-press. Other cyanides may be similarly obtained, or ammonium cyanide may be substituted for the acid in the process, in which case ammonia is evolved. To obtain Prussian blue, or similar cyanogen compounds, ammonium cyanide, obtained as described, is passed into water acidulated with hydrochloric acid, and containing ferric chloride.

Ammonium cyanide may, alternatively, be produced by passing a mixture of carbon monoxide, nitrogen and hydrogen over heated nickel, the process being preferably conducted in the apparatus described in Eng. Pat. 12,461, of 1902 (this J., 1903, 990). Apparatus is described whereby the process referred to may be conducted almost automatically.—E. S.

**Copper in the Form of Copper Sulphate ; Process for the Extraction of — from Burnt Pyrites or other Ores of Copper.** F. Benker and E. Hartmann. Fr. Pat. 355,584, June 24, 1905.

THE ferrous sulphate contained in liquors obtained by the lixiviation of burnt pyrites or other ores containing copper, with ferric sulphate solution, is oxidised by a current of air in the presence of just sufficient alkali (lime) to cause the precipitation of the iron in the form of basic ferric sulphate. From the filtered solution, the copper is precipitated in the form of basic sulphate by the addition of the necessary quantity of an alkali (milk of lime), the other metals (zinc, manganese, &c.) being left in solution in the form of sulphates. The precipitate is separated, washed, and dissolved in sulphuric acid, and it is claimed that by a single crystallisation, copper sulphate of 98–99 per cent. purity can be obtained.

—A. S.

**Alkali Hypochlorites ; Electrolytic Apparatus for the Preparation of —.** A. Vogelsang. Fr. Pat. 355,656, June 27, 1905. XI-1., page 1241.

**Ammoniacal Liquors Resulting from the Manufacture of Lighting Gas ; Apparatus for the Distillation of —.** J. Adriaanse. Fr. Pat. 355,971, July 7, 1905. III., page 1220.

**Brine ; Apparatus for the Evaporation of — and for the Simultaneous Production of Vapour of High Tension.** E. Moll. Fr. Pat. 356,927, July 10, 1905.

BRINE, having, when cold, a density of about 24° B., is continuously pumped into a closed superheater, which is maintained completely full, and has no outlet but through a valved tube, to a closed evaporating vessel with funnel-shaped bottom, placed on a higher level. The flow of brine, thus highly heated under pressure, from the superheater, gives rise in this evaporator to the evolution of steam, stated to attain a pressure of four atmospheres or more, which steam is conducted into a tubular system immersed in a closed brine pan, from which the steam produced is conducted in like manner through other, but open, pans, in which salt of different grains is formed. The evaporator in which the high-pressure steam is stated to be set free, is provided with a manometer, by the indications of which the flow of heated brine from the superheater is regulated by the action of the valve, the flow into and through the superheater being practically continuous. The salt accumulating in the narrow bottom of the evaporator, is discharged from time to time, with drainage liquor, into the closed salt pan mentioned, from the bottom of which a conveyor removes the salt deposited to an elevator and into a draining

receptacle. It is claimed that no back flow of super-saturated brine can take place into the superheater owing to the working of the non-return valve, and hence that danger of saline deposits occurring in the superheater are avoided. (See Eng. Pat. 28,518 of 1903: this J., 1904, 411.)—E. S.

*Oxygen and Hydrogen; Electrolysis for Production of —*  
K. J. Vareill. Fr. Pat. 355,652, June 27, 1905.  
XII., page 1240.

### VIII.—GLASS, POTTERY, AND ENAMELS.

(Continued from page 1172.)

#### UNITED STATES PATENT.

*Glass-Furnace.* H. G. Slingluff, Hartford City, Ind.,  
U.S.A. U.S. Pat. 804,775, Nov. 14, 1905.

THE furnace consists of a glass-melting tank, communicating with a series of drawing-tanks, into which the molten glass flows. Above each drawing tank is arranged an enveloping top or hood, that can be raised or lowered, and is provided with drawing openings, which can be closed when required. When the hood is raised, sections of a flue, attached to it, engage with sections of a flue from the melting-tank on the one hand, and on the other with a draught-stack flue, so that when the glass in the drawing-tank becomes cooled, it can be heated again ("reduced"),

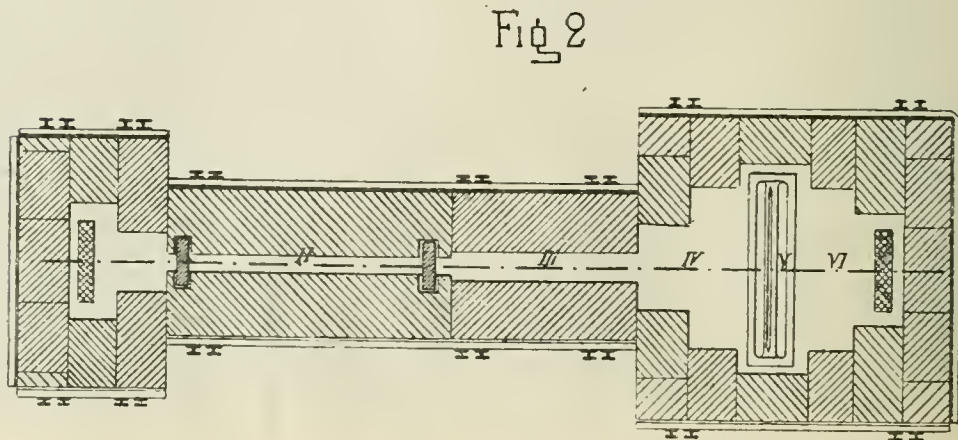
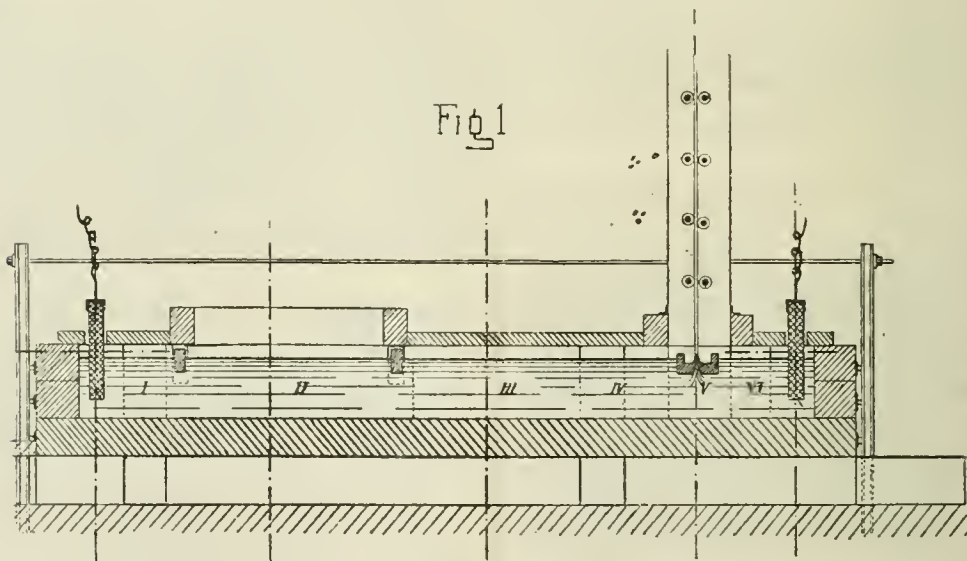
by hot products of combustion drawn through the flue from the melting-tank. Thus the movable hood can be either lowered close to the surface of the glass in the drawing tank, or raised so as to form above the glass in it a heating chamber for the reception and circulation of products of combustion, in order to "reduce" the cold glass at the surface of the mass.—W. C. H.

#### FRENCH PATENTS.

*Quartz-Glass; Method for the Manufacture, at a Relatively Low Temperature of a Composition of — Free from Air-bubbles.* J. Bredel. Fr. Pat. 355,791, July 1, 1905.

THE quartz or other material to be fused is first heated in a current of hydrogen at a temperature of about 1200° C., at which it is permeable by hydrogen. The latter combines with the oxygen of the air in the interstices of the material, the resulting steam largely expelling the residual nitrogen. The current of hydrogen is then stopped, and the material immediately exposed to the action of an oxyhydrogen blow-pipe flame rich in oxygen, whereby the combustion of the hydrogen in the interior of the material is continued, and a liquid mass free from air-bubbles obtained at the relatively low temperature of 1950°–2000° C.—A. G. L.

*Glass; Continuous Electric Furnace for Production of — and Other Products.* V. M. Sanvageon. Fr. Pat. 355,824, July 3, 1905.





This is a furnace in which the heat is generated by the resistance which molten glass offers to the passage of the electric current. Several compartments are provided for the various stages of the manufacture, the cross-sections and lengths of which vary in accordance with the particular work to be performed so as to supply the requisite heating. In the figures, I. and VI. form the electrode chambers in which the current density is low, so as to avoid a high temperature and consequent corrosion of the carbons. Section II. is the fusion chamber proper having a very reduced section, and therefore considerable development of heat. Compartment III. is for refining, and IV. is a settling chamber. The glass is withdrawn for working at V.—R. S. H.

*Glass-Furnace; Regenerative — for Gas.* C. Deselle.  
Fr. Pat. 355,874, July 4, 1905.

THE waste heat of the products of combustion is utilised in this furnace in pre-heating the air. This is done by superimposing two arches above the roof of the furnace-chamber proper, thus forming two hollow spaces above the latter; through the outer one the burnt gases find their way into the chimney, whilst the air needed for combustion has to pass through the inner one, which is heated both by the waste gases and the furnace itself. Below the furnace-chamber are arranged a number of hollow spaces in the form of sectors of a circle; the waste gases have to pass through one alternate set of these chambers before entering the above-mentioned hollow space above the roof of the furnace, whilst the air traverses the other set of chambers after passing through the inner space above the roof.

—A. G. L.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(Continued from page 1173.)

### ENGLISH PATENTS.

[Artificial Stone] *Siliceous Composition; Improved*—. C. de la Roche, Paris. Eng. Pat. 25,884, Nov. 28, 1904.

CRUSHED glass, which may be previously granulated, is mixed with hydraulic or fat lime and sand or other similar material. A small amount of water is then added; the paste obtained is moulded, strongly compressed, and then placed in a digester and submitted for six hours to a steam pressure of 6 to 8 kilos. per sq. cm. Suitable proportions are: lime, 1 part; crushed glass, 4; sand, 20; water, 10 per cent. of the mixture. A product is obtained in this way, the strength of which is stated frequently to exceed 1000 kilos. per sq. cm. crushing strain; a weaker material (200 kilos. per sq. cm.) is obtained by replacing the final digestion under pressure by treatment with steam at 100° C.; whilst for many purposes a sufficiently strong product may be obtained by omitting this treatment altogether and simply air-drying.—A. G. L.

*Insulating Medium; Process of Producing a Heat*—. C. Henke, Witten a/Ruhr, Germany. Eng. Pat. 3669, Feb. 22, 1905.

SEE Fr. Pat. 351,192 of 1905; this J., 1905, 848.—T. F. B.

### UNITED STATES PATENTS.

*Stone from Magnesite; Making Artificial*—. M. Gerster, Assignor to H. Freund und Söhne, Budapest, Austria-Hungary. U.S. Pat. 803,479, Oct. 31, 1905.

SEE Eng. Pat. 27,857 of 1904; this J., 1905, 240.—T. F. B.

*Wood; Process of Producing Liquid-tight Joints for Impregnating*—. G. Kron, Copenhagen. U.S. Pat. 803,603, Nov. 7, 1905.

SEE Fr. Pat. 346,723 of 1904; this J., 1905, 241.—T. F. B.

*Wood; Process of Saturating [Preserving]*—. W. C. Jones, W. R. J. Stratford, F. B. Byrnes, and E. J. Nixon, Texarkana, Tex., Assignors to The International Creosoting and Construction Co., Galveston, Tex. U.S. Pat. 804,132, Nov. 7, 1905.

THE sap and other liquid substances in the wood are vaporised and drawn off, and the wood maintained under a vacuum until thoroughly dried. It is then saturated, under pressure, with a chemical preservative, the surplus preservative is drawn off, and the wood subjected to a high pressure of air, which is maintained until the preservative has thoroughly penetrated all portions of the wood.

—W. C. H.

*Clays; Method of Revivifying Spent*—. A. B. Latting, Memphis, Tenn. U.S. Pat. 804,016, Nov. 7, 1905.

By this process, spent clays are pulverised, and heated in contact with a flame, hot air being forced through the clays at the same time. The organic impurities are burned out and the oxygen forced through, for the purpose it is said, "of restoring the active qualities of the clays."

—W. C. H.

*Cement; Furnace for Burning*—. G. Gröndal, Djursholm, Sweden. U.S. Pat. 803,530, Oct. 31, 1905.

SEE Fr. Pat. 341,382 of 1904; this J., 1904, 867.—T. F. B.

### FRENCH PATENTS.

*Veinings in One or More Colours; Process for Obtaining — on all Kinds of Objects or Solid Materials*. J. M. J. Truchelut. Fr. Pat. 350,194, Sept. 27, 1904.

COLOURING matters of all kinds are mixed with a sticky liquid, which is then spread in a very thin layer on the surface of another immiscible and heavier liquid. By agitating the surface, coloured veins, &c., are obtained, which are then transferred to the object to be decorated (which may be of most varied kind) by applying it to the surface of the heavy liquid. A suitable composition with which the colours may be mixed consists of: Oil of turpentine, 100 grms.; colophony, 10 grms.; linseed oil, 10 grms. "siccatisf soleil," 5 grms. The heavy liquid may be water, mercury, &c.; and any colours, organic or mineral, may be used. Claim is also made for new industrial products and effects.—A. G. L.

*Bricks from Pitch and Coal Tar*. A. Monicole and M. Dupont. Fr. Pat. 355,901, Jan. 10, 1905.

POWDERED coke and sea-sand are gently heated in a suitable vessel, and 20 per cent. of pitch and 10 per cent. of coal tar added with stirring. The pasty mass obtained is then moulded under pressure. The product obtained may be employed alone, or together with a framework of iron, or with hydraulic lime or cement.—A. G. L.

*Fibres, Films, Blocks or Plates; Transparent Plastic Product for the Manufacture of*—. H. C. M. L. Cathelineau and A. A. R. Fleury. Addition. Dated June 8, 1905, to Fr. Pat. 354,942, June 5, 1905. V., page 1226.

*Building Material from Blast-Furnace Slag, Possessing the Properties of Trass and similar Products; Process of Making*—. H. Collosens. Fr. Pat. 356,146, July 12, 1905.

SEE Eng. Pat. 13,886 of 1905; this J., 1905, 971.—T. F. B.

### GERMAN PATENTS.

*Asbestos Objects from finely-divided Asbestos; Preparation of — without the use of Binding Agents*. J. Bernfeld. Ger. Pat. 160,981, April 19, 1904. Addition to Ger. Pat. 148,936, June 12, 1901. (Compare this J., 1905, 444.)

In order to render the objects resistant to acids, they are impregnated with a warm or hot solution of water-glass (alkali silicate), from which silicic acid is separated subsequently by known means.—A. S.

*Stone; Process for the Preparation of Porous Artificial — and of other Porous Bodies*. H. Schmidt. Ger. Pat. 161,641, May 10, 1904.

THE mass used for the preparation of the artificial stone is mixed with pieces of ice, the amount of ice added varying with the degree of porosity desired. The mixture is then formed into the required shapes.—A. S.

## X.—METALLURGY.

(Continued from page 1178.)

*Coke; Properties of Good Blast-Furnace* ——. Weill. Bull. Soc. d'Encourag., 1905, 107; Rev. de Metall., 557—566.

**Hardness.**—A good coke must be hard, to minimise the waste by breakage. The smalls on drawing the coke may be taken at  $2\frac{1}{2}$  per cent.—say, 1 per cent. of 2 cm. fragments and  $1\frac{1}{2}$  per cent. of dust. When the coke goes direct into trucks and is thence discharged into receptacles at the furnaces, 4 per cent. may be estimated as breakage; but if it goes from the trucks into lighters, thence into a steamer, whence it must be again discharged into lighters and trucks before reaching its destination, the waste may amount to 10 or even 20 per cent. Assuming a breakage of 4 per cent., and taking the price of the coke delivered at the furnaces as 25 fr., and the value of the smalls as 3 fr. per ton, the cost of the breakage, in a furnace using 150 tons daily, amounts to 134 fr. per day. Still greater loss occurs through breakage of the coke in the furnace itself, for not only do the "smalls" favour the formation of stoppages in the furnace, but by exposing greater surface to the ascending gases it is more readily reacted on by the carbon dioxide and carried off as monoxide. The breakage cannot be due to actual crushing stress, for in a furnace 20m. high, using per ton of pig-iron, 1800 kilos. of ore, 500 of flux, and 1200 of coke, assuming the weights in kilos. per cb. m. to be 1800, 1400 and 450, the burden of the 20m. column would be 1.70 kilos. per sq. cm., while the resistance of coke to crushing pressure is given by Rossignaux and by Simmersbach as 60 to 175 kilos. per sq. cm. The breakage is no doubt due to the successive shocks and slides during the passage of the charge down the furnace, which, of course, is not continuous but intermittent. The comparison of cokes in this respect can be roughly effected by placing a sufficient quantity in a cylinder or drum of considerable diameter, which is then rotated on a horizontal axis (say, 400 kilos. of coke in a cylinder 2m. diameter and 60 cm. long, rotated for fifteen minutes at 10 revolutions per minute), and grading and weighing the *débris*. The cost can then, of course, be estimated by assuming values for the different grades of "smalls."

**Porosity.**—Coke is usually porous enough to burn rapidly in the furnace. Compared with charcoal, it is much more coarsely porous, though the total volume of its pores is less. The following figures indicate this:—

	Total volume of 100 grms. c.c.	Volume of sub- stance. c.c.	Volume of pores. c.c.
Gas coke (Osnabrück) .....	116.4	54.8	61.6
Coke from compressed coal (Mor- gensonue) .....	101.6	54.0	47.6
Coke from Neu Iserlohn .....	114.4	54.0	60.4
Wood charcoal, pine .....	262.0	61.6	200.4
" beech .....	168.4	67.6	100.8
" birch .....	206.5	74.0	132.5

Wood charcoal burns in air at roughly twice the rate of coke or anthracite, and when heated in a stream of carbon dioxide, at twelve times the rate of coke. This great facility of reaction with carbon dioxide forms a disadvantage to wood charcoal, and the good results formerly obtained with this fuel are, no doubt, due to the rapidity of its action, allowing the use of rich and easily reducible ores, rather than to its mere porosity; with modern conditions of temperature and pressure of blast, equally favourable results are obtainable with coke, and furnace managers are directing their efforts towards obtaining denser rather than more porous cokes. A diminution of 20 per cent. in the volume of the coke means (assuming the volume of coke to be half the total volume of the charge) an effective increase of 10 per cent. in the capacity of the furnace. The connection between hardness and porosity has not been worked out; the nature of the pores

depends, no doubt, both on the nature of the coal and the conditions of the coking, but it is quite certain that a very dense coke may yet be less hard than another coke which is much more porous. The ash, according as it is low or high, and still more according as it is fusible and uniformly distributed and thus binding, or infusible and existing in pockets or bands and thus disintegrating, also influences greatly the effective hardness of the coke.

**Ash.**—Suppose a furnace uses daily 150 tons of coke, containing 10 per cent. of ash, containing, say, 55 per cent. of silica, and 30 per cent. of alumina. To flux this 15 tons of ash will require 13 tons of lime or 23 tons of limestone, and there will be formed about 28 tons of slag and 10 tons of carbon dioxide. From Osann's figures, there will be needed to fuse the slag 4.48, to expel the carbon dioxide 2.90, in all 7.38 tons of carbon, or 8.6 tons of coke. The cost of materials will be for limestone (3 fr. per ton) 69, for coke (25 fr. per ton) 215, total 284 fr. Taking 10 per cent. as the normal ash, then each 1 per cent. additional means a daily cost of 28 fr. for flux and fuel, and 43 fr. because  $1\frac{1}{2}$  tons of ash are being paid for as  $1\frac{1}{2}$  tons of carbon at 29 fr. per ton, in all 71 fr. Moreover, the additional carbon dioxide produced dilutes the furnace-gases, and lowers the steam production and the temperature of the blast, which means more coke in the furnace and more coal in the boilers. Not counting this, it seems that 1 per cent. extra ash means a lessened value of 71/150 or 0.45 fr. per ton of coke, or of 0.30 fr. per ton of the coal used to produce it.

**Water.**—This proceeds, of course, from the quenching of the coke, and may vary enormously according to the care with which this is done. Good Newcastle coke has not more than  $1\frac{1}{2}$  per cent. of water, but contents of 4, 6 and even 8 per cent. are often met with. Assuming 0.2 kilo. of carbon to drive off 1 kilo. of water, 150 tons of coke containing 4 per cent. of water will need for this purpose 1.2 tons of carbon, or 1.4 tons of coke. Thus, if 4 per cent. be the normal water-content, each 1 per cent. extra will cost daily 8.75 fr. (0.35 ton of coke) for extra coke, and 43.5 fr. for water bought as carbon (1.5 tons), in all 52 fr.; or each 1 per cent. of extra water lowers the value of the coke by 52/150 or 0.35 fr. per ton.

**Sulphur.**—German (Ruhr), Cardiff and Newcastle cokes contain 0.8 to 1.5. Northern French and Belgian cokes 0.5. Russian cokes 3.0 to 3.5 per cent. of sulphur. Suppose 1 per cent. as the normal amount. To convert this into calcium sulphide needs (on 150 tons) 3.30 tons of limestone, containing 1.43 tons of carbon dioxide; this requires for fusion 0.54, for expulsion of carbon dioxide 0.41 ton of carbon, in all, say, 1.1 tons of coke. The cost is for flux 9.9, for fuel 27.5, in all 37.4 fr.; so that an extra 0.5 per cent. of sulphur costs 18 fr. per day, or reduces the value of the coke by 0.12 fr. per ton. This is not the only disadvantage of sulphur, however, for the slag will only contain a certain proportion—a proportion which varies enormously with the proportions of the other constituents of the slag, and which can only be found by trial in each case. If the amount of sulphur in the coke increases so that the slag is more than saturated, then the materials to produce an extra amount of slag per ton of pig must be added and dealt with.

**Phosphorus.**—Newcastle cokes contain about 0.012 per cent. of phosphorus, French from 0.022 to 0.07. Cardiff 0.022 to 0.05, Ruhr 0.022 to 0.035. To obtain, with 50 per cent. ores, pig-iron containing below 0.06 per cent. of phosphorus, the ores must not contain above 0.02 per cent., unless the coke contains less than this. For special purposes, certain cokes are excluded by the amount of phosphorus they contain.

**Alkali Chlorides.**—These are contained in the ash of most cokes. They are without influence on the production of pig-iron, but have without doubt much to do with the wear and tear of the furnace. They react on the lining, where a certain temperature exists, to produce readily fusible silicates, and hence arises considerable corrosion at these parts, which can only be lessened by employing very dense and compact bricks, or by using water to cool the lining. Where the only water available for quenching the coke is briny, the amount of alkali chloride carried by the coke may be enough to produce serious damage in this way.—J. T. D.



*Manganese Silicide; Preparation of —, by Reduction with Aluminium.* E. Vigouroux. *Comptes rend.*, 1905, 141, 722—724.

The compound  $\text{SiMn}_2$  has been obtained in the pure crystalline condition by reducing a mixture of silica and the brown or red oxide of manganese with aluminium. The silica was especially prepared from silicon chloride, and the oxide of manganese by calcination of the dioxide, itself prepared from potassium permanganate, and the aluminium filings were carefully freed from iron by a magnet. In one experiment the quantities taken were 120 grms. of silica, 300 grms. of manganese dioxide, and 150 grms. of aluminium; but the same compound resulted when other proportions were used.

In carrying out the process a crucible lined with compressed magnesia contains the charge, and a mixture of manganese dioxide and aluminium is used as priming. The reaction is accompanied by the evolution of great heat, which melts the product. The impure substance, freed from slag, is readily powdered, and after prolonged digestion with hydrochloric acid (of 2 per cent. strength), small crystals may be obtained from which accompanying silica is washed by water acidulated with hydrofluoric acid. They then correspond to the formula given above. The substance is attacked by hydrochloric or nitric acid with the formation of silica.—F. Spx.

*Blast-Furnace; Notes on the Physical Action of the —* J. E. Johnson, jun. *Bull. Amer. Inst. Mining Eng.* 1905, 1111—1145.

STARTING from theoretical considerations, the author shows that the fuel-consumption of blast-furnaces is capable of further reduction. He then discusses in detail certain problems of importance in blast-furnace practice, namely: the pressure of the blast; the descent of the charge, and the origin and nature of "slips," as affected by the blast-pressure; and the effect of heating and of drying the blast.—A. S.

*Iron; Rusting of —.* W. R. Dunstan, H. A. D. Jowett and E. Goulding. *Chem. Soc. Trans.*, 1905, 87, 1548—1574.

A DETAILED account of the experimental evidence and the reasoning leading to the conclusions already given in this J., 1903, 745. The work is treated under the following headings:—Action of dry and moist gases on iron; action of oxygen and liquid water on iron; action of water alone on iron; effect of salts and other substances on the process of rusting; formation of hydrogen peroxide during the oxidation of metals; aerial oxidation or rusting of metals in general; the general theory of rusting; composition of iron rust; the reaction between iron and water at high temperatures; the influence of carbon dioxide on rusting; formation of rust by electrolytic action.—A. S.

*Iron; Dunstan, Jowett, and Goulding's Paper on the Rusting of —.* E. Divers. *Chem. Soc. Proc.*, 1905, 21, 251—253.

THE fact which throws into the background all others contained in the important paper by Dunstan, Jowett, and Goulding on the rusting of iron (*Chem. Soc. Trans.*, 1905, 87, 1548, see preceding abstract, also this J., 1903, 745), and, indeed, constitutes its substance, is that even the purest available iron is freely rusted by oxygen and liquid water, unaided by carbon dioxide or any other substance. Yet, in the construction of the paper, this fact seems to have been subordinated, perhaps without intention, to the setting forth of, and submitting evidence for the theory that the rusting of iron is a process involving the formation of hydrogen peroxide. Accordingly, the publication of a preliminary abstract of the contents of the full paper led Moody (this J., 1903, 745) to suppose Dunstan's contention to be that ordinary rusting is caused by hydrogen peroxide. There is, therefore, reason to fear that those chemists who may hesitate to accept the hydrogen peroxide theory will be apt to overlook the fact that whether with or without the intervention of hydrogen peroxide, iron rusts when in contact with nothing more than an aqueous solution of oxygen.

Now the truth of the authors' theory to explain the

fact may well be doubted, although they themselves hold that they have obtained a considerable body of experimental evidence in favour of the temporary formation of hydrogen peroxide. For, in support of the theory, no other fact is to be found in the paper than that the alkalis and other substances, which interfere with the existence of hydrogen peroxide, likewise prevent the rusting of iron. But the coincidence here observed is fully and accurately accounted for, without dependence on hydrogen peroxide, as being the result of the inability of oxygen and water in presence of one of these substances to act together as *hydroxyl*, whether it be to form hydrogen peroxide,  $(\text{HO})_2$ , or such a compound as zinc hydroxide,  $\text{Zn}(\text{HO})_2$ . Hydrogen peroxide is not wanted in order to explain the rusting of iron; indeed, its production stands rather in the way of a simple theory. What is wanted is the presentation of free or at least available hydroxyl groups to unite with the iron. Again, it is hardly a tenable argument that a substance, because it interferes with the existence of another substance, must likewise prevent its formation. For instance, ferrous sulphate ends the existence of free chlorine, but it does not prevent manganese dioxide and hydrochloric acid in contact with it producing the atomic chlorine, which it immediately proceeds to consume.

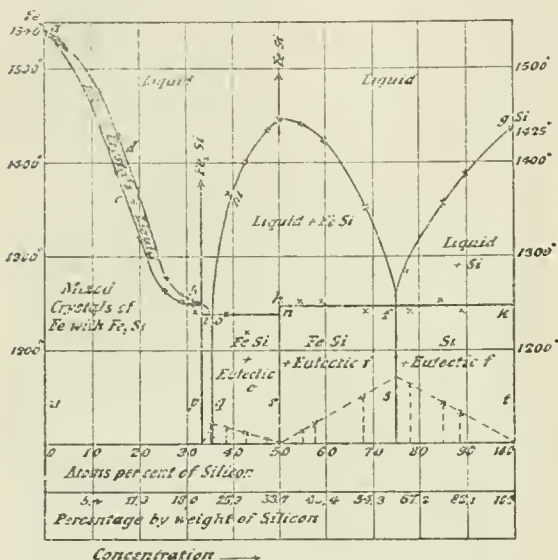
Moritz Traube explained and experimentally illustrated what he called the "autoxidation" of metals and other substances as being the chemical intervention of the water molecule between that of the autoxidising substance and that of the oxygen. Water, which cannot be acted on by either alone, is capable of chemical partition between the two: with zinc present to seize the hydroxyl of the water, the oxygen can take the rest of its hydrogen to form hydrogen peroxide, and, accordingly, this substance is not an uncommon product of autoxidation. It is easy and natural to admit that, with the great evolution of energy in the union of zinc with hydroxyl, only the small addition of energy afforded by the hydrogenation of free oxygen into hydrogen peroxide should be sufficient to half dehydrogenate the oxygen of water. Traube's equation satisfactorily represents, therefore, the formation of the hydrogen peroxide. The authors, however, give equations which are indistinguishable from those suggested by Hoppe-Seyler, although they very rightly reject this physiological chemist's conception of the nature of oxidation. They write (*loc. cit.*, page 1549)  $\text{Fe} + \text{O}_2 + \text{H}_2\text{O} = \text{FeO} + \text{H}_2\text{O}_2$  [Traube would have written it  $\text{Fe} + 2\text{OH} \cdot \text{H} + \text{O}_2 = \text{Fe}(\text{OH})_2 + \text{H}_2\text{O}_2$ ]. Again, they write  $\text{Fe} + \text{OH}_2 = \text{FeO} + \text{H}_2$ ;  $\text{H}_2 + \text{O}_2 = \text{H}_2\text{O}_2$ , equations which have none of the acceptability of Traube's. Can it be admitted that iron may do what potassium cannot do, displace all the hydrogen of water? Can it be allowed by the laws of thermal chemistry that cold water can be endothermically oxidised into hydrogen peroxide? There is another equation, given to explain the action of hydrogen peroxide on iron, to which also exception must be taken:  $\text{Fe} + \text{H}_2\text{O}_2 = \text{FeO} + \text{H}_2\text{O}$ . Surely if the equation holds good at all, the right side of it should be written  $\text{Fe}(\text{OH})_2$ , the hydroxyls uniting with the iron, even if, afterwards, water separates.

The conversion of iron into rust seems to be as fully explained and as simply displayed as the facts allow by the following equation:  $(\text{O}_2 + 2\text{H} \cdot \text{HO}) + 4\text{Fe} + 2\text{O}_2 = 4\text{HO} \cdot \text{Fe} : \text{O}$ . or, if preferred,  $2(\text{HO})_2\text{FeO}_2$ . If it is proper, as it apparently may be, to represent the ferrous and the ferric oxidation as distinct, then the above equation may be resolved into  $(\text{O}_2 + 2\text{H} \cdot \text{HO}) + 4\text{Fe} + \text{O}_2 = 2(\text{HO} \cdot \text{Fe}')_2\text{O}$  (ferrous oxyhydroxide) and  $2(\text{HO} \cdot \text{Fe}'')_2\text{O} + \text{O}_2 = 4\text{HO} \cdot \text{Fe}''\text{O}$ . Putting these equations into words, rusting consists in the oxidation of iron by oxygen, with the intervention of water as hydroxyl hydride to the extent of 2 \* mols. for every 3 mols. of oxygen consumed. To account for the non-formation of hydrogen peroxide nothing need be advanced; that seems to come as a matter of course. The point to be explained is, rather, the very production of this substance during the autoxidation of zinc and other substances. Why do not all the hydroxyls combine with the zinc, instead of a very small

\* Instead of the 6 mols. of water required by Traube's equation in the theoretical production of  $\text{Fe}_2(\text{OH})_6$ .

proportion of them remaining as hydrogen peroxide? The equation  $\text{Zn} + 2\text{OH} \cdot \text{H} + \text{O}_2 + \text{Zn} = 2\text{Zn}(\text{OH})_2$  seems to express accurately what really does happen to a very great extent.

*Iron and Silicon; Compounds of* — W. Guertler and G. Tammann. *Z. anorg. Chem.*, 1905, 47, 163–179.



THE alloys examined were prepared by fusing together mild steel and commercial silicon. The steel contained: carbon, 0.07; silicon, 0.06; manganese, 0.10; phosphorus, less than 0.01; sulphur, 0.019; and copper, 0.015 per cent. The silicon contained: silicon, 98.07; iron, 0.95; and aluminium, 0.39 per cent.; after fusion with caustic soda, and extraction with water, it left an insoluble residue which, after heating with hydrofluoric acid, amounted to 1.27 per cent. The alloys were heated in a porcelain tube in an electric carbon-tube furnace in an atmosphere of nitrogen, and the porcelain sheath of the thermo-element was protected from the action of the fused silicon by a casing of platinum foil coated with magnesia. The results obtained are shown in the accompanying diagram, the temperatures at which crystallisation and melting respectively began and ended being calculated from the rates of cooling and heating, with the application of suitable corrections. For alloys containing up to about 30 atoms per cent. of silicon, the beginning of crystallisation is represented by the curve *a d b* and the end by the curve *a c b*. The cooling curve of the alloy containing 33.3 atoms per cent. of silicon has the same form as that of pure iron; this alloy (m. pt. 1251° C.) is thus either a chemical compound,  $\text{Fe}_2\text{Si}$ , or consists of saturated mixed crystals, and the fact that on treatment with acids, a residue of the same composition as the original substance is left, indicates that the first-named view is the correct one. The micro-structure of the alloys containing up to 33 atoms per cent. of silicon is in accord with the conclusion drawn from the cooling curves that these alloys solidify in the form of a continuous series of mixed crystals of iron and the compound  $\text{Fe}_2\text{Si}$ . The curve *m f* represents the separation of a new kind of crystals, *viz.*, of the compound  $\text{FeSi}$  (m. pt. 1443° C.), containing 50 atoms per cent. of silicon. Micrographic examination of the alloys containing from 33.3 to 50 atoms per cent. of silicon, showed that the primary separated crystals of the compound,  $\text{FeSi}$ , were not surrounded, as was expected, by the homogeneous structural element,  $\text{Fe}_2\text{Si}$ , but by a mass showing a distinct eutectic structure. The amount of the eutectic decreases as the proportion of silicon rises, and it disappears entirely when the silicon amounts to 50 atoms per cent. These facts point to the existence of a short branch curve *b o*, the point *o* corresponding to the alloy with about 34.7

atoms per cent. of silicon, which consists entirely of the eutectic (m. pt. 1235° C.). The branch *g f* is the solubility curve of crystallised silicon, which intersects the curve *m f*, at the eutectic point *f*, corresponding to the alloy (m. pt. 1245° C.) containing 76 atoms per cent. of silicon. In the alloys corresponding to the branch curve *g f*, the primary separated crystals consist of silicon, and these are surrounded by an eutectic consisting of silicon and the compound  $\text{SiFe}$ .

The behaviour to reagents of the different kinds of crystals existing in iron-silicon alloys is as follows:—Silicon is rapidly attacked by hot potassium hydroxide solution, the compound  $\text{FeSi}$  is attacked much less readily, whilst the compound  $\text{Fe}_2\text{Si}$  and iron are scarcely acted upon. With hydrochloric acid, on the other hand, iron is rapidly attacked, the compound  $\text{Fe}_2\text{Si}$  much less easily, and the compound  $\text{FeSi}$  and silicon scarcely at all. By cold sodium hydroxide solution, silicon alone is appreciably attacked. The hardness of the crystals decreases as the proportion of iron increases. The presence of silicon appears to have no appreciable influence on the transformation point of  $\beta$ -iron into  $\alpha$ -iron. Attention is drawn specially to the exceptional position of the compound  $\text{Fe}_2\text{Si}$  as the end member of a series of mixed crystals.—A. S.

*Cyanide Treatment of Sands and Slimes; Impts in* — C. H. Pead. *J. Chem. Metall. and Min. Soc. of S. Africa*, 1905, 6, 76–78.

IN discharging slimes, weak precipitated cyanide solution should be used instead of water. The liquid is gradually forced to the top in the slimes dam by the settlement of the slimes, and carries with it the gold which it has dissolved; if this liquor be then returned to the slimes plant, the gold it contains is recovered, and amounts in the course of a year to something considerable.

In precipitating the gold from slimes plant solutions, the zinc is usually dipped in or sprinkled with lead acetate solution, and free cyanide is added at the head of the precipitation box. The author finds that if cyanide be added to every compartment, the zinc needs much less frequent changing (15 days instead of 5), and considerable economy in zinc is thus effected.

The addition of sodium carbonate to working cyanide solutions aids precipitation; the author adds it every day, and finds that the solutions leave the precipitation boxes containing much less gold than if none is added. The effect persists for some days after the last addition, if it be dropped; and if resumed, some days elapse before the full effect is reached again.

Under certain conditions sulphuric acid added to the cyanide solutions is beneficial, causing a lessened consumption of zinc and richer gold slimes.—J. T. D.

*Alloys; Segregation of Metals in* —, and its Cause. A. Bock. *Chem.-Zeit.* 1905, 29, 1199–1201.

THE results are given of assays of silver coinage alloy (900 parts of silver and 100 parts of copper) taken from various parts of the cross-section of an ingot of 25 to 30 kilos. in weight. The diagram (Fig. 1) shows the results, the figures indicating silver per 1,000 parts. It is seen that the silver collects in the centre and upper parts, and retreats from the sides and bottom. A strip for 2-mark pieces as originally cast, formed an accurately rectangular block 400×45×9 mm., and weighed 250 kilos. The crucible assay before pouring gave a fineness of 899.5. The slip was broken across, and, after careful cleaning, was planed on all sides and bored out in the centre as indicated by the dotted line in the figure (Fig. 2), along a length of about 20 mm. from the broken end. The assays of these planings and borings were as shown in the figure. Such a strip is rolled out to a thickness of 1.780 mm., becoming about 1600 mm. long and 60 mm. wide, and two rows of 2-mark pieces are then stamped out of it. These are of course not homogeneous, and their assay is executed from two strips cut from a quadrant as shown in the figure (Fig. 3). If the original fineness of the melt was 899.5 the coins will assay almost exactly 900; so that the rest of the slip is poorer—about 899—and on remelting requires the addition of silver to bring it up again to 899.5. Silver-gold alloys show the same phenomenon;



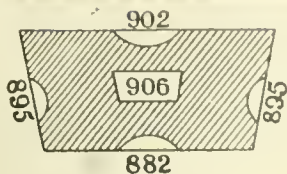


FIG. 1.

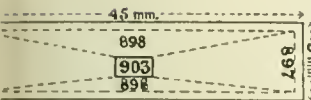


FIG. 2.

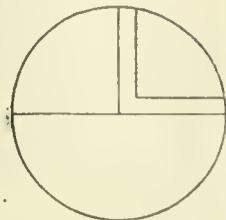


FIG. 3.

an ingot of native gold, for instance, containing up to 200 of silver per 1,000, shows clearly by the colour of the cross-section, how the gold accumulates towards the centre and the silver towards the outside. The author considers that in these cases, as also in the Pattinson process for desilvering lead, and similar instances, the effect is due to a differential "thermo-potential" between the iron of the mould or melting-pot and the metals of the alloy.—J. T. D.

*Magnetic Alloys; Heusler's* —. B. V. Hill. Phys. Review, Nov. 1905; through Electrician, 1905, 56, 225.

HEUSLER'S magnetic alloys composed of non-magnetic metals (see this J., 1905, 850) show an irreversibility with regard to high temperatures, similar to that exhibited by nickel steels with respect to low temperatures. An alloy containing 60 per cent. of copper, 25 per cent. of manganese and 15 per cent. of aluminium lost its magnetism permanently when heated to 950° C., and became perceptibly lighter. (Nickel steels are heavier in the non-magnetic condition.) Another alloy containing more aluminium than the one just mentioned, was subjected to repeated heating and cooling. Starting with an intensity of magnetisation of 311 units, the magnetism had completely disappeared at 320° C., whilst, after cooling, the magnetisation was 267 units. On again heating, the intensity of magnetisation fell to 7 units at 500° C., and then rose to 27 units on cooling to the ordinary temperature, and to 36 units at the temperature of liquid air. By heating to bright redness, the magnetisation increased to 155 units and to 165 units on subsequent cooling in liquid air.—A. S.

*Alloys; Copper-Aluminium* —. L. Guillet. Bull. Soc. d'Encourag., 1905, 107, Rev. de Metall., 567—388.

THE results of the thermal and micrographic study of these alloys already recapitulated (this J., 1905, 1019) are given in greater detail, with photomicrographs, showing the structure of the alloys.

The alloys used industrially are those with less than 11 and with more than 94 per cent. of aluminium. The former (aluminium bronzes) consist of the solution  $\alpha$  or of the solution  $\alpha$  with the constituent  $\beta$ . This constituent, however, renders the alloy hard and brittle; hence, alloys containing more than 11 per cent. of aluminium are not used. No industrial alloy contains the compound  $\text{AlCu}$ , which renders the alloy extremely brittle. The compound  $\text{Al}_2\text{Cu}$  has the same tendency; and the industrial alloys at the aluminium end of the series all consist of aluminium with but small proportions of the eutectic  $\text{Al—Al}_2\text{Cu}$ . This cementing eutectic is hard, and assists in the working of the metal. Of alloys high in aluminium, however, those with iron and manganese (which seem to form solid solutions) are more used industrially than those with copper. The similar alloys

with nickel consist of aluminium surrounded by the eutectic  $\text{Al—Al}_6\text{Ni}$ , and decompose water readily. A number of results of mechanical tests of aluminium-copper alloys are given in the paper.—J. T. D.

*Zinc-Cadmium Alloys [containing Lead]; Properties of* —. F. Novak. Z. anorg. Chem., 1905, 47, 421—445.

THE author has investigated the effects of alloying ordinary zinc containing lead, along with small quantities of cadmium, as bearing on its suitability for use in process-engraving.

Zinc alloyed with 0.5—1 per cent. of cadmium, and rolled into sheets at 120° C., has a lower speed of reaction with dilute hydrochloric acid than the original zinc, but with dilute nitric acid a higher speed. After recrystallisation by heating at 270° C., the original zinc or its cadmium alloy has a higher speed of reaction with dilute nitric acid than when merely rolled at 120° C. Increasing the percentage of lead up to its saturation point (2 per cent.) has no effect on the speed of reaction with this acid. Zinc alloyed with 0.25 per cent. of cadmium, possesses, after rolling, and recrystallisation by strongly heating, a more finely-grained structure than zinc which is free from cadmium. Its hardness and tenacity are moreover increased, and its brittleness diminished, but above 0.5 per cent. of cadmium has the reverse effect and influences the quality of the metal unfavourably.—F. SDN.

*Metals; Influence of Phase Changes on the Tenacity of Ductile* —, at the ordinary Temperature and at the Boiling-point of Liquid Air. G. T. and H. N. Beilby. British Assoc., South Africa, 1905, Section B.; Chem. News, 1905, 92, 220. (See also this J., 1904, 788.)

THE crystalline (C) phase of ductile metals is the mechanically unstable, the amorphous (A) the mechanically stable phase. Annealed wires, in the C phase, stretch before breaking when stressed beyond the yield point; hardened wires, in the A phase, break without extension. During the stretching of annealed wires, they partly change into the A phase, but never completely, and their tenacity approximates towards, but never rises to, the tenacity of the metal in the A phase. The authors have measured the tenacity of wires which had been as nearly as possible converted into the A phase by drawing at the ordinary temperature; and the figures recorded are higher than any previous records for equally pure metals. The gold had a purity of 9997 per 10,000, the silver of 10,000 per 10,000, and the copper a conductivity of 100 per cent. The tenacities were, in tons per sq. in., for

	At 288° Abs.	At 93° Abs.
Gold .....	15.6	22.4
Silver .....	25.7	34.4
Copper .....	28.1	36.0

The wires broken at the ordinary temperature showed no stretching; but at the boiling point of liquid air, all stretched (uniformly over the whole length between the grips) from 11 to 12 per cent. The fractured ends of the copper wires all showed a cupped formation, apparently due to the presence of gas-bubbles which the drawing had stretched out into tubes. The silver wire ends occasionally showed the same formation, but the fractures of the gold wires were almost perfectly viscous.—J. T. D.

*Mercury [in Ores, &c.]; Volumetric and Gasometric Determination of* — by Hydrazine Salts, and of Hydrazine by Mercury Salts. E. Ebler. XXIII., page 1257.

*Tin in Copper-Tin Alloys; Rapid Method for the Determination of* —. A. G. Levy. XXIII., page 1257.

*Paper; Lead Foil* —. C. Beadle. XIX., page 1251.

## ENGLISH PATENTS.

*Separating Certain Constituents of Finely Divided Material ; Process for — by Flotation.* F. E. Elmore, London. Eng. Pat. 17,816, Aug. 16, 1904.

THE pulp having been mixed with tar, oil, or other liquid, alone or in conjunction with alkalis, acids, air, or gas, or having had a gas generated within the mixture electrolytically or otherwise, a partial vacuum is produced within the separating chamber, whereby a smaller proportion of added substance is rendered sufficient to effect the desired separation.—J. H. C.

*Ores ; Apparatus for Separating Certain Constituents of — by Flotation.* A. J. F. de Bavay, Kew, Victoria, Australia. Eng. Pat. 25,858, Nov. 28, 1904.

THE suitably prepared ore-pulp is fed from a cistern by means of an adjustable rotary feed contrivance in a thin sheet or film on to an inclined table, the angle of which may be varied, and is there spread by tags or brushes. The lower edge of the table dips into a well or trough of water having an adjustable lip or overflow for the removal of the floating particles. An endless travelling belt supported on suitable rollers works in the said trough, and carries off the non-flotable particles for re-treatment on a similar table. Water sprays are provided for the tables, and belts as may be required.—J. H. C.

[“*Flotation Process*” for Broken Hill Ores] *Processes for Separating Certain Constituents of Finely Divided Material by Causing them to Rise or Float in a Liquid.* A. S. Elmore, London. Eng. Pat. 5953, March 21, 1905.

THE “flotation” (i.e., separation of ore particles from gangue) is effected by a liquid consisting of an aqueous solution of one or more chlorides and hydrochloric acid. Thus “zinc middlings” are treated with a solution of calcium chloride at 32° B. containing 0.1 per cent. of free hydrochloric acid at a temperature of 100° to 120° F. —A. G. L.

*Ore Concentrators ; Impts. in —.* E. Deister, Fort Wayne, U.S.A. Eng. Pat. 4052, Feb. 27, 1905.

SEE Fr. Pat. 354,549 of 1905 ; this J., 1905, 1114.—T. F. B.

*Furnaces ; Impts. in [Muffle] —.* T. G. Blundell, London. Eng. Pat. 25,507, Nov. 23, 1904.

THE claim is for the introduction of a bridge or baffle-plate between the combustion chamber and the muffle or crucible chamber of the furnace. The baffle plate has sloping surfaces and ports or apertures which deflect the flames in such a way that they do not impinge directly upon the muffle or crucible, but rather upon the furnace walls.—W. H. C.

*Furnaces ; Impts. in or relating to Crucible Steel Smelting — and the like.* R. Lindemann, Osabrück, Germany. Eng. Pat. 26,093, Nov. 30, 1904.

THE object of the invention is to obtain a very high temperature in a crucible furnace in a very short time, and to utilise as much as possible of the waste heat. To this end the roof of the furnace chamber proper is double-walled, and, by means of specially arranged horizontal partitions between, air introduced under pressure from above is forced to pass along a zig-zag course to the underside of the grate, where it rises to the crucibles through the fuel, and then passes into an open-hearth furnace attached to the crucible furnace proper, the open-hearth furnace being used for metals requiring a lower temperature than steel, e.g., cast iron.—A. G. L.

*Moisture from the Air ; Apparatus for Removing — more especially intended for Treating Air for Supply to Blast Furnaces, Converters and the like.* E. Hesketh, London and H. Brier, Dartford, Kent. Eng. Pat. 27,408, Dec. 15, 1904.

A SERIES of refrigerating chambers are connected with heat interchangers by means of diverting valves so that a counter current interchange of temperature is maintained between the inflowing current of warm air and the

outflowing current of cooled air. This allows the melting of the snow formed on the pipes of the refrigerators to be performed in an economical manner at the expense of the inflowing warm air.—W. H. C.

*Bronze ; Manufacture of —.* A. Jacobsen, Hamburg, Germany. Eng. Pat. 25,882, Nov. 28, 1904.

SEE Fr. Pat. 353,999 of 1905 ; this J., 1905, 1071.—T. F. B.

## UNITED STATES PATENTS.

*Furnace ; Metallurgical —.* H. H. Goodsell, Leechburg, Pa. U.S. Pat. 803,337, Oct. 31, 1905.

THE furnace consists essentially of a heating chamber, a pan containing a suitable liquid, and a “blueing” chamber. By means of a by-pass the gases of combustion from the heating chamber can be cut off from the pan and caused to pass to the “blueing” chamber. Means are provided for heating the “blueing” chamber by steam without materially heating the liquid contained in the pan, and also for supplying air to the pan in order to cool it. The metal plates under treatment are passed through the “blueing” chamber over a set of horizontal rollers, and through the pan over rollers disposed in the form of an arc of a circle. Below the rollers in the pan is a perforated baffle-plate also in the form of an arc of a circle.—A. S.

*Furnace for Smelting Ore.* R. Baggaley, Pittsburg, Pa. U.S. Pat. 803,737, Nov. 7, 1905.

THE invention relates to a matte-furnace having converting tuyères near the bottom and smelting tuyères at a higher level, with a slag outlet between the two sets of tuyères. Air under pressure is supplied both to the converting tuyères and to the smelting-tuyères ; the former discharge into a clean body of molten matte, whilst the air from the latter acts on a charge floating on the matte. A burner is provided for supplying heat above the smelting-tuyères.—A. S.

*Blast-Furnace Flue Dust ; Process of Utilising —.* S. B. Sheldon, Buffalo, N.Y. U.S. Pat. 803,792, Nov. 7, 1905.

THE flue-dust from a blast-furnace is mixed with a quantity of coal equal to that which had been consumed in the furnace during the period in which the flue-dust was produced, and the mixture is coked. According to one claim, the proportion of flue-dust in the mixture is specified as from 3 to 5 per cent. of the weight of the coal.—A. S.

*Zinc ; Extraction and Purification of —.* A. V. Cunningham, Winnington. U.S. Pat. 803,472, Oct. 31, 1905.

SEE Eng. Pat. 4706 of 1904 ; this J., 1904, 1220.—T. F. B.

*Zinc Alloys ; Process of Making —.* P. and A. Gührs, Berlin. U.S. Pat. 804,006, Nov. 7, 1905.

SEE Fr. Pat. 332,657 of 1903, and Addition thereto ; this J., 1903, 1247 ; and 1904, 191.—T. F. B.

*Iron Ores ; Treatment of —.* C. Ellis, New York. U.S. Pat. 803,886, Nov. 7, 1905.

THE process claimed is for the manufacture of metallic iron, and consists in subjecting a moving stream of finely-divided iron ore mixed with a flux, to the action of a high-temperature flame, a stratum of a reducing gas, such as producer gas, being interposed between the high temperature flame and the stream of ore.—A. S.

*Alloy.* F. W. Moffett, Assignor to H. M. Thomas, Bloomfield, N.J. U.S. Pat. 803,921, Nov. 7, 1905.

CLAIM is made for an alloy containing lead and sodium, the amount of the latter metal being from 0.5 to 4 per cent. of the weight of the lead ; and also for an antifriction-bearing metal, composed of lead alloyed with 1.5 per cent. of its weight of sodium.—A. S.

*Ore-Slimes, &c., containing Gold, Silver, or other Values ; Process of Treating —.* L. J. Drabek, Turner, S.D. U.S. Pat. 804,186, Nov. 7, 1905.

THE ore-slime, mixed with cyanide solution, is charged continuously into a tank and allowed to settle. The



thickened mass which settles is discharged by its own weight, and that of the overlying cyanide solution, through an opening at the bottom of the tank into the top of a second tank containing fresh solvent solution. The thickened slime is then withdrawn from this tank, mixed and agitated with water, and passed into a third tank containing water, from which the exhausted slime is discharged from time to time as is necessary. The solutions containing the dissolved metals are freed from suspended slime by filtration.—A. S.

**Soldering Paste.** M. Leisel, Cologne, Germany. U.S. Pat. 804,664, Nov. 14, 1905.

SEE Fr. Pat. 345,593 of 1904; this J., 1905, 32.—T. F. B.

#### FRENCH PATENTS.

**Separating certain Constituents of Finely Divided Materials [Ores] by Causing them to Rise or Float in a Liquid; Process for —.** F. E. Elnors. Fr. Pat. 355,855, July 4, 1905. Under Int. Conv., Aug. 16, 1904.

SEE Eng. Pat. 17,816 of 1904; preceding these.—T. F. B.

**Minerals; Apparatus for Concentrating and Separating —.** J. Buss. Fr. Pat. 356,112, July 12, 1905. Under Int. Conv., July 15, 1904.

SEE Eng. Pat. 15,793 of 1904; this J., 1905, 929.—T. F. B.

**Furnace; Crucible — with Double Air-supply.** F. Forster. Fr. Pat. 355,155, June 10, 1905.

ARRANGEMENTS are made whereby air may be admitted either between the furnace bars or directly into the hearth, or both ways as may be desired.—J. H. C.

**Furnace; Roasting —.** J. E. Greenawalt. Fr. Pat. 355,312, June 17, 1905.

A REVERBERATORY furnace is claimed, having a porous bed or filter upon which the mineral or other substance to be treated is placed and mechanically rabbled. Means are provided for passing air or other gas through the porous bed to the mineral, and also for cooling the rabbles.—J. H. C.

**Metals; Crucibles for Melting and Casting —.** W. Sommer. Fr. Pat. 355,632, June 26, 1905.

SEE Eng. Pat. 14,115 of 1905; this J., 1905, 974.—T. F. B.  
**Briquettes of Friable Minerals. Powdery Residues of Spent Pyrites, &c.; Process of Making —.** C. Reinke. Fr. Pat. 355,667, June 27, 1905.

SEE Eng. Pat. 19,464 of 1904; this J., 1905, 974.—T. F. B.

**Steel of Inferior Quality; Process for the Manufacture of a Product destined for the Impt. of —.** G. Hoffmann. Fr. Pat. 355,786, July 1, 1905.

LINSEED oil, potassium ferrocyanide, wood charcoal and copper sulphate are added, with constant stirring, to fused colophony, and the molten mass is cooled till of thick consistency, and then allowed to solidify in moulds.—A. S.

**Nickel from Nickel Carbonyl; Apparatus for Producing —.** The Mond Nickel Co., Ltd. Fr. Pat. 355,682, June 28, 1905.

SEE Eng. Pat. 13,350 of 1905; this J., 1905, 1070.—T. F. B.

**Nickel; Process and Apparatus for Treating with Carbon Monoxide Ores or other Compounds of —.** The Mond Nickel Co., Ltd. Fr. Pat. 355,683, June 28, 1905.

SEE Eng. Pat. 13,351 of 1905; this J., 1905, 1113.—T. F. B.

**Silvering; Process of Manufacturing a Product for Use in —.** W. Bclsterli. Fr. Pat. 355,518, May 15, 1905.

CLAIM is made for the method of preparing a product, which, it is claimed, when simply rubbed on to articles suitably prepared, will give a deposit of silver. 0.8 kilo. of silver nitrate is dissolved in 30 litres of water and precipitated with the necessary quantity of 12 per cent. hydrochloric acid. The silver chloride is filtered off and well washed, and then dissolved, with constant agitation, in a solution of 3.3 kilos. of sodium hyposulphite

(thiosulphate) in 30 litres of water. The solution thus obtained is finally mixed with 1.8 kilos. of 8 per cent. ammonium chloride solution ("esprit de sel ammoniac"), ammonia, and 8 kilos. of levigated chalk.—A. S.

**Aluminium, Silicon and their Compounds; Process for the Manufacture of — and Employment of these Products for the Reduction of Metallic Oxides.** E. A. O. Viel and M. Jeantet. Fr. Pat. 355,539, June 7, 1905.

The present patent is an improvement on Fr. Pat. 353,070 of 1905 (this J., 1905, 977), the use of any other suitable kind of furnace being claimed in addition to that of an electric furnace as proposed in the latter.—A. S.

**Alloy; Inoxidisable — and Method for Making the same.** N. Evangelidi. Fr. Pat. 355,450, June 22, 1905.

To 90 parts of melted copper, 5 parts of aluminium are added, and finally half a part of iron pyrites. Small quantities of antimony, nickel, phosphorus and certain other elements may be added if desired.—J. H. C.

**Alloy specially applicable for Jewellery, and Solder for this Alloy.** J. B. Chaumet. Fr. Pat. 355,761, June 30, 1905.

The alloy is prepared by melting together aluminium (86—95 per cent.), copper (4 per cent.) and cadmium (1—10 per cent.). It is soft but strong, and does not oxidise on exposure to the air. It can be readily soldered by means of a solder prepared by melting together aluminium (70 per cent.), tin (25 per cent.) and copper (5 per cent.).—A. S.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(Continued from page 1179.)

### (A.)—ELECTRO-CHEMISTRY.

**Nickel Oxide Electrode in the Jungner-Edison Accumulator; Chemical Composition of the —.** J. Zedner. Z. Elektrochem. 1905, 11, 809—813.

CONTRARY to previous supposition of the formation of a peroxide of nickel, the author has been able to prove by direct analysis that the active nickel oxide has the composition  $\text{Ni}_2\text{O}_3 + \text{Aq.}$ ; the exact degree of hydration, however, has not yet been fixed. It is possible to prepare electrolytically oxides of nickel which show a potential of 1.75 volts, which is the same value as that of the positive accumulator plate measured in the same way against zinc.—R. S. H.

**Hypochlorite Production; Relation of Stability to Electrochemical Efficiency in —.** W. P. Higby. VII., page 1229.

**Iodoform from Acetone [Electrolytic Production of —].** G. A. Roush. XX., page 1253.

### ENGLISH PATENTS.

**Electrode; Improved —, for Apparatus Producing Radiant Electrical Energy.** Siemens and Halske Akt.-Ges., Berlin. Eng. Pat. 25,282, Nov. 21, 1904. Under Int. Conv., Nov. 24, 1903.

The electrode is for use in Röntgen tubes, Geissler tubes, &c., and is constructed of tantalum, or the latter may be used as a carrier for another more easily fusible material.—B. N.

**Diaphragms for use in Electrolytic Cells; Impts. relating to Permeable —.** H. Hirtz, London. Eng. Pat. 28,129, Dec. 22, 1904.

THIS invention relates to a method of modifying fabrics for use as diaphragms in electrolytic cells, the fabric being successively impregnated with a solution of a double cyanide, and a solution of a metallic salt, so as to deposit an insoluble double cyanide in the material. The

fabric is impregnated with the soluble double cyanide only, if the metal, of the solution to be electrolysed, itself forms an insoluble double cyanide.—B. N.

*Batteries; Impts. in Electric Dry* — H. W. Butler, London. Eng. Pat. 29,065, Dec. 30, 1904.

THE zinc cell is lined with a pasty separating mass, consisting of the excitant, such as ammonium chloride, starch or starchy matter, and also a substance, such as plaster of Paris, to give the requisite consistency to the mass, with or without a hygroscopic salt, such as zinc chloride. The mass is subjected to heat and moisture so as to cook the starch. This lining is separated from the carbon element by a suitable depolarising material.—B. N.

*Battery; Dry* — F. Weatherill, London. Eng. Pat. 8631, April 22, 1905.

THE sheet zinc electrode is bent in one piece and surrounds the grooved carbons which are packed with a depolarising mixture of manganese peroxide and graphite. The electrolyte is a stiff vegetable jelly, made from the palm sago, and containing chlorides of zinc and ammonium and sodium carbonate. The fermentation of the sago keeps the cell from getting dry.—R. S. H.

*Electrolytic Cells; Treating the Contents of* — J. Hargreaves, Farnworth-in-Widnes, Lancs. Eng. Pat. 25,331, Nov. 22,

THE invention relates chiefly to the electrolysis of alkali chlorides. In order to decompose any hypochlorites or chlorates produced in the electrolytic decomposition of alkali chlorides, a bisulphate is admitted to the anode chamber. Provision is made for jets of liquid to be projected against the internal surface of the diaphragm so as to free it from solid deposits which are apt to raise the electrical resistance of the cell. The dissolved chlorine is removed from the waste anode liquors by means of a partial vacuum or injection of air so as to render them harmless.—R. S. H.

*Carbon; Treated — and Method of Producing same.* The British-Thomson-Houston Co. From General Electric Co. Eng. Pat. 28,062, Dec. 21, 1904. VII., page 1230.

*Carbonising Wool, Rags, Silks and other Fibres.* S. Roberts. Eng. Pat. 4593, March 6, 1905. V., page 1225.

#### UNITED STATES PATENTS.

*Furnace; Electric* — E. Appleby, Chicago, Ill. U.S. Pat. 803,147, Oct. 31, 1905.

A RECEPTACLE, vertically disposed and open at the bottom, is mounted on a frame, a second receptacle, open at the top, surrounding and telescoping with the first. Two electrodes are mounted in the frame, and extend into the furnace near to the lower end of the first receptacle. Mechanism is provided for raising and lowering the second receptacle, and also a means for tilting this vessel and discharging its contents, after it has been drawn out of the telescopic engagement with the first receptacle.—B. N.

*Electrolytic Cell.* H. S. Anderson, El Paso, Tex. U.S. Pat. 803,263, Oct. 31, 1905.

THE bottom of the electrolytic cell is covered with a layer of mercury, and a cell, open at the bottom, is supported within the electrolytic cell so that the bottom is sealed by the layer of mercury, thus forming an outer washing chamber and an inner electrolyte or cathode compartment. The anode compartment is formed by a cell, with impervious side walls, but with a horizontal porous diaphragm for the bottom, the anode compartment being supported within the cathode compartment so that the diaphragm is close to the mercury. A thin layer of a solution of the substance to be decomposed flows continuously through the cathode compartment, between the diaphragm and the mercury, the pressure of the electrolyte on the diaphragm being greater than that of the liquid in the anode compartment. A horizontal

reciprocating movement is given to the outer cell, thus bringing the mercury successively into contact with the liquids in the electrolyte and washing compartments.

—B. N.

*Insulating Material.* W. L. R. Emmet, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 803,816, Nov. 7, 1905.

SEE Eng. Pat. 17,030 of 1901; this J., 1902, 259.—T. F. B.

*Nitrogen, Oxides of; [Electrical] Means for Producing* — E. Marquardt, Schöneberg, and H. Viertel, Charlottenburg, Germany. U.S. Pat. 804,021, Nov. 7, 1905.

SEE Fr. Pat. 339,730 of 1904; this J., 1904, 717.—T. F. B.

#### FRENCH PATENTS.

*Electrodes for Arc Lamps.* E. Mendoza and R. Bueno. Fr. Pat. 350,186, Sept. 23, 1904. II., page 1220.

*Filaments for Incandescent [Electric] Lamps.* A. Just and F. Hanaman. Addition, dated June 10, 1905, to Fr. Pat. 347,661, Nov. 4, 1904. II., page 1220.

*Accumulator [Plates; Regenerating]* — I. I. Kitsee. Fr. Pat. 355,839, July 3, 1905.

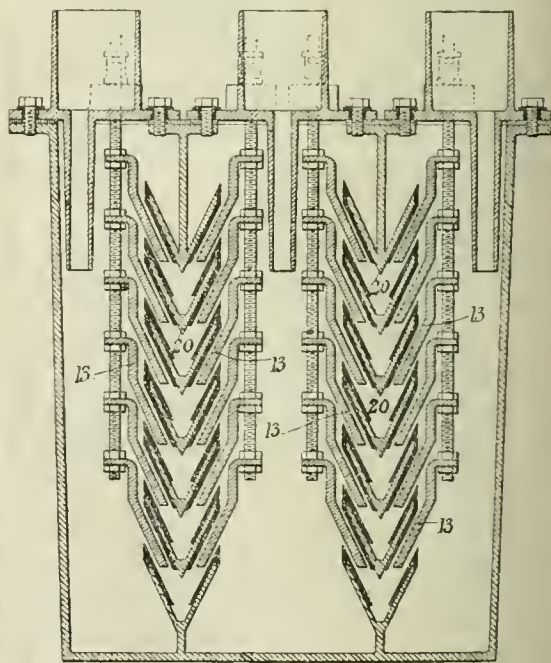
SEE U.S. Pat. 793,881 of 1905; this J., 1905, 850.—T. F. B.

*Electric Insulating Material and its Method of Preparation.* V. E. Boitelet and F. Spigel. Fr. Pat. 356,028, July 10, 1905.

CRUDE animal or vegetable products which are bad conductors of heat and electricity are made more suitable by finely dividing them and mixing with some hydrocarbon with which they are heated. After this the material is hot-pressed and the process repeated. Finally, the insulator is moulded under strong pressure. If desired, rubber may be added and the mixture vulcanised.

—R. S. H.

*Oxygen and Hydrogen; Electrolysis for Production of* — K. J. Varelle. Fr. Pat. 355,652, June 27, 1905.



WITH the object of completely preventing admixture of the two gases and at the same time keeping the electrical resistance low, the electrodes are arranged as shown in the figure. Vertical rows of V-shaped troughs are pro-



vided with suitable insulation and serve to separate the positive and negative electrodes which are placed on opposite sides. The extremities (20) of these troughs are lower than the ends of the electrodes (13), so that the bubbles of gas coming from the latter cannot mix. The electrodes are both insulated from the vat. R. S. H.

*Alkali Hypochlorites; Electrolytic Apparatus for the Preparation of —.* A. Vogelsang. Fr. Pat. 355,656. June 27, 1905.

THE electrolyser consists of a tank open at the top and provided with partial dividing walls by which the thin platinum foil electrodes are held, thus dividing the cell into a number of small chambers, or the foil electrodes may be threaded through the dividing walls. The characteristic construction of this electrolyser lies in the provision of rods or bars upon or between the electrodes and projecting beyond them so as to protect the thin metal from destruction whilst the cell is being scraped out to remove deposits upon the electrode holders.—R. S. H.

*Glass; Continuous Electric Furnace for Production of — and other Products.* V. M. Sauvageon. Fr. Pat. 355,824, July 3, 1905. VIII., page 1232.

*Bec; [Electrical] Process for Preserving —.* P. A. Roche. Fr. Pat. 350,182, Sept. 17, 1904. XVII., page 1248.

### (B.)—ELECTRO-METALLURGY.

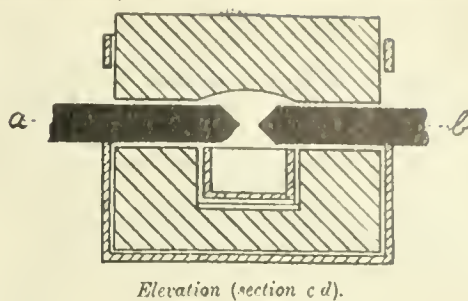
*Copper; Crystalline Structure of Electro-Deposited —.* A. K. Huntington. Paper read before Faraday Soc., Oct. 31, 1905 [Advance Proof].

THE author explains the fact that copper deposited on to a surface which has a scratch or groove parts very easily along the line of the groove as due to the direction of the lines of crystallisation.

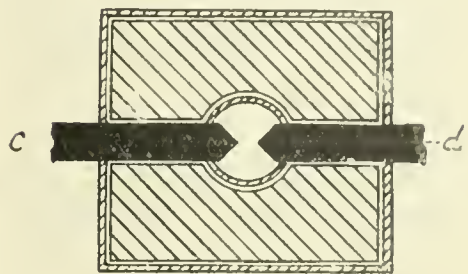
The same phenomenon is observed in castings. The crystals form at right angles to the surface on which the deposit or casting is made. It follows that when the crystals which form on surfaces more or less at an angle to one another meet, there will be want of continuity in the two sets of crystals, and a line of weakness will be developed. The paper is fully illustrated with photographs.—R. S. H.

*Aluminium Carbide; Reduction of Metallic Oxides by —.* J. N. Pring. Chem. Soc. Trans., 1905, 87, 1530—1540.

ALUMINIUM carbide was prepared by heating aluminium in a carbon crucible in a Moissan electric arc furnace. With a furnace of the dimensions shown (see Fig. 1), 2 kilowatt-hours were required, on the average, to heat the aluminium (300—400 grms. in pieces about the size of a walnut) to the boiling point. The furnace worked very steadily with a current of 250—300 ampères at 35—45 volts. To obtain good results, it was found necessary to take at least 9 mins. in heating the aluminium to the boiling point, and to continue the heating for about 6 mins. after this point was reached. When the aluminium began to boil, the voltage fell considerably; the return of the current to its normal condition indicated the completion of the process. During the cooling, a large quantity of metallic aluminium was forced out from the surface of the carbide. When the mass was cooled out of contact with furnace gases and air, the exuded metal was found to contain 99.9 per cent. of aluminium, showing that aluminium carbide is insoluble in metallic aluminium. The yield of aluminium was greatly diminished by working in an atmosphere of hydrogen, and the change in weight of the crucible and its contents, together with the formation of a large quantity of alumina, showed that the carbide is formed chiefly, and probably entirely, by the action on the aluminium of carbon monoxide derived from the carbon dioxide evolved from the limestone blocks of the furnace.  $3\text{CO} + 6\text{Al} = \text{Al}_2\text{O}_3 + \text{Al}_4\text{C}_3$ . The product obtained contained, on the average, aluminium carbide, 30; alumina, 25; carbon, 2; and aluminium, 43 per cent. After treatment in the cold with strong caustic soda solution, a product was obtained



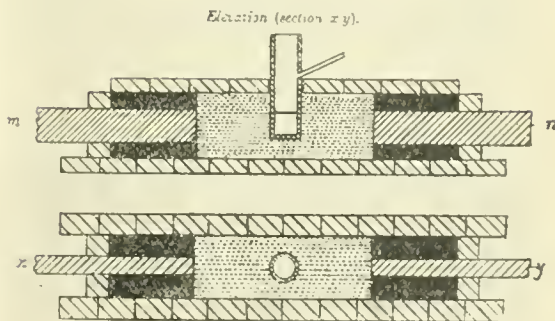
Elevation (section c d).



Plan (section a b).

0 5 10 cm.

FIG. 1



Plan (section m n).

FIG. 2.

containing only about 2 per cent. of metallic aluminium. It was not found possible to obtain the carbide free from alumina, as the latter occurred in a very stable and insoluble form.

Numerous experiments were made as to the action of the carbide on metallic oxides (cupric, ferric, lead and bismuth oxides), with and without a flux, and in some cases in contact with a bath of molten metal. In the latter experiments, the apparatus shown in Fig. 2 was employed. The current was led into the furnace by graphite bars, 5.0×2.4 cm. in cross-section, Acheson graphite being tightly packed around these for a distance of 12 cm. The resistance core, in which the carbon crucible, 4 cm. in outside diam., and 3 cm. high, was embedded consisted of particles of retort carbon of uniform size. Above the crucible and clamped in contact with it was a carbon cylinder 12 cm. high, fitted with a brass branch tube, through which hydrogen or other gas could be passed. By means of a graphite piston fitting loosely in the cylinder, the slag could be pressed beneath the surface of the molten metal. In general, the experiments with metallic oxides showed that aluminium carbide acts as a strong reducing agent, but up to about 1400° C. no separation of aluminium or of

carbon could be detected. For example, with copper oxide, metallic copper, alumina and carbon dioxide were produced, together with small quantities of carbon monoxide. At higher temperatures, alloys of aluminium and the reduced metal were obtained, the percentage of aluminium in the alloys increasing with the temperature of the reaction. Copper alloys were obtained containing up to 28 per cent. of aluminium, and iron alloys containing up to 46.7 per cent. When the reaction between ferric oxide and aluminium carbide was effected in contact with a bath of molten iron, alloys were obtained in which more than 90 per cent. of the aluminium in the carbide used had been set free and taken up by the iron.

Aluminium carbide reacts with copper at a temperature below the melting point of platinum, and with iron just above this temperature, alloys being produced, and free carbon liberated. (See also this J., 1895, 353.)

*Reaction between Calcium Carbide and Lead Oxide at a High Temperature.*—By dropping lead oxide, in very small quantities, into molten calcium carbide, an alloy containing 2.6 per cent. of calcium was obtained. (See this J., 1898, 33; 1901, 582.)

*Action of Metallic Calcium on Aluminium Carbide.*—Aluminium carbide was reduced by metallic calcium at temperatures above the melting point of the latter. At the lower temperatures used, 83 per cent. of the carbide was reduced, but the amount of reduction diminished as the temperature of reaction rose. The reverse reaction,  $3\text{CaC}_2 + 3\text{Al} = 2\text{Al}_4\text{C}_3 + 3\text{Ca}$ , was also found to take place, the amount of calcium carbide reduced ranging from 7 to 25 per cent. according to the temperature.—A. S.

*Passive State of Metals; Theory of the* — W. J. Müller. Z. Elektrochem. 1905, 11, 823–824.

THE author summarises his views on the passivity of metals (this J., 1904, 751), showing how closely the phenomenon is connected with questions of valency. He considers the passive and active forms of the metal as two phases which are never in stable equilibrium.—R. S. H.

#### ENGLISH PATENTS.

*Metals; Apparatus for Electro Deposition of* — B. M. Bailey, Walsall, Staffs. Eng. Pat. 26,849, Dec. 9, 1904.

THE materials to be plated are enclosed in a perforated aluminium barrel, which is not only rotated around a horizontal axis, but is also held in a carriage which is moved to and fro through a long vat. Anode plates are hung around the sides of the vat and afford a much larger anode surface in proportion to the work surface than is usually employed.—R. S. H.

*Copper; [Electrically] Annealing* — E. A. Claremont, Manchester. Eng. Pat. 3032, Feb. 14, 1905.

THE copper article to be annealed is, whilst being submerged in water, heated to the required temperature by an electric current, on arresting which, the article cools in the same vessel, whereby contact with air whilst cooling is obviated. Apparatus is shown whereby a continuous wire or band of copper may be conducted into a vessel containing water, by passage over two submerged conducting rollers, placed at a certain distance apart, and respectively in connection with the two terminals of a dynamo.—E. S.

#### UNITED STATES PATENTS.

*Electrolytic Process [Copper Deposition] Using Insoluble Anodes.* A. G. Betts, Troy, N.Y. U.S. Pat. 803,543, Nov. 7, 1905.

THIS invention relates to a process of converting, in solution, ferrous to ferric sulphate, and simultaneously depositing copper. The solution, practically free from halogen ions, is electrolysed, using an insoluble carbon anode and a suitable cathode. The anode is moved through the solution in order to facilitate the continuous oxidation of the ferrous salt by the liberated anions, and at the same time prevent the evolution of gas containing oxygen at the anode.—B. N.

*Lead; Apparatus for Refining* —, by Electrolysis. A. G. Betts, Troy, N.Y. U.S. Pat. 803,544, Nov. 7, 1905.

THE lead to be refined is used as the anode, an electrolyte being employed which is adapted to dissolve metal from the anode, and electro-deposit the same on a suitable cathode. The electrolytic tank has a lining of copper plates soldered together at their adjacent edges, the soldered connections being electroplated with copper, and the whole of the copper lining is coated with insulating material.—B. N.

*Anode-Slimes; Process of Treating* — E. F. Kern, Assignor to A. G. Betts, both of Lansingburg, N.Y. U.S. Pat. 803,601, Nov. 7, 1905.

THE anode-slime is mixed with sulphuric acid, and roasted with access of air so as to convert arsenic and antimony into oxides, the arsenic being volatilised as arsenious acid. Copper is extracted from the product by means of a solution containing sulphuric acid, and the antimony is extracted from the residue with a suitable solvent.—B. N.

#### FRENCH PATENT.

*Furnaces; Electric* — Metallurgiska Patentaktiebolaget. Fr. Pat. 355,756, June 30, 1905. Under Int. Conv., July 11, 1904.

IN furnaces of the induction type in which an annular crucible surrounds a central high tension coil, it is necessary to provide means for protecting the latter from heating. For this purpose a double-walled jacket through which cold air or water can be passed, immediately surrounds the high tension coil. The metal jacket does not form a complete cylinder, but is broken at least once throughout its length by some insulating material to prevent the production of induction currents in the jacket.—R. S. H.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

(Continued from page 1180.)

*Enzyme Action; Studies on* — Lipase. H. E. Armstrong. Roy. Soc. Proc., 1905, 76, 606–608.

IN the hydrolysis of fatty oils by the lipase of ground castor-oil seeds, little or no action takes place unless an acid is present. The author finds that any acid is effective provided a sufficient amount be used. Aspartic and glutamic acids, which are formed at an early stage of the germination of seeds, were found to be highly active, but glycine and asparagine were practically without effect. Different acids in equivalent quantities do not have equal effects, and it is probable that the strength of the acid is a factor in the action. Apparently the acids do not act merely by liberating the enzyme, since when the material, free from fat, was digested with sulphuric acid under the conditions which favour the maximum lipolytic action, the product, when washed free from acid, had become perfectly inactive, either when used alone or with the addition of a fresh quantity of acid. The Ricinus enzyme has very little action on ethyl butyrate, acetin, or the dimethyl esters of tartaric and racemic acids. It is also almost without action on ethyl mandelate, which is said to be readily attacked by animal lipase; its action is therefore probably specific for the glycerides of the higher acids of the fatty series.—J. F. B.

*Wool-Fat; Water-absorbing Power of* — J. Lifschütz. Apoth.-Zeit., 1905, 20, 857. Pharm. J., 1905, 75, 723.

THE author finds that if wool-fat be dissolved in benzene (petroleum spirit) and the solution digested with animal charcoal at 50°–60° C., then the residue left after distilling off the solvent from the filtered solution has a much smaller water-absorbing power than the original fat. Further, by exhausting the animal charcoal with alcohol, and evaporating the alcoholic solution, a very tough, adhesive, fatty substance is left, which is capable of absorbing water to a very marked extent. For



example, it is stated that 2 per cent. of this substance is sufficient, when mixed with paraffin ointment, to render the latter capable of taking up a large proportion of water.

—A. S.

#### ENGLISH PATENT.

*Soaps or Soap Size; Utilisation of Waste Products in the Manufacture of —.* H. Arledter, Widnes. Eng. Pat. 28,442, Dec. 27, 1904.

THE saponification of resins, fats, and oils by means of sodium carbonate, or other suitable alkali, is effected in a closed steam-jacketed boiler, provided with a rotary stirrer (*cf.* Eng. Pats. 17,077 of 1902 and 1049 of 1903; this J., 1903, 569; 1904, 196). The mixture of carbon dioxide, steam, and the more volatile constituents of the resin, chiefly turpentine and rosin oil vapour, after arriving at a given pressure in the boiler, is constantly allowed to pass through a weighted valve or otherwise into a large vessel. This vessel contains a froth-breaking grid having a series of sharp ridges or points all over its under surface for the purpose of breaking the bubbles of the froth, in the upward course of the vapours through the vessel. The mixed vapours pass through a condensing worm and the condensed portions run into a series of collectors, or into a single collector, with draw-off cocks at different levels. The carbon dioxide passes on to the usual purifying apparatus and then to a compressor. The liquids in the collector arrange themselves, on being allowed to settle, in layers; the turpentine and lighter oils or spirits form the uppermost, an oil not soluble in turpentine an intermediate layer, whilst the water settles at the bottom. The water is found to have absorbed certain constituents of the rosin very similar to, if not identical with, what is known as Russian turpentine, and this solution is claimed as an excellent disinfectant.

The other liquids are drawn off from their respective layers, and, if necessary, can be redistilled and separated.

—E. W. L.

#### UNITED STATES PATENTS.

[*Fat*] *Rendering or Reducing Apparatus.* E. R. Edson and B. F. Silliman, Cleveland, Ohio, Assignors to the Edson Reduction Machinery Co., Augusta, Me., U.S.A. U.S. Pat. 803,050, Oct. 31, 1905.

THE apparatus claimed comprises a rendering vessel provided at the top with a dome, the inner chamber of which is in communication with the interior of the vessel. Means are provided for the introduction of the material at the bottom and for heating it, whilst a pneumatic pressure is maintained within the dome in excess of that resulting from heating the liquid in the vessel. There is also a valved vapour pipe between the dome and the vessel, with means for the production of suction or for interrupting the passage of the vapour, together with a valved liquid-conducting pipe, means for pumping water into the rendering vessel, and a hollow shaft with lateral arms through the openings in which fluid can be discharged into the interior of the vessel.—C. A. M.

*Drying Material from which Oil has been Extracted; Process of —.* E. R. Edson and B. F. Silliman, Cleveland, Ohio, Assignors to The Edson Reduction Machinery Co., Augusta, Me., U.S.A. U.S. Pat. 803,051, Oct. 31, 1905.

THE material, from which the oil has been extracted by the apparatus described in the preceding abstract, is stirred continually whilst the liquid is being drained off, and the free moisture still remaining evaporated, after which heated air is admitted and distributed throughout the mass.—C. A. M.

#### FRENCH PATENTS.

*Fats; Apparatus for the Extraction of — by means of Carbon Tetrachloride, &c.* A. E. Urbain. Fr. Pat. 355,813, July 1, 1905.

THE apparatus claimed consists of a battery of at least seven connected extraction vessels together with distillation apparatus and condensers. The extraction vessels are cylindrical in form and are preferably arranged to

receive the superheated vapour of the solvent under low pressure. They are advantageously made of graphitic iron, with joints and pipes of lead.—C. A. M.

*Enzymic Hydrolysis [of Fats]; Active Products for —.* E. Urbain. Fr. Pat., 350,179, Sept. 15, 1904.

CLAIM is made for the use of amino-acids as stimulating agents in the hydrolysing action of cytoplasm upon fatty oils, and it is stated that, with this addition, 0.025 per cent. of the dry enzymic agent is sufficient for the hydrolysis of the oil on a manufacturing scale. A simple method (claimed) of obtaining these active products is to triturate oil-cake with its own weight of water, and to allow the mixture to undergo spontaneous proteolytic hydrolysis at 40° C. After eight days the mass is filtered, and the filtrate used in place of water in the enzymic hydrolysis of oils.—C. A. M.

*Soap Liquors; Evaporator for Treating Waste —.* Milwaukee Evaporator Co. Fr. Pat. 356,086, July 12, 1905.

SEE U.S. Pat. 794,831 of 1905; this J., 1905, 880.—T.F.B.

### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(Continued from page 1181.)

(A.)—PIGMENTS, PAINTS.

#### ENGLISH PATENTS.

*Lakes [from Azo Dye-stuffs]; Manufacture of Colour —.* C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 27,496, Dec. 16, 1904.

THE insoluble metallic salts of the azo dye-stuffs formed by combining a diazotised aminosulphonic acid of the benzene or naphthaleno series with *o*-nitrophenol, constitute colour lakes very fast to light. Three lakes are described, prepared from sulphanilic acid, naphthionic acid, and 1,3,4-chloroaminobenzenesulphonic acid respectively; all are yellowish-red in colour.—T. F. B.

*Pigment Colours [from Azo Dye-stuffs]; Manufacture of Yellow and Orange —.* O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 28,259, Dec. 23, 1904.

YELLOW to orange lakes, stated to compare favourably with chrome pigments as regards fastness, are obtained by precipitating on a white substratum, an azo dye-stuff produced by combining a diazotised unsulphonated base with a pyrazolone. For example, 50 kilos. of sodium sulphate dissolved in 500 litres of water are added to 250 kilos. of a 20 per cent. paste of the dye-stuff from  $\alpha$ -naphthylamine and phenylmethylpyrazolone suspended in 2,000 litres of water; a solution of 100 kilos. of barium chloride in 500 litres of water is then stirred in to the mixture.—T. F. B.

*Pigments; Manufacture of —.* J. F. Bennett, Dronfield, Derby, and J. Mastin, Sheffield. Eng. Pat. 15,398, July 27, 1905.

THE improved process of making pigments the object of which is to produce pigments of an absolutely permanent character, consists in grinding together to a paste in water, substances of a clayey, stony, earthy, or vitreous nature, and certain metallic oxides, or "prepared oxides," such as are commonly used in the pottery trades; drying, and powdering the paste, and subjecting the powder to the heat of a furnace, of such a temperature that the requisite colour is obtained, and for such length of time that the colour strikes through the whole substance. For example, 8 parts of black oxide of cobalt, 12 parts of oxide of zinc and 36 parts of alumina, when incorporated with 20 times their combined bulk of clay and treated as described, yield a rich blue pigment in the case of a white clay, and a rich green in the case of a yellow clay. Long continued firing in this case improves the colour.

—E. W. L.

## FRENCH PATENTS.

*Paint; Process of Manufacturing* — J. H. Lebon.  
Fr. Pat. 350,171, Sept. 13, 1904.

The inventor proposes to utilise the oxidising action of manganese oxides on colloidal substances, such as albumin, in presence of alkalis and an antiseptic, the proportions recommended being manganese oxide 3 parts by weight, colloid 10, alkaline substance 1.5, calcium carbonate 15, zinc oxide 10, 90° alcohol 1, volatile antiseptic oils 1—3, boric acid 1 part, with a variable quantity of water according to circumstances. The colloid is first treated with the alkali, dissolved in filtered water at 25° C., and mixed with the colouring matters and the antiseptics. The product is suitable as a ground colour and dries hard.  
—C. S.

*Lithopone which Remains White when Exposed to Light; Process of Making* — R. Alberti. Fr. Pat. 356,144, July 10, 1905.

SEE Eng. Pat. 13,455 of 1905; this J., 1905, 978.—T.F.B.

## GERMAN PATENTS.

*Lakes [from Azo Dyestuffs] Fast to Light; Process of Preparing Red* — Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 161,424, March 30, 1904.

The dyestuffs prepared by combining diazonium compounds with 1.4.8-naphtholdisulphonic acid, in the form of their metallic salts, are lakes of yellowish-red to Bordeaux red colours, stated to be very fast to light.—T.F.B.

*Dyestuff suitable for Preparing Lakes; Process for Producing a Yellow to Orange-yellow Monoazo [Azo]* — Badische Anilin und Soda Fabr. Ger. Pat. 161,277, July 27, 1904. IV., page 1224.

*Dyestuffs suitable for Preparing Lakes; Process of Producing Monoazo* — Kalle und Co. A.-G. Ger. Pat. 162,180, Aug. 30, 1904. IV., page 1224.

## (B.)—RESINS, VARNISHES.

*Colophony; Decomposition Temperature of American* — C. Schwalbe. Z. angew. Chem., 1905, 18, 1852.

ACCORDING to Tschirch and Studer (this J., 1903, 1250) American colophony cannot be distilled from glass vessels, but when distilled *in vacuo* in an iron tube, yields a yellow substance resembling colophony. On the other hand, Easterfield and Bayley (this J., 1904, 989) assert that they have distilled colophony with but little decomposition from glass vessels under a pressure of 31 mm., and at a temperature of 270°—290° C., but that at a pressure of 100 mm. decomposition is inevitable. The author has studied the effect of heat upon the colophony under conditions comparable with those that occur in the manufacture and applications of the resin. In the preparation of colophony, the crude pine resin is distilled in the presence of steam until no more oil of turpentine passes over, and the residual resinous mass is freed from water by fusion. If this process be carried out over a fire, superheating above the melting point of the resin can scarcely be avoided; even if indirect steam be used, temperatures of 120° to 150° C. may be reached. The same remarks apply to the fusion of the resin in the preparation of colophony sizing. Experiments, in which American colophony was gradually heated to 160° C. in glass vessels, through which was passed a current of air freed from carbon dioxide, showed that the resin or its chief constituent, abietic acid, began to decompose with the liberation of carbon dioxide, even at a temperature as low as 120°—130° C.—C. A. M.

*Lac; The Commercial Grades of* — and their Valuation. J. C. Umney. Pharm. J., 1905, 75, 653—654.

The various grades of lac met with in commerce are described, and the methods for their analysis discussed. Parry's results (this J., 1901, 1245; 1902, 782; 1903, 320) are confirmed. The Hübl method is preferred as giving the most constant figures for the iodine value. The figure 10 is suggested as a standard iodine value on

which the percentage of rosin is to be calculated. The paper concludes with analytical data concerning various kinds of lac, and also touches briefly on the bleaching of shellac. (See also Langmuir, this J., 1905, 12.)—T. F. B.

## UNITED STATES PATENT.

*Lincrusta, &c.; Process of and Apparatus for Painting and Colouring* — F. Walton, London. U.S. Pat. 804,283, Nov. 14, 1905.

SEE Fr. Pat. 345,848 of 1904; this J., 1905, 35.—T. F. B.

## FRENCH PATENT.

*Phenolic Alcohols; New Condensation Products [Gum-Resins] of* — Fabr. de Prod., Chim. Organique de Laire. Fr. Pat. 350,180, Sept. 16, 1904.

PHENOLIC alcohols, such as saligenin, *p*-hydroxybenzyl alcohol, the alcohol  $\text{CH}_3\cdot\text{C}_6\text{H}_3(\text{OH})(\text{CH}_2\text{OH})$  derived from *p*-cresol, are heated under reduced pressure between their melting and boiling points. Water is given off, and, on cooling, a hard, homogeneous, transparent and slightly coloured substance is obtained. The products resemble the natural hard gum-resins in their properties, and can be used in place of lacs, copals, &c.—F. S.

## (C.)—INDIA-RUBBER, Etc.

*Rubber Plants; Notes on Some* — A. Chevalier. Comptes rend., 1905, 141, 683—686.

STATEMENTS have recently appeared to the effect that some examples of a botanical species of plant produce rubber, whilst others of the same species give none. The result of seven years' experience in various parts of Africa has led the author to the conclusion that these statements are entirely erroneous, and that every individual of a rubber-bearing species which is fully grown, and has been cultivated under natural conditions, produces rubber. This conclusion is substantiated by instances of specimens of *Ficus elastica*, *Landolphia ovariensis*, *L. Klainii* and *Manihot Glaziosi* grown under widely differing conditions, all of which produced rubber when fully matured. It is pointed out that the yield of rubber from examples of the same species, grown under identical conditions, may differ considerably, but that the general properties of the rubbers from such examples, are identical. In many cases, the young branches of rubber plants contain viscine in their latex, the rubber not making its appearance until the second or third year.—T. F. B.

## ENGLISH PATENTS.

*Rubber Waste; Method of and Apparatus for Treating* — R. R. Gubbins, London. Eng. Pat. 2575, Feb. 8, 1905.

A TANK is filled with rubber waste, and the latter saturated with sulphuric acid or other carbonising fluid, and the contents heated to boiling point. A second tank is filled with rubber waste, which is then heated, and the liquid in the first tank is transferred to the second and the boiling continued. The first tank is filled up with water, the latter boiled, a suitable alkali being added to neutralise the acid, and the liquid afterwards drawn off. The rubber waste is removed for after treatment to extract the rubber, and the tank again filled with fresh rubber waste, the operations being then repeated. Two or more tanks are used, and arrangements are employed for lifting them alternately to allow of the liquid in one tank being emptied into the other.—B. N.

*Caoutchouc Solutions; Process for the Production of Aqueous* — and for the Regeneration of Caoutchouc Waste. P. Alexander, Charlottenburg, Germany. Eng. Pat. 14,681, July 17, 1905.

THE production of aqueous solutions of caoutchouc, raw or vulcanised, is accomplished by first heating the rubber under pressure at 150° C. with one of the known hydrocarbon or other solvents of rubber, and then heating the solution obtained with a strong alkaline liquid, such as



aqueous caustic soda solution, under pressure at the same temperature. On submitting the product to distillation in a current of steam, the organic solvent is removed, and the rubber remains dissolved in the alkaline liquid. This solution may be readily filtered, and the rubber precipitated from the filtrate by the addition of acid, or by combustion gases. In the utilisation of the process for the regeneration of rubber waste, the waste is treated as described above, and, on filtering the aqueous solution, or by subsidence, the mineral and other impurities present are removed, and the caoutchouc material may be precipitated from the solution by suitable precipitants. By this means a specifically light regenerated rubber, containing only fractions of a per cent. of mineral matters, can be obtained from the specifically heaviest substances.—E. W. L.

*Leather; Manufacture of* — for use as a Substitute for India-Rubber and for various other Purposes. J. Owen and T. Threlfall. Eng. Pat. 19,780, Sept. 14, 1904. XIV., see below.

#### FRENCH PATENTS.

*Caoutchouc from Rubber-yielding Plants; Process for the Extraction of Raw* —. K. von Stechow. Fr. Pat. 355,611, June 5, 1905.

The plants containing the rubber are cut into small pieces, ground in a suitable mill working in water, and then extracted with a mixture of acetone and amyl, methyl, and ethyl alcohols, to remove the resin, oil, wax, &c. The residual caoutchouc is washed and dried.—A. S.

*Rubber Goods; Process and Apparatus for Manufacturing* —. A. S. Rowley and T. W. Hammer. Fr. Pat. 355,798, July 1, 1905. Under Int. Conv., Aug. 8, 1904.

CAOUTCHOUC, either slightly vulcanised or not at all, is divided into fragments, the surface of which is moistened with a vulcanising liquid, such as sulphur monochloride greatly diluted with carbon bisulphide, and the semi-liquid mass is immediately forced into a mould. The latter may be arranged to take to pieces, or provided with a discharge orifice when the production of hollow articles (tubes, &c.) is in question.—C. S.

### XIV.—TANNING, LEATHER, GLUE, SIZE.

(Continued from page 1182.)

#### ENGLISH PATENTS.

*Leather; Manufacture of* —. J. Owen, Salford, and T. Threlfall, Manchester. Eng. Pat. 19,779, Sept. 14, 1904.

HIDES prepared in the usual way are treated first in a solution of chrome alum until coloured through, then in a solution of lead acetate in order to fix in the fibres the oxides of chromium and lead. The hides may be tanned in a mixture of the two solutions, but it is claimed that it is more expeditious and economical to use the solutions separately in the order given.—W. B. H.

*Leather; Manufacture of* — for use as a Substitute for India Rubber and for various other purposes. J. Owen, Salford, and T. Threlfall, Manchester. Eng. Pat. 19,780, Sept. 14, 1904.

HIDES and skins tanned with chrome alum and lead acetate (see preceding abstract) are partly dried and then stamped or embossed for various purposes.—W. B. H.

*Bone; Process of Treating* —. J. R. Hunter, Philadelphia. Eng. Pat. 2455, Feb. 7, 1905.

SEE U.S. Pat. 781,882 of 1905; this J., 1905, 245.—T. F. B.

#### FRENCH PATENTS.

*Leather; Process of Manufacturing* — by means of Colouring Matters. P. D. Zacharias. First Addition, dated June 29, 1905, to Fr. Pat. 329,708, Feb. 25, 1903 (this J., 1903, 1056).

In this addition it is stated that to obtain leather of good

quality, it is necessary that the colouring matter should be insoluble and a colloidal substance. Thus insoluble dyestuffs may be precipitated in the fibre, or Prussian blue, or colloidal tin oxide may be employed; lakes of organic dyestuffs are also suitable for the purpose; the less soluble the dyestuff, the better will be the resulting leather.—T. F. B.

*Parchment-like Skin; Process of Making* —. Zephyr-leider Fabrik Ges. m. b. H., vorm. Treckmann und Co. Fr. Pat. 355,981, July 7, 1905.

SEE Eng. Pat. 12,266 of 1905; this J., 1905, 1076.—T. F. B.

*Dyeing and Securing of Skins and Hair by Spraying*. C. and E. Pichard. Fr. Pat. 355,121, June 9, 1905. VI., page 1227.

### [ XV.—MANURES, Etc.

(Continued from page 1182.)

*Nitrates and Nitrites as Manures; Use of* —. T. Schloesing. Comptes rend. 1905, 141, 745–746.

EXPERIMENTS were carried out in which maize was grown in pots, each pot containing 9 kilos. of soil and receiving the addition of 0.405 gm. of phosphoric anhydride (as superphosphate), 1.5 gm. of potassium sulphate and a quantity of nitrate or nitrite equivalent to 0.20 gm. of nitrogen. From the weight of ripe grain obtained, it is seen that sodium nitrate and nitrite and calcium nitrate and nitrite are equally efficacious as manures. The crop obtained in pots to which nitrate or nitrite had not been added was about 20 per cent. less than that yielded by the other pots. The calcium nitrate used in the experiments was prepared with nitric acid obtained by the action of an electric discharge on air.—W. P. S.

*Calcium Cyanamide; Reactions of* — in Agricultural Practice. R. Perotti. Staz. sperim. agrar. ital., 1905, 38, 581–609. Chem. Centr., 1905, 2, 1507.

At the ordinary temperature and pressure, calcium cyanamide suffers hydrolytic decomposition in aqueous solution, with formation of ammoniacal compounds, as ammonia, urea, &c., which have no injurious action on vegetation. The decomposition, however, proceeds very slowly, and considerable loss of soluble nitrogen may take place. In the soil, however, owing to the presence of humus, the decomposition proceeds more rapidly, and owing to the absorptive power of the soil, the losses are much smaller than in aqueous solution. The use of peat with calcium cyanamide (this J. 1905, 554) is especially suitable, as in contact with that substance, calcium cyanamide is very rapidly decomposed, without any appreciable loss of nitrogen. (See also this J., 1905, 143.)—A. S.

*Phosphoric Acid; Equilibrium between some Bases when they are Present Simultaneously with* —. A. Quartaroli. VII., page 1229.

#### ENGLISH PATENT.

*Sewage; Treatment and Utilisation of* —. F. M. Spence and P. Spence and Sons, Ltd. Eng. Pat. 28,646, Dec. 29, 1904. XVIII.B., page 1249.

#### UNITED STATES PATENT.

*Fertilisers; Apparatus for Making* —. A. von Krottnaurer, Aussig, Austria-Hungary. U.S. Pat. 802,996, Oct. 31, 1905.

SEE Fr. Pat. 336,852 of 1903; this J., 1904, 448.—T. F. B.

#### FRENCH PATENT.

*Manure; New Humous* —. L. C. Jeannin. Fr. Pat. 355,935, July 7, 1905.

PEAT is dried, powdered, and saturated with a boiling potash or soda lye of from 1 to 3 per cent. strength, and the mass is mixed with powdered calcium phosphate, and spread out to dry. Lastly, the product is incorporated with a suitable proportion of powdered "potash."—E. S.

## XVI.—SUGAR, STARCH, GUM, Etc.

(Continued from page 1182.)

*Saccharose in Scammony Root; Presence of —.* P. Requier. *J. Pharm. Chim.*, 1905, 22, 435—438.

AFTER precipitating the resins extracted from scammony root with water, the aqueous liquid contains besides a tannin and a reducing sugar, a considerable amount of saccharose, equivalent to 3.36 per cent. on the dry root. —J. O. B.

[*Sugar*] *Syrups; Viscosity of —.* J. de Grobert. *Bull. Assoc. Chim. Syrc. Dist.*, 1905, 23, 424—426.

REDUCING agents, e.g., sulphurous acid or hydrosulphites, are used to some extent in sugar factories and are regarded as having a distinctly favourable action on the rapidity of the concentration and the crystallisation of the syrups.

Fouquet in certain experiments with these reducing processes failed to observe any diminution of the viscosity of the syrups as a result of the treatment. The author points out that the function of these agents is to modify the nature of the non-sugar constituents, and that it is only near the crystallising point that the influence of the quantity and, above all, of the quality of the non-sugar makes itself felt. Even if the purity of the syrup is not increased by the treatment, the constitution of the non-sugar constituents should be changed in a direction which is frequently favourable. Unfortunately sulphitation is rarely pushed sufficiently far to obtain this benefit, most factories being content with a slight decrease in the alkalinity and a certain amount of decolorisation. The author is convinced that if sulphitation be applied in a full degree, the effect of the treatment on the viscosity of the syrups will be well marked, provided that the measurements of viscosity be made on syrups as concentrated as possible. —J. F. B.

*Dextrin; Dichloroacetic Ester of —.* Khidiaschwili. *J. Russ. Phys. Chem. Ges.*; through *Brewers' J.*, 1905, 41, 688.

TWENTY grms. of rice starch were heated with 40 grms. of dichloroacetic acid under a reflux condenser until the colour reaction with iodine could no longer be observed. The product was poured into water and dried over sulphuric acid. The determination of the molecular weight, in acetone solution, of the dextrin dichloroacetic ester obtained indicated a sextuple molecule. The proportion of dextrin in the ester was determined by saponification by calcium hydroxide and precipitation of the dextrin by alcohol. —J. F. B.

*Beetroots; Determination of Sugar in —.* A. T. Höglund. *XXIII.*, page 1258.

*Sugars and other Optically Active Hydroxy-Compounds; Action of Alkaline Uranyl Salts on the Rotatory Powers of —.* H. Grossmann. *XXIV.*, page 1260.

### ENGLISH PATENT.

*Food [Molasses Fodder] for Animals and for other purposes. Process for Making a Product for use as —.* F. Livingstone. From A. Stein. *Eng. Pat.* 24,288, Nov. 9, 1904. *XVIII.A.*, page 1249.

## XVII.—BREWING, WINES, SPIRITS, &c.

(Continued from page 1184.)

*Yeast; Probable Existence of Emulsin in —.* T. A. Henry and S. J. M. Auld. *Roy. Soc. Proc.*, 1905, 76, 568—580.

THE authors have observed that yeast decomposes amygdalin in the same manner as emulsin does, with the production of benzaldehyde and hydrocyanic acid, whilst

the dextrose is fermented. This action is independent of that of the invertase of yeast, which is manifested by the action of an aqueous extract of yeast on amygdalin, and which only proceeds as far as the production of mandelonitrile-glucoside and dextrose. Yeast preparations free from living cells, e.g., "Aceton-Dauerhefe" and Buchner's yeast cell-juice also decompose amygdalin in the same manner, but not so rapidly as living yeast. Hydrocyanic acid has no inhibitive influence upon the activity of the glucosidolytic enzyme of yeast-juice, but this activity undergoes a slight diminution when the juice is kept for some time, owing to the digestive action of the yeast-trypsin. By the fractional coagulation of yeast juices by heat, as described by Wroblewsky (this *J.*, 1899, 156), the resistance of the glucosidolytic enzyme to heat was determined. When the yeast juice was heated for 30 minutes at 58° C., the filtrate from the coagulum produced thereby was free from zymase and endotryptase, but still contained the glucosidolytic enzyme and the invertase in the active state. When this filtrate was caused to act upon amygdalin at 40° C., dextrose was produced in addition to the benzaldehyde and hydrocyanic acid. The glucosidolytic enzyme of yeast hydrolyses amygdalin, salicin, arbutin, phaseolunatin, and mandelonitrile-glucoside, but does not attack sinalbin, digitalin or quercitrin. The temperature at which its activity is destroyed is about 70° C., and it is most active at 40° C. Its activity is inhibited by the presence of small quantities of alkalis or mineral acids, but is not affected by antiseptic agents. In all these respects this enzyme so closely resembles the emulsin of almonds that there remains little doubt that the two are identical. —J. F. B.

*Yeasts; Non-Inverting —.* Van Laer. *Centralbl. Bakt.*; through *Brewers' J.*, 1905, 41, 688.

THE number of species of saccharomycetes and allied organisms (torulaceae) which are endowed with the power of inverting saccharose is comparatively small, but this power cannot be used for a systematic classification since the elaboration of the enzymes depends on the environment. In some cases the inverting enzyme is secreted in the cell, but is not transfused through the cell wall into the surrounding medium. In the case of strongly aerobic organisms like *Mycoderma*, the saccharose-inverting enzyme may be present, but the products of inversion may be oxidised before they can be detected. With other ordinarily non-inverting organisms, in which the oxidising action is less powerful than in *Mycoderma cerevisiae*, the production of invert sugar in saccharose media can be detected under certain conditions. *S. hyalosporus*, *Torula pulcherrima*, *S. apiculatus*, *S. anomalous*, *S. farinosus*, and an unnamed yeast (I.B.) from Jørgensen have been studied from this point of view, and the author concludes that when the vegetative cells predominate, the non-inverting species are capable of inverting the saccharose nutrient as a preliminary to its assimilation. —J. F. B.

*Enzyme Action; Studies on —.* VII. *Synthetic Action of Acids Contrasted with that of Enzymes. Synthesis of Maltose and Isomaltose.* E. F. Armstrong. *Roy. Soc. Proc.*, 1905, 76, 592—599.

THE author has extended the work of Hill (this *J.*, 1898, 684 and 1903, 505) and of Emmerling (this *J.*, 1901, 377) on the synthesis of bioses from dextrose, and has correlated his results with the theory of the constitution of the glucosides.

*Synthetic Action of Hydrochloric Acid.*—100 grms. of glucose [dextrose] were dissolved in 300 c.c. of concentrated hydrochloric acid, the solution was cooled to 0° C. and treated with hydrogen chloride gas until the colour began to darken. The solution was kept at a temperature below 10° C. for about 40 hours, then neutralised with lead carbonate, shaken with silver carbonate and filtered. In the product of the reaction the two bioses, isomaltose and maltose, were characterised, the former being present in larger quantity than the latter.

*Synthetic Action of Yeast-maltase.*—50 grms. of glucose were dissolved in 75 c.c. of a filtered aqueous extract of top yeast and the solution was digested in presence of



toluene for two to three months at 25° C. After the removal of the fermentable sugar, isomaltose was definitely characterised in the product; maltose was probably absent.

*Synthetic Action of Emulsin.*—50 grms. of glucose were digested with 75 c.c. of a solution containing 1 gm. of emulsin under conditions identical with those employed with yeast-maltase. The product of the reaction was entirely fermentable, and, therefore, free from isomaltose. Further, after the removal of the glucose by *S. marrianus*, the presence of maltose was established.

According to the glucoside theory, maltose is glucose- $\alpha$ -glucoside sensitive to maltase, whilst isomaltose is glucose- $\beta$ -glucoside and is hydrolysed by emulsin. The synthetic action of acids, like their hydrolytic action, is non-specific, and the condensation of glucose under the influence of hydrochloric acid therefore gives rise to the formation of a mixture of both ( $\alpha$ - and  $\beta$ -glucosides, the maltose and isomaltose) in proportions in equilibrium with their relative stabilities. But the hydrolytic action of the enzymes, on the other hand, is selective, maltase acting only on  $\alpha$ -glucosides and emulsin on  $\beta$ -glucosides. Similarly it is now found that their synthetic action is also selective, and that only a single biiose is produced by each enzyme, viz., the biiose which is isomeric with the one which is hydrolysed by the same enzyme.—J. F. B.

*Enzyme Action; Studies on* —. VIII. *The Mechanism of Fermentation.* E. F. Armstrong. Roy. Soc. Proc., 1905, 76, 600—605.

THE author has investigated the fermentability of various sugars by various species of yeast, the results being set forth in the following table:—

Yeast.	Dextrose.	Levulose.	Mannose	Galactose.	Maltose.	Saccharose.	Lactose.
Yeasts containing maltase and invertase.							
<i>S. cerevisæ</i> (top).....	+	+	+	+	+	+	0
<i>S. Carlsberg</i> (bottom).....	+	+	+	+	+	+	0
<i>Schiz. Pombe</i> .....	+	+	+	0	+	+	0
<i>S. thermantitum</i> .....	+	+	+	+	+	+	0
Yeasts containing invertase only.							
<i>S. Marxianus</i> .....	+	+	+	+	0	+	0
<i>S. eriquus</i> .....	+	+	+	0	0	+	0
<i>S. Ludwigii</i> .....	+	+	+	0	0	+	0
<i>Willia Saturnus</i> .....	+	+	+	0	0	+	0
<i>Willia anomala</i> .....	+	+	+	0	0	+	0
Yeasts containing maltase only.							
<i>Schiz. octosporus</i> .....	+	+	+	0	+	0	0
<i>S. capsularis</i> .....	+	+	+	+	+	0	0
<i>S. Kloecker</i> .....	+	+	+	+	+	0	0
Yeasts containing lactase and invertase.							
<i>S. fragilis</i> .....	+	+	+	+	0	+	+
<i>Kefir yeast</i> .....	+	+	+	0	0	+	+
<i>Torula Kayser</i> .....	+	+	+	0	0	+	+
<i>Torula Adametz</i> .....	+	+	+	0	0	+	+
No. 698.....	+	+	+	+	0	+	+
Yeasts without sucrorlastic enzymes.							
<i>S. apiculatus</i> .....	+	+	+	0	0	0	0
<i>S. apiculatus Schweiz</i> .....	+	+	+	0	0	0	0
<i>S. mali Duclauxi</i> .....	+	+	+	?	0	0	0

It is remarked that all the yeasts are able to ferment dextrose, levulose, and mannose, apparently with equal ease, and that these three hexoses all have the same enolic form. Hence it is concluded that the formation of the enol is the initial stage in the fermentation of the hexose, and that the breakdown of the molecule commences at the terminal carbon atom, the resistance of the bioses to direct fermentation being due to the stability of the carbon-oxygen ring and the consequent non-formation of the enol. The different behaviour of the yeasts towards galactose indicates that the mechanism of fermentation of this hexose is a different one from that according to which the three other hexoses are fermented, but it is also certain that the fermentation of galactose is equally independent of the presence of any of the sucrorlastic enzymes.—J. F. B.

*Amyl Alcohol; Formation of* — in Fermentations by Beer Yeast. J. Ellront. Bull. Assoc. Chim. Sucr. Dist., 1905, 23, 393—397.

THE author discusses the work of Ehrlich (this J., 1905,

683), in which the origin of the fusel oil is traced to the amino acids of the wort. He regards this as a very important discovery which should lead to the manufacture of fusel oil on a more extended scale. He has made some preliminary experiments in this direction by converting the albuminoids of brewers' grains into amino acids by the action of mineral acids. The addition of 5--6 kilos. of these "peptonised" grains per hectolitre of molasses wash considerably increases the yield of fusel oil. The increase in the quantity of fusel oil is proportional to the quantity of peptonised grains added. The maximum yield of fusel oil obtained amounted to 5--6 per cent. of the ethyl alcohol produced. The more closely the maximum of fusel oil is approached, the worse is the yield of ethyl alcohol. Amyl alcohol is also a product of the autodigestion of yeast; the quantity formed varies very largely according to the conditions. It is produced with maximum intensity at the period when denutrition is very far advanced and its formation does not cease before the death of the cells. It would appear, therefore, that the fusel oil is not a direct product of the living cells, but is formed by the action of an enzyme secreted by the yeast cells.—J. F. B.

*Ethyl Alcohol; Preparation of Pure* —. L. W. Winkler. XX., page 1253.

*Alcohol; Methods of Denaturing* — Employed in Different Countries. A. Lecomte. II., page 1218.

ENGLISH PATENTS.

*Wort from Mash; Method and Apparatus for Separating* — by Centrifugal Action. R. Baeger, Ehrenberg,

and M. Güttner. Chemnitz, Germany. Eng. Pat. 8576, April 20, 1905.

DURING the centrifugal process, the mash is caused to pass over a suspended layer of spent malt or grain either increasing or decreasing in thickness from the top towards the bottom. The centrifugal apparatus consists of a truncated conical perforated wall fixed to a vertical shaft. Inside this wall is a horizontal mash-distributor adapted to revolve with the wall. The distributor is arranged concentrically within the upper part of the latter, and the lower edge of the wall is provided with an annular flange projecting inwards. A number of annular walls may be provided within the perforated wall, and, in this case, holes or recesses are provided so that the wort takes a zig-zag path, and the coagulated albuminous matters and other impurities are pressed and retained against the inner surfaces of these walls. The mash-distributor may revolve at a different speed to that of the perforated wall. An outside jacket encloses the apparatus, and is fitted with apertures which allow the supply of air to be regulated, and the jacket may be

provided with means for keeping the wort at a suitable temperature.—W. P. S.

*Fermented Liquors; Material for use in Manufacture of* —. E. C. Schrottky, Calcutta. Eng. Pat. 23,277, Oct. 28, 1904.

Raw grain, such as maize, rice, wheat or barley is steeped in water (preferably hard water) for about three days, the water being changed every twelve hours. The water is then drained off and the grain is thoroughly mixed with pressed brewers' yeast, suspended in ten times its weight of water, about 1 part of pressed yeast being taken for every 100 parts of moist grain. Care must be taken that practically every grain comes in contact with the yeast. The mixture is then fermented at a temperature of 85° F. for ten to fourteen days in a closed vessel, after which it is either steamed or dried on the kiln. This treatment effects such a modification of the endosperm and albuminoids of the raw grain, that it may be used in admixture with barley malt for the preparation of worts, equivalent in body, flavour and yeast nutrients to those prepared entirely from malt.—J. F. B.

*Beer; Apparatus for Chilling and Carbonating* —. E. G. Adlam, Bristol. Eng. Pat. 1337, Jan. 24, 1905.

The apparatus consists of a series of "battery" of tubes disposed parallel to the axis of rotation, so as to act as beaters to agitate the beer. This "battery" constitutes a multitubular vessel, through the tubes of which the chilling agent is caused to pass. It is caused to rotate in a stationary, insulated cylinder or drum, into which the beer is charged, and in which it is chilled and carbonated. The multitubular vessel is mounted in the stationary drum on a "tubular-ended shaft," serving for the admission and escape of the cooling agent, and arranged to rotate at two different speeds as desired.—J. F. B.

*Fermentation Backs; Apparatus for Collecting and Sterilising Carbonic Acid Gas from* —. J. C. Stead and T. C. Palmer, London. Eng. Pat. 27,396, Dec. 15, 1904.

ONE or more gas-collecting bells of light construction are suspended in the fermenting wort and are counterbalanced so that they will just sink when cocks, situated at their highest points, are opened. Each of the bells is connected to a gas holder by means of a flexible tube attached to the collecting main. The bells are dipped in the liquid, the cocks are closed and the gas which is at first collected is expelled; the flexible tubes are then connected with the cocks and the gas which is evolved is conducted to the reservoir. From this the gas is pumped through washing vessels and finally through a filter of porous earthenware, which sterilises the gas by filtration, and which can itself be sterilised by periodical steaming.—J. F. B.

*Food [Molasses Fodder] for Animals and for other Purposes; Process for Making a Product for use as* —. F. Livingstone. From A. Stein. Eng. Pat. 24,288, Nov. 9, 1904. XVIII., page 1249.

*Liquids; Evaporating — as Brewers' Wash, Sewage, Waste or Spent Dyes, and the like, the Evaporator being also applicable as a Smoke Washer.* A. B. Lennox. Eng. Pat. 28,951, Dec. 30, 1904. XVIII., page 1250.

#### UNITED STATES PATENT.

*Fermenting Apparatus.* H. H. Freund, New York. U.S. Pat. 803,478, Oct. 31, 1905.

THE fermentation vessel consists of a closed tank provided with an overflow cock and a row of closable openings at a level just above the overflow cock. Means are provided for admitting and discharging the wort or beer to or from the tank, and for retaining the yeast and solid matters in the tank. There are also means for cooling the liquid in the tank, and for sterilising and filtering the air supply, which can be admitted at will either near

the bottom or top of the tank. The air-pipe which enters the tank at the bottom can be arranged to deliver either one large stream of air or a number of fine streams, and the air pipe which enters near the top is in connection with a gas-escape pipe by means of a three-way cock, a liquid seal being provided to prevent the return of the gas into the tank.—J. F. B.

#### FRENCH PATENTS.

*Seeds and Grains; Process for Restoring Water-damaged* —. M. Hecking. Fr. Pat. 355,920, June 27, 1905.

THE process of restoring damaged grain consists of three treatments—cleaning, drying and cooling. The cleaning is effected by a vigorous agitation of the grain with the application of the waste heat from the drying apparatus. The grain may be cleaned either by its own friction or by the admixture of sand or sawdust to increase the friction; in some cases a stream of water must also be employed. The drying apparatus consists of a horizontal cylinder, provided internally with means for the aëration and transport in a longitudinal direction of the grain; this may be effected either by rotating the cylinder or by providing rotatory agitators inside a stationary cylinder. The dried grain is delivered into a rotatory sieve in which it is cooled by the current of air entering the drying drum, this air is then heated, passed through the grain at a suitable speed, and discharged from the cleaning apparatus.—J. F. B.

*Wort from Mash; Process and Apparatus for Extracting — by Centrifugal Action.* M. Güttner and R. Baeger. Fr. Pat. 356,134, May 4, 1905.

SEE Eng. Pat. 8576 of 1905; preceding these.—T. F. B.

*Beer; [Electrical] Process for Preserving* —. P. A. Roche. Fr. Pat. 350,182, Sept. 17, 1904.

THE beer is subjected to the action of an electric current of low voltage, in presence of soft iron, previously oxidised. The iron is preferably supplied in the form of a bundle of sheets; the acid of the beer attacks the iron, and the salt of iron thus produced acts as a precipitating and clarifying agent. At the same time ozone is said to be produced by the action of the electric current which thus sterilises the beer.—J. F. B.

*Beer; Manufacture of Sterilised* —. J. F. Bergo and D. Kainseop. Fr. Pat. 355,612, June 6, 1905.

THE whole of the operations of brewing and fermentation are conducted in closed sterilised vessels, and the liquid is allowed to come in contact only with sterilised air. The malt is mashed in a closed mash-tun, and the wort is driven off by means of compressed air. The wort in the copper is first concentrated under reduced pressure and then sterilised by boiling at a temperature of 150° C., after the introduction of hops. The boiled wort is passed through a closed refrigerator into the fermentation tuns in which it is aërated with sterilised air. The primary fermentation takes place in one vessel and the secondary fermentation in another, the gases from the primary fermentation being passed into the beer undergoing secondary fermentation. Finally the beer is passed through a filter into casks protected from the air.—J. F. B.

*Lactic Acid; Process for the Manufacture of* —. E. A. Mislin and L. Lewin. Fr. Pat. 355,520, May 16, 1905.

ALTERNATE layers of malt and rye are placed in a suitable apparatus in equal proportions, until the saccharification of the starch is complete. The must is removed from the mass by pressure, and is then fermented with a lactic acid ferment, e.g., *acidificans longissimus*, milk of lime being added every twelve hours to keep the acidity of the liquor constant. When fermentation is complete, the solution is neutralised with lime and the calcium lactate decomposed by means of sulphuric acid.—T. F. B.



## XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(Continued from page 1185.)

### (A.)—FOODS.

*Wheat Grain; Influence of Different [Coloured] Rays of Light on the Migration of Albuminoids in —.* J. Dumont. XXIV., page 1260.

*Meat Extract; Determination of the Organically Combined Phosphorus in — as a Means of Judging its Freedom from Decomposition.* M. Siegfried and E. Singewald. XXIII., page 1258.

### ENGLISH PATENTS.

*Food [Molasses Fodder] for Animals and for other Purposes; Process for Making a Product for use as —.* F. Livingstone, London. From A. Stein, Prague, Austria. Eng. Pat. 24,288, Nov. 9, 1904.

CERTAIN quantities of moss-peat and molasses or "sacchariferous liquid," are mixed together and then heated until acids and odorous matters are driven off, and the residue is dried. The latter serves as a half-product in the manufacture of alcohol. Other food materials may be added to the residual mixture.—W. P. S.

*Fruits and Vegetables containing Sugar and Preparations of such Fruits and Vegetables; Drying —.* J. R. Hatmaker, Paris. Eng. Pat. 25,563, Nov. 24, 1904.

THE fresh fruits or vegetables are reduced to a pulp and then dried on the hot-roller apparatus described in Eng. Pat. 8743, 1903 (this J., 1903, 815). If the drying be effected under reduced pressure, only sufficient heat to cause rapid evaporation need be employed.—W. P. S.

*Liquid or Semi-liquid Substances [Milk, &c.] composed of various Constituents; Process for Making — more Homogeneous.* G. Kumick, London. Eng. Pat. 28,250, Dec. 23, 1904.

WHEN a liquid, such as milk, is "homogenised" in the usual way the fat globules are not completely disintegrated. The patentee, therefore, subjects such homogenised milk to centrifugal action, whereby a fatty portion is obtained, whilst the milk, although naturally poorer in fat, still contains from 50 to 75 per cent. of its original fat. The fatty portion is then once more homogenised, either alone or with a fresh quantity of milk, and mixed with the separated milk. An alternative method is to separate the cream from the milk by means of a centrifugal machine, homogenise the cream, and re-mix it with the separated milk. The process is also applicable to egg-yolk and oil emulsions.—W. P. S.

*Lard Compounds; Apparatus for Bleaching —.* J. N. Humphreys, Assignor to Armstrong Packing Co., Dallas, Tex., U.S.A. U.S. Pat. 804,129, Nov. 7, 1905.

THE bleached substance is chilled by being passed between hollow inclined rollers, in contact throughout their length, and provided with inlets and outlets for the cooling agent, e.g., brine, and with rotating mechanism.—C. A. M.

*Yeast Extracts; Process of Freezing — from Bitter Principles.* M. Elb, Dresden, Germany. U.S. Pat. 804,524, Nov. 14, 1905.

SEE Fr. Pat. 343,712 of 1904; this J., 1904, 1039.—T. F. B.

### FRENCH PATENTS.

*Food Products Derived from Milk and Process for Obtaining them.* J. R. Hatmaker. Fr. Pat. 355,914, June 15, 1905. Under Int. Conv., June 17, 1904.

SEE Eng. Pat. 13,715 of 1904; this J., 1905, 632.—T. F. B.

*Pepsin; Process for Converting — into a Stable, Water-soluble Product.* Act.-Ges. f. Anilinfabr. Fr. Pat. 355,560, June 20, 1905.

PEPSIN is converted into stable products, easily soluble

in water, by adding to it the hydrochloride of a suitable basic substance, such as betaine, glycocholl, alanine or leucine. For example, a white powder, containing 10 per cent. of combined hydrochloric acid, is obtained by incorporating three parts of powdered pepsin with two parts of betaine hydrochloride.—T. F. B.

*Peptone from Silk Fibroin; Manufacture of —.* Act.-Ges. f. Anilinfabr. Fr. Pat. 355,805, July 1, 1905.

RAW silk is boiled with an acid, such as sulphuric acid, capable of forming an insoluble calcium or barium salt. The acid is then precipitated from the extract, and the peptone obtained by evaporation, preferably in a vacuum.—F. S.

*Fruits; Preserving —, by means of Dry Sugar.* G. E. Grenard. Fr. Pat. 355,817, July 3, 1905.

THE fruits are embedded in a thick layer of dry powdered sugar to which they give up the greater part of the water contained in them. At the same time, a quantity of sugar passes through the skins into the interior of the fruits. Afterwards, the fruits are washed once, wiped, and completely dried.—W. P. S.

*Butter; Process for Making —.* S. C. Boykin and R. B. Mitchum. Fr. Pat. 355,837, July 3, 1905.

FRESH milk is allowed to stand until the cream has risen, and the whole is then heated to the boiling temperature. After cooling, the cream is removed, one or two small spoonfuls of sugar are added to each 560 c.c. of cream, and the mixture is allowed to ferment. When the cream becomes thick and appears to have risen, it is worked, salted and washed.—W. P. S.

### GERMAN PATENTS.

*Filter with Inclined Division Plates, for the Separation of Solids from Liquids [Milk].* C. Baechler. Ger. Pat. 161,170, May 6, 1903.

IN separating particles of dirt, &c., from milk, filters or separators having inclined division plates with passages alternately above and below, are used. According to the present patent, the plates, having passages at their lower ends, are bent so that the cross-section has the form of a hook. The direction of the moving liquid is thus changed, and the solid particles separate more readily and fall into the collecting troughs below.—A. S.

### (B.)—SANITATION; WATER PURIFICATION.

*Water; Methods used for Controlling Supplies of Drinking —, and the Significance of the Results obtained with them.* F. Dienert. Ann. Inst. Pasteur, 1905, 19, 541–563; Chem. Centr., 1905, 2, 1547–1548.

AS a means of controlling supplies of drinking water (e.g., spring water), the author recommends determination of the electric conductivity of the water and counting of the number of *Bact. coli*. The electric conductivity of some spring waters examined by the author varied only within narrow limits, viz., between 10 and 20 ohms. When, however, owing to heavy showers, impurities from the surface found their way into the springs, the conductivity increased rapidly to a maximum, afterwards falling again to its normal value. In dry weather also, the conductivity of a spring water may become greater, especially in the case of springs subject to subterranean intermittent inflow of water from doubtful sources.

FOR counting the number of *Bact. coli*, the author uses small culture flasks filled with a nutrient solution containing per 1000: 60 parts of peptone (Defresne), 60 of sodium chloride, 2.2 of phenol, and 2 parts of lactose. To different quantities of this solution are added 200 c.c. of the water to be examined, and the mixture is kept at 42° C. for 24 hours. Sub-cultures of 0.5–1 c.c. of the mixture are then prepared on Neutral Red-gelatin.—A. S.

### ENGLISH PATENTS.

*Sewage; Treatment and Utilisation of —.* F. M. Spence and P. Spence and Sons, Ltd., Manchester. Eng. Pat. 28,646, Dec. 29, 1904.

THE invention relates to the utilisation of clayey or non-

porous land for sewage purification and concurrent crop growing. For this purpose, the land is surface-drained and is then covered with graded ashpit or like refuse. The sludge obtained by precipitation of the sewage is also spread over the land and the effluent is used for irrigating the whole prepared surface.—W. P. S.

*Liquids ; Evaporating* —, as *Brewers' Wash, Sewage, Waste or Spent Dyes and the like, the Evaporator being also applicable as a Smoke Washer.* A. B. Lennox, Newcastle-on-Tyne. Eng. Pat. 28,951, Dec. 30, 1904.

THE evaporating chamber is built around a chimney or smoke-stack, an entrance for the flue gases being provided at a low level and an exit into the chimney at a higher level. The evaporating chamber is divided into a large number of compartments by baffle-plates fixed alternately to the top and the bottom of the chamber, so that the gases are forced to take a zig-zag course. In each compartment is fixed a pipe from which the liquid is discharged through a spraying nozzle. The spray of liquid thus comes in contact with the flue gases, the liquid is evaporated, and the smoke is removed from the gases.

—J. F. B.

*Sewage and other Waste Waters ; Removal of Floating and Suspended Matters from* —. F. Bruzotte, Hamburg. Eng. Pat. 11,231, May 29, 1905.

THE apparatus consists of a number of separate gratings connected with one another so as to form an endless chain or conveyor. The bars forming the gratings extend out of the plane of the latter throughout their entire length in order to permit a clearing device to penetrate between them from end to end, and also to form recesses or intervals between the succeeding gratings. In these recesses, the coarser materials are retained and afterwards ejected as the apparatus revolves. The clearing device rocks back after the passage of one or more gratings and the material is removed from it by means of a scraper.

—W. P. S.

*Sewage ; Purification or Filtering of* —. A. Vogel-sang, Dresden. Eng. Pat. 17,383, Aug. 28, 1905. Under Int. Conv., Sept. 1, 1904.

A BRICKWORK tank is placed at any desired depth below the surface of the ground and is tightly closed at the top by an iron plate. The bottom of the tank is formed of a perforated arch providing a channel under the tank, whilst the interior of the latter is partly filled with layers of filtering material of different sizes. The layer consisting of the largest sized pieces is placed at the bottom and, at the

*Mercury Compounds to be used for Medicinal, Disinfecting and Antiseptic purposes.* S. Cooke, Glasgow. Eng. Pat. 1530, Jan. 26, 1905.

A COMPOUND consisting of equal parts of mercuric bromide and potassium bromide is claimed for use as a disinfectant, &c. The compound is soluble in water and does not coagulate albumin, nor form an insoluble compound when mixed with soap. Sodium or ammonium bromide may be used instead of the potassium salt.—W. P. S.

# XIX.—PAPER, PASTEBOARD, Etc.

(Continued from page 1185.)

*Paper as a Material for Textiles.* H. P. Stevens. Paper and Pulp. 1905, 10, 656—661.

THE yarn known as "Xyloidine" is prepared from ribbons of paper unwound from spools by a differential motion which twists the ribbons as they are unwound. The twisted ribbons are then passed through two "condensers" which roll them longitudinally into threads. Later processes, such as the Kellner-Türk and Kron's "Silvaline" process, treat the paper in the moist state direct from the paper machine. In the former of these the paper is made on the cylinder machine and is divided up into ribbons by circumferential wires fixed on the making cylinder. The strips are sufficiently adherent to pass the dry end of the machine as a single web ; they are then separated, rolled up longitudinally, by passing through a "condenser," and collected in cans in which they are preserved moist until ready for twisting on a ring-spindle twisting frame. The drawbacks of this process are the slow speed of the making machine and the small number of strips (80—100) obtained in the width of the machine. In Kron's process a Fourdrinier machine is employed, which travels at a high speed ; the web is split up into as many as 400 strips by fine jets of water (see this J., 1903, 757) applied in very close proximity to the paper, which is then reeled up moist. When the reel is unwound, the strips are separated and are twisted into yarn on the ring-spindle twisting frame. The strength of the yarn is, of course, determined by the strength of the pulp from which it is made, but the following data show that the process of twisting has a very marked influence in increasing the strength :—

	No. of metres per 1 grm. weight.	Breaking strain.	Breaking stretch.
		Kilos.	Per cent.
1. Dry strips of "Silvaline" pulp .....	2·891	2·390	3·06
2. Thread prepared from same .....	2·900	4·810	6·44
3. Strip of pulp prepared by Türk's process .....	13·153	4·170	2·84
4. The same rolled parallel to its length .....	8·222	5·014	2·24
5. The same rolled and twisted .....	12·100	6·413	3·06

air-outlet side of the tank, forms almost the total thickness of the bed. The sewage is admitted from a settling vessel and is distributed over the surface of the filter by means of conduits. A current of air is drawn down a shaft communicating with the channel under the filter bed, and after passing through the latter, leaves the chamber by a flue leading to a chimney. The draught up the chimney causes a continuous current to be drawn through the tank. The filtered sewage is led away by the channel under the filter. A number of similar tanks may be used in combination with a central chimney, but the main object of the invention is to provide a domestic sewage-disposal plant, the kitchen chimney supplying the necessary draught. The air may be ozonised or heated before entering the tank.—W. P. S.

## (C).—DISINFECTANTS.

### ENGLISH PATENTS.

*Soaps or Soap Size ; Utilisation of Waste Products in the Manufacture of* —. H. Arledter. Eng. Pat. 28,442, Dec. 27, 1904. XII., page 1243.

Thus the twisting of the "Silvaline" pulp hardly affects its length, whilst it doubles its strength and elasticity, but the rolling and twisting of the Türk pulp reduce its length very considerably.—J. F. B.

*Papers ; Printing* — for *Cheap Illustrations [Mechanical Wood-Pulp]*. C. Hofman. Papier-Zeit., 1905, 30, 3374.

For illustration papers containing mechanical wood-pulp the first consideration is the selection of a suitable quality of pulp. This should be short-fibred and "wet," such as is obtained by the use of fine-grained blunt stones ; it must be well refined and very finely strained. The whitest pulp is got from freshly felled wood, but even then a chemical bleaching process is necessary. For this purpose 10 kilos. of sodium bisulphite solution at 40° B. and one litre of concentrated sulphuric acid are generally allowed for 100 kilos. of dry pulp. The diluted bleaching liquor is best applied to the pulp on the *presse-pâte*, by spraying it uniformly over the web before the latter passes the press rolls. The pulp is then stacked moist, in sheets,



and becomes bleached ready for use in about six days. There is an increasing demand for illustration papers of low specific gravity; such papers are prepared without mineral filling, the absence of which must be compensated by extra attention to the fineness and whiteness of the pulp. These bulky papers are made with Ritter-Kellner wood pulp in combination with well bleached mechanical pulp from aspen wood.—J. F. B.

*Papers; Hard Sized or Strong Packing* ——. C. Hofmann. *Papier-Zeit.*, 1905, 30, 3584.

It is pointed out that in the case of wrapping papers it is impossible to combine the maximum hardness of sizing (resistance to rain, &c.) with the maximum tensile strength. The increased proportion of size has the effect of lowering the tensile strength of the paper. Consumers should therefore decide which quality is most important for the purpose for which the paper is required, and should determine some mean limits which shall secure sufficient resistance in both respects.—J. F. B.

*Paper; Lead Foil* ——. C. Beadle. *Paper and Pulp*, 1905, 10, 661–662.

THERE is a demand in Russia for paper coated with lead for packing tea, similar to the tin-coated paper used in this country. Experiments, made by Weichert with the object of preparing a finely divided metallic lead powder for coating paper, failed owing to the tendency of the lead to coagulate into lumps. Successful results were, however, obtained by using a mixture of lead and tin prepared as follows:—Three parts of a concentrated solution of lead acetate are mixed with one part of a concentrated solution of stannous chloride; a white precipitate is thus formed which redissolves on shaking. The solution is then placed in contact with strips of sheet zinc, which gradually dissolve, causing the separation of a spongy mass of lead and tin. This preparation does not tend to form clots and may be washed with water, incorporated with starch paste, and applied to the paper. Such paper, when passed through friction rolls slightly greased with coconut oil, takes a fine metallic polish.—J. F. B.

*Cellulose Acetosulphates*. II. C. F. Cross, E. J. Bevan and J. F. Briggs. *Ber.* 1905, 38, 3531–3538.

THESE investigations confirm, in the main, the account given in the first paper (this J. 1905, 685). The sulphuric acid residue of these esters is, however, now recognised as, if not existing in the form of  $-\text{SO}_4\text{H}$ , certainly so reacting in presence of water, and, therefore, capable of combining with the bases present in hard water. The bodies previously described as neutral sulphuric esters were purified by methods which are current for the production of the ordinary acetates and were, in fact, the calcium salts of acetyl-cellulose sulphuric acids. The corresponding magnesium and zinc salts have now been prepared and analysed, and the proportions of the respective bases fixed correspond to half the equivalent of the total sulphuric acid in combination. The magnesium salts are neutral bodies, which, after drying in the air, can be heated at  $100^\circ\text{C}$ . without decomposition. The zinc salts on the other hand, after washing until neutral, split off free sulphuric acid when dried in the air and are completely charred when heated at  $100^\circ\text{C}$ . The free "acid esters" gradually dissociate and break up in contact with water free from dissolved bases, but they have been prepared by washing the product of the reaction with amyl alcohol. Prepared without contact with water, these esters can be dried at  $100^\circ\text{C}$ . without charring, but they react as free acetyl-cellulose sulphuric acids when titrated in presence of water or alcohol. These investigations illustrate the relatively great stability of the combination between cellulose and sulphuric acid towards alkaline saponifying agents and its extreme sensitiveness towards acid reagents including water. The relation of sulphuric esters of this type to the question of the stability of cellulose nitrates is discussed (compare Hake and Lewis, this J., 1905, 274), and it is remarked that when cellulose nitrates are treated with the sulphuric acid acetylating mixture, a series of mixed esters, containing nitric, acetyl and sulphuric groups, in every way analogous to the above bodies, is produced.—J. F. B.

# ENGLISH PATENTS.

*Paper Making [Pulp Concentrating] Apparatus* P. Couper, Flint. Eng. Pat. 2774, Feb. 10, 1905.

THE apparatus for solidifying or concentrating paper pulp in the course of manufacture consists of a drum with a foraminous surface, e.g. of wire gauze, rotating in a stationary outer casing; a feed pipe with contracted mouth-piece in connection with a centrifugal pump, delivers the fluid pulp with force against the meshes of the drum, with which the mouth-piece is in close proximity. The fibres are retained on the drum, whilst the water penetrates to the interior, where it is collected and discharged by buckets, partitions, troughs or other suitable means. The layer of pulp is pressed on the drum by means of an external roller revolving in contact with it and is then removed by scrapers and delivered into a suitable receptacle. This apparatus is used for concentrating the pulp before and after bleaching, and replaces the *presse-pâte* for collecting the washed half-stuff.—J. F. B.

*Paper; Manufacture of Marbled* ——. O. Imray, London. From K. Franz, Hoechst a/Main, Germany. Eng. Pat. 3799, Feb. 23, 1905.

WHEN certain so-called "harsh" pulps, e.g., those prepared from wood cellulose, are delivered on to the paper-making machine, they part with their water very quickly, leaving the fibrous constituents in the form of irregularly distributed elevations or depressions. A marbled dyeing effect is obtained on such pulps by placing a vessel containing the solution of dyestuff immediately behind the skimming boards or "sluices" and delivering the solution on to a fabric suspended above the pulp in such a manner as just to brush against the elevations of the web of pulp as it passes beneath it. The irregular elevations are thus coloured differentially, as compared with the rest of the sheet, whilst the whole sheet is subsequently compacted and smoothed on passing the vacuum boxes and press-rolls.—J. F. B.

*Soaps or Soap Size; Utilisation of Waste Products in the Manufacture of* ——. H. Arledter. Eng. Pat. 28,442, Dec. 27, 1904. XII., page 1243.

*Substances capable of Resisting Water and Chemical and Similar Influences; Manufacture of* —— [for Impregnating Textiles, Paper, &c.]. C. Kochmann and J. Kaufmann. Eng. Pat. 16,744, Aug. 18, 1905. V., page 1225.

*Cellulose; Manufacture of Threads and Films of* ——. A. G. Bloxam, London. From Verein. Glanzstoff-Fabriken A.-G. Elberfeld, Mülhausen, Alsace. Eng. Pat. 1283, Jan. 23, 1905.

SEE FR. PAT. 351,208 OF 1905; THIS J., 1905, 856.—T. F. B.

# UNITED STATES PATENTS.

*Celluloid; Non-inflammable* ——, and *Process of Making same*. G. E. Woodward, Boston. U.S. Pat. 803,952, Nov. 7, 1905.

SEE FR. PAT. 344,048 OF 1904; THIS J., 1904, 1111.—T. F. B.

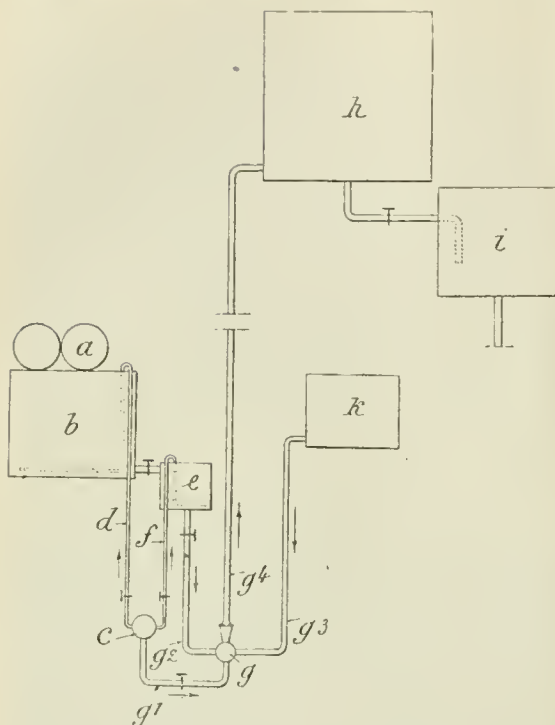
*Cellulose; Process of Manufacturing Films or Threads of* ——. M. Fremery, Oberbruch, and E. Bronnert, Mülhausen-Niedermorschweiler, Germany, and J. Urban, St. Pölten, Austria-Hungary. U.S. Pat. 801,191, Nov. 7, 1905.

A solution of cellulose in ammonium is coagulated by means of a strong caustic soda solution, and the solid product is treated in a centrifugal machine with a cold solution containing not less than 20 per cent. of caustic soda and not more than 6 per cent. of ammonia. It is then washed and dried under tension.—T. F. B.

# FRENCH PATENTS.

*Size; Process and Apparatus for Making Liquid* —— by Means of a Solution of Rosin Soap. M. Erfurt. Second Addition, dated June 5, 1905, to Fr. Pat. 325,901, Oct. 24, 1902 (this J., 1903, 757).

THE apparatus is shown in the accompanying diagram:  
F 2



(a) represents barrels of soap, (b) a tank of rosin soap, (c) a measuring tank, (e) a steam pipe, (d) and (f) steam pipes to heat the rosin soap in (b) and (e); (g) is an injector fed by steam through (g<sup>1</sup>) from (c), by soap through (g<sup>2</sup>) from (c), and by hot water through (g<sup>3</sup>) from (k); the mixture is forced by the injector through the tube (g<sup>4</sup>) into the tank (h). The emulsion may be run from (h) to a measuring tank (i). In the original patent the injector was placed on the same level as the tank (h). According to this addition it may be placed 5 m. or more lower than (h).—W. B. H.

*Paper Pulp; Solid Material [Rosin Soap] for Sizing* —. Soc. anon. "Mirabet." Fr. Pat. 355,852, July 4, 1905. Under Int. Conv., May 5, 1905.

THE rosin is saponified in the usual way by heating it with sodium carbonate in open boilers; the soap thus produced is then evaporated to dryness by any suitable process. The product is a solid, pulverulent, dry material, soluble in cold water, and suitable for preparing size.—J. F. B.

*Cellulose and Copper Compounds; Manufacture of Artificial Threads composed of* —. A. W. Kracht. Fr. Pat. 355,064, May 1, 1905. V., page 1226.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

(Continued from page 1189.)

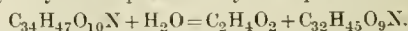
*Indaconitine, the Alkaloid of Aconitum Chasmanthum; Contributions to our Knowledge of the Aconite Alkaloids. Part XVI.* W. R. Dunstan and A. E. Andrews. Chem. Soc. Proc., 1905, 21, 233—234.

INDACONITINE is a highly poisonous alkaloid which has been obtained from the Indian plant known as "mohri," at first thought to be the same as the European *Aconitum Napellus*, but now recognised as a distinct species, *Aconitum chasmanthum*.

Indaconitine (C<sub>37</sub>H<sub>47</sub>O<sub>10</sub>N) is a crystalline alkaloid very closely resembling aconitine from *Aconitum Napellus* in its general properties, but differing, however, in its habit of

crystallisation and in many of its physical properties. Most of the salts crystallise well and are distinct from the corresponding aconitine salts. Its physiological action has been shown to closely resemble that of aconitine and pseudaconitine (Cash and Dunstan, Roy. Soc. Proc., 1905).

Indaconitine undergoes hydrolysis in two stages, in the first of which an acetyl group is eliminated as acetic acid, with the formation of a base, indbenzaconine, which has not been crystallised, but furnishes crystalline salts. This hydrolysis is represented by the equation:



Indbenzaconine is practically non-poisonous. On further hydrolysis, indbenzaconine furnishes benzoic acid and pseudaconitine identical with the final hydrolytic product of pseudaconitine.

Indaconitine is therefore of interest as representing a type of highly toxic alkaloid intermediate in its properties between the aconitine of the common European aconite (*A. Napellus*) and the pseudaconitine derived from the Indian aconite of Nepal. The discovery of this alkaloid and its proximate constitution has led the authors to change the formula of pseudaconitine from C<sub>36</sub>H<sub>49</sub>O<sub>12</sub>N, the formula originally assigned to the alkaloid by Wright, to C<sub>36</sub>H<sub>51</sub>O<sub>12</sub>N.

*Bikhaconitine, the Alkaloid of Aconitum spicatum; Contributions to our Knowledge of the Aconite Alkaloids. Part XVII.* By W. R. Dunstan and A. E. Andrews. Chem. Soc. Proc., 1905, 21, 234—235.

THIS alkaloid, like indaconitine, is highly poisonous. It has been isolated from a supposed variety of *Aconitum ferox* of India, which has now been proved to be a distinct species, *Aconitum spicatum*. The vernacular name of the plant being "bikh," the name bikhaconitine is proposed for the new base.

Bikhaconitine (C<sub>36</sub>H<sub>51</sub>O<sub>11</sub>N) does not crystallise so readily as other "aconitines," and its physical properties are distinct. A number of its salts have been prepared, and most of them crystallise well. Its physiological action very nearly resembles that of the other aconitines: its toxicity towards warm-blooded animals is greater than that of either aconitine or japaconitine, but is slightly inferior to that of pseudaconitine, which is the most poisonous alkaloid of the group.

Bikhaconitine, like the other aconitines, undergoes hydrolysis in two stages. In the first of these, an acetyl group is eliminated as acetic acid, and a new base (veratroylbikhaconine) is formed. This alkaloid does not crystallise, but furnishes crystalline salts. On further hydrolysis, veratroylbikhaconine furnishes veratric acid and bikhaconine, which does not crystallise, but furnishes crystalline salts. This alkaloid differs from other "aconitines" previously described.

The formula of bikhaconitine differs from that of pseudaconitine by one atom of oxygen.

*Aconitine Group of Alkaloids; Contributions to our Knowledge of the Aconite Alkaloids. Part XVIII.* By W. R. Dunstan and T. A. Henry. Chem. Soc. Proc., 1905, 21, 235.

IT is pointed out that now that it has been established that closely-related Indian aconites furnish similar, but nevertheless quite distinct, toxic alkaloids, it is most desirable that a similar examination should be made of the European aconites of the type of *Aconitum Napellus*. The work of Wright, Jurgens, and other chemists, as well as that of the present investigators, renders it highly probable that an examination of European plants commonly classed as *Aconitum Napellus* will reveal the presence of alkaloids very closely resembling, but yet distinct from, aconitine. The evidence already recorded goes to show that the aconitine, isolated by Wright from English plants and analysed by him and others, which was described in the course of the present investigation, is a distinct substance from the aconitine of German origin, now an article of commerce.

*Calycanthus Gloucus; The Crystalline Alkaloid of* —. H. M. Gordin. J. Amer. Chem. Soc., 1905, 27, 1418—1429.

In continuation of a former paper (this J., 1905, 289).



the preparation and properties of the following salts of calycanthine are described:—Nitrate, normal and acid sulphates, chloraurate, picrate, and normal oxalate. An acid oxalate could not be obtained, but an "abnormal" oxalate, corresponding to a mixture of 3 mols. of the acid oxalate with 1 mol. of the base, was isolated. A double salt of 3 mols. of calycanthine hydrochloride with 2 mols. of mercuric chloride was also obtained. The tartrates could not be obtained in a pure state. One of the nitrogen atoms of calycanthine is secondary, as shown by the formation of a nitrosamine  $C_{11}H_{13}N_2 \cdot NO$ , which is described; it exhibits Liebermann's reaction, and gives a brilliant green coloration when warmed with hydrochloric acid and methyl alcohol. Calycanthine contains one methyl group attached to a nitrogen atom.—T. F. B.

**Odorous Principles: Formation of —, during the Growth of the Plant.** E. Charabot and A. Hébert. *Comptes rend.*, 1905, **141**, 772–774.

The authors have carried out experiments similar to those described previously in the case of peppermint (this J., 1904, 454), but in this instance the plant employed was sweet basil (*Ocimum basilicum*), an aromatic pot-herb. The results show that plants which have been deprived of their flower buds produce appreciably more essential oil than plants allowed to grow naturally, the increase of oil obtained amounting to about 82 per cent. The weight of the plant was also increased by about 39 per cent. Fecundation and fructification are therefore accompanied by a consumption of the odorous principles of the plant.—W. P. S.

**Distillation of Immiscible Liquids [Steam Distillation of Essential Oils].** C. v. Rechenberg and W. Weisswange. *J. prakt. Chem.*, 1905, **72**, 478–488. (See this J., 1904, 628.)

The formula  $\frac{P}{P^1} = \frac{M \cdot F}{M^1 \cdot F^1}$  only holds good when the mixture of vapours is saturated for both its components. In actual practice, as in the essential oil industry, this condition is not realised. When the distillation is so conducted that the vapour of the essential oil is saturated and the steam unsaturated, the proportions in the distillate are expressed by  $\frac{P}{P^1} = \frac{M \cdot t}{M^1 \cdot (T-t)}$  where M and M<sup>1</sup> are the mole-

cular weights of oil and water respectively, T the tension of the mixed vapours, and t that of the oil contained in the vapours. This formula agrees with the experiments of the authors, who fail to confirm the formula of Charabot and Rocherolles (this J., 1904, 628), and, moreover, regard it as theoretically unsound. The converse relation  $\frac{P}{M(T-t)} = \frac{P^1}{M^1 t}$ —where t<sup>1</sup> is the tension of the steam, holds P<sup>1</sup> M<sup>1</sup> t when the vapour of the essential oil is unsaturated. The former condition obtains when oils or parts of plants are distilled in a rapid current of steam, the latter when an excess of oil is heated from outside and steam passed through.—W. A. C.

**Liverworts; Essential Oils of the —.** K. Müller. *Z. physiol. Chem.*, 1905, **45**, 299–319. *Chem. Centr.*, 1905, **2**, 768–770.

The author examined the essential oils yielded by different species of *Jungermanniaceae*:—

(1) *Mastigobryum trilobatum* (L.).—This plant loses 90 per cent. of its weight on drying in the air. On steam distillation it yields 0.93 per cent. (on the weight of dry substance) of an orange-yellow essential oil. A specimen of the oil prepared by the author had the sp. gr. 0.975 at 12° C., as compared with 0.945–0.947 at 15° C. for a commercial oil;  $[a]_D = +12.88$  when the oil itself was examined, and  $+14.05$  when the determination was made with a 42.26 per cent. solution in alcohol; saponification value, 5.4. The oil does not contain any volatile acids, but, after saponification with alcoholic potash, yields small quantities of an acid, semi-solid at the ordinary temperature, from which a white lead salt, soluble in ether, can be prepared. On fractionation, the chief

quantity of the oil distills at 260–270° C.; the distillate has a bluish-green colour; sp. gr. at 20° C., 0.946;  $[a]_D = +25.59$ . The higher-boiling fraction (270–285° C.) contains 5.4 per cent. of oxygen and has  $[a]_D = +42.21$ . The fraction distilling at 260–270° C. probably consists of a terpene; on oxidation with chromic anhydride and glacial acetic acid, it yields a compound boiling at 260° C., and having the composition  $C_{10}H_{14}O$ .

(2) *Liooscyphus Taylori* (Hook.).—This moss after drying at 100° C., yields 1.6 per cent. of a thick, bluish-green oil, of intense odour and unpleasant taste. The oil has the sp. gr. 0.978–0.986 at 20° C.;  $[a]_D = -3.44$ ; saponification value, 11.4. On distillation, the first fraction is obtained between 260 and 265° C.; it has the sp. gr. 0.937 and probably contains a sesquiterpene alcohol. The fraction distilling between 265 and 278° C. probably contains a sesquiterpene. The portion boiling at 280–290° C. is of a dark blue colour, and has  $[a]_{white} = +26.88$ ; it has the composition  $C_{15}H_{26}O$ .

(3) *Madotheca levigata* (Schrad.).—The air-dried material yields 0.9 per cent. of a relatively thin orange-yellow oil having a pleasant odour. The oil has the sp. gr. 0.856 at 16° C.,  $[a]_D = +72.74$ ; saponification value, 5.56. On distillation the following fractions are obtained:—(1) 50–100° C. (25 mm.),  $[a]_D = +10.51$ , unpleasant smell; (2) 150°–160° (17 mm.), sp. gr. 0.968 at 15° C.,  $[a]_D = +132.23$ , boils with decomposition at 280° C. under atmospheric pressure.

(4) *Alicularia scalaris* (Corda).—The oil from this moss has a lemon-yellow colour and has the sp. gr. 0.965 at 15° C., and  $[a]_D = -33.49$ .—A. S.

**Ethyl Alcohol; Preparation of Pure —.** L. W. Winkler. *Ber.*, 1905, **38**, 3612–3616.

THE impurities to be removed from commercial absolute alcohol are aldehyde and 1–2 per cent. of water. The aldehyde is removed by oxidation by means of precipitated silver oxide in presence of caustic alkali. A few grams of dried silver oxide are ground in a mortar with a little of the alcohol and the mixture is added to a litre of alcohol containing 1–2 grms. of caustic alkali. The silver oxide is allowed to act upon the spirit with frequent agitation at the ordinary temperature, for a few days, until the presence of aldehyde can no longer be detected. The removal of the water is effected by the action of metallic calcium in the form of filings. The alcohol is heated for several hours with 2 per cent. of calcium in a distillation flask with a long neck connected with a condenser by a short piece of india-rubber tube. After the evolution of hydrogen has almost ceased, the alcohol is distilled off; it should have a strength of 99.9 per cent. In order to make it perfectly anhydrous, the alcohol should be heated again for one hour with a small quantity of calcium and re-distilled. If the first runnings have a strange odour they should be rejected; the receiver should be protected from the entrance of atmospheric moisture by means of a calcium chloride tube.

**Specific Gravity and Boiling Point of Pure Alcohol.**—The author has made a series of careful determinations of the specific gravity of pure alcohol at temperatures between 0° and 30° C. From these observations the following formula has been deduced, showing the specific gravity of alcohol *in vacuo* compared with water at 4° C.:—

Sp. gr. (0°–30° C.) =  $0.80629 - 0.000838t - 0.0000004t^2$ . These values agree with those of Mendeleeff up to 15° C., above which temperature they are slightly lower than those of the latter author.

The boiling points of pure alcohol for different barometric pressures are: 740 mm., 77.69° C.; 745 mm., 77.86°; 750 mm., 78.03°; 755 mm., 78.20°; 760 mm., 78.37°; and 765 mm., 78.54° C.

It is remarked that the hygroscopicity of anhydrous alcohol has been somewhat exaggerated: 200 c.c. of alcohol, after standing exposed in an open beaker for fifteen minutes, had not absorbed 0.1 per cent. of water.

—J. F. B.

**Iodoform from Acetone [Electrolytic Production of —].**

G. A. Roush. *Amer. Electrochem. Soc.*, Sept. 20, 1905. *Electrochem. and Metall. Ind.*, 1905, **3**, 383–4. THE electrolysis of potassium iodide and acetone without

a diaphragm produces 2 mols. of alkali for each mol. of iodoform produced, whilst with a diaphragm, 4 mols. of acid are obtained to each mol. of iodoform. It is now proposed to combine these two reactions. The apparatus used consisted of a glass cell of 350–400 c.c. capacity; the anode was a platinum crucible, presenting 15–20 sq. cm. of electrode surface; it was mounted on a rod, which could be rotated. Two cathodes were used, one consisting of a platinum wire, of which about 10 cm. was immersed in the electrolyte, and the other of copper gauze of about 100 sq. cm. surface, the latter being in a porous pot. Each cathode was connected to a separate resistance, so that the current flowing from the anode to each could be regulated. Theoretically, the current to the copper cathode should be one-half that to the platinum, but, since the solution is best kept acid, a ratio of about 2:3 was maintained. The following conditions were found to give at the same time the highest current efficiency and the highest iodoform yield:—Electrolyte, 20 grms. of potassium iodide, 1.5 c.c. of acetone, 300 c.c. of water; current, to platinum cathode, 1.5 amp., and to copper cathode, 1.0 amp.; temperature, 15° to 18° C.—T. F. B.

*Calomel; New Modification of* —. J. Meyer. Z. anorg. Chem., 1905, 47, 399–400.

The author added to a solution of mercuric chloride a solution of lithium sulphite, with the view of preparing lithium mercurisulphite. An immediate precipitate of ordinary calomel was formed and was filtered off. After twenty-four hours the still clear filtrate was gradually warmed to 70° C., when shining plates formed, and settled on cooling. These were filtered off, and analysis showed them to be, not lithium mercurisulphite, as was expected, but calomel. Even when dried they are light and bulky compared with ordinary calomel (sp. gr. 4.5–5.0, against 6.5–7.5). They are not an allotropic form of calomel, for they show no E.M.F. when a galvanic element is formed from the two substances, but differ from it only physically. The new form is exceedingly pure, is very readily powdered, and may possibly be substituted with advantage for the other in pharmacy. It seems to resemble the Japanese calomel described by Lunge and by Divers. —J. T. D.

*Saccharose in Scammony Root; Presence of* —. P. Requier. XVI., page 1246.

*Wool-Fat; Water-absorbing Power of* —. J. Lifschütz. XII., page 1242.

*Pyramidone [Dimethylaminoantipyrine]; Determination of* —. A. Astruc and G. Pégurier. XXIII., page 1259.

*Pyramidone and Antipyrine; Volumetric Determination of* — in a Mixture of the two Substances. G. Pégurier. XXIII., page 1259.

*Lactic Acid; New Test for* —. W. Croner and W. Cronheim. XXIII., page 1258.

*Cream of Tartar; Analysis of* —. E. J. Parry. XXIII., page 1259.

*Hydrocyanic Acid; Modification of the Methods of Liebig and of Fordos and Gelis for the Volumetric Determination of* —. Application to the Titration of Cherry Laurel and Bitter Almond Waters. G. Guerin. XXIII., page 1258.

*Mercury [in Ores, &c.]; Volumetric and Gasometric Determination of* — by Hydrazine Salts, and of Hydrazine by Mercury Salts. E. Ebler. XXIII., page 1257.

#### ENGLISH PATENTS.

*Pyrimidine Derivatives; Manufacture of* —. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,149, Dec. 22, 1904.

SEE U.S. Pat. 787,360 of 1905; this J., 1905, 559.—T. F. B.

*Barbituric Acids; Manufacture of Dialkylated* —. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 2566, Feb. 8, 1905.

SEE U.S. Pat. 780,421 of 1905; this J., 1905, 151.—T. F. B.

*Hydrocarbons; Process for the Production of Sulphuretted* —. F. W. Howorth, London. From Morana Co. Act.-Ges., Zürich, Switzerland. Eng. Pat. 29,330, Dec. 31, 1904.

SEE Fr. Pat. 349,833 of 1904; this J., 1905, 750.—T. F. B.

*1,3-Dimethylxanthine and 1,3,7-Trimethylxanthine; Manufacture of a Double Salt of* —. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 4958, March 9, 1905.

By dissolving 2 mols. of either 1,3-dimethylxanthine or 1,3,7-trimethylxanthine in a solution of 1 mol. of barium salicylate, and evaporating the solution to dryness *in vacuo*, double salts of the two components are obtained. —T. F. B.

*Mercury Compounds to be used for Medicinal, Disinfecting and Antiseptic Purposes.* S. Cooke. Eng. Pat. 1530, Jan. 26, 1905. XVIII., page 1250.

#### UNITED STATES PATENTS.

*Oxalic Acid; Process of Making* —. F. A. Feldkamp, Newark, N.J. U.S. Pat. 802,980, Oct. 31, 1905.

A MIXTURE of carbon monoxide and carbon dioxide, *e.g.*, water-gas or producer-gas, is heated with caustic soda, forming a mixture of sodium formate and carbonate. This mixture is then heated to a higher degree until the evolution of hydrogen ceases and a mixture of oxalate and carbonate is produced. The caustic alkali is then regenerated by the addition of slaked lime, and the precipitated calcium oxalate and carbonate are decomposed by sulphuric acid.—J. F. B.

*Bromolecithin and Process of Making same.* P. Bergell. Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 803,541, Nov. 7, 1905.

SEE Ger. Pat. 156,110 of 1903; this J., 1905, 512.—T. F. B.

*Dialkylmalonylurea; Process of Making* —. F. Mayer, Mayence, Germany. U.S. Pat. 803,774, Nov. 7, 1905.

SEE Eng. Pat. 2787 of 1905; this J., 1905, 749.—T. F. B.

*Acetylene Tetrachloride; Process of Making* —. P. Askenasy and M. Mugdan, Nuremberg, Germany. U.S. Pat. 804,516, Nov. 14, 1905.

SEE Eng. Pat. 18,602 of 1904; this J., 1905, 150.—T. F. B.

*Protocatechuic Aldehyde; Process of Making* —. R. J. M. Sommer, Vienna, Assignor to F. Fritzsche und Co., Hamburg-Uhlenhorst, Germany. U.S. Pat. 804,682, Nov. 14, 1905.

SEE Eng. Pat. 15,784 of 1904; this J., 1904, 1043.—T. F. B.

#### FRENCH PATENTS.

*Chloroform; Process for Preserving* — from Air and Light, and for Eventually Indicating its Decomposition. P. J. Breteau. First Addition, dated June 30, 1905, to Fr. Pat. 353,858, May 2, 1905.

The following substances are given as "preservatives" of chloroform in addition to those given in the principal patent (this J., 1905, 1083):—Ethyl alcohol and ethyl ethers, nitrobenzene, methyl and amyl salicylates, thymol, coniferin. As "indicators," cellulose and gelatin may be used, in addition to dyestuffs. The indicator may also consist of a dyestuff which changes colour in presence of the decomposition products of chloroform.—T. F. B.

*Lactic Acid; Process for Making* —. E. A. Mislin and L. Lewin. Fr. Pat. 355,320, May 16, 1905. XVII., page 1243.



*Acetylene; Chlorination of* ——. Salzbergwerk, Neu Stassfurt. Fr. Pat. 355,776, June 30, 1905.

ACETYLENE can be safely chlorinated by allowing it to act on a mixture of sulphur chloride and a catalyser such as iron, ferric compounds, &c. To produce tetrachlorethane, it is best to saturate the mixture of sulphur chloride and the catalyser with acetylene cooling if necessary. The tetrachlorethane is obtained by fractionation. If the mixture, after being saturated with acetylene, is saturated with chlorine at a boiling temperature, hexachlorethane separates on cooling.—F. S.

*Fats and Oils containing Iodine and Sulphur; Process of Making* ——. W. Loebell. Fr. Pat. 355,864, July 4, 1905.

SEE Eng. Pat. 27,105 of 1904; this J., 1905, 857.—T. F. B.

*Dialkylmalonylureas; Process of Preparing* ——. W. Traube. Fr. Pat. 355,933, July 5, 1905. Under Int. Conv., July 13, 1904.

SEE Eng. Pat. 14,161 of 1905; this J., 1905, 1188.—T. F. B.

#### GERMAN PATENT.

*C-C-Dialkyl-2,4-Diimino-6-Oxypyrimidines; Process for Preparing* ——. E. Merck. Ger. Pat. 162,657, Nov. 10, 1903.

DIALKYL CYANOACETIC esters and guanidine are condensed by means of an alkali amide or alkali metal to form dialkyl-2,4-diimino-6-oxypyrimidines. (Compare Eng. Pat. 22,126 of 1904; this J., 1905, 689.)—T. F. B.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(Continued from page 1190.)

*Sensitising Plates by Bathing*. E. König. Phot. Korr., Sept., 1905. Through Phot. J., 1905, 45, 370.

PHOTOGRAPHIC plates bathed with a solution of a dye-stuff are more sensitive than those coated with an emulsion containing the dyestuff. It is necessary to use ammonia with certain dyestuffs to obtain their full sensitising power. When using ammonia in conjunction with Pinachrome or Orthochrome, only certain makes of plate can be used, but, without ammonia, all brands of plate appear to be available. Other alkalis may be substituted for ammonia; for instance, a 1 per cent. solution of potassium carbonate gives greater red sensitiveness. If 1 per cent. of ammonium chloride or sodium chloride be added to the Pinachrome solution, greater sensitiveness results; the alkali sulphates are without effect.—T. F. B.

#### ENGLISH PATENTS.

*Developing Photographic Images; Means for* ——. P. Mercier, Paris. Eng. Pat. 11,452, May 31, 1905.

THE shade of prints produced by developing under-exposed "printing-out" papers is stated to be modified by the addition to the developer of aluminium sulphate or an alum, or other sulphate which forms a double sulphate with potassium sulphate (e.g., manganese or indium sulphate). This is stated to give violet and blue prints. Instead of the normal sulphite, sodium bisulphite may be added to the developer, or an acid may be added to the developer containing the normal sulphite, to convert it wholly into bisulphite, and leaving no excess of acid.

—T. F. B.

*Engraving and (or) Etching of Copper Rolls for Calico Printing; Impts. in* ——. D. C. Paterson. Eng. Pat. 27,222, Dec. 14, 1904. V., page 1225.

#### UNITED STATES PATENTS.

*Photographic Process and Product*. G. N. Pifer, Cleveland, Ohio. U.S. Pat. 804,038, Nov. 7, 1905.

A PLATE having interposed between the support and the

film a substance or layer which is transparent to transmitted light, but opaque to reflected light (e.g., a line screen), is exposed in a camera with the support towards the lens, and is developed in the usual way and converted into a positive, e.g., by removing the portion of the picture which have been acted upon by light, and converting the portions which have not been acted on to a negative. The product is thus a positive picture both as regards position and light and shade.—T. F. B.

*Photographic Plate or Film*. G. N. Pifer, Cleveland, Ohio. U.S. Pat. 804,039, Nov. 7, 1905.

THE plate or film is of the nature described in the preceding abstract; the intermediate layer may be of a substance which possesses the above properties, or which is capable of developing those properties during the subsequent operations.—T. F. B.

*Cellulose; Process of Manufacturing Fibres or Threads of* ——. M. Freymery, E. Bronnert and J. Urban. U.S. Pat. 804,191, Nov. 7, 1905. XIX., page 1251.

#### FRENCH PATENTS.

*Fibres, Films, Blocks or Plates; Transparent Plastic Product for the Manufacture of* ——. H. C. M. L. Cathelineau and A. A. R. Floury. Addition, dated June 8, 1905, to Fr. Pat. 354,942, June 5, 1905. V., page 1226.

*Photographs on Silver Chloride Paper; Printing and Developing* ——. H. J. Mallabar. Fr. Pat. 355,790, July 1, 1905.

PRINTS are obtained on silver chloride papers without toning by development with a solution containing an organic developer, citric or tartaric acid, an alkali bichromate, and an alkali cyanide, thiocyanate or iodide. The photographs are printed to about one-third of the usual depth. The developer may consist of pyrogallol, 0.25 grm.; potassium bichromate, 0.002 grm.; anhydrous potassium thiocyanate, 0.016 grm.; anhydrous citric acid, 0.06 grm.; water, 150 c.c. Development is complete in about one minute, when the prints are fixed in "hypo," as usual. The claims also cover the use of a developer such as is described above, in the form of tablets, one lot of tablets being composed of pyrogallol, and the second of the three other components. The tones produced are generally black, but by using excess of thiocyanate, browns and reds may be obtained.—T. F. B.

## XXII.—EXPLOSIVES, MATCHES, Etc.

(Continued from page 1190.)

*Explosion of Nitroglycerin; Circumstances Attending an* —, which Occurred in the Fitter's Shop of the Factory of the "Explosive and Chemical Products, Ltd." at Bramble Island, in the County of Essex, on July 11, 1905. By Captain M. B. Lloyd, H.M. Inspector of Explosives.

A WORKMAN was engaged in renewing the gauze of two copper gauze sieves used for retaining the salt in the filter in the washing house; and, having removed the old gauze, was tinning one of the brass frames preparatory to soldering on the new gauze, when an explosion occurred, blowing pieces of the frame through his body. The sieves had previously been washed, first with methylated spirits, then with caustic soda, and finally four times with hot water. It appears, however, that although the brass rim of one of the sieves was solid, the other was made of brass tubing of 12 mm. outside and 9 mm. inside diameter. By constant wear, pinholes had formed, which allowed nitroglycerin to accumulate in the interior of the tube; and since there was nothing to show that the rim was not solid, its presence was unsuspected.

Attention is called to the necessity of apparatus of this kind being so constructed that there is no difficulty in cleansing it both inside and out. The use of tubing should be avoided as far as possible, and, where unavoidable, large holes should be left which would indicate the existence of the hollow space, and facilitate its complete cleansing.

—B. J. S.

*Match Igniting Compositions; Analysis of* —  
C. Bender. XXIII., page 1257.

#### ENGLISH PATENTS.

*Explosives; Impts. in* — L. Lheure, Paris. Eng. Pat. 27,459, Dec. 16, 1904.

CLAIM is made for the use as an explosive of ammonium nitrate by itself, or for its use as the base of an explosive, especially in mines, on account of its low temperature of detonation. To effect detonation, a priming core is employed, extending throughout the charge, ignition being produced from without by means of a fulminate detonator or a fuse of small diameter. The charge may be used either as powder, crystals, or compressed pellets; but to ensure success the whole must be very carefully tamped. In this way explosives not usually regarded as sensitive may also be detonated.—B. J. S.

*Explosives; Impts. in* — and to the Priming of the same. L. Lheure. Paris. Eng. Pat. 27,460, Dec. 16, 1904.

THE invention consists essentially in priming by means of a detonating fuse which extends through the middle of the charge, and is fired from without by means of a fulminate detonator or another detonating fuse. By this means, it is claimed that complete detonation of the charge is assured, and the danger attendant on the presence of a fulminate detonator within the charge during the process of tamping is minimised.—B. J. S.

*Explosives; Manufacture of* — J. C. Gonsalves, Colombo, Ceylon. Eng. Pat. 4968, March 9, 1905.

NITROGLYCERIN is absorbed by cocoa-nut fibre (coir dust or "poonac"), the quantity being dependent on the size and quality of the fibre. By selecting fibres of different coarseness the power of the resulting explosive can be varied at will. In addition to this, the fibre prevents freezing of the nitroglycerin, and, owing to its own combustible nature, it prevents or lessens the formation of noxious fumes on explosion. Mixtures of gelatinised nitroglycerin, coir dust and nitre or barium nitrate, are suggested. The invention also comprises the use of a solution of shellac in methyl alcohol during the process of incorporation, as a binding agent.—B. J. S.

*Explosive; Manufacture of a New Safety* — G. Schultz and F. Gehre, Munchen, Germany. Eng. Pat. 5687, March 18, 1905.

SEE Fr. Pat. 352,990 of 1905; this J., 1905, 1032.—T. F. B.

*Explosive Coherer-powder.* F. Schneider, Langenfeld, Germany. Eng. Pat. 17,741, Sept. 1, 1905. Under Int. Conv., Oct. 27, 1904.

THE coherer filling is for use with blasting or mine apparatus, the detonating action of which is effected by spark-producing stations.

The metallic coherer-powders at present in use have the disadvantage of being good electric conductors: this is remedied by the addition of gunpowder or blasting powder, which, being a bad conductor, ignites when a current is passed through the coherer.—T. F. B.

*Explosives Containing Nitroglycerin; Process for the Preparation of* — Deutsche Sprengstoff Act.-Ges. Fr. Pat. 355,844, July 3, 1905.

SUBSTANCES previously suggested for preventing the freezing of nitroglycerin or nitroglycerin explosives have failed owing to the fact that they are not efficacious, or that they diminish the power of the explosive. Claim is made for the use of dinitromonochlorhydrin, which, when added to the nitroglycerin up to 20 per cent., overcomes these difficulties. It may also be introduced by mixing monochlorhydrin with the glycerin before nitration.

—B. J. S.

*Matches; Inflammable Paste for* — of all kinds, both of Wood and Wax. W. Bokmayer and A. Swoboda. Fr. Pat. 355,846, July 4, 1905.

It is claimed that the danger of explosion during the preparation of match composition may be minimised by

addition to the paste of the following mixture:—3 parts by weight of finely powdered cork, 15 parts of oxide of iron, 23 parts of flour and about 40 parts of water. In practice, 30 parts of gum arabic are dissolved in 40 parts of water, and to the solution are added 57 parts of powdered potassium chlorate, and when this is well distributed, 7 parts of amorphous phosphorus and 15 parts of powdered glass are stirred in. The above mixture is then immediately introduced, and when mixing is complete, the composition can be applied to wooden sticks, which need not have been previously dried or paraffined. The head of the match is finally coated with tallow, which prevents atmospheric action and also spontaneous ignition.

—B. J. S.

### XXIII.—ANALYTICAL CHEMISTRY.

(Continued from page 1193.)

#### INORGANIC—QUALITATIVE.

*Copper; Microchemical Reaction for* — in presence of Lead and Bismuth. P. A. Meerburg and H. Filippo. Chem. Weekblad., 1905, 2, 641—643. Chem. Centr., 1905, 2, 1466.

It is stated that 0.0001 mgrm. of copper can be detected in the microchemical way by adding caesium chloride, CsCl, to a hydrochloric acid solution of a copper salt. On addition of only a small quantity of caesium chloride, there are formed, besides colourless compounds, red crystals (probably CuCl<sub>2</sub>.CsCl) generally needle-shaped, but frequently also hexagonal prisms. On adding more caesium chloride, yellow crystals (probably CuCl<sub>2</sub>.2CsCl) are formed, which can be re-converted into the red ones by the addition of a small quantity of cupric chloride. The presence of iron and cobalt interferes with the reaction. Lead and bismuth have no influence, and if these two metals are present together with copper, the bismuth can be detected by means of Behrens' method, simultaneously with the detection of copper by the method described above, whilst the lead can afterwards be identified as caesium-lead-copper nitrite.—A. S.

#### INORGANIC—QUANTITATIVE.

*Ammonium Salts; Volumetric Determination of* — by means of Alkali Hypobromite. E. Rupp and E. Roessler. Arch. der Pharm., 1905, 243, 104—114.

A SUITABLE volume of a solution of the ammonium salt is added to a known volume, for example, 75 c.c. of an alkaline solution of alkali hypobromite (10 grms. of sodium hydroxide, 17 grms. of bromine and 500 c.c. of water) in a stoppered glass vessel. The amount of hypobromite solution should be such that from one-third to one-half remains in excess. After shaking and allowing to stand for 5—10 minutes, about 50 c.c. of water are added, the solution is acidified with hydrochloric acid, potassium iodide added, and, after two minutes, the separated iodine determined by titration. Free ammonia may be determined by adding slowly a very dilute solution of it to the hypobromite solution, and then running in, drop by drop, dilute hydrochloric acid, until the solution contains a trace of free acid, this point being indicated by the solution acquiring a faint yellow tinge. After five minutes, the determination is completed as described above.—A. S.

*Silicate Analysis.* E. Jordis and W. Ludewig. Z. anorg. Chem., 1905, 45, 362—367; 47, 180—189.

THE authors have adopted the following as the most satisfactory method for the determination of silicic acid in silicates. The sample is evaporated to dryness with hydrochloric acid and ignited three times in succession, and then taken up with water and evaporated to dryness twice, in order to remove mineral acids. The platinum dish containing the residue is then heated for two hours at 140° C. in a drying oven, and the cooled contents moistened with lukewarm water, the dish being covered with a watch-glass. The moist mass is warmed gradually



on the water-bath, washed four times with hot water by decantation, and then twelve times with hot water on the filter, to free it from chlorine. The amount of silicic acid which passes through the filter is, in some cases, considerable. With pure barium silicates it was very small; with strontium silicates, 0.5; and with calcium silicates up to 12 per cent. of the weight of the sample. The amount is still greater in presence of alkalis. From the filtrate, barium or strontium is precipitated as sulphate, and calcium as oxalate. The solution, after separation of the alkaline-earth metal and still containing some silicic acid, is evaporated to dryness, and the residue treated as described above to recover the silica, the alkali metals being subsequently determined as sulphates. —A. S.

*Mercury [in Ores, &c.]: Volumetric and Gasometric Determination of — by Hydrazine Salts, and Determination of Hydrazine by Mercury Salts.* E. Ebler. Z. anorg. Chem., 1905, 47, 377—385.

MERCURY salts in mineral acid solution are not reduced by hydroxylamine or hydrazine, but in acetic acid or ammoniacal solution, the mercury is completely precipitated.

*In acetic acid solution.*—The mercuric salt is dissolved in 10 c.c. of dilute hydrochloric acid, 5 grms. of sodium acetate dissolved in 10 c.c. of water are added, and the whole introduced into a flask (500—700 c.c.) fitted with a ground stopper carrying (i.) a tap-funnel; (ii.) a tube passing to the bottom of the flask, for the introduction of carbon dioxide; (iii.) a reflux condenser, the inner tube of which is prolonged as a gas-delivery tube which can be connected to a Schiff's gas-collecting tube. Carbon dioxide is passed through till all air is expelled, the liquid being meanwhile kept just under 100° C. The solution of hydrazine hydrochloride is then added from the tap-funnel, and a slow stream of carbon dioxide kept up till the volume of gas ceases to increase; the gas is then transferred to a Hempel's gas-burette for measurement. No other gas than nitrogen is produced. The results are accurate whether mercury salt or hydrazine salt is in excess, so that the process can be used for the determination of either.

*In ammoniacal solution.*—The process is carried out in general in the same way, save that the air in the flask may be boiled out by ammonia. In this case, however, volumetric determination of the amount of hydrazine remaining from a given quantity may be used to determine the mercury, using Stolle's method (this J., 1902, 1351) of titrating the hydrazine by iodine in presence of alkali bicarbonate. N/10 iodine and N/40 hydrazine sulphate solutions are prepared and are equivalent, volume for volume ( $N_2H_4 + 4I = 4HI + N_2$ );  $N_2H_4$ , moreover, is equivalent to 2Hg, so that 1 c.c. of either solution = 0.01 gm. of mercury. The mercuric compound (0.5 gm.) is dissolved in a 300 c.c. flask and made strongly acid with hydrochloric acid; ammonia is then added in such excess as to redissolve the first-formed precipitate, and 50 c.c. of the hydrazine solution added. The liquid is heated on the water-bath till the mercury has completely subsided, cooled, made up to the mark, and successive portions of 50 c.c. titrated, after adding potassium bicarbonate, with iodine and starch. The amount of hydrazine solution used by the mercury compound is thus arrived at.

These methods, from their simplicity and quickness, are well adapted for the rapid assay of mercury ores. They are not interfered with by other metals, save copper, silver, and the rare noble metals. If copper and silver be present in a mercury ore, the acid solution is supersaturated with ammonia, and to the clear solution excess of hydrazine salt is added. The silver and mercury are precipitated, the copper reduced to cuprous salt. After filtering and washing, the silver and mercury are dissolved in nitric acid, the silver precipitated as chloride and filtered off, the filtrate rendered ammoniacal, and the mercury precipitated by hydrazine. The thoroughly washed precipitate, with the filter, is dissolved in *aqua regia*, evaporated to dryness, the residue taken up with water, and the mercury in the solution determined as above. —J. T. D.

*Tin in Copper-Tin Alloys: Rapid Method for the Determination of —.* A. G. Levy. Analyst, 1905, 30, 361—367.

The method described is especially applicable to gun- and bearing metals containing not more than traces of bismuth and antimony. 0.5 gm. of the alloy in the form of saw-dust or fine drillings is gently heated in a 30 c.c. distilling flask through which is passed a current of perfectly dry chlorine, carrying hydrogen chloride derived from its passage through a wash-bottle containing fuming hydrochloric acid. The stannic chloride formed is collected in water contained in two Volhard receivers, connected with the side-tube of the distillation flask by a bent glass tube. To prevent the mechanical carrying-over of chlorides of copper, lead, &c., a plug of glass-wool is wrapped around the chlorine inlet tube below the side-tube of the flask; the side-tube itself is first bent upwards for a short distance and then only down. When apparently the whole of the stannic chloride has been volatilised, the heating is interrupted, 10 c.c. of hydrochloric acid are added after pushing the plug of glass-wool down into the flask, and the liquid is distilled nearly to dryness. This treatment sweeps the last traces of stannic chloride into the receivers. The tin in the latter is precipitated as sulphide, which is washed thoroughly and ignited to oxide, without removing it from the filter-paper. A fairly bright red heat is used for the final ignition. The usual trace of antimony is then identified by fusing the stannic oxide with sodium hydroxide, dissolving the melt in a small excess of hydrochloric acid, and treating the solution in a platinum dish with iron wire. From the test-analyses quoted the method appears to give good results. For alloys containing appreciable quantities of antimony, it may be modified by washing the mixed sulphide precipitate into a dish, oxidising with nitric acid, igniting to oxides, and then separating these by Rose's method. —A. G. L.

*Match Igniting Compositions: Analysis of —.* C. Bender. Chem. Ind., 1905, 28, 679—682.

Owing to the inflammable nature and complicated character of match compositions, special care and special methods are necessary for their analysis. The author gives an outline of the analytical methods he would use for the analysis of a match consisting of cotton threads, with a head composed of a mixture of ordinary phosphorus, potassium chlorate, gums, ultramarine and lycopodium, the whole being varnished and paraffined.

Since in this case the heads cannot be removed mechanically, a quantity of the matches are weighed out, placed in a Soxhlet apparatus and extracted with ether. In this way paraffin, shellac and a trace of phosphorus are removed; and on distilling off the ether, the extracted matter may be weighed. The paraffin is directly estimated by saponifying the extract, and diluting with a large quantity of water—to precipitate any paraffin retained in solution by the alcohol formed on saponification—or by treating it with fuming sulphuric acid.

The author considers that the small quantity of phosphorus extracted by the ether is negligible, but it can be estimated by boiling the final distillate under a reflux condenser with bromine water, and precipitating as phospho-molybdate.

The matches are then placed in a reflux apparatus, carbon dioxide being passed through till all the air is expelled, and the flask warmed and shaken to loosen the composition from the threads. The phosphorus may then be melted, and collected into a globule which is taken out and weighed. The phosphorus may also be estimated as phospho-molybdate, but the above method is said to be quite accurate enough for ordinary requirements.

The threads are then boiled with water, which dissolves the gum and the chlorate, and a portion of the solution is evaporated to constant weight to determine the total extract. The chlorate is estimated by reduction either with oxalic acid or zinc and acetic acid, and precipitated as chloride, the gum thus being obtained by difference.

The insoluble residue consists of lycopodium, ultramarine and organic matter. It is filtered, dried at 100° C., weighed, and finally ignited, an analysis being carried out on the inorganic residue if necessary.

Two other samples of match compositions are mentioned by the author, one of which contained paraffin in the mixture itself, together with potassium chlorate, gums, red phosphorus and calcium sulphate, whilst the other contained antimony sulphide, but no paraffin nor calcium sulphate.

In the first, the residue after extraction with ether was boiled with water, and the insoluble portion treated with bromine water to remove the phosphorus, and with hydrochloric acid to dissolve the antimony sulphide. The undissolved portion consists of cellulose, and if washing has not been thorough, a trace of calcium sulphate will be present.

In compositions which contain yellow phosphorus, it is essential that it be very finely divided. This is best ascertained by the microscope, the use of which forms a valuable adjunct to the analytical methods.—B. J. S.

*Solutions, Solid* —. R. F. Korte. XXIV., page 1259.

#### ORGANIC—QUALITATIVE.

*Paranitraniline Red; A Simple Test for* —. E. Knecht. J. Soc. Dyers and Colourists, 1905, 21, 296.

To test a dyed or printed fabric for Paranitraniline Red, it is held above a very small gas flame, about  $\frac{1}{4}$  in. high, at a height of about  $\frac{3}{4}$  in. above the top of the flame. In the case of Paranitraniline Red, an orange-coloured spot makes its appearance, and something is seen to volatilise from the surface. The colour does not return on exposure to air or on moistening. If a small piece of white paper or calico be placed on the cloth at the point where it is heated, the sublimed Paranitraniline Red deposits on it. With Naphthylamine Claret the test is even more striking. Other red dyestuffs behave in quite another manner. With Turkey Red or Ahizarin Red, the heated part becomes blackish, but resumes its normal colour on exposure to the air, or, more rapidly, on moistening. With Benzopurpurin and most other direct reds, the colour merely becomes duller and also resumes its normal appearance when moistened.—E. F.

*Lactic Acid; New Test for* —. W. Croner and W. Cronheim. Berliner Klin. Wochenschr., 1905, 42, 1080; Z. Spiritusind., 1905, 28, 429.

This test is based on the conversion of the lactic acid into iodoform, and of the latter into phenyl isocyanide, which can be recognised in very small quantities by its smell. Two grms. of potassium iodide are dissolved in water. 1 gm. of sublimed iodine added, and the solution filtered through glass-wool or asbestos and made up to 50 c.c.; 5 c.c. of aniline are then added, and the liquid kept in a dark-coloured bottle. A few c.c. of the liquid to be tested are rendered alkaline with 10 per cent. potassium hydroxide solution, after which the liquid is boiled for a few minutes and then mixed with a little of the iodine-aniline solution; the presence of lactic acid is indicated by the well-known isomitrile odour.—T. H. P.

#### ORGANIC—QUANTITATIVE.

*Beetroots; Determination of Sugar in* —. A. T. Höglund. Z. Ver. dent. Zuckerind., 1905, 55, 1048–1058.

For the determination of sugar in beetroot, a weighed quantity of beet pulp is either extracted by alcohol in a Soxhlet's apparatus or digested with alcohol at a temperature of 75°–80° C. When the alcoholic solution of sugar thus obtained is filtered, the first portion of the filtrate will be found to have a considerably lower polarisation value than later portions, and the amount of the difference will be found to be greater as the thickness of paper through which the solution is passed is increased. The author has studied the importance of this error by filling a number of polarisation tubes consecutively with the filtrate, and determining the polarisation value of each portion comparatively with the unfiltered solution. This experiment was conducted with increasing thicknesses of filter paper from one to five. With several filters, it was found that the real polarisation value was not attained

by any portion of the 100 c.c. of solution employed, but with single or double filters, the true polarisation value is reached after two or three tubes have been filled. Hence the rule, always to throw away the first half of the filtrate, is deduced. This effect is not due to the moisture of the paper, since it occurs with perfectly dry paper, but it depends on the property possessed by the cellulose of absorbing sugar from alcoholic solutions, just as bone-charcoal absorbs sugar. From the above observation it is inferred that the cellulose of the beetroot pulp holds back sugar when the method of digestion is employed. The author shows that such is indeed the case, and that the method of digestion gives slightly lower results than the method of extraction. The error involved is not, however, a very serious one, and may probably be neglected in the analysis by digestion of normal beetroots. But in the case of beets poor in juice or otherwise abnormal, the extraction method is to be preferred to that of digestion.—J. F. B.

*Meat Extract; Determination of the Organically Combined Phosphorus in* —, as a Means of Judging its Freedom from Decomposition. M. Siegfried and E. Singewald. Z. Unters. Nahr. Genussm., 1905, 10, 521–527.

It is shown by actual experiment that the organically combined phosphorus in meat extract is destroyed as decomposition proceeds, and that in a badly decomposed extract, it is practically non-existent. On this fact, the authors base a method to ascertain whether a meat extract has been prepared from fresh meat, and also whether the extract has remained free from decomposition after its manufacture.

*Determination of the Organic Phosphorus.* Fifteen grms. of the extract are placed in a 500 c.c. flask, dissolved in about 300 c.c. of water, and the inorganic phosphorus compounds (phosphates) precipitated by the addition of 50 c.c. of 10 per cent. barium chloride solution and 10 c.c. of 10 per cent. ammonia. After shaking and allowing the precipitate to settle, a portion of the clear liquid is tested with a little more barium chloride to see whether enough has been added, and the portion tested returned to the flask. The contents of the flask are then diluted to the mark, mixed and filtered; 450 c.c. of the filtrate are transferred to a silver basin, evaporated, and the residue fused with a mixture of sodium hydroxide and potassium nitrate. The melt is then dissolved in dilute nitric acid, the solution boiled to remove nitrous acid, and the phosphoric acid precipitated with molybdic acid solution. The precipitate is finally converted into ammonium magnesium phosphate and weighed as pyrophosphate.

The total phosphorus is also determined by dissolving 7 grms. of the extract in 250 c.c. of water, evaporating 100 c.c. of the solution in a silver basin and fusing the residue with sodium hydroxide and potassium nitrate. The phosphoric acid in the melt is then determined as above described. Ammoniacal barium chloride solution does not precipitate any organic phosphorus compounds.

Six samples of meat extract, manufactured in the years 1894 to 1903 inclusive, contained from 2.22 to 3.29 per cent. of total phosphorus, and from 0.22 to 0.38 per cent. of organically combined phosphorus. The organic phosphorus constituted from 9.3 to 11.6 per cent. of the total phosphorus, the average being 10.3 per cent. The age of an extract has therefore no influence on the amount of organically combined phosphorus. A portion of meat extract prepared in 1901, when dissolved in water and allowed to spontaneously decompose for 19 days, gave at the end of this period only 0.02 per cent. of organically combined phosphorus.—W. P. S.

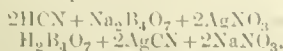
*Hydrocyanic Acid; Modification of the Methods of Liebig and of Fodoros and Gelis for the Volumetric Determination of* —. Application to the Titration of Cherry Laurel and Bitter Almond Waters. G. Guérin. J. Pharm. Chim., 1905, 22, 433–435.

THE modification consists in the addition of borax, before titration.

*Modified Liebig Method.* A measured quantity of the solution containing the hydrocyanic acid, suitably diluted is treated with an equal volume of 3 per cent. solution of borax, and then titrated with standard silver nitrate

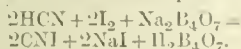


solution, in the usual manner, until a permanent opalescence appears. The reaction takes place according to the following equation:—



Thus, if the standard silver solution contain 3.448 grms. of silver nitrate per litre, each c.c. will be equivalent to 0.001 grm. of hydrocyanic acid. The solutions titrated must be free from ammonium salts, since these prevent the precipitation of silver cyanide; but this difficulty may be overcome by the addition, before titration, of a slight excess of saturated aqueous solution of boric acid.

*Modified Fordos and Gelis Method.* Before titration with standard iodine solution, a known quantity of the liquid to be tested is treated with an equal volume of 3 per cent. borax solution. The volumetric solution of iodine is then run in until one drop gives a permanent yellow tint. The reaction takes place thus:—



If, therefore, the volumetric solution of iodine contain 9.107 grms. per litre, 1 c.c. will be equivalent to 0.001 grm. of hydrocyanic acid.

In the case of cherry laurel water and bitter almond water, 10 c.c. is a convenient quantity to operate on. The presence of benzaldehyde in the water does not, in the least, interfere with the iodometric method with solutions of the strength indicated.—J. O. B.

*Pyrimidone [Dimethylaminoantipyrine]; Determination of —.* A. Astruc and G. Pégurier. *Ann. Chim. anal. appl.*, 1905, 10, 302—303. *Chem. Centr.*, 1905, 2, 927—928.

LEMAIRE (this J., 1905, 109) has used a method for the determination of antipyrine based upon the precipitation of the base by picric acid. The author recommends a similar method for the determination of pyrimidone. 0.231 grm. of the sample is dissolved in 10 c.c. of water, and 10 c.c. of N/20-picric acid solution are added. After shaking for some minutes, the mixture is filtered, and in 25 c.c. of the filtrate the excess of picric acid is titrated with N/10-alkali, using phenolphthalein as indicator. If *n* c.c. of alkali be required, the percentage of pyrimidone in the sample is given by the expression:  $(40 - 4n) \cdot 5$ .—A. S.

*Pyrimidone and Antipyrine; Volumetric Determination of — in a Mixture of the two Substances.* G. Pégurier. *Ann. Chim. anal. appl.*, 1905, 10, 392—393. *Chem. Centr.*, 1905, 2, 1554.

The author makes use of the fact that whilst antipyrine is neutral to methyl orange, pyrimidone reacts as a monobasic substance with this indicator. The two bases are first determined together as described in the preceding abstract. 0.231 grm. of the sample is then dissolved in 10 c.c. of water, the solution exactly neutralised with N/10-acid in presence of methyl orange, and the antipyrine afterwards determined by means of picric acid as already described. (See also this J., 1905, 639).—A. S.

*Cream of Tartar; Analysis of —.* E. J. Parry. *Chem. and Druggist*, 1905, 67, 838—839.

The author states that in numerous legal cases with respect to the presence of more or less lead in cream of tartar, the amount of lead has been exaggerated owing to failure to separate other metallic impurities. The colorimetric method for the determination of lead proposed by Warington, which is similar to that employed in the case of tartaric acid (see this J., 1893, 97), except that sodium sulphide is used instead of ammonium sulphide, is stated to be the most satisfactory one.

For the determination of the potassium bitartrate, direct titration of an aqueous solution of the tartar with sodium hydroxide is probably the best method for refined cream of tartar, but for crude products, the following method is more useful: Two grms. of the substance are treated with successive quantities of water until the last extract is quite neutral to litmus. The combined extracts are evaporated to 20 c.c., and treated with 200 c.c. of alcohol.

After two hours, the precipitated potassium tartrate is filtered off and titrated.

Calcium sulphate is determined by dissolving 10 grms. of cream of tartar in 150—200 c.c. of boiling water acidulated with hydrochloric acid, and adding barium chloride, the quantity of calcium sulphate being calculated directly from the weight of barium sulphate.—A. S.

## XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(Continued from page 1194.)

*Ice Formation and the Grained Structure of Glaciers.* G. Quincke. *Ann. der Physik*, 1905 [4], 18, 1—80. *Chem. Centr.*, 1905, 2, 1510—1511.

A CONCENTRATED aqueous solution of saline substances can appear oily, that is, exhibit surface tension, at the place of contact with water or a dilute solution of saline substances. If pure water or water containing dissolved saline substances be frozen at different rates, and then allowed to thaw slowly under varied conditions, the different layers or strata of the ice prisms show the same phenomena, in a similar order, as solutions of silicic acid, glue and other colloids, which have been dried to jellies or lamellae. Ice may be regarded as a liquid jelly with foam-walls ("Schaumwanden") of liquid, oily, concentrated saline solutions, enclosing foam-cells ("Schaumkammern") containing viscous, doubly-refracting dilute saline solution or pure water. The plasticity of ice decreases as the temperature falls. "Glacier-grains" are foam-cells separated from one another by foam-walls of an oily saline solution. Jellies of silicic acid and glue exhibit phenomena quite analogous to the regelation of ice. It was not found possible to prepare water free from traces of salts. The white portions of ice, containing most air-bubbles, are also the richest in salts, and these parts melt first. Very dilute solutions (from three to six-millionths per cent.) of different salts, when frozen slowly under similar conditions, gave oily lamellae of different viscosity and surface tension. By repeated fractional freezing and thawing of the ice crystals, purer ice with larger hexagonal prisms or foam-cells (glacier-grains) was obtained, but it was not found possible to obtain ice free from such foam-cells. Artificial ice is clearer, denser and harder to cut, the more slowly it is frozen and the purer the water. Ice crystals consist of doubly-refracting cohesive liquid, and occupy an intermediate position between the soft crystals of serum-albumin and the hard crystals of quartz, felspar, &c. The blue bands of glacier ice consist of almost pure ice, whilst the white portions contain saline substances and air-bubbles.—A. S.

*Solutions; Solid —.* R. F. Korte. *Chem. Soc. Trans.*, 1905, 87, 1503—1515.

EXPERIMENTS were made with a view to ascertain whether van't Hoff's theory of solid solution is sufficient to explain some well-known cases of adhesion (or carrying down of foreign substances by precipitates) in quantitative analysis. *Absorption of Iron Salts by Barium Sulphate* (see this J., 1889, 819). A constant quantity of sulphuric acid was precipitated, at the boiling temperature, with barium chloride in presence of varying amounts of ferric chloride. It was found that the amount of ferric salt carried down by the barium sulphate bore no relation to the quantity present in the solution. The dried precipitate loses in weight on ignition, sulphur trioxide being evolved. The results indicate that the carrying-down of ferric salts by barium sulphate is due to a combination of physical and chemical processes and is not a case of solid solution. *Occlusion of Magnesium Oxalate by Calcium Oxalate* (see this J., 1901, 1026). A constant amount of calcium chloride in presence of varying quantities of magnesium nitrate was precipitated with excess of ammonium oxalate in slightly ammoniacal aqueous solution at the boiling temperature. The precipitate, after standing for four hours, was washed twice by decantation with a hot 1 per cent. solution of ammonium oxalate, and four times on the filter with cold water. It was then dissolved in dilute nitric acid, and the free oxalic

acid titrated with permanganate. It was found that so long as the quantity of magnesium present was not greater than 36 parts per 5 parts of lime, the amount occluded by the calcium oxalate increased with the amount of magnesium present, but was very slight as compared with the total precipitate formed; up to the limit mentioned, the amount of occluded magnesium was independent of the time of contact of the solution with the precipitate before filtration. When the amount of magnesium present exceeded the limit given, however, the quantity of magnesium oxalate precipitated increased rapidly. The amount of occluded magnesium is slightly greater when the precipitation is carried out in the cold. The magnesium oxalate carried down by the calcium oxalate can only be removed to a very slight extent by repeated washing with boiling water. This occlusion of magnesium oxalate thus appears to be a case of solid solution, and when calcium is precipitated as oxalate in presence of considerable quantities of magnesium, it is necessary to dissolve and reprecipitate the calcium oxalate in order to obtain accurate results. *Solid Solution of Manganese Oxide in Ferric Oxide.* On precipitating a constant quantity of iron, in presence of varying quantities of a manganeous salt, with ammonia and ammonium chloride at the boiling temperature, it was found that the weight of the precipitate increased in proportion to the amount of manganese salt present until a fairly well-defined point was reached, beyond which no further increase was observed. The weight of the precipitate was, however, also influenced by other factors. On boiling the solution containing the hydrated precipitate before filtering, the occluded manganese hydroxide is dissolved to some extent. For example, the precipitates obtained from equal quantities of iron and manganese salts were boiled for one minute and ten minutes respectively; after ignition the first was found to contain 0.0061 grm., and the second only 0.0016 grm. of manganese protosessquioxide,  $Mn_2O_3$ . A large excess of ammonium chloride causes considerable irregularities in the quantity of manganese hydroxide carried down. The occluded manganese hydroxide is partially oxidised, if the water used for solution or washing contain dissolved air or oxygen. The maximum quantity of manganese hydroxide is occluded when the aqueous solution contains iron and manganese oxides in the proportions: 5 parts of ferric oxide to 1 part of manganeous oxide. If oxidation of the manganese hydroxide be prevented as much as possible, practically manganese protosessquioxide alone is in solid solution with the ferric oxide, but if the manganese hydroxide become partially oxidised, or if basic salts of manganese be formed by oxidation of the double salt,  $MnSO_4 \cdot 2NH_4Cl$ , in solution, higher oxyhydroxides of manganese are probably produced, and on ignition of the precipitate, a mixture of the sesquioxide and protosessquioxide of manganese in solid solution with ferric oxide is obtained. It is not possible practically to remove all the occluded manganese hydroxide by repeated precipitations of the iron. *Solid Solution of Nickel Oxide in Ferric Oxide.*—A constant quantity of a ferric salt in presence of varying quantities of a nickel salt was precipitated with ammonia and ammonium chloride at the boiling temperature. The amount of nickel carried down by the ferric hydroxide increased with the quantity present in the solution up to a maximum, which was attained when the solution contained about 0.043 grm. of nickel oxide ( $NiO$ ) to 0.11 grm. of ferric oxide. The precipitate after ignition contained ferric and nickel oxides in the proportion 5.9 : 1.

Experiments with aluminium hydroxide showed that whilst this compound carries down considerable quantities of foreign substances, the amounts so carried down vary in a most irregular manner, even in experiments under similar conditions, and the phenomenon, in this case, is probably due to mechanical inclusion, depending on the gelatinous nature of the aluminium hydroxide.—A. S.

*Iron; Rusting of* — W. R. Dunstan, H. A. D. Jowett, and E. Goulding. X., page 1235.

*Iron; Dunstan, Jowett and Goulding's Paper on the Rusting of* — E. Divers. X., page 1235.

*Sugars and Other Optically Active Hydroxy-Compounds; Action of Alkaline Uranyl Salts on the Rotatory Powers of* — H. Grossmann. Z. Ver. deut. Zuckerind., 1905, 55, 1058—1073.

In a series of studies analogous to those with lead and bismuth salts (see this J., 1905, 1119), the author found that levulose and mannitol readily react with alkaline solutions of uranyl nitrate, forming alkaline solutions with an intense golden yellow colour, the rotatory powers of which are widely different from those of the original substances. Complex compounds are thus produced in which the hydrogen atoms of the hydroxyl groups are replaced by the uranyl residue  $UO_2$ . The combination of equimolecular proportions of uranyl salt and levulose or mannitol is accompanied by reversal of the sign of the rotation. Dextrose, galactose, milk sugar and rhamnose also react with uranyl salts in alkaline solutions, but the sign of the rotation is not reversed; only in the case of rhamnose is the rotatory power increased by the uranyl salt, with the other sugars it decreases. Cane sugar changes slowly into the alkali-uranyl compound which is levorotatory; the sugar molecule does not appear to be changed by the reaction. The extremely low rotatory power of mannitol  $[a]_D = -0.25^\circ$  is changed by the action of a large number of reagents which give strongly dextrorotatory compounds: the compounds of boric acid, molybdic acid and uranic acid with mannitol have been studied.

The increase in the rotatory power of tartaric acid by uranyl nitrate and caustic soda, first recorded by Walden, is not a reaction which takes place in alkaline media, but requires the presence of hydrogen ions. For this reason it would appear that the uranyl residue combines not with the hydroxyl groups but with one of the carboxyl groups. Saccharic acid behaves, in the main, similarly to tartaric acid, but changes in the sign of the optical rotations occur as the proportions of the reagents are varied. The precipitation of uranium salts by alkalis is not prevented by the presence of tartaric acid.—J. F. B.

*Wheat Grain; Influence of Different [Coloured] Rays of Light on the Migration of Albuminoids in* — J. Dumont. Comptes rend., 1905, 141, 686—688.

PORTIONS of a field of growing wheat were covered with ventilated glass casings of various colours from the time when the grain first appeared until it was fully ripened: and samples were examined each week, as well as a sample grown in the open air. It was found that the wheat grown under coloured glass was much richer in nitrogen than the ordinary sample, the increase being most notable in the case of the green glass, followed by the dark brown, blue and red. The increase was observed both in the grains and in the husk. It is concluded that the rays which contribute most to the migration of albuminoids in the wheat grain are those which act least on the "chlorophyllian function."—T. F. B.

## New Books.

CHEMIKER-KALENDAR, 1906. Ein Hilfsbuch für Chemiker, Physiker, Mineralogen, Industrielle, Pharmazeuten, Hüttenmänner u. s. w. Von Dr. RUDOLF BIENER-MANN. 27 ster Jahrgang. In zwei Theilen. Julius Springer's Verlag. Monbijouplatz 3. Berlin. 1905. Price M.4.

*Part I.*—Arranged as a pocket-book, and containing almanack for 1906, with also a table of the more frequently used atomic weights and their multiples. The general text refers principally to matters of pure chemical interest. I. Atomic and Molecular Weights. II. Different Properties of Chemical Substances. III. Gaseous and



Vapour Densities. Specific Gravities. (1) Alkalis. (2) Acids. (3) Salts. (4) Alcohols, &c. IV. Solubility. V. Analysis. VI. Volumetric Analysis. VII. Gas Analysis. VIII. Spectrum Analysis. The matter in these different groups is mainly composed of Tables. A Notebook Calendar with blank pages is arranged for the different days of the year. The subject matter, exclusive of the Calendar and the blank pages for Notes, fills 367 pages.

*Part II.*—This supplement is of similar size to the pocket-book, but is unbound, and is more directly concerned with Chemical Technology. It contains Tables relating to:—I. Physics and Physical Chemistry. II. Mineralogy. III. Technical Chemical Analysis and Investigations. Besides the tabulated matter, however, there are concise descriptive paragraphs of introductory character, with descriptions of Analytical Methods. The subdivisions are as follows:—(1) Water. (2) Assaying. (3) Fuels. (4) Sulphuric Acid. (5) Alkali. (6) Bleaching Powder. (7) Salt-petre and Explosives. (8) Ceramics. (9) Glass. (10) Mortar and Cement. (11) Illuminants. (12) Starch and Sugar. (13) Fermentation Industry. (14) Fats and Oils. (15) Tanning. (16) Textile Fibres and Paper. (17) Photography. (18) Dyeing. (19) Physiological Chemical Analysis. Appendix with various recipes, &c. The subject matter fills 516 pages.

UNTERSUCHUNG DER MINERALÖLE UND FETTE. Sowie der ihnen verwandten Stoffe, mit besonderer Berücksichtigung der Schmiermittel. Von Dr. D. HOFDE, Professor, Abteilungsvorsteher am Kgl. Materialsprüfungsamt zu Gr.-Lichterfelde, W. Berlin, &c. 2. Auflage. Julius Springer's Verlag, Berlin. Price M. 10.

Svo volume, containing 400 pages of subject matter, illustrated with 99 engravings, and alphabetical indexes of subjects and names of authors. The subjects treated of are classified as follows:—I. PETROLEUM AND ITS PRODUCTS. A. Crude Petroleum. B. Benzine [Petroleum Spirit]. C. Petroleum as an Illuminating Agent. D. Cleansing and Polishing Oils from Crude Petroleum. E. Gas Oils. F. Oils for Electrical Transformers (Electr. Power Stations). G. Heating Oils (Masut, astatki). H. Lubricating Oils. J. Testing the consistency of Lubricants. K. "Water-soluble" or Emulsified Mineral Oils. L. Paraffin Scale and Soft Paraffin from Crude Petroleum. M. Vaseline. N. Tarry- and Pitch-like Distillation Residues. O. Refuse Products of the Petroleum Industry. II. TARS AND SOLID BITUMENS. A. Bitumen and Tar from Brown Coal. B. Shale tar. C. Peat tar. D. Mineral wax. III. SAPONIFIABLE FATS AND WAXES. A. Vegetable and Animal Fats and Oils. B. Waxes. IV. TECHNICAL PRODUCTS PREPARED FROM SAPONIFIABLE FATS AND WAXES. A. Stearin Candles. B. Wool Oils. C. Soaps. D. Soap Powders. E. Turkey Red Oil. F. Varnishes and Lacs. G. Blown Oils. F. Dégras. J. Linoleum. K. Iodised Fats. L. "Faktis," or Indiarubber substitutes.

GLUE, GELATINE, AND THEIR ALLIED PRODUCTS. A practical Handbook for the Manufacturer, Agriculturist, and Student of Technology. By THOMAS LAMBERT, Chas. Griffin and Co., Limited, Exeter Street, Strand, London. 1905. Price 5s. nett.

SMALL Svo volume, containing 148 pages of subject matter and the alphabetical index. The text is illustrated with 25 woodcuts, and treats of the following leading subjects:—I. HISTORICAL. Properties of Glue and Gelatin. Installation of Works. II. to IV. GLUE. V. GELATIN. VI. SIZE AND ISINGLASS. VII. TREATMENT OF EFFLUENTS PRODUCED IN GLUE AND GELATIN MAKING. VIII. LIQUID AND OTHER GLUES, CEMENTS, &c. IX. USES OF GLUE AND GELATIN. X. RESIDUAL PRODUCTS FROM GLUE AND GELATIN. XI. ANALYSES OF RAW AND FINISHED PRODUCTS. APPENDIX. Some recent specifications relating to the Manufacture of Glue and Gelatin. TABLES relating to Tests for Glue and Gelatin, Viscosity, Price, Odour, Viscosity and percentage of non-gelatin in glues, &c., &c.

INTRODUCTION TO THE STUDY OF ORGANIC CHEMISTRY. A Theoretical and Practical Text Book for Students in the Universities and Technical Schools. By JOHN WADE, D.Sc. (Lond.), Lecturer on Chemistry at Guy's Hospital, University of London. New and Enlarged Edition. With Appendix containing Supplementary Practical Details, forming with the text an Illustrative Laboratory Course. Swan Sonnenschein and Co., Ltd., 25, High Street, Bloomsbury, London, W.C. 1905. Price 8s. 6d. nett.

CONTAINS 621 pages of subject matter, with 24 illustrations and numerous diagrams.

CHEMIE DER ALICYKLISCHEN VERBINDUNGEN. Von OSSIAN ASCHAN, A. O. Professor an der Universität Helsingfors, Friedrich Vieweg und Sohn's Verlag, Braunschweig, Germany. 1905. Price M.40. Bound in cloth, M.42.

LARGE Svo volume, containing a Dedication to Prof. A. von Baeyer, 1133 pages of subject matter with four illustrations, and the alphabetical index. The leading themes considered in this work are as follows:—I. GENERAL PORTION. Introduction. (i) Theoretic Development of the Chemistry of the Alicyclic Compounds. (ii) Influence of the Ring formation and binding on the Chemical Nature of the Alicyclic Compounds. (iii) Influence of the Ring Formation on some physical properties of the Alicyclic Compounds. (iv) The Stereo-Chemistry of the Alicyclic Compounds. II. SPECIAL PORTION. (i) Methods of Formation and Preparation of the Alicyclic Compounds, systematically considered. (ii) Monocyclic Compounds. (iii) Bicyclic Compounds. (iv) Tri- and Polycyclic Compounds.

COLONIAL IMPORT DUTIES. [Cd. 2627.] Wyman and Sons, Fetter Lane, E.C. Price 2s. 3d.

Svo volume of 520 pages, comprising a return relating to the rates of import duties levied upon articles imported into the British Colonies, Possessions and Protectorates. (For summary of contents, see this J., 1905, 1194.)

ASBESTOS, ITS OCCURRENCE, EXPLOITATION AND USES. By F. CIRKEL, Mines Branch of the Department of the Interior, Ottawa. 1905.

LARGE Svo volume, containing 169 pages, including an index; also a map and 57 illustrations. The subject is treated according to the following classifications:—(i) History, Qualities of Asbestos, Geological Distribution and Character of the Deposits. (ii) Mining of Asbestos. (iii) The Dressing of Asbestos for the Market; Summary of the Principles in the Separation of Asbestos. (iv) Costs of Extraction, Market and Prices; Statistics and Status of Industry. (v) Asbestos Mines and Prospects. (vi) Asbestos in Foreign Countries. (vii) Commercial Applications of Asbestos. There is also a short Appendix giving an abstract of the Mining Laws of the Province of Quebec, and some bibliographical notes.

MICA, ITS OCCURRENCE, EXPLOITATION AND USES. By F. CIRKEL. Published by the Mines Branch of the Department of the Interior, Ottawa, Canada. 1905.

LARGE Svo volume, containing 148 pages of subject matter and index, with 38 illustrations and two maps. The following are the headings under which the subject is dealt with:—(i) Physical and Chemical Properties and Geographical Distribution of Micæ. (ii) Muscovite and Phlogopite. (iii) Mining and Preparation of Mica. (iv) Mica Mines and Locations. (v) State of the Canadian Mica Industry. (vi) Commercial Applications of Mica. (vii) Mica in Foreign Countries. An Appendix contains an abstract of the Mining Law of the Province of Quebec and of the Mining Act of the Province of Ontario, together with a Bibliography.

## Trade Report.

### I.—GENERAL.

COMMERCE AND INDUSTRY; RUSSIAN MINISTRY OF ——. *Times Financial Supplement*, Nov. 18, 1905.

An Imperial Ukase, issued on November 9, provided for the establishment of a Russian Ministry of Commerce and Industry. The scope of the new Ministry is defined as follows:—(1) The promulgation of all regulations respecting trade and industry (with the exception of trade taxation) and of all mining regulations; the control of the tariff council, the tariff committee, and the railways (except as regards finance). (2) The control of all matters affecting associations of merchants and commercial and industrial Courts, which have hitherto been under the Ministry of Internal Affairs. (3) The control of ports and merchant shipping. The Ukase also provides for the institution of departments to deal with matters concerning industrial taxes and other trade taxation, and with railway finances.

SWITZERLAND; NEW "GENERAL" CUSTOMS TARIFF OF ——. [*Cd.* 2768.]

This is a translation of the new "general" tariff of Switzerland as modified by the new commercial treaties concluded with Germany and Italy. It is intended to publish a further statement as soon as the whole series of Swiss Commercial negotiations has been concluded. The present return is obtainable from Wyman and Sons, Fetter Lane, E.C. Price 7d.

### III.—TAR PRODUCTS, PETROLEUM, Etc.

PETROLEUM PRODUCTION OF THE WORLD IN 1904. *Chem. Trade J.*, Nov. 25, 1905.

The table given below shows the entire production of crude petroleum in all the known countries for 1903 and 1904, and under the head of "All other countries" an estimate for all of the smaller countries which are known to produce a limited quantity of petroleum, but from which it was impossible to secure returns.

There is a remarkable increase in all the known countries producing petroleum. In the United States the increased production in the new fields of Kansas, Texas, Louisiana and California has, in the last two years, amounted to more than one-half the crude oil of the entire world. The increase in the world's production in 1904 over 1903 was 23,958,990 barrels, equal to 12.3 per cent., as compared with a gain of 5.1 per cent. in 1903 over 1902, and of 11.7 per cent. in 1902 over 1901. The increase in the United States in 1904 over 1903 was 16,602,084 barrels. For the same period in Russia there was an increase of 2,909,649 barrels. There was a notable increase in the production of India, Roumania and Germany. Of the world's production in 1904 the United States and Russia produced 89.24 per cent.; India, Galicia, and Roumania produced 5.89 per cent., leaving 4.87 per cent. for all the remaining countries.

The table is one of production only, irrespective of quality and value. The quality of the greater proportion of crude petroleum produced in the United States is superior to any other in the percentage of valuable products secured by distillation:—

Country.	1903.	1904.
	Quantity.	Quantity.
	Barrels.	Barrels.
United States .....	100,461,337	117,063,421
Canada .....	481,504	492,492
Peru and South American countries .....	61,745	66,200
Russia .....	75,591,256	78,500,905
Galicia .....	5,234,475	5,947,383
Sumatra, Java and Borneo .....	6,640,000	8,008,380
Roumania .....	2,768,117	3,572,625
India .....	2,510,259	3,385,468
Japan .....	964,000	1,411,975
Germany .....	445,818	637,332
Italy .....	20,000	36,400
All other countries .....	30,000	40,000
Total .....	195,203,511	219,162,501

### PETROLEUM TRADE OF TURKEY.

*Bd. of Trade J.*, Nov. 16, 1905.

According to the September Report of the Austro-Hungarian Consulate in Constantinople, the annual consumption of petroleum in Turkey is estimated at more than 2½ million cases. This total is divided as follows:—Constantinople, 1,050,000; Smyrna, 400,000; Salonica, 350,000; Syria, 600,000; other places, 250,000. About 95 per cent. of this total have hitherto come from Russia, and the remainder from Roumania and Austria-Hungary. Since the Baku disturbances, however, a decided alteration has taken place, and, owing to the deficient supply of Russian petroleum, petroleum from other countries has appeared in larger quantities on Turkish markets. This is especially the case with American petroleum, which, owing to its high price, was scarcely represented in Turkey.

The increase in the price of Russian petroleum has enabled American producers to offer their article at the same price. Imports of Roumanian petroleum will, it is expected, also increase. Petroleum from Austria-Hungary is found to be of satisfactory quality, but greater attention to method of packing is required. Petroleum is imported into Constantinople in tins, which when empty are used for various purposes, such as for holding water, paints, oils, &c., and consequently customers in Turkey pay special attention to having these tins of good material. In September prices, which were at the same time level for American and Russian petroleum, steadily rose.

### V.—TEXTILES, YARNS, AND FIBRES.

#### ANILINE BLACK DYEING.

\*FACTORY AND WORKSHOP ACT, 1901.

*Home Office Memorandum*, Nov., 1905. [*Form* 829].

The vapour of aniline oil as used industrially is known to give rise to definite symptoms of ill-health, due to alteration in the blood\* and to direct action, in severe cases, on the nerve centres. The effects are shown in a greyish or bluish coloration of the lips, with tendency to distension of the small veins, and characteristic paleness of the face. In slight cases these are often the only signs, but in others they are accompanied by varying degree of headache and dizziness, feebleness of the heart's action, some difficulty in breathing, a feeling of drowsiness and lassitude, and blueness of ears and nails. Occasionally—it may be as the result of accident, e.g., upsetting a carboy of acid into the mixing tank—complete unconsciousness, with very pronounced cyanosis (lividity) and paralysis of movement and of the senses, supervenes. In those who have worked long with aniline, in addition to the changes in the blood, gastric disturbance with loss of appetite is common.

Chronic acid or solutions of the alkali bichromates cause ulceration of the skin, which commences frequently, but not always, after an abrasion of the skin. The root of the nails, the creases over the knuckles, and the skin between the fingers are the parts most generally attacked. This ulceration, though less extensive than has been noted in workers engaged in the manufacture of the crystals, may penetrate to the bone and lead to loss of the nails or deformity of the joints of the finger. Danger is perhaps greatest in the handling of the crystals and boiling up of the solution, and among those thus employed perforation also of the septum of the nose has been found. In slab dyeing the chrome affection in susceptible persons has been found usually to take the form of a papular eruption on the hands, especially round the knuckles, on the palm, in the fold between the thumb and first finger, and about the wrists and forearms. Constant contact with the solu-

\* The red blood cells become altered in shape and are considerably reduced in number. As a consequence the red colouring matter and its capacity for conveying oxygen is much lower than normal. As the cyanosis produced by aniline differs from that of ordinary asphyxia in colour, duration, and sometimes in symptoms, it is possible that aniline undergoes chemical changes in the blood with formation of coloured products which account to some extent for the appearance presented.



tion causes the papule to burst leaving the chronic ulcerated condition so often found in workers.

Among 60 persons employed in seven factories in the mixing, preparing, and ageing processes, who were examined by the Medical Inspector in the months of July and August, 28 (47 per cent.) showed pale grey or blue colour of the lips, 31 (57 per cent.) characteristic pallor, and 5 scars, the result of previous work in chrome or of injury to the skin; while among 82 persons employed in the chroming, washing, drying, and other processes, 28 (34 per cent.) showed the same condition of the lips, 16 (20 per cent.) the pallor, and 11 (14 per cent.) present or past effects of chrome. Symptoms of headache, indigestion and heartburn, distaste for food, and drowsiness were complained of not infrequently. Some tremor or slight weakness of grasp which pointed to debility was noted in 22 (16 per cent.). The symptoms are aggravated in hot, close weather. The fact that, with exception of mixing, all the processes are carried on in the same general atmosphere no doubt accounts for the presence of symptoms in the persons employed in chroming, washing off, and drying, although the incidence is considerably less than among those employed in preparing and ageing.

The following summary of provisions necessary for the protection of the health of persons employed in mixing, preparing, ageing, chroming, washing off, and drying, is based mainly on conditions already existing in one or other of the factories in question\* :—

(1) Exhaust ventilation by means of ducts and hoods in connection with a fan (a) over each preparing machine, (b) at the point where dust is produced in chroming, and (c) in the process of steaming. Suitable inlets for air are of course necessary in each room.

(2) Ventilation of the "ager" to the outside air, by suitable ducts and by a fan where necessary.

(3) A mealroom† for the use of persons employed. No one should be allowed to introduce, prepare, or partake of food on the premises, except in the room provided for the purpose.

(4) Proper provision for keeping food, overalls, and clothing not worn during working hours.

(5) Ample washing accommodation,‡ e.g., basin for every five persons, with water laid on, and the necessary supply of soap, towels, and nailbrushes. There would be advantage in arranging the special washing accommodation near the cloakroom and mealroom. In some factories enamelled iron troughs fitted with waste pipes (without plugs) and a constant supply of warm water have proved more satisfactory than basins, and enable the worker to wash in running water. In addition, in view of the share taken by the skin in the absorption probably of aniline and certainly of bichromate, there should be facilities for the men to rinse the hands close to the place of employment.

(6) No person to be allowed to come into contact with bichromate who has any rash or ulcer (the result of chrome) on fingers, hands, or arms. The person weighing out the bichromate crystals, or ladling out the prepared aniline liquor, should be provided with (and wear) indiarubber gloves in good condition.

The high temperature caused by the presence of the ageing machine and drying rollers in the same room as that in which the other processes are carried on emphasises the need for exhaust ventilation, even apart from the

presence of aniline vapour. Exhaust ventilation, as near as possible to the point where the dust is produced, should obviate the necessity for wearing respirators, e.g., at the chroming machine. The acid dust (due to copper sulphate) here produced in some factories gives rise to much discomfort and even injury to health. Ulceration of the margin of the nose, found in a lad engaged in sweeping the floors, was probably due to this.

The need of clauses (3) and (4) above is illustrated by the fact that paper used to wrap up food is well known to turn yellow when kept in the workroom.

Great improvement in the conditions of work has resulted where the process of mixing has been done in a separate room. There would be less evolution of vapour if water were introduced first into the tank, then the hydrochloric acid, and finally the aniline oil. No person should be allowed to remain in the mixing room while the chemical action is going on.

A short notice, posted in the workroom, may serve to call attention to the need for special care on the part of the workmen. A draft of such a notice is appended.

#### *To persons employed in Aniline Black.*

Vapour of aniline oil and contact with bichromate may act injuriously on the health. This can be best avoided by attention to the following points :—

(1) Before meals and on leaving the factory the hands must be washed with soap in the washing basins provided. Constant use of chemie causes the hands to harden and become cracked. Opportunity should be taken during intervals of work to rinse the hands when wetted by the solutions.

(2) The same clothes should not be worn in the factory and at home.

(3) Food must not be taken into the workrooms. It must be eaten in the mealroom provided.

(4) Persons who find that their skins cannot stand bichrome, or who have sores, however slight, must report the fact to the foreman in order that work may be found for them elsewhere if possible. To continue to work in bichrome when sores have broken out is almost certain to lead to incapacity, with its consequences.

(5) The effects of aniline poisoning are made worse by indulgence in alcoholic liquor.

### IX.—BUILDING MATERIALS, Etc.

#### SAND-LIME BRICK INDUSTRY OF THE UNITED STATES.

*Mining World*, Nov. 18, 1905.

The sand-lime brick industry, in the manufacture of which the first plant was erected in the United States in 1901, made slow progress until 1904. In 1903 there were only 16 plants that actually put a product on the market, which was valued at 155,400 dols. In 1904 this number had increased to 57 plants, reporting a product valued at 463,128 dols. That this method of manufacture of building material is a success and will be a permanent factor in the building industry is hardly to be doubted.

### X.—METALLURGY.

#### GOLD PRODUCTION OF THE WORLD.

*Eng. and Mining J.*, Nov. 11, 1905

The total gold production of 1904 is the largest on record, exceeding that of 1903 by 17,697,288 dols., or 5.1 per cent.; that of 1902 by 48,912,651 dols., or 14.1 per cent.; and that of 1901 by 86,448,215 dols., or 24.9 per cent. It was more than two and one-half times the average of the decade which followed the discovery of gold in California and Australia.

\* Section 74 of the Factory and Workshop Act, 1901, authorises H.M. Inspectors to require exhaust ventilation where dust, gas, vapour, or other impurity is generated and inhaled by the workers to an injurious extent.

† Section 75 requires (1) suitable washing conveniences when poisonous substances are used and (2) suitable provision for enabling persons employed in rooms where such substances are used so as to give rise to dust or fumes, to take their meals elsewhere in the factory.

With the exception of the large increase in the Transvaal, the changes were not great, when 1904 is compared with 1903. Australasia retained the first rank as a producer, largely owing to the excellent results from the mines of Western Australia. The United States retained the second rank, while the Transvaal remained third, notwithstanding its gain of 27.5 per cent. Russia was fourth, the production being nearly the same in both years, which is remarkable in view of the disturbance caused in Siberia by the war. Canada was fifth, though its total decreased 13.4 per cent., a decline due to the smaller production of the Yukon, which is now passing through the depression inevitable to all placer mining countries in the time between the first working of the rich deposits, and the advance which will surely come with the more general and systematic exploitation of the country. Mexico and India were, respectively, sixth and seventh in the list of producers; and they are the only other countries showing over 10,000,000 dols. in the yearly totals.

#### Gold Production of the World.

	1903.	1904.
America, North:	Dols.	Dols.
United States .....	73,591,700	80,723,200
Canada .....	18,843,590	16,400,000
Newfoundland .....	141,477	209
Mexico .....	11,511,530	12,605,300
Central America .....	1,875,001	1,120,700
America, South:		
Argentina .....	30,000	9,200
Bolivia .....	19,520	3,000
Brazil .....	2,274,000	2,032,984
Chile .....	665,000	636,900
Colombia .....	2,724,000	2,032,984
Ecuador .....	275,000	132,900
Guiana (British) .....	1,611,000	1,460,580
Guiana (Dutch) .....	438,564	520,212
Guiana (French) .....	2,101,000	1,738,800
Peru .....	716,567	399,654
Uruguay .....	57,800	25,368
Venezuela .....	300,000	300,000
Europe:		
Austria-Hungary .....	2,251,086	2,240,166
Germany .....	1,707,650	1,817,288
Italy .....	31,663	44,000
Norway .....	7,404	7,234
Portugal .....	864	827
Russia .....	24,980,320	25,075,358
Spain .....	5,382	5,312
Sweden .....	33,900	42,235
Turkey .....	20,607	29,000
United Kingdom .....	102,339	102,400
Africa:		
Madagascar .....	1,139,963	1,345,121
Rhodesia .....	4,174,513	4,820,223
Transvaal .....	61,259,281	78,122,701
West Coast .....	1,239,807	1,500,000
Asia:		
Borneo (British) .....	725,000	723,450
China .....	6,500,000	4,500,000
E. Indies (Dutch) .....	501,000	662,500
India .....	11,140,069	11,602,464
Japan .....	2,086,657	4,500,000
Korea .....	3,500,000	1,000,000
Malay Peninsula .....	325,000	392,522
Australasia (Six States and New Zealand) .....	89,220,102	87,100,852
Unspecified .....	1,500,000	1,500,000
Total .....	329,628,356	347,325,644

Not all this increase has been due to discoveries of new gold deposits. A very considerable portion of it is the result of improved methods of treating ores. The cyanide process alone has furnished an appreciable part of the gain, and other methods of working and treatment of ores have done their share. No small portion of the output of 1904 came from gold mines which had been abandoned at an earlier date as not payable, but the operation of which has been renewed under improved methods. This is the case not only in the United States, where the advance in metallurgy has been very great, but also in other countries, as in Western Australia, where successful treatment of the ores in some of the largest mines now in operation presented problems which were at first regarded as difficult of solution.

#### Gold Production of the World, 1850-1904.\*

	Dols.
1851-55, yearly average .....	132,701,302
1856-60 .....	134,070,945
1861-65 .....	122,977,770
1866-70 .....	129,602,578
1871-75 .....	115,566,164
1876-80 .....	114,576,000
1881-85 .....	101,614,811
1886-90 .....	112,409,599
1891-95 .....	162,724,688
1896-1900 .....	261,906,948
1901 .....	260,877,420
1902 .....	298,412,993
1903 .....	329,628,356
1904 .....	347,325,644

\* From 1850 to 1882 the figures are Soetbeer's; from 1882 to 1900, they are those of the United States Mint; from 1900 to 1904, they are those published by "The Mineral Industry."

#### MINERAL PRODUCTION OF PERU.

*Eng. and Mining J.*, Nov. 11, 1905.

The Boletín del Cuerpo de Ingenieros de Minas del Peru, No. 24, states that the mineral and metallic production of Peru in 1904, compared with 1903, was as follows:

	1903.	1904.
Coal, metric tons .....	—	42,920
Bituminous shale, metric tons .....	—	16,000
Coke, metric tons .....	—	1,000
Crude petroleum, metric tons .....	37,079	38,683
Kerosene, cu. meters .....	—	2,744
Gasoline, cu. meters .....	—	110
Benzine, cu. meters .....	—	50
Residium, metric tons .....	—	4,000
Lead, metric tons .....	1,302	2,209
Copper, metric tons .....	9,497	9,504
Silver, kilos. ....	170,804	145,166
Gold, kilos. ....	1,078	601
Borax, metric tons .....	2,466	2,675
Salt, metric tons .....	17,637	18,545
Sulphur, metric tons .....	—	21

The output in 1904 had a total value of 6,662,910 dols. United States currency.

#### IRON-ORE DISTRICT OF FRANCE; MINETTE —.

*Eng. and Mining J.*, Nov. 18, 1905.

The iron ores of the Minette district are coming into prominence simultaneously with the entrance of France upon the world's iron market. These Minette ores are of oolitic nature, closely resembling the Clinton iron ores of the Eastern and Southern States of America, and are developed along the borders of Luxemburg and Lorraine. Two distinct basins are recognisable in French territory, that of Nancy and that of Briey and Longwy, the outputs of which during the last two years, have been, in metric tons:—

	1903.	1904.	Increase.
Nancy .....	1,668,533	1,711,770	43,237
Briey and Longwy .....	3,233,131	3,821,437	588,306
Quarries .....	390,679	418,067	27,388
Total Meurthe-and-Moselle .....	5,292,343	5,951,274	658,931

The Nancy district is not expected to show any important increase in the future, but Longwy, with its outcrop mines, and Briey with its deep mines, are looked to for further rapid growth in output.

Shipments of this ore to other departments of France, to Belgium, Luxemburg and Germany, totaled 1,043,000 tons in 1904; its average value at point of production was 2s. 10d. per ton. Employees in the iron mines numbered 6,075 in 1904; in the Longwy-Briey basin



their wages averaged about 5s. per day. Cutting machinery is popular, electrically driven Morgan Gardner chain machines being used in the mines at two localities.

### XIX.—PAPER, PASTEBOARD, Etc.

#### PAPER INDUSTRY OF GERMANY.

For. Off. Miscell. Series, No. 642.

Whilst the home demand for nearly all descriptions of paper continues to increase in Germany, as well as in all other countries, the export trade of paper and pasteboard, and also of articles made of these materials, from the German Empire is of very considerable importance, as will be seen from the following figures:—

The following shows the various descriptions of paper and pasteboard exported to the United Kingdom in 1904, as compared with the figures for 1901:—

	Value.	
	1901.	1904.
	£	£
Coloured and gold and silver paper ...	351,200	209,200
Printing paper (also coloured) .....	71,800	131,000
Packing paper, glazed .....	163,950	172,750
Packing paper, not glazed .....	56,100	67,700
Photographic paper .....	56,250	220,900
Paper not specially mentioned, also parchment paper .....	104,450	85,300
Wall paper .....	38,650	61,550
Articles made of paper and pasteboard	206,750	320,350

#### A.—Imports.

	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
	Tons.*	£	Tons.*	£
(1) HALF-FINISHED MATERIALS FOR PAPER MAKING.				
Half-stuff of rags .....	460	9,200	296	6,350
Wood-stuff (ground) .....	13,837	62,250	23,425	105,400
Cellulose, straw and other fibre stuff .....	27,529	245,900	47,317	435,850
(2) PAPER AND PASTEBOARD.				
Roofing, asphalt, tar pasteboard .....	1,070	6,950	1,161	7,500
Blotting paper, grey and straw paper .....	68	500	27	200
Pasteboard not otherwise mentioned .....	8,392	60,810	12,712	92,100
Polishing, smoothing, emery, sand and fly paper .....	301	12,050	282	11,300
Packing paper, coarse .....	330	3,500	690	7,250
Glazed and leather pasteboard .....	301	15,100	330	21,450
Packing paper, glazed .....	2,550	44,600	2,844	49,750
Photographic paper .....	135	55,900	291	102,100
Coloured, gold and silver paper .....	279	37,700	296	40,000
Blotting paper (except grey), filtering and tissue paper .....	1,705	102,350	1,862	111,750
Writing paper, and paper prepared for labels, accounts, &c. ....	761	36,500	692	28,450
Printing paper (also coloured) .....	352	5,600	275	4,400
Drawing paper .....	153	11,500	213	15,950
Paper not otherwise mentioned .....	508	10,400	421	11,750
(3) ARTICLES MADE OF PAPER AND PASTEBOARD.				
Articles made of stoneboard, &c. ....	81	2,500	72	2,250
Covers made of kamptulicon, linoleum, korticum, &c. ....	70	2,100	61	1,850
Toys made of paper and pasteboard .....	4	300	4	300
Articles made of paper not otherwise mentioned .....	1,234	111,100	1,297	116,750
Wall paper .....	317	26,590	338	24,800
All other articles made of paper and pasteboard, also combined with other materials .....	451	39,950	454	40,250
Total .....	60,897	903,350	95,270	1,237,750

#### B.—Exports.

	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
	Tons.*	£	Tons.*	£
(1) HALF-FINISHED MATERIALS FOR PAPER MAKING.				
Half-stuff of rags .....	651	15,300	736	15,450
Wood-stuff (ground) .....	6,702	33,500	6,639	36,500
Cellulose, straw and other fibre stuff .....	66,486	664,850	63,706	668,900
(2) PAPER AND PASTEBOARD.				
Roofing, asphalt, tar pasteboard .....	11,150	61,300	11,160	66,950
Blotting paper (grey) and straw paper .....	1,135	6,800	1,039	7,300
Pasteboard not otherwise mentioned .....	14,035	105,200	12,130	91,000
Polishing, smoothing, emery, sand and fly paper .....	2,239	86,600	2,282	91,300
Packing paper, coarse .....	20,441	214,650	20,350	223,700
Glazed and leather pasteboard .....	1,211	12,100	1,064	10,650
Packing paper, glazed .....	23,804	416,600	24,252	388,500
Photographic paper .....	1,218	660,500	1,644	747,150
Coloured, gold and silver paper .....	7,865	786,560	8,728	698,800
Blotting paper (except grey), filtering and tissue paper .....	3,527	141,100	3,679	147,150
Writing paper, and paper prepared for labels, accounts, &c. ....	8,366	271,900	10,000	325,000
Printing paper (also coloured) .....	30,141	339,100	32,233	362,600
Drawing paper .....	921	41,450	920	41,400
Paper not otherwise mentioned .....	10,828	311,750	11,199	282,150
(3) ARTICLES MADE OF PAPER AND PASTEBOARD.				
Articles of stoneboard, asphalt and pasteboard .....	89	1,950	889	8,150
Covers of kamptulicon, linoleum, &c. ....	5,302	183,350	6,679	227,100
Paper cartridge cases .....	217	17,350	169	11,900
Articles made of paper and pasteboard not otherwise mentioned .	18,832	1,328,240	21,138	1,486,200
Wall paper .....	9,779	387,200	10,401	412,050
All other kinds of articles .....	100	7,800	100	8,250
Total .....	245,129	6,095,150	250,637	6,358,150

\* 1,000 kilos.

## Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

### I.—PLANT, APPARATUS, AND MACHINERY.

(Continued from page 1196.)

- [A.] 23,658. Braun. Process of manufacturing a dry medium for use in damp- and light-proof packings.\* Nov. 17.
- „ 23,991. Christenson. Liners for centrifugal separators. [Appl. in Sweden, Nov. 26, 1904.]\* Nov. 21.
- „ 24,042. Hewitt and Goreham. *See under IX.*
- „ 24,144. Mewes. *See under VII.*
- „ 24,175. Hulme and Crosfield. Centrifugal machines. Nov. 23.
- „ 24,186. Ray. Evaporating apparatus.\* Nov. 23.
- „ 24,252. Brunner. Furnaces. Nov. 24.
- „ 24,412. McPhail. *See under XVIII B.*
- [C.S.] 25,477 (1904). Gillie. *See under II.*
- „ 26,578 (1904). Barham. Apparatus for cooling or heating liquids. Nov. 29.
- „ 28,456 (1904). Macgregor and Pearson. Presses for expressing liquids. Nov. 22.
- „ 28,539 (1904). Decauville. Combined autoclave and hydraulic press. Nov. 29.
- „ 29,364 (1904). Scherding. Furnaces. Nov. 22.
- „ 5748 (1905). Koepff. *See under XIV.*
- „ 7495 (1905). Dawkins (Massey-Harris Co., Ltd.). Centrifugal liquid separator. Nov. 22.
- „ 11,327 (1905). Stern. Capsules containing compressed or liquefied gas. Nov. 22.
- „ 12,300 (1905). Forster. Crucible furnaces. Nov. 22.
- „ 19,894 (1905). Schuler. Centrifugal separators. Nov. 29.

### II.—FUEL, GAS, AND LIGHT.

(Continued from page 1197.)

- [A.] 22,512B. Newton. Scrubbers for use with gas producing plant. Nov. 22.
- „ 23,255. Hutchins. Producer gas generators. Nov. 13.
- „ 23,464. Timmis and Jones. Retorts for making gas, &c. Nov. 15.

- [A.] 23,650. Young and Glover. Process of carbonising coal for the production of heating and illuminating gases. Nov. 17.
- „ 23,739. Lackner. Gas generators. Nov. 17.
- „ 23,902. Bock. Manufacture of weatherproof briquettes by means of binding materials soluble in water. Nov. 20.
- „ 23,966. Walker. Apparatus for the manufacture of air gas. Nov. 21.
- „ 24,032. Export-Gas-*l*ühlicht-Ges. Process for forming and hardening incandescent gaslight bodies. [Ger. Appl., Dec. 30, 1904.]\* Nov. 21.
- „ 24,128. Van der Heyden. Enrichment of coal gas by means of a liquid hydrocarbon. Nov. 22.
- „ 24,136. Export-Gas-*l*ühlicht-Ges. Method of making incandescent bodies. [Ger. Appl., May 15, 1905.]\* Nov. 22.
- „ 24,398. Hills. Enriching gas for illuminating, heating or power purposes. Nov. 25.
- „ 24,418. Jaubert. Purification of acetylene gas. [Fr. Appl., Nov. 28, 1904.]\* Nov. 25.
- „ 24,433. Marconnet. Gas generators. [Fr. Appl., Nov. 28, 1904.]\* Nov. 25.
- [C.S.] 22,002 (1904). Hennebutte. Manufacture of coke. Nov. 22.
- „ 25,477 (1904). Gillie. Pressure raising apparatus for air, gas, or the like fluids, for gasifying hydrocarbons or for other purposes. Nov. 29.
- „ 25,527 (1904). Koppers. Coke ovens. Nov. 29.
- „ 29,610 (1904). Hatton. Regenerative gas furnaces. Nov. 29.
- „ 2770 (1905). Howorth (Reeser, Schmidinger and Philippe). Apparatus for carburetting air. Nov. 22.
- „ 8530 (1905). Bécigneul. Treatment of gas purifying materials for the recovery of useful products. Nov. 22.
- „ 14,405 (1905). Gasmotorenfabr. Deutz. Production of motor fluid from bituminous coal. Nov. 22.

### III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(Continued from page 1197.)

- [A.] 24,318. Oppenheimer and Kent. Lubricating oil and process for obtaining same. Nov. 24.
- „ 24,319. Oppenheimer and Kent. Lubricating oil and process for obtaining same. Nov. 24.
- [C.S.] 4766 (1905). Lessing and Wilton. Manufacture and recovery of pyridine and similar organic bases. Nov. 22.

### IV.—COLOURING MATTERS AND DYESTUFFS.

(Continued from page 1197.)

- [A.] 23,316. Johnson (Kalle und Co.). Manufacture of red sulphur containing colouring matters. Nov. 13.



[A.] 23,733. Vidal. Production of sulphuretted black colouring matters. Nov. 17.

„ 23,740. Vidal. Production of colouring matters. Nov. 17.

[C.S.] 9138 (1905). Newton (Bayer und Co.). Manufacture of anthracene dyestuffs. Nov. 22.

„ 10,677 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series and employment thereof for dyeing and printing. Nov. 29.

## V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

(Continued from page 1197.)

[A.] 23,317. Johnson (Kalle und Co.). Printing and dyeing red on textile fibres. Nov. 13.

„ 23,345. Iekringill. Sterilisation of wool, cotton, rag, hair, fibres, or other similar material. Nov. 14.

„ 23,509. Nicholas. Apparatus for cleaning, dyeing, or otherwise treating wool textile fabrics and like materials. Nov. 15.

„ 23,537. Macpherson and Heys. Process and means for removing insoluble soaps produced in or upon fabrics washed in hard or sea water. Nov. 16.

„ 23,666. Wiener. Process of waterproofing and ornamenting textile fabrics. Nov. 17.

„ 23,787. Brandt. Method of impregnating absorbent materials, textiles, paper, &c., with resins, fatty acids and the like. [Ger. Appl., Nov. 19, 1904.]\* Nov. 18.

„ 24,126. Crepelle-Fontaine. Apparatus for bleaching and creaming fabrics. [Fr. Appl., Nov. 26, 1904.]\* Nov. 22.

\*[C.S.] 25,166 (1904). Calico Printers' Association, Ltd., and Warr. Treating vegetable fibres, chiefly cotton, to render them less inflammable. Nov. 22.

„ 25,167 (1904). Calico Printers' Association, Ltd., and Warr. Treating vegetable fibres, chiefly cotton, to render them less inflammable. Nov. 22.

„ 4371 (1905). Bastin. Apparatus for washing wool, &c. Nov. 29.

„ 6332 (1905). Wilding Bros., Ltd., and Nelson. Means for producing a wavy or watered pattern on woven fabrics. Nov. 29.

„ 7692 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of discharging agents. Nov. 22.

„ 10,677 (1905). Johnson (Badische Anilin und Soda Fabrik). See under IV.

„ 17,960 (1905). Kelling. Machine for washing or dyeing carpets. Nov. 29.

## VI.—COLOURING WOOD, PAPER, LEATHER, ETC.

(Continued from page 1137.)

[C.S.] 24,456 (1904). Chapal Frères et Cie. Machines for dyeing furs and carotting skins. Nov. 22.

„ 17,338 (1905). Lamb and Rennie. Printing on leather. Nov. 22.

## VII.—ACIDS, ALKALIS, AND SALTS.

(Continued from page 1197.)

[A.] 23,717. Stoneham and Pearson. Manufacture of cyanides and ammonia. Nov. 17.

„ 23,807. Stoneham and Pearson. Manufacture of cyanides and ammonia. Nov. 18.

„ 23,836. Van Eyndhoven. Treatment of the waste gases from the manufacture of ammonium sulphate or chloride. Nov. 18.

„ 23,841. Gaillard. Process of concentrating sulphuric acid.\* Nov. 18.

„ 24,000. Stoneham and Pearson. Manufacture of cyanides and ammonia. Nov. 21.

„ 24,001. Stoneham and Pearson. Manufacture of cyanides and ammonia. Nov. 21.

„ 24,144. Mewes. Process for liquefying air and winning oxygen. [Ger. Appl., Nov. 27, 1904.]\* Nov. 22.

„ 24,226. Bacon. Manufacture of crystallised sodium monosilicate. Nov. 23.

„ 24,267. Brentnall. Manufacture of aluminium hydrate and of aluminium salts from disused bricks, &c., made from clay and from burnt clays. Nov. 24.

„ 24,330. Jaubert. Preparation of oxygen by the decomposition of oxygenated salts. [Fr. Appl., Dec. 7, 1904.]\* Nov. 24.

„ 24,422. Knudsen. Treatment of liquid air. Nov. 25.

[C.S.] 25,010 (1904). Thompson (Westdeutsche Thomas-phosphat Werke). See under XI.

## VIII.—GLASS, POTTERY, AND ENAMELS.

(Continued from page 1198.)

[A.] 23,714. Pitt. Manufacture of coloured glass. Nov. 17.

## IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(Continued from page 1198.)

[A.] 23,816. Peters. Manufacture of Portland cement and apparatus therefor. Nov. 18.

„ 24,042. Hewitt and Goreham. Machines for testing cement and like substances. Nov. 21.

„ 24,219. Gardeur. Manufacture of artificial sandstone. Nov. 23.

„ 24,224. Klinge and Schourup. Manufacture of artificial stones and similar building materials.\* Nov. 23.

„ 24,267. Brentnall. See under VII.

[C.S.] 21,233 (1904). Reavell. Manufacture of artificial stone. Nov. 22.

„ 9496 (1905). Bohne and Herrmann. Process of preparing wood for polishing purposes. Nov. 29.

„ 16,166 (1905). Hlassam and Percy. Pavement and process of laying the same. Nov. 29.

## X.—METALLURGY.

(Continued from page 1198.)

- [A.] 23,319. Beaumont. Apparatus for recovering gold from disintegrated ores. Nov. 13.
- „ 23,408. Asbeck. Process for obtaining lead and silver from their ores. Nov. 14.
- „ 23,450. Swinburne. Treatment of poor ores. Nov. 15.
- „ 23,592. Henning. Process for manufacturing foundry pig iron. [Ger. Appl., Nov. 17, 1904.]\* Nov. 16.
- „ 23,648. Cowper-Coles. Process for the alloying and amalgamation of metals. Nov. 17.
- „ 23,783. Davies. Flux for the treatment of cast iron and other metals. Nov. 18.
- „ 23,860. Hannay. Treatment of galena for the production of white lead and the extraction of silver. Nov. 20.
- „ 23,879. Sulman, Picard and Ballot. Ore concentration. Nov. 20.
- „ 23,977. MacIvor and Fradd. Treatment of sulphide ores containing zinc. Nov. 21.
- „ 24,003. Lake (Parker). Producing metallic iridium.\* Nov. 21.
- „ 24,068. Charles. Zinc smelting. Nov. 22.
- „ 24,124. Simson. Process for treating and annealing metals. Nov. 22.
- „ 24,129. Van der Heyden. Reduction of metalliferous ores. Nov. 22.
- „ 24,238. Ogle. Method of treating complex ores (sulphides) containing copper, zinc and lead. Nov. 23.
- [C.S.] 17,407 (1904). Wolf. Separation of metals from their ores. Nov. 22.
- „ 17,660 (1904). Davies and Clark. Method of uniting or coating iron and steel with other metals and fluxes therefor. Nov. 22.
- „ 21,790 (1904). Goode, Mitchell, and Briquette (Minerals Binding) Co., Ltd. Composition for briquetting. Nov. 22.
- „ 3225 (1905). Hodgkinson. Removal of copper and nickel from iron or steel surfaces. Nov. 22.
- „ 8386 (1905). Baggaley, Allen, and Lindquist. Method of smelting ores and separating mattes and of recovering mineral values from slag. Nov. 22.
- „ 15,055 (1905). Ganz und Co., Eisengiesserei und Maschinenfabr., A.-G. *See under XI.*

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(Continued from page 1198.)

- [A.] 23,312. Cowper-Colles. Electro-deposition of copper and other metals. Nov. 13.
- „ 23,402. Girod. Electric furnaces. [Fr. Appl., Dec. 24, 1904.]\* Nov. 14.

- [A.] 23,474. Roberts and Jaffray. Electro-deposition of metals, alloys and the like. Nov. 15.
- „ 23,526. Platschick. Electrical furnaces. Nov. 15.
- [C.S.] 25,010 (1904). Thompson (Westdeutsche Thomasphosphat Werke). Process of producing nitric acid by aid of electricity. Nov. 22.
- „ 15,055 (1905). Ganz und Co., Eisengiesserei und Maschinenfabr., A.-G. Extracting metals from ores and other metalliferous material by electrolytic means and apparatus therefor. Nov. 29.
- „ 20,898 (1905). Rüber. Electrolytic apparatus. Nov. 29.

## XII.—FATTY OILS, FATS, WAXES, AND SOAP.

(Continued from page 1198.)

- [A.] 4092A. Krebitz. Process for converting an insoluble soap into soluble soda or potash soap. Nov. 17.
- „ 23,546. Macpherson and Heys. Detergent for use with hard and salt waters. Nov. 16.
- „ 23,670. Kremer, and Ges. f. Abwässerklärung. Apparatus for the recovery of fats and the like.\* Nov. 17.
- „ 24,030. Kremer, and Ges. f. Abwässerklärung. Apparatus for the recovery of fats and the like.\* Nov. 21.
- „ 24,131. Van der Heyden. Soap. Nov. 22.
- „ 24,318. Oppenheimer and Kent. *See under III.*
- „ 24,319. Oppenheimer and Kent. *See under III.*
- [C.S.] 3763 (1905). Grice. Soap tablets. Nov. 22.
- „ 6161 (1905). Rivoir. Apparatus for the manufacture of soap. Nov. 20.

## XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(Continued from page 1199.)

## (A.)—PIGMENTS, PAINTS.

- [A.] 23,633. Griffiths. Pigments. Nov. 16.
- „ 23,860. Hannay. *See under X.*
- „ 24,343-5. Gay and Co., Ltd., and Tervet. *See under XVIII B.*
- [C.S.] 25,092 (1904). Flack (Williams). Writing ink. Nov. 22.

## (B.)—RESINS; VARNISHES.

- [A.] 23,744. H. C. Meyer, jun., Kommandit-Ges. auf Aktien. Process for removing resin from the surface of rattan. [Ger. Appl., Dec. 5, 1904.]\* Nov. 17.

## (C.)—INDIA-RUBBER.

- [A.] 23,290. Bonnefin. Process for extracting india-rubber from any plant or part of a plant. Nov. 13.



## XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

*(Continued from page 1199.)*

- [A.] 23,299. Flöring and Lenneberg. Process for rendering chrome leather waterproof and durable. Nov. 13.
- „ 23,370. Feilmann. Manufacture of colloidal preparations. Nov. 14.
- „ 23,397. Betz. Process for producing a hornlike substance from casein. Nov. 14.
- [C.S.] 24,456 (1904). Chapal Frères et Cie. *See under VI.*
- „ 5748 (1905). Koepff. Apparatus for drying gelatin, glue, paste goods, brewers' grains, &c. Nov. 22.

## XV.—MANURES, ETC.

*(Continued from page 1199.)*

- [C.S.] 18,990A (1905). Gooding. *See under XVIII.A.*

## XVI.—SUGAR, STARCH, GUM, ETC.

*(Continued from page 1199.)*

- [C.S.] 10,273 (1905). Roy. Treatment of massecuite and apparatus therefor. Nov. 22.

## XVII.—BREWING, WINES, SPIRITS, ETC.

*(Continued from page 1199.)*

- [A.] 23,727. Haslam. Apparatus for the treatment of beer. Nov. 17.
- [C.S.] 16,478 (1905). Scholvien. Non-alcoholic beverages resembling beer. Nov. 22.

## XVIII.—FOODS; SANITATION, WATER PURIFICATION; &amp; DISINFECTANTS.

*(Continued from page 1199.)*

## (A.)—FOODS.

- [A.] 23,391. Lake (Nordyke and Marmon Co.). Treatment of cereals and apparatus therefor. Nov. 14.
- „ 23,452. Hogarth. Treatment of wheat or flour and other cereals. Nov. 15.
- „ 23,460. Hogarth. Treatment of wheat or flour and other cereals. Nov. 15.
- „ 23,710. Parker. Manufacture of extract of germ of wheat for use in making cereal foods. Nov. 17.
- „ 23,982. Salomons. Preservation of alimentary substances.\* Nov. 21.
- „ 24,245. Rozer. Apparatus for automatic acetification.\* Nov. 24.
- „ 24,414. Meinel. Manufacture of malt-containing chocolate. Nov. 25.
- [C.S.] 27,718 (1904). Haccius. Manufacture of dry milk powder. Nov. 29.

- [C.S.] 29,367 (1904). Mills (Bévenot and De Neveu). Desiccation of milk, cream, casein, and their derivatives. Nov. 29.

- „ 28 (1905). Hatmaker. Eggs and egg-containing substances in dry form and process for obtaining same. Nov. 22.
- „ 18,990A (1905). Gooding. Treatment of kiln dirt and the like, and production of a cattle food and a manurial product therefrom. Nov. 29.

## (B.)—SANITATION; WATER PURIFICATION.

- [A.] 24,322. Bordigoni. Destruction or bacterial treatment of sewage and purification of effluent or residual liquids.\* Nov. 24.
- „ 24,343. Gay and Co., Ltd., and Tervet. Means for conveying away dust of white lead or other injurious material as it is being shovelled out from casks. Nov. 24.
- „ 24,344. Gay and Co., Ltd., and Tervet. Helmets applicable especially for the prevention of lead poisoning. Nov. 24.
- „ 24,345. Gay and Co., Ltd., and Tervet. Means for preventing escape of white lead or other injurious dust into the outer air during its preparation or grinding. Nov. 24.
- „ 24,402. Schmidt. Clearing vat for sewage.\* Nov. 25.
- „ 24,412. McPhail. Purification of liquids and separation of bodies contained therein. Nov. 25.
- „ 24,435. Krüger. Water purifying apparatus.\* Nov. 25.
- [C.S.] 645 (1905). Klecan and Laska. Removing and preventing formation of scale in boilers. Nov. 22.

## XIX.—PAPER, PASTEBOARD, ETC.

*(Continued from page 1199.)*

- [A.] 23,399. Macnaughton. Impts. in paper making apparatus to separate sand, metal, &c., from the pulp.\* Nov. 14.
- „ 23,748. Beresford. Manufacture of half-stuff from peat moss as a basis for millboard and paper making. Nov. 17.
- „ 23,787. Brandt. *See under V.*
- [C.S.] 13,184 (1904). Trotman. Watermarking of paper. Nov. 22.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

*(Continued from page 1199.)*

- [A.] 23,718. Newton (Bayer und Co.). Manufacture of dialkylbarbituric acids. Nov. 17.
- „ 24,194. Siepermann. Preparation of sulphocarbamidophenylate of diethylamine or amines of a similar nature. Nov. 23.
- [C.S.] 2348 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of derivatives of aldehydes. Nov. 22.
- „ 6948 (1905). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of salicylic acid glycerine formal ester. Nov. 29.
- „ 11,926 (1905). Lieber. Radium surfaces. Nov. 29.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*(Continued from page 1200.)*

- \*[C.S.] 9324 (1905). Abel (Act.-Ges. f. Anilinfabr.). Sensitising layers of gelatin, glue or the like for the pigment and like photographic processes. Nov. 29.

## XXII.—EXPLOSIVES, MATCHES, Etc.

*(Continued from page 1200.)*

- [A.] 23,238. Bennett and Mastin. Explosives for guns. Nov. 13.  
„ 23,895. Silberrad. Explosives.\* Nov. 20.  
[C.S.] 19,112 (1905). Smith. Explosives and process of manufacturing the same. Nov. 29.



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 R. Seligman, Ph.D., and F. J. Willott. "The Determination of Zinc in Zinc-Aluminium Alloys."  
 R. Seligman, Ph.D. "Distilled Water Supply for 'Works' Laboratories."  
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### SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY, ROME, 1906.

The Sixth International Congress of Applied Chemistry will be held in Rome in April, 1906, during Easter week. All communications should be addressed to the General Secretary, Prof. Vittorio Villavecchia, Via Panisperna, 89, Rome.

Members are reminded that the subscription of 25s. for 1906, payable on January 1st, should be sent in good time to the Hon. Treasurer (Mr. Samuel Hall) in order to ensure continuity in the receipt of the Society's Journal. Any changes of address for the new List of Members now in course of preparation should reach the General Secretary not later than January 31st, 1906.

### DECENNIAL INDEX, 1896-1905.

A Collective Index to the first fourteen volumes of the Journal (1882-1895), a volume of 550 pages, was published in 1899; a few copies of this are still left, price 10s. A second volume, embracing the period 1896-1905, is now in preparation, and will be ready for printing in 1906. It will contain both a subject matter and authors' names portion, and will be a volume of about 900 pages, uniform in size with the Journal. As the number of copies to be printed will depend on the number of applications from members, the Treasurer is prepared to receive subscriptions at the rate of 10s. each copy. A form of application for this purpose will shortly be issued.

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## London Section.

*Meeting held at Burlington House on Monday, December 4th, 1905.*

MR. A. GORDON SALAMON IN THE CHAIR.

### NOTES ON GUTTA PERCHA AND BALATA.

BY DR. W. A. CASPARI.

The following observations were made with the object, firstly, of extending the knowledge of the hydrocarbons of gutta percha and balata generally, and, secondly, of bringing the chemistry of them into line, in certain respects, with that of india-rubber.

Ten marketable varieties of raw gutta percha, outwardly different, were available. Of balata, which is less adulterated and is understood to vary little in quality for a given year, a specimen imported in 1902 was taken. These were mechanically freed from adventitious mineral and vegetable matter and rolled into porous sheets containing several per cent. of water, in which condition they very readily parted with their resinous components on extraction with ether or petroleum ether. The proportion of hydrocarbon to resin varied in the gutta perchas from 61.4 : 38.6 to 39.6 : 60.4, whilst in the balata it was 46.5 : 53.5. The india-rubber employed in comparative experiments was a specimen of Island Para, which was quite free from dirt and yielded 2 per cent. of empyreumatic and resinous matter to acetone.

#### THE HYDROCARBONS.

These will be referred to later as gutta, balata and caoutchouc respectively, under the generic term of polyprene. The first step towards preparing gutta and balata in the pure state was to eliminate the small amount of dirt still present. The extracted materials were dissolved in benzene and the insoluble matter allowed to settle. The solutions are too viscid to be easily filtered, but they become perfectly clear on standing for 24 hours, especially after being shaken up with a few drops of water. The hydrocarbon may then be precipitated by alcohol or acetone. The colour of the clear solutions varied from sherry-brown to pale yellow; it appears to increase with the small amount of ash (0.3–0.6 per cent.) present, and

is not removed by numerous re-solutions and reprecipitations; in quite dilute solution (1 : 100), however, the colouring matter is deposited as a fine powder on standing for some months. Balata was almost water-white in solution. On precipitation by alcohol, the bulk of the hydrocarbon comes down as a stringy mass of the texture of loofah, whilst the mother-liquor is milky and deposits the remainder in a finely-divided state on standing. The essential difference between these two forms claimed by Oesterle (this J., 1893, 609 and 848) was not confirmed. It appears to be merely a question of dilution whether stringy or fine gutta will be precipitated, and by starting with sufficiently dilute solutions a yield of the latter, without any clot, can always be obtained. The limit was found to be about 0.8 gr. in 100 c.c., and from solutions stronger than this the formation of a clot is inevitable. Caoutchouc, as is well known, contains a skeleton of matter which swells up, but remains insoluble in benzene and other solvents; from the clear solution an elastic coagulum is precipitated, which runs together to a comparatively dense mass.

Precipitated gutta readily absorbs oxygen, and is best dried and preserved in hydrogen. This precaution being taken, analysis by combustion shewed that precipitated guttas were never free from oxygen; a specimen which was five times reprecipitated and then dried in hydrogen still contained 1 per cent. The oxidised constituent is not removed by extraction with petroleum ether and is not, therefore, a resin. It seems probable that the first oxidation products of gutta are colloids not far removed in their general properties from the parent hydrocarbon.

The final purification is effected by a process resembling recrystallisation, for which ether, benzene, or ligroin may be employed. The pure hydrocarbon is thus obtained in white flakes or granules. Analyses of various guttas and balata, thrice deposited from benzene, confirmed the formula  $(C_8H_8)_n$ . The hydrocarbons derived from the ten gutta perchas and from balata were identical in general properties. The only difference observed was that solutions of equal strength showed slight differences in viscosity, that of balata having about twice the viscosity of average gutta solution; they are vastly more mobile, however, than corresponding caoutchouc solutions. Gutta is of leathery consistency and almost destitute of elasticity; in this respect it differs sharply from caoutchouc, which is highly elastic. At temperatures well below 100° it becomes soft, and can be kneaded into any desired form, whilst caoutchouc becomes sticky and moderately plastic, but still retains some resiliency. At higher temperatures the two hydrocarbons tend to approximate in behaviour. Gutta is soluble in ether, chloroform, carbon tetrachloride, carbon bisulphide, and hydrocarbons. Boiling sodium-proof ether takes up a small percentage of gutta and deposits the bulk in small flakes on cooling. The presence of water or alcohol in small amounts renders ether almost a non-solvent. In  $CHCl_3$ ,  $CCl_4$  and  $CS_2$  gutta swells somewhat to a transparent mass and then yields, on shaking, a homogeneous solution in the cold. In benzene and its homologues gutta behaves differently; a quantity of solvent is taken up with swelling, but the resulting mass is not dispersed throughout the liquid on shaking unless the temperature be raised to 40° or higher. Benzene solutions of gutta are supersaturated below 20°; on local freezing, and often spontaneously, most of the gutta separates out in hyaline, gelatinous flakes which, when pressed dry, still contain half their weight of solvent. Apparently there is a temperature limit below which an insoluble gutta-benzene complex is favoured and above which clear homogeneous solutions are stable. The solubility of gutta in paraffins increases with their molecular weight; cold petroleum ether of 30°–40° B.P. is a non-solvent and is useful for the assay of resin by extraction. In the higher fractions gutta dissolves easily on boiling, but it does not absorb them in the cold. Ligroin of B.P. 60°–80°, especially, is a very suitable "recrystallising" medium, from which the gutta deposits in opaque granules on cooling. The above are also solvents for caoutchouc; this hydrocarbon swells up to an enormous volume, and the resulting jelly-fish-like mass goes into solution on shaking, at any temperature. There is hardly a liquid, solvent or non



solvent, which caoutchouc does not absorb with swelling. It does not grain out of solutions.

The specific gravity of the several guttas and balata was determined by precipitating in the finely divided state and floating in a suitably adjusted mixture of alcohol and water; it ranged between 0.9604 and 0.9619. Caoutchouc, which cannot be precipitated in fine flakes, does not lend itself to this procedure.

*Action of heat.*—Gutta never attains a truly fluid condition. It becomes dough-like on warming, but the mass does not melt to a continuous bubble-free mass before decomposition sets in. When finely divided gutta is heated in ordinary melting-point tubes, the softening-point at  $59^{\circ}$ – $60^{\circ}$  is marked by the hitherto opaque particles becoming translucent. At  $185^{\circ}$ – $190^{\circ}$  vapour is evolved, and the decomposing substance runs together to a fused mass.

#### ADDITION PRODUCTS.

*Chlorine.*—Solutions of polypréne absorb chlorine with avidity. The nature of the solvent is not a matter of indifference, since, if it forms hydrochloric acid in reaction with chlorine, partial addition of HCl to the polypréne may take place. Thus, in benzene, products were obtained which contained fluctuating, and usually comparatively low, percentages of Cl. On passing pure dry chlorine into solutions of gutta, balata, and caoutchouc in dried carbon tetrachloride to saturation, most of the product separated out as a gummy mass, being easily soluble in hot carbon tetrachloride, but only sparingly in cold. There was a marked disengagement of hydrochloric acid. The liquids were poured into alcohol and the resulting clot redissolved and reprecipitated. By dropping dilute benzene or chloroform solutions into alcohol, the chlorinated bodies were obtained in small white flakes, which were dried *in vacuo*. They are toughish and of the consistency of bread crumbs. Below  $100^{\circ}$  they become plastic, and at  $150^{\circ}$  they darken with evolution of hydrochloric acid. They dissolve easily in the ordinary polypréne solvents.

Gutta:—0.1939 gr. gave 0.2801  $\text{CO}_2$  and 0.698  $\text{H}_2\text{O}$ .

0.1788 gr. gave 0.4116 AgCl.

C = 39.45; H = 4.00; Cl = 56.98 per cent.

Balata:—0.1865 gr. gave 0.2466  $\text{CO}_2$  and 0.6624  $\text{H}_2\text{O}$ .

0.1815 gr. gave 0.4418 AgCl.

C = 36.08; H = 3.72; Cl = 60.17 per cent.

Caoutchouc:—0.1767 gr. gave 0.2580  $\text{CO}_2$  and 0.6645  $\text{H}_2\text{O}$ .

0.1276 gr. gave 0.2876 AgCl.

C = 39.84; H = 4.06; Cl = 55.79 per cent.

Required for  $\text{C}_{20}\text{H}_{36}\text{Cl}_{14}$ :—C = 40.38; H = 4.03; Cl = 55.58 per cent.

From these figures, it is evident that more substitution than addition has taken place; the formula  $\text{C}_{30}\text{H}_{36}\text{Cl}_{14}$  would indicate that 12 atoms of chlorine have been substituted, and two added, in the molecule  $\text{C}_{30}\text{H}_{48}$ .

*Bromine.*—Here again, the use of benzene as solvent leads to low bromine-contents (60–62 per cent.). On conducting the reaction in dried chloroform, white amorphous bodies, very much resembling the above chlorination-products, were obtained, not without a slight disengagement of HBr. They darken with evolution of hydrobromic acid at  $130^{\circ}$ .

Gutta:—0.1988 gr. gave 0.2102  $\text{CO}_2$  and 0.0658  $\text{H}_2\text{O}$ .

0.2044 gr. gave 0.3242 AgBr.

C = 28.68; H = 3.68; Br = 67.50 per cent.

Balata:—0.1412 gr. gave 0.1558  $\text{CO}_2$  and 0.0493  $\text{H}_2\text{O}$ .

0.1773 gr. gave 0.2719 AgCl.

C = 30.08; H = 3.88; Br = 65.27 per cent.

Caoutchouc:—0.1688 gr. gave 0.1824  $\text{CO}_2$  and 0.0598  $\text{H}_2\text{O}$ .

0.2114 gr. gave 0.3270 AgBr.

C = 29.48; H = 3.94; Br = 65.82 per cent.

Required for  $\text{C}_{20}\text{H}_{36}\text{Br}_{10}$ :—C = 29.83; H = 3.82; Br = 66.34 per cent.

Bromine, then, has not nearly the same tendency to substitute in the polypréne molecule as chlorine. From the above approximate formula, an unsaturation corresponding to eight atoms of bromine per  $\text{C}_{30}\text{H}_{18}$  molecule is indicated.

*Iodine.*—When the hydrocarbons are subjected to the action of excess of iodine in dry chloroform solution, a jelly separates beneath a clean dark brown solution, and after a day or two, the jelly shrinks to a leathery mass.

Slight fumes of hydriodic acid are observed. By working with known weights of iodine, shaking up after three days with potassium iodide solution, and titrating, the iodine absorption values of 104, 105, and 92 for gutta, balata, and caoutchouc respectively were determined. But whereas compounds containing about 50 per cent. of iodine might be expected from these data, it was found that on shaking up and precipitating with alcohol, a great part of the iodine was liberated again. The bodies thus obtained are greyish-brown flakes, capable of being finely powdered.

Gutta:—0.2012 gr. gave 0.0150 AgI.

I = 12.11 per cent.

Balata:—0.2584 gr. gave 0.0618 AgI.

I = 12.92 per cent.

Caoutchouc:—0.1315 gr. gave 0.0304 AgI.

I = 12.49 per cent.

By precipitating only the clear liquid resulting from the reaction in chloroform, very similar bodies of a rather lighter colour were obtained.

Gutta:—0.1578 gr. gave 0.0361 AgI.

I = 12.49 per cent.

Balata:—0.1528 gr. gave 0.0380 AgI.

I = 13.47 per cent.

Caoutchouc:—0.1625 gr. gave 0.0382 AgI.

I = 12.72 per cent.

These substances are tolerably stable, and it thus appears that the bulk of the iodine absorbed in solution is held much more loosely than the residual 12–13 per cent. They shrink and darken at  $180^{\circ}$ , but do not give off notable quantities of iodine below  $200^{\circ}$ . Once isolated, they are insoluble in chloroform and all other solvents, though they swell up more or less.

*Hydrochloric Acid.*—Benzene solutions of gutta and of balata were saturated with gaseous hydrochloric acid and precipitated with alcohol. The resulting clots were redissolved and reprecipitated, yielding white leathery flakes easily soluble in benzene, chloroform, &c. They begin to decompose at  $185^{\circ}$ .

Gutta:—0.1893 gr. gave 0.4255  $\text{CO}_2$  and 0.1614  $\text{H}_2\text{O}$ .

0.2303 gr. gave 0.2788 AgCl.

C = 61.26; H = 9.48; Cl = 28.92 per cent.

Balata:—0.1348 gr. gave 0.3014  $\text{CO}_2$  and 0.1118  $\text{H}_2\text{O}$ .

0.2223 gr. gave 0.2628 gr. AgCl.

C = 61.00; H = 9.22; Cl = 29.20 per cent.

The behaviour of caoutchouc was found to be somewhat different. From benzene solutions hydrochloric acid gas brought down insoluble gelatinous flakes, which, after "drowning" in alcohol, yielded a friable substance capable of being finely powdered. It is easily soluble in chloroform and carbon bisulphide, but in benzene only swells without dissolving.

0.1026 gr. gave 0.2209  $\text{CO}_2$  and 0.0931  $\text{H}_2\text{O}$ .

0.1690 gr. gave 0.2164 AgCl.

C = 58.72; H = 10.08; Cl = 31.72 per cent.

The difference in composition between gutta and caoutchouc hydrochlorides is not so great as might be expected from the difference in properties. The former correspond approximately to  $\text{C}_{30}\text{H}_{45}(\text{HCl})_6$ , which requires C = 61.00; H = 8.98; and Cl = 30.01 per cent.

All these halogenised derivatives are exceedingly inert chemically. Towards aqueous reagents especially their state of aggregation renders them very resistant. Heated under pressure with sodium ethylate, they all pass into coffee-coloured oxygenated bodies insoluble in all solvents; in no instance, however, were these obtained halogen-free, and therefore fit for analysis.

#### VULCANISATION.

*Sulphur Chloride* is absorbed by gutta and balata in the same way as by caoutchouc, and the resulting compounds closely resemble Weber's  $\text{C}_{10}\text{H}_{16}\text{S}_2\text{Cl}_2$  (this J., 1894, 13, 14), but they only remotely approximate to this composition. Excess of sulphur chloride was mixed with benzene solutions (2:100) of the hydrocarbons; the former had been thrice refractionated from the purchased article, and sodium-proof benzene was used throughout. The liquids set to stiff jellies, balata rather more rapidly than gutta. The jellies were comminuted by squeezing through calico, repeatedly washed with benzene, and drowned in acetone. Hard light yellow granules, yielding inappreciable white powders, free from uncombined sulphur,

were thus obtained. Hydrochloric acid was invariably given off. The sulphur—and chlorine—contents of two sets of preparations are appended; in I. the reagents were allowed to stand for half an hour, in II. over-night.

	I.	II.
Gutta { Sulphur .....	20.6	23.4
{ Chlorine .....	15.9	21.0
Balata { Sulphur .....	20.5	24.9
{ Chlorine .....	15.5	20.2

Sulphur was found to vulcanise gutta and balata very effectively. In default of machinery, the materials were incorporated by softening the hydrocarbons in benzene, mixing with 5–10 per cent. of powdered sulphur, driving off the solvent, and heating the mass in the steam-oven with frequent kneadings until tolerably uniform. It was then bound with canvas and subjected for three hours to 130° in an autoclave. The resulting substances were of firm, springy consistency; they were cut into strips and deprived of free sulphur by extraction with carbon bisulphide and acetone. Preparations containing 1.72–2.33 per cent. of sulphur became somewhat sticky on heating to 100°, and were, therefore, under-vulcanised. With 2.78 (gutta) and 2.69 (balata) per cent., however, they no longer resembled the parent hydrocarbons in any way. They were decidedly elastic, though less so than vulcanised caoutchouc; they swelled in solvents without dissolving; heated to 100° they showed no trace of plasticity or stickiness, but rather gained in elasticity. Traces of  $H_2S$  were evolved in vulcanisation. No vulcanising effect was observed when the hydrocarbons were boiled with sulphur in xylene or heated with sulphur in toluene to 150°.

To determine the maximum absorption of sulphur, vulcanisations were carried out as above with equal weights of hydrocarbon and sulphur for five hours at 130° (I.), and for ten hours at 160° (II.). The resulting ebonites were rasped to powder and extracted for 24 hours with acetone:—

I. Gutta:—0.1800 gr. gave 0.4084 $BaSO_4$ . S=31.18 per cent.	
Balata:—0.1292 gr. gave 0.3100 $BaSO_4$ . S=32.90 per cent.	
II. Gutta:—0.1023 gr. gave 0.2698 $BaSO_4$ . S=36.21 per cent.	
Balata:—0.1756 gr. gave 0.4526 $BaSO_4$ . S=36.38 per cent.	

These sulphur contents are of the order of those found by Weber (Gummi-Ztg., 1902, 16, 563) for the upper limit of caoutchouc vulcanisation, with respect to which the formula  $C_{10}H_{16}S_2$  (S=32.00 per cent.) is claimed. The higher figures of I., which are paralleled in Weber's experiments, point to substitutive action.

#### ACTION OF NITROGEN OXIDES.

The action of nitrogen oxides upon caoutchouc and gutta percha has been studied by Weber (Ber., 35, 1947) and by Harries (Ber., 35, 3256; see this J., 1902, 1404). In dealing with gutta and balata, nitrogen peroxide, prepared by acting on arsenic with nitric acid and mixing the gases with oxygen, was passed into benzene and the solution added to benzene solutions of the hydrocarbons. The first products of reaction were greenish gelatinous precipitates which dried to horny masses: they were not directly soluble in acetone, but passed into solution on standing; they were of variable composition, the nitrogen-contents fluctuating between 9 and 11 per cent. On adding more nitrogen peroxide, yellow clots separated, which soon became granular; they were filtered off and purified by dissolving in acetone and precipitating with ether. These substances are buff-coloured impalpable powders, soluble in acetone and ethyl acetate with tawny colour, also in caustic alkalis, but not in ammonia. They shrink about 90°, darken, and become pasty at 120°, and finally gases are slowly given off with charring. Concentrated  $H_2SO_4$  dissolves them quietly.

Gutta:—0.1815 gr. gave 0.3488 $CO_2$ and 0.1133 $H_2O$ . 0.3218 gr. gave 33.5 c.c. N at 15° and 762 mm. C=52.44, H=6.94, N=12.42 per cent.	
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Balata:—0.1120 gr. gave 0.2144  $CO_2$  and 0.0706  $H_2O$ .

0.3258 gr. gave 32.9 c.c. N at 15° and 763 mm.

C=52.31, H=7.00, N=11.20 per cent.

required for  $C_{10}H_{16}N_2O_4$ :—C=52.62, H=7.02, N=12.28 per cent.

On subjecting these bodies to the further protracted action of nitrogen peroxide, heat was evolved and bubbles of gas given off. The products, after reprecipitation by ether from acetone solution, were saffron-yellow powders soluble in acetone, ethyl acetate, alkalis, and ammonia with a deep orange colour. The yield upon gutta and balata was 218 and 216 per cent. respectively. These bodies intumescence at 160° and deflagrate, yielding a puffy residue of carbon. They are decomposed violently by concentrated  $H_2SO_4$ .

Gutta:—0.1491 gr. gave 0.2169  $CO_2$  and 0.0675  $H_2O$ .

0.2447 gr. gave 29.0 c.c. N at 9° and 770 mm.

C=41.50, H=5.03, N=14.63 per cent.

Balata:—0.1452 gr. gave 0.2231  $CO_2$  and 0.2680  $H_2O$ .

0.2988 gr. gave 36.8 c.c. N at 15° and 766 mm.

C=41.89, H=5.20, N=14.76 per cent.

required for  $C_{10}H_{16}N_2O_7$ :—C=41.52, H=5.19, N=14.53 per cent.

Thus they are evidently identical with Harries' "nitrosite c" of the above formula. The gas evolved in their formation was analysed and found to consist of nitrogen with 4 per cent. of carbon dioxide. It is certain that the formation of these bodies is a step in the degradation of the polyprene molecule, and their further decomposition may be expected to throw light in this direction. By the action of reducing agents more or less nitrogenous, amorphous substances are produced, and in many cases ammonia is formed. Nitric acid eventually yields oxalic acid, but an intermediate yellow amorphous body soluble in alcohol was isolated for which Harries' formula  $C_{15}H_{21}N_4O_{11}$  was confirmed:—

0.2448 gr. gave 0.3518  $CO_2$  and 0.0993  $H_2O$ .

0.2668 gr. gave 28.0 c.c. N at 19° and 758 mm.

C=42.65, H=4.90, N=12.31 per cent.

required for  $C_{15}H_{21}N_4O_4$ :—C=41.55, H=4.85, N=12.94 per cent.

The "nitrosite c" does not dissolve without decomposition in alkalis. The precipitated product, which, in other ways, resembled the original, contained only 12.42 per cent. of nitrogen. On boiling the alkaline solution, a brown powder insoluble in aqueous liquids separates out, which contains alkali; in the mother liquors formic acid, nitric acid, and a yellow nitrogenous body soluble in ether and striking deep yellow with alkalis, were found.

Unexpected results were obtained by acting on benzene solutions of polyrenes with pure, dry nitric oxide. Alcohol precipitated yellow elastic gums soluble in acetone and chloroform. They go into solution on boiling with caustic and are reprecipitated in sticky clots.

Caoutchouc:—0.1140 gr. gave 0.2750  $CO_2$  and 0.0844  $H_2O$ .

0.2714 gr. gave 16.6 c.c. N at 21° and 761 mm.

C=65.80, H=8.23, N=7.13 per cent.

Gutta:—0.1578 gr. gave 0.3736  $CO_2$  and 0.1174  $H_2O$ .

0.3015 gr. gave 16.4 c.c. N at 22° and 761 mm.

C=70.31, H=8.74, N=6.32 per cent.

required for  $C_{10}H_{16}NO_2$ :—C=65.92, H=8.79, N=7.69 per cent.

Thus nitrogen and oxygen are not in the proportion in which they were supplied; probably the substances underwent oxidation in the course of purification.

It is noteworthy that all the nitrogenous derivatives here mentioned reduce Fehling's solution.

In conclusion, it is evident that the hydrocarbons of gutta percha and of balata are identical. As regards the comparison between gutta and caoutchouc, it has long been known that they behave similarly on destructive distillation and on nitration, and the above experiments indicate that there is no essential difference in the chemistry of these two forms of polyprene. It seems as if there were a common molecule, differences in the, perhaps polymeric, aggregation of which caused differences in mechanical structure. Any degradation of the molecule would lead to identical products, but in addition-products the dif-



ferentia of the parent hydrocarbons might be transferred. Thus vulcanised gutta is far from identical with vulcanised rubber mechanically, and even the marked divergence in the solubilities of the hydrochlorides might be due to this.

#### DISCUSSION.

Mr. WALTER F. REID said they were indebted to Dr. Caspari for the addition he had made to their knowledge of the reactions of those important raw materials. Some of the observations made were already known, especially with solvents, but many were new, and those which indicated the composition of these bodies were of great importance to chemical industry. If they could succeed in synthesising either gutta percha or india-rubber, it would have an important bearing on several industries. There were some points on which those connected with the trade would like to have more information, which, perhaps, they might hope the author would give them at a future time. Taking a piece of balata and a piece of gutta percha, to the ordinary untrained eye they simply appeared to be varieties of the same substance, but nevertheless there were very important differences. Gutta percha was the only substance known which could be used for submarine cables. If gutta percha was dissolved and precipitated, a product apparently purer than the natural product was obtained, but its insulating properties were so inferior that it could not be used for the same purpose. That was a point he would recommend to Dr. Caspari's attention in the hope that he might find out to what that difference was due. The necessity of having a material which was a good insulator was very great, and was increasing every year. The price of gutta percha was rising, and the supplies were diminishing, so that there was a very wide field for anyone who could find out the reason for this change in its properties. Again there were differences in connection with the action of the atmosphere on these bodies. Balata withstood the action of the air, but the best gutta percha when exposed to the air, even for a few months, especially if in the light, became very brittle, but he had seen balata machine belts which had run for 10 or 12 years and been almost as supple then as at the beginning. There was a remarkable similarity in composition between gutta percha and india-rubber which might to some extent be due to the conditions under which these gums originated. Looking at a map of the world, it would be seen they were both produced in bulk in regions which had a high average temperature, and a considerable amount of moisture. Some plants contained gutta percha which had never been utilised; for instance, he had found two in the forests of Brazil which contained a considerable percentage. If they could find that gutta percha of good insulating quality could be extracted or produced from a cheap material, such as balata, or some of these gums which were obtainable in considerable quantities in tropical and semi-tropical regions, they would render a signal service to the electrical and other industries. He was treating the matter more from the practical than from the scientific point of view, because he understood the author had not developed any constitutional formula, but he hoped in future he might be able to do so, and thus, perhaps, help them to a synthesis. There was only one case of a synthesis of india-rubber, and that was practically from one of its own decomposition products, when Tilden obtained india-rubber by the polymerisation of isoprene. He hoped in future they would also carry out some electrical experiments on these various decomposition products, as these would be of much value. The electric uses were most obvious at present, but others might be found in future.

Mr. J. SPILLER said in 1861 Dr. A. W. Hofmann published a paper on the oxidation of gutta percha, and the result at which he arrived was that the product contained 62.79 per cent. of carbon, 9.29 per cent. of hydrogen, and 27.92 per cent. of oxygen. The material obtained was from telegraph wires which had been coated and exposed in India. Four years later he (Mr. Spiller) carried out a similar investigation with india-rubber. He discovered a waterproof material in the market of

which he bought several yards for photographic purposes, and which was also used for packing cutlery. It was cotton wool matted together with india-rubber in benzene solution. This exposed to the air for about six years had been entirely converted into resin, an india-rubber resin, of which he made an analysis (Chem. Soc. Trans. 1865). The proportions of carbon, hydrogen and oxygen, whether derived from gutta percha or from india-rubber, were practically identical. Dr. Hofmann and himself were of opinion that they could not safely draw even an empirical formula for the resinous product from such a slender foundation, but that it was probably an additive compound derived from the native hydrocarbon by absorption of oxygen from the air, and then becoming soluble in alcohol, whereas the original was, of course, perfectly insoluble.

Prof. W. R. HODGKINSON said a good while ago he was at work on the action of bromine and chlorine on gutta percha dissolved in chloroform and carbon tetrachloride. The bromine solution in particular gave off an enormous amount of hydrobromic acid during the reaction. If he remembered rightly he obtained a substance which was not crystalline, but its composition corresponded very closely to the formula on the board. He thought it was  $C_{15}H_8Br_6$ , but they were very unsatisfactory compounds to work with.

Dr. J. LEWKOWITSCH asked what evidence there was that those compounds whose formulae had been given were anything approaching to individuals. It was natural to connect these substances with the terpenes. Taking the ordinary oil of turpentine, addition products corresponding to a definite molecular formula could be obtained, but those cited by the author, the chlorine compounds, for example, looked very strange. The action of the chlorine was so energetic that an addition product could not be expected; it would be a product of decomposition. On employing bromine something more approaching a molecular compound was obtained. If a still milder reagent was used, as in the case of hydrochloric acid, an addition product was apparently obtained, although he would have expected 6HCl instead of 5HCl. Since the iodine compound had been mentioned he would like to know what formula was assigned to it, as it was more likely that with so mild a reagent, like the one used in the preparation of nitrosite, a definite addition compound might result. As regards the sulphur chloride compounds the action of the sulphur chloride was very energetic, and, of course, hydrochloric acid was evolved. No wonder, therefore, that the formulae of the compound looked hopeless. If the analyses given referred to one and the same product, or to two preparations, then it was evidently hopeless to base any conclusions on these results. The author had referred several times to Weber. Weber's papers were excellent to read, but, unfortunately, the whole experimental evidence had been doubted by everyone who had been over the ground. Since Dr. Caspari had brought them forward, as of more or less supplementary evidence, he should like to know how far that evidence went.

Mr. W. C. HANCOCK said that with regard to these chlorine and bromine compounds there was a paper, which probably the author was well acquainted with, by Gladstone and Hibbert, published in the *Journal of the Chemical Society* for 1888, in which they dealt with the chemical and also with the optical properties of these substances, chiefly in solutions of benzene. The formula obtained for the bromine compound by those authors was approximately  $C_{10}H_{16}Br_4$ . In the case of chlorine he had great difficulty in obtaining anything like a definite compound as there was a copious evolution of hydrochloric acid. He mentioned that with the solvent chloroform he had found practically no action with iodine on caoutchouc. It was interesting to notice that this paper confirmed the work of Greville Williams and others that caoutchouc and gutta percha were practically identical chemically, but very different in physical properties, also the results which Sir William Ramsay laid before them two years ago as to the great difficulty there was in dealing with these substances. Some interesting information with regard to gutta percha, which the author was doubtless

aware of, could be found in the Cantor lectures delivered before the Society of Arts in 1897 by Dr. Obach.

Dr. W. A. CASPARI, in reply, said with regard to the difference between gutta percha and balata, he could only say that, as far as the hydrocarbons were concerned, he found no chemical difference between them and scarcely any mechanical difference. But it must be remembered that gutta percha and balata as used for industrial purposes contained the full amount of resin with which they were associated in nature, and in that respect differed from good india-rubber, in which the resin amounted to a few per cent. at most. In both gutta percha and balata the percentage was extremely high. The good insulation of gutta percha was due really more to the resin than to anything else; the resins by themselves were magnificent insulators, but it was not possible to use extracted gutta percha resin to cover the wires for it lacked mechanical strength. It seemed to be the aim of the telegraph wire-maker to get just the right proportions of the hydrocarbons and resin in his covering material to give the best possible results. There were no doubt several kinds of trees which had not yet come into use which might give bodies resembling india-rubber if not in paying quantities, but he would point out that the conditions under which raw gutta percha and balata were imported into England varied notably. Balata was very little adulterated. It contained the resin with which it was associated in the tree (whether that was an oxidised product of the hydrocarbon or not it would be interesting to know, but he was not at present prepared to say). On the other hand, gutta percha, which came from Eastern Asia, mostly passed through the hands of Chinamen, and was grossly adulterated. Every one of the specimens he had worked with was adulterated. Not only were various qualities of gutta percha mixed up beyond recognition, but a lot of entirely foreign resins had been added and mixed up with the bulk. If there had been any obvious commercial application of those derivatives which he had obtained he should have mentioned it. It seemed to him that all the halogen and nitrogenated compounds were little likely to be of use on the lines on which gutta percha itself was used. The vulcanising seemed to offer greater possibilities. The chonites obtained did not seem to differ from india-rubber ebonite. If it were possible to get bubble-free ebonite (which he could not do, as he had no machinery for the purpose), he did not see why vulcanised balata should not do as well as india-rubber and be possibly cheaper. But the vulcanised products, with a few per cent. of sulphur only, were of very little use, he thought. Dr. Hodgkinson's experiences of the difficulties of working with these polyene derivatives confirmed his own, and that led up to the point whether most of these bodies were chemical individuals. He did not believe they were, and if Dr. Lewkowitsch had had to do with them he would have come to the same conclusion. The most he could do was to get the maximum amount of halogen added to the hydrocarbon and see what came out. The data hitherto obtainable were not in good agreement. Some of Weber's results, as had been mentioned, differed widely from these, and he had a certain diffidence about speaking of Weber at all. Weber's iodide contained an enormous quantity—70 per cent.—of iodine, whereas other observers had not been able to add iodine to caoutchouc.

Prof. HODGKINSON said he had the same experience.

Dr. CASPARI said there was no doubt it went in, and a substance was obtained *toto coelo* different from the original hydrocarbon. He should like to point out that in external characteristics the iodides he obtained were very much what Weber described his to be, but he could only get from 12 to 13 per cent. of iodine into them. The situation, therefore, was this: they must have some considerable body of evidence as to the practical effects of chemical action on these hydrocarbons before they could begin to talk about either chemical individuals or molecular structure, and it would be well to get one or two authorities to agree one with the other before going further. As regards the nitrogenated bodies there was more hope. No doubt the first body mentioned was an

individual, and other workers before him had made it clear that the second was an individual; unfortunately, they were not crystalline—nothing connected with gutta percha was. In the formation of the second body, the polyene molecule had been broken into; if they could further break that down and obtain a definite known substance, there might be some hopes of getting a glimpse of the constitution of these hydrocarbons.

## THE DETERMINATION OF ZINC IN LIGHT ZINC-ALUMINIUM ALLOYS.

BY RICHARD SELIGMAN, PH.D., AND F. J. WILLOTT.

A rapid method of estimating zinc in zinc-aluminium alloys is rendered particularly desirable by the increasing number of uses to which such compounds are now put. For this purpose, we have not found any of the customary modes of procedure well suited.

The alloys most generally met with contain up to 20 per cent. of zinc and 80 per cent. of aluminium with varying proportions of copper. Minute traces of silicon iron and lead are usually present as impurities of the aluminium and zinc; more rarely small quantities of nickel and tin are found.

In such cases, it is impossible to carry out a volumetric determination of the zinc by precipitating the aluminium from acid solutions with ammonia owing to the bulk of the precipitate thus formed and the stubbornness with which the latter retains zinc.<sup>(1)</sup>

On the other hand, separation by means of sulphuretted hydrogen with a view to gravimetric determination of the zinc is rendered tedious and lengthy, by the difficulty of washing the zinc sulphide precipitate free from aluminium salts. The subsequent conversion of zinc sulphide to a weighable form also consumes much time.

By combining these methods, and by taking advantage of the solubility of the alloys in question in caustic soda,<sup>(2)</sup> we find it possible to complete a zinc determination in little more than an hour, whilst a comparison of the two columns annexed shows that the accuracy of this method is all that is desired for technical purposes.

These results are taken at random from many such determinations, and none have been arbitrarily suppressed.

Volumetric. Zinc per cent.	Gravimetric. Zinc per cent.
42.80	43.08
19.00	18.88
18.10	17.93
13.87	13.90
12.50	12.41
11.68	11.88
8.70	8.72
1.99	1.89

Our mode of procedure, or which details are given below, consists in dissolving the sample in caustic soda, precipitating the zinc from this solution as sulphide, redissolving the precipitate in hydrochloric acid, and titrating the zinc with potassium-ferrocyanide solution. For the titration we have chosen this latter method,<sup>(3)</sup> as we are convinced that it is in every way preferable to that of using sodium sulphide solution.

In a 400 c.c. beaker, covered with a clock glass, half a gram of the drillings to be analysed is dissolved in 25 c.c. of a 25 per cent. caustic soda solution. The contents of the beaker are warmed until rapid evolution of gas takes place, and are then allowed to stand until solution is complete. This occurs in from five to ten minutes according to the coarseness of the drillings or turnings used.

The solution is then diluted to 300 c.c. with boiling water, and any undissolved iron, copper, lead, tin or nickel allowed to settle. The clear liquid, which contains almost all the zinc and aluminium, is removed by decantation, and the residue washed twice by the same means. It is found that a small quantity of zinc is usually contained in this residue, although we have not determined



in what form it is present. This is removed by dissolving the residue in a few drops of concentrated hydrochloric acid, and diluting to 20 c.c.; having neutralised with caustic soda, 2 c.c. of the latter are added in excess. After warming, the precipitated hydrates are removed by filtration and washed, filtrate and washings being added to the main bulk of the zinc and aluminium solution.

From the solution of sodium aluminate and sodium zincate the zinc is now precipitated by sulphuretted hydrogen, the stream of gas being checked when it is seen that alumina is being precipitated with the zinc sulphide. This moment may be easily recognised by the formation of a skin at the point where the bubbles of gas burst. Contrary to the case of a gravimetric determination, the presence of a small amount of alumina in the zinc precipitate is quite innocuous, up to 10 per cent. of the former not interfering with the accuracy of the ferrocyanide determination.<sup>(4)</sup> The zinc sulphide precipitate, which is usually flesh coloured owing to the presence of a negligible trace of iron, is now allowed to settle for about five minutes, the clear liquid decanted, and the precipitate finally thrown upon a filter. For the same reason as above, it is entirely unnecessary to wash the precipitate free from aluminium salts, and thus the greatest difficulty in handling zinc sulphide is avoided. The precipitate is now dissolved from the filter with 8 c.c. of hydrochloric acid, and the paper carefully washed, the washings being collected in the beaker used for precipitation. After dilution to 250 c.c. with boiling water 5 grms. of ammonium chloride are added, and the amount of zinc is at once <sup>(5)</sup> determined by titration with a standard solution containing 22 grms. of potassium ferrocyanide to the litre. Uranium nitrate, uranium acetate, or ammonium molybdate<sup>(6)</sup> is used as indicator.

This method of titration is now so well known, and its advantages so well recognised<sup>(7)</sup> that we do not propose to discuss it here. We will only mention the following points, which have appeared to us advantageous:—

Instead of a porcelain plate, we use a slab of paraffin wax for carrying out the spot tests. Though we have not heard of the use of this device in Europe, it is frequently adopted in the United States. Owing to the form the drops take on such a surface, the ease with which it can be cleaned and the large number of tests which may be made in a small space, we consider a paraffin wax plate, or better still a porcelain plate covered with a thin coat of wax, most useful.

The presence of minute traces of iron in the zinc solution to be titrated is beneficial. The solution assumes a faint blue colour, which disappears shortly before the main reaction is complete.

(1) See also R. E. Barnett (this J., 1905, 833).

(2) This property is generally made use of for estimating iron in aluminium and light aluminium alloys.

(3) Galetti, Z. Anal. Chem. 1865, 213; De Koninck and Prost, Z. ang. Chem., 1896, pp. 460 and 564.

(4) See also Miller and Hall. Columbia School of Mines quarterly, 1900, 21, iii., 267—272.

(5) If tin is present it is necessary to pass sulphuretted hydrogen through the solution before titration.

(6) Nissenson and Kettembeil, Chem. Zeit., 1905, 73, 591.

(7) Nissenson and Kettembeil, loc. cit.

#### DISCUSSION.

Mr. GRANT HOOPER said, with reference to Dr. Seligman's remarks as to the character of the zinc sulphide precipitate in alkaline solution, he would suggest precipitation in acetic acid. He could quite understand, however, that the author had no real difficulty in this case, inasmuch as the presence of a small proportion of alumina made no difference in his determination, and he thought, with the results before them, the method which he had brought forward was very suitable for the purpose in view. If he needed to go further, and it was a question of a gravimetric determination of the zinc, he would suggest its precipitation and weighing as phosphate, which was a most convenient and ready method.

Mr. THOMAS TYRER said he could confirm what Mr. Grant Hooper had said with regard to phosphate.

Dr. SELIGMAN, in reply, said that, in some respects, the precipitation from an acetic acid solution was

better, but this would mean an extra operation, and for works purposes that was a disadvantage; owing to not having to wash the precipitate the present operation took practically no time. The chief difficulty with zinc sulphide was always in washing. The same remark applied to the phosphate. They knew that was an excellent form in which to precipitate zinc, but it was not desirable for their purposes.

#### THE ESTIMATION OF NAPHTHALENE IN COAL GAS.

BY C. J. DICKENSON GAIR.

At first sight the estimation of naphthalene, either in pure or impure coal gas, does not appear to be beset with any great difficulty. The well-known fact that the vapour of naphthalene precipitates naphthalene picrate, when passed into a strong solution of picric acid, is apparently all that is necessary on which to base a method of estimation, but it is found to be impossible to estimate naphthalene in coal gas by merely passing a measured quantity of the gas through a picric acid solution and then weighing the ppt. so formed as naphthalene picrate; because, in the first place all the hydrocarbon will not combine with the picric acid, but some of it condenses out in the free state. Secondly, a quantity of naphthalene invariably condenses in the delivery pipe and connections of the apparatus, and thirdly, with coal gas containing quantities of ammonia the picric acid is neutralised to some extent, ammonium picrate being formed, which destroys any degree of accuracy.

The first method of estimation to be noticed was devised by Colman and Smith (this J., 1900, 128). It is unnecessary to go into elaborate details of such a well-known test, the following being a short sketch of a slight modification of the original, which has been found very simple and rapid of execution. The gas to be tested is passed through three Woulff's bottles containing exactly 500 c.c. of N/20 picric acid solution and then through an experimental meter. After a known number of cubic feet of gas have been passed, the test is shut off and the contents of the Woulff's bottles mixed together in a 20 oz. flask, and carefully heated on a water-bath to a temperature of about 60° C. until the precipitate of naphthalene and naphthalene picrate has entirely dissolved. Naphthalene picrate is easily decomposed by excessive heat, and to guard against loss from this cause, the flask is always fitted with a cork through which a glass tube dips into a beaker containing a small quantity of picric acid, from the Woulff's bottles. After the experiment, the picric acid in the beaker is poured back into the flask, the contents of which are then cooled. Crystalline masses of naphthalene picrate separate out, and when quite cold the precipitate is filtered off, dried *in vacuo* or in a warm room, and weighed. From the weight of naphthalene picrate thus found, the amount of naphthalene per 100 cu. ft. of gas can easily be calculated. A volumetric method of estimation is also in vogue and this may be carried out as follows:—An aliquot portion of the clear residual picric acid solution is taken, Laemoid indicator added, and the whole titrated with N/10 sodium hydroxide solution. The difference between the result thus found and the quantity of picric acid in the original solution, represents the amount of picric acid which has combined with the naphthalene; and as 229 parts of the former combine with 128 parts of the latter, the amount of naphthalene in the gas is easily calculated. To guard against loss of naphthalene by condensation in the pipe leading to the apparatus, it is well to have a connection as near the main as possible, and to surround it by a steam jacket. The author has found this to be an immense advantage in all methods of estimation. Colman and Smith's test is really devised for pure or nearly pure coal gas, but it can be made to give gravimetric results with

cool impure coal gas, if the ammonia be removed. This is effected by means of oxalic acid solution, maintained at a temperature of about 80° C. All that is necessary is to introduce a Woulff's bottle containing the hot liquid in front of the bottles containing picric acid solution.

The next method to be noticed is one devised by Somerville. Three glass tubes about 7 in. long and 1 in. wide are fitted up in a similar manner to Woulff's bottles, and about 35 c.c. of 70 per cent. alcohol are poured into each, the three are closely connected a measured quantity of gas passed through and the test disconnected. The contents of the tubes are then intimately mixed in a flask. If the gas used is impure, it will be necessary to add concentrated oxalic acid solution, until the ammonia is entirely neutralised, as shown by litmus paper. The contents of the flask are now filtered and the filter paper thoroughly washed with dilute alcohol. Concentrated picric acid is added in large excess, about 500 c.c. are generally necessary, the liquid agitated and allowed to stand for about half an hour. By that time all the naphthalene picrate will have separated out, and may be filtered, dried slowly, and weighed. The advantage of this method and the following one is that the naphthalene picrate is readily obtained without the risk of loss of weight. The liquid filters somewhat slowly in Somerville's method, and, owing to the finely divided state of part of the precipitate, it is often necessary to pour back the first part of the filtrate several times, until it becomes quite clear.

There is one other method for the gravimetric estimation of naphthalene in coal gas which may be cited here. This test, devised by the author, is founded on the action of a suitable solvent. The solvents for naphthalene which are applicable for its estimation are few and far between, and in this case use is made of acetic acid of a sp. gr. of about 1.044. About 350 c.c. are taken in two Woulff's bottles or towers. A small Woulff's bottle containing 150 c.c. of picric acid solution is also added after the acetic acid to act as a catch, and a measured volume of gas, not more than 3 to 6 cb. ft. usually, passed through at the rate of about 1 cb. ft. per hour. If the gas is impure, use is made of the hot oxalic acid solution as mentioned previously. In the event of there not being sufficient pressure to force the gas through the wash bottles, or if the gas be under vacuum itself, use is made of a piece of apparatus which pulls the gas through the bottles by means of a water pump, and then automatically separates it from the water, the gas passing through the experimental meter at ordinary atmospheric pressure. After the experiment is finished, the acetic acid and picric acid from the bottles are mixed in a flask, and about 500 c.c.s. of concentrated picric acid solution added. Pure naphthalene picrate separates out at once, in large flocculent masses, which have the advantage of being extremely easy to filter. After filtering, the naphthalene picrate is dried *in vacuo* or a warm room, and weighed. The method was proved to be correct in the following manner. A small corked bottle or U-tube was taken, having inlet and outlet tubes, a quantity of pure dry naphthalene crystals inserted in the bottle and the whole weighed. The bottle was then connected up to a supply of coal gas from which every trace of naphthalene had been removed. The Woulff's bottles containing acetic acid were connected, the experiment started and allowed to proceed for some time. The gas was then shut off, the bottle stoppered and placed in a desiccator for a few minutes and again weighed, the difference in the two weighings being the quantity of naphthalene passed into the bottles. The same process of precipitation, &c., was gone through as previously described, care being taken that any naphthalene crystals that might have been condensed in the colder parts of the apparatus, were first dissolved in a small quantity of alcohol and then added to the acetic acid. The quantity of naphthalene found by calculation was then compared with the quantity found by actual weighing. The results of experiments were as follows:—

Weight of naphthalene passed in grains.	Weight of naphthalene found by experiment in grains.
0.500	0.470
0.800	0.778

And using air as naphthalene conveying agent:

Weight of naphthalene passed in grains.	Weight of naphthalene found by experiment in grains.
0.500	0.491
0.550	0.537
0.400	0.394
0.400	0.394

showing that the method is sufficiently accurate for all technical purposes, the average error being about 1.8 per cent. As regards coal gas, numerous comparative experiments were made with Colman and Smith's method, and a few of the results are here appended:—

Acetic acid method. Grains of naphthalene per 100 cb. ft. of gas.	Colman & Smith's method. Grains of naphthalene per 100 cb. ft. of gas.
Pure { 39.4	38.4
Gas { 30.1	29.5
31.3	32.0
38.4	38.2
Impure { 33.1	36.7
Gas { 35.8	35.8
55.6	48.4

It is almost unnecessary to state, that in no experiment was any length of rubber tubing left exposed to the gas, because of its power to absorb large quantities of naphthalene.

It should be mentioned, in conclusion, that the reason for adding such large excesses of picric acid in the alcohol and acetic acid tests is because naphthalene picrate itself is quite soluble in both alcohol and acetic acid.

#### DISCUSSION.

Dr. H. G. COLMAN said the author had shown how, by the use of acetic acid, he could obviate the chief difficulty which he and Mr. Smith experienced in the test they devised. They found that when gas was passed through an aqueous solution of picric acid, the whole of the naphthalene was removed from the gas and it came down partly in combination with picric acid as picrate, and partly as free naphthalene. What they were afraid of, at first, was that the other vapours in the gas, like xylene, would also come down, but as a matter of fact they did not do so in an aqueous solution. The picrates of these hydrocarbons were then dissociated entirely, whereas, in the case of naphthalene, dissociation was only partial. To get over this difficulty and to obtain the naphthalene in a form in which it could be weighed, Küster's method was adopted, namely, heating the liquid containing the naphthalene and picric acid on a water-bath until they were dissolved. Then, on cooling, the naphthalene separated out as picrate. The author had shown that in the presence of dilute acetic acid the naphthalene came down at once as picrate, and in that way he obviated the necessity of heating, which was perhaps more objectionable from the length of time it required than for any other reason, although it introduced another possible source of error. By his method, Mr. Dickinson Gair obtained the naphthalene picrate direct in a form which could be weighed. It seemed to him rather a disadvantage to have a gravimetric method as the only option. He preferred a volumetric method if one sufficiently accurate could be obtained, particularly when tests had to be made in different parts of the country and in small works where perhaps a balance did not exist. It was easy to take a sufficient amount of standard solution to work the test. There appeared to him a possibility that by combining the new method with the one devised by Mr. Smith himself, a volumetric process could be devised in which the heating process was avoided. As naphthalene picrate was formed without dissociation in dilute acetic acid solution it seemed possible that by adding some acetic acid to the standard picric acid solution the naphthalene would come down directly as picrate, instead of as a mixture of free naphthalene and naphthalene picrate. He had made a few experiments, and although it was too soon to say that the method would work, the results, as far as they went, indicated that there was a reasonable



possibility of success. With regard to the use of alcohol, he had tried some experiments, at the suggestion of Mr. Somerville, and found that, unfortunately, in this case a certain amount of xylene and other hydrocarbons did form picrates, and were precipitated along with the naphthalene so that the results of the test came out too high. The picrates produced looked just the same as the naphthalene picrates, but whereas naphthalene picrate melted at about 149°, when using alcohol he got a mixture with a m. pt. about 90°. On heating with caustic soda, instead of solid naphthalene, a mixture of naphthalene and other hydrocarbons was produced.

Mr. J. HEWETT said he had tried a similar method recently. The acid he generally used was of a strength of about 70 per cent. He had also tried the alcohol method mentioned by Dr. Colman, and found that the cloudy precipitate (being, he took it, the xylenes) was not present in such quantity as in the acetic acid method. If any came down it cleared in a much shorter time, and the solution could be filtered quicker. He had made experiments using dilute acetic acid for the estimation of naphthalene in coal gas, and he had also tried it for extracting naphthalene from turpentine, petroleum, paraffin, oils, and so forth. If naphthalene was dissolved in turpentine or other oils, and acetic acid added, a homogeneous solution resulted, from which crystals of naphthalene picrate separated on addition of picric acid. In most cases the oil did not separate except on the surface. The results, he believed, were fairly accurate.

Mr. BUTTERFIELD said he had had considerable experience with various modifications of Küster's method, as elaborated by Colman and Smith. Working on gas at ordinary temperatures, that method left little to be desired; but with crude coal gas at a temperature of, say, 80° F., the maintenance of the temperature of the connections with a steam coil and of the solution for the absorption of ammonia for several hours, as referred to by the author, were matters of some difficulty on gas works, and in that respect he thought the picric acid methods as a whole failed. He could not speak as to the method of Mr. Somerville with alcohol, but it seemed more promising. When estimating naphthalene in coal gas at a temperature over 100° F., he thought some method of absorption by an oil which was not a coal tar product, and subsequent recovery of the naphthalene by fractional distillation of the oil, would be likely to give more satisfactory results than the picric acid method.

Dr. COLMAN said the picric acid method was only applicable to gases at ordinary temperatures; at high temperatures it did not work at all.

Mr. DICKENSON GAIR, in reply, said the question raised by Dr. Colman in reference to the gravimetric and volumetric methods of analysis was only a matter of taste; when there was any difficulty in obtaining a balance it was a very simple matter to collect the samples, bring them home, and test them in the ordinary manner. He could confirm the statement that alcohol took out toluene and xylene. Xylene picrate was undoubtedly precipitated to some extent. In his experience it made the results higher by about 5 grs. per 100 ft. The acetic acid method was applicable to hot coal gas, because the warmer the acetic acid became the greater power it had of dissolving naphthalene, and if a sufficient number of absorption bottles were used, a gradual cooling down of the gas took place, and the last bottle would contain no naphthalene. As for the fractionating method Mr. Butterfield had suggested he did not think it had any advantage, inasmuch as it was just as likely to become blocked up during the four or five hours working as was the acetic acid test. He believed a method was introduced by a German chemist some years ago for estimating naphthalene in coal gas by passing it through benzene and then fractionating the benzene.

## SALTS OF THE ALKALOID CINCHONAMINE.

BY BERNARD F. HOWARD, A.I.C., AND F. PERRY.

*Introductory.*—The most recent research work published on the alkaloid cinchonamine is a paper by Arnaud, in the *Annales de Chimie et de Physique*, in 1896. In this paper Arnaud sums up all the work done previously by Hesse, and compares his own results with those obtained by the latter. The object of the present research was to prepare and investigate the customary salts and derivatives of the alkaloid with a view to throwing some light upon its constitution. This first paper is devoted mainly to investigations on the salts of cinchonamine.

The crude cinchonamine was in the form of a very impure nitrate, and had been precipitated as such from the alkaloids obtained from the bark of *Remijia Purdciana*. The chief impurity in this crude precipitated nitrate was the amorphous alkaloid paricine, and this was eliminated by dissolving, filtering and crystallising twice as nitrate from water (the cinchonamine being obtained as the crystallised nitrate and the paricine remaining in the mother liquor), precipitating the alkaloid, redissolving in hydrochloric acid and recrystallising three or four times as hydrochloride. The purified hydrochloride was then precipitated, giving a perfectly white alkaloid, and this was crystallised from acetone, when a clean colourless, crystalline product was obtained.

*Cinchonamine Hydrochloride*,  $C_{19}H_{24}N_2O.HCl$ , was obtained by dissolving the pure alkaloid in a considerable excess of dilute hydrochloric acid, and crystallising from the acid solution. The salt crystallised in soft laminae, almost white, and of a glistening appearance. The chlorine was estimated in the usual manner by precipitation with silver nitrate. Owing to the slight solubility of cinchonamine nitrate, it was necessary to make the solution very dilute and hot before acidifying with nitric acid, otherwise the nitrate was partially precipitated.

Percentage of chlorine obtained (1) 10.55, (2) 10.48, mean, 10.51 per cent.; Arnaud, 10.44 per cent.; Hesse, 10.24 per cent.; calculated for  $C_{19}H_{24}N_2O.HCl$ , 10.67 per cent.

Arnaud describes a hydrated hydrochloride containing 1 mol. of water prepared by recrystallising the ordinary hydrochloride from a neutral solution. The percentage of water in the sample he prepared was 5.30 per cent. as against 5.10 per cent. calculated for the above formula.

Repeated experiments were made with neutral solutions and the salt obtained after carefully drying contained from 0.39 per cent. to 4.75 per cent. of water. The appearance of the crystals also varied considerably, those containing the least water being similar to the ordinary hydrochloride in appearance, whilst the most hydrated crystals were solid, transparent, and cube-shaped. This corroborated Arnaud's statement that the hydrated hydrochloride was "essentially different from the crystals of the original hydrochloride."

The extraordinary variations obtained above from solutions exactly similar in neutrality, led the authors to investigate whether Arnaud's statement was correct, that the hydration of the product was merely a question of the neutrality of the solution from which it was crystallised.

For this purpose the salt obtained above which most nearly attained to the theoretical 5.10 per cent. of water was utilised to obtain a curve of solubility. This was plotted with the ordinary hydrochloride curve, and it was observed that the curves crossed at 27° C.

This gave rise to the possibility of the hydration of the product being solely due to the temperature of crystallisation. Accordingly, a hot saturated neutral solution of the hydrochloride was cooled down to 27° C. and rapidly filter-pumped. The filtrate was placed in a refrigerator for several hours, and allowed to deposit a further crop of crystals. This was filtered and dried as far as possible with the vacuum pump, then with drying paper, and the percentage of water determined. The same process was repeated with another hot, saturated solution to obtain confirmatory results. The percentage lost on drying at 100° C. in two experiments was 5.26 per cent. and 4.94 per cent., giving a mean of 5.10 per cent., which is the theoretical percentage of water for the mono-

hydrated salt. This result is very strong evidence in favour of the hydration of the hydrochloride being merely a question of temperature of saturation, and to confirm this, in each of the two experiments described above, the hydrated crystals were of the solid, cubical type previously mentioned, and quite different from the ordinary anhydrous crystals.

In order to ascertain whether a dihydrochloride could be formed, a strong aqueous solution of the ordinary hydrochloride was treated with sufficient hydrochloric acid to form a compound of the formula  $C_{19}H_{24}N_2O \cdot 2HCl$ , and allowed to crystallise. The crystals (which exactly resembled the ordinary hydrochloride in crystalline structure), were dried at  $100^\circ C.$ , and the chlorine estimated. The percentage found was 10.53 per cent., which was fairly close to the calculated percentage of chlorine in the ordinary hydrochloride, *viz.*, 10.67 per cent. This product was, therefore, considered to be the ordinary hydrochloride, and it was consequently concluded that in this case the alkaloid will not form a dihydrochloride, and only acts as a monovalent base.

The *Hydrobromide* was prepared in a manner exactly similar to the hydrochloride. The alkaloid was dissolved in a considerable excess of 10 per cent. hydrobromic acid, and crystallised. The product was dried between drying paper at the ordinary temperature, and the amount of water lost at  $100^\circ C.$ , was 0.13 per cent. From this it was concluded that the hydrobromide was an anhydrous salt.

The bromine was estimated after drying at  $100^\circ C.$  Percentage of bromine found (1), 20.89, (2) 21.09; mean, 20.99 per cent.; Arnaud, mean, 20.97 per cent.; Hesse, mean, 20.89 per cent.; calculated for  $C_{19}H_{24}N_2O \cdot HBr$ , 21.22 per cent.

It was next ascertained whether a hydrated hydrobromide could be obtained by recrystallising from an absolutely neutral solution below  $27^\circ C.$ , as was done in the case of the hydrochloride. Owing to the very slight solubility of the hydrobromide in cold water, a large quantity of solution had to be used to obtain sufficient crystals below  $27^\circ C.$  The crystals obtained were dried between filter papers and tested for hydration. There was no change in weight on heating at  $100^\circ C.$ , whence it was concluded that the alkaloid does not form a hydrated hydrobromide corresponding to the hydrated hydrochloride.

An unsuccessful attempt was made to form a dihydrobromide by treating a solution of the hydrobromide with sufficient hydrobromic acid. The percentage of bromine in the product was 21.05 per cent., which corresponded fairly closely to the calculated percentage for the ordinary hydrobromide, *viz.*, 21.22, and showed that, as in the case of the hydrochloride, the alkaloid will only act as a monovalent radicle.

*Cinchonamine Hydriodide.*—Arnaud describes the preparation of this salt by the double decomposition of a salt of cinchonamine with potassium iodide. It can also be prepared by boiling the alkaloid with a dilute solution of hydriodic acid (about 5 per cent) for some hours with a reflux condenser. Prepared by either method, it crystallises in shining, plate-shaped laminae, slightly yellow, very like the hydrochloride in crystalline structure.

*Analysis of the Hydriodide.*—Percentage of iodine obtained:—(1) 27.7, (2) 27.2; mean, 27.45 per cent.; Arnaud, mean, 29.63 per cent.; Hesse, mean, 29.55 per cent.; calculated for  $C_{19}H_{24}N_2O \cdot HI$ , 29.95 per cent.

In preparing the hydriodide from the alkaloid and hydriodic acid, care must be taken to use sufficiently dilute acid. If 50 per cent. acid is used decomposition takes place and the product is a brown, amorphous salt, which gives a lower percentage of iodine on analysis than that prepared from dilute acid, *viz.*, 26.08 per cent., as against 28.87 per cent. This latter product was only slightly yellow, and in other respects closely resembled the hydriodide prepared from potassium iodide.

The salt used for these estimations had been dried at  $100^\circ C.$ , at which temperature evidently some hydriodic acid had been lost owing to slight decomposition. In order to verify this a current of dry air was passed over a weighed quantity of the salt, and then through a solution of silver nitrate. After a few minutes

the silver nitrate became turbid, showing that hydriodic acid was being given off from the salt. The current of air was continued for eight hours, and then the silver iodide formed was weighed. The weight of cinchonamine hydriodide over which the dry air was passed was 0.1406 gm.; 0.0167 gm. of silver iodide was collected, equivalent to 0.00945 gm. of hydriodic acid; hence the percentage of hydriodic acid collected was 6.5 per cent.

If on exposure to dry air the cinchonamine iodide lost 6.5 per cent. of hydriodic acid, it was only natural that after drying at  $100^\circ C.$  low results were obtained in the iodine estimations. It is evidently very difficult to obtain the salt quite dry without partial decomposition taking place.

*Solubility of Cinchonamine Iodide.*—Arnaud states that this salt is almost insoluble in cold water. He does not state, however, that it is very fairly soluble at higher temperatures. At  $100^\circ C.$  1 part of cinchonamine iodide dissolves in 90 parts of water, and it will be observed that the difference in solubility of the three halogen salts at high temperatures is not so very large. At ordinary temperatures, however, there is a great difference in the solubility, the iodide being very much less soluble than the other salts.

*Cinchonamine Platinochloride.*—This was prepared by adding a slight excess of platinic chloride to a solution of cinchonamine hydrochloride. It formed a very insoluble, semi-crystalline, yellow precipitate. This was dried and the platinum estimated; 0.4722 gm. gave on ignition 0.0928 gm. of platinum. Percentage of platinum obtained, 19.65 per cent.; Arnaud, mean result, 19.55 per cent.; Hesse, mean, 19.52 per cent.; calculated for  $(C_{19}H_{24}N_2O)_2H_2PtCl_6$ , 19.46 per cent.

*Cinchonamine Salicylate.*—This was formed by neutralising a warm solution of salicylic acid with cinchonamine alkaloid. A resinous mass was obtained on cooling, which, on dissolving in warm water and cooling, crystallised in short, thick, colourless prisms. These crystals were very readily soluble in acetone, from which they crystallised freely. In order to obtain the salt by crystallisation from water, it is necessary to have the solution very dilute, and the temperature must not be carried above about  $70^\circ C.$ , as, in that event, a resinous mass is again deposited. The white crystals obtained above melted in warm water but were only slightly soluble. The salt was not very easily dissolved by dilute mineral acids, decomposition only taking place on prolonged warming.

A weighed portion of the salicylate was dissolved in dilute sulphuric acid, and placed in a separator with ether. The alkaloid was then precipitated with an excess of sodium hydroxide and extracted with the ether. The ether was evaporated off and the alkaloid weighed. 0.1491 gm. of alkaloid was obtained from 0.2224 gm. of the salicylate, *i.e.*, 67.04 per cent; calculated for  $C_{19}H_{24}N_2O \cdot C_6H_4(OH)COOH$ , 68.29 per cent.

*Cinchonamine Sulphate.*—This salt is most easily prepared by neutralising a solution of cinchonamine alkaloid in absolute alcohol with dilute sulphuric acid. This operation should be carried out at a temperature just below the boiling point of alcohol; the neutral solution is just acidified and removed quickly from the water-bath, and the cinchonamine sulphate crystallises out on cooling, in small needles. The formation of the salt takes place most readily if the alcoholic solution of the alkaloid is about half saturated. The product is filtered, washed with alcohol, and may be safely dried at  $100^\circ C.$  without any decomposition.

A weighed portion of the sulphate was dissolved in water, and hydrochloric acid and barium chloride solution was added. 0.4305 gm. of barium sulphate was obtained from 1.3649 grms. of the sulphate. Percentage of  $SO_3$  obtained, 10.81 per cent.; Arnaud, 11.15 per cent.; calculated for  $(C_{19}H_{24}N_2O)_2H_2SO_4$ , 11.59 per cent. As this low result was again obtained on repeating the estimation, it was thought possible that the low percentage of  $SO_3$  might be due to the presence of water of crystallisation, or alcohol of crystallisation in the sulphate obtained above. For instance, if the formula  $(C_{19}H_{24}N_2O)_2H_2SO_4 \cdot 3H_2O$  represented the product obtained, the percentage of  $SO_3$  would be 10.83.



Accordingly, to ascertain if this were the case, a weighed quantity was dried for a long period at  $100^{\circ}\text{C}$ . 1.3930 grms. under these circumstances lost 0.0023 grm., being a loss of only 0.164 per cent. This was considered sufficient evidence to show that the salt contained no water of crystallisation. The low result was, therefore, as in the case of the halogen salts, attributed to a slight tendency of the salt to decomposition while drying.

The sulphate is extremely soluble in water, and when dissolved cannot be recrystallised. The solution on evaporation only yields a gummy residue. It can, however, be crystallised out of a mixture of alcohol and water. If some of the sulphate is dissolved in hot water and then about four times its own volume of hot alcohol added, the salt will crystallise again on cooling in perfectly transparent prismatic crystals.

It is practically insoluble in absolute alcohol. It is very soluble in pyridine from which it crystallises in masses of crystals containing 1 mol. of pyridine. The sulphate in this pyridine cinchonamine sulphate was estimated in the usual way.

Weight of salt used = 0.5130 grm.; weight of  $\text{BaSO}_4$  obtained = 0.1520 grm.;  $\text{SO}_3$  obtained, 10.16 per cent.; calculated for  $(\text{C}_{19}\text{H}_{24}\text{N}_2\text{O})_2\text{H}_2\text{SO}_4\text{C}_5\text{H}_7\text{N}$ , 10.39 per cent. This would point to the molecule containing 1 mol. of pyridine on crystallisation. The crystals obtained above had been washed quite free from free pyridine with alcohol, and the presence of pyridine in combination was further demonstrated by obtaining dibromopyridine as follows:—

A solution of the salt was treated with hydrochloric acid and barium chloride, with formation of cinchonamine hydrochloride, pyridine hydrochloride and barium sulphate. The barium sulphate was filtered out and the filtrate contained was treated with ammonia and the bases freed. The cinchonamine being insoluble was filtered out and the solution containing pyridine treated with 2 mols. of bromine. The dibromopyridine thus formed crystallised out freely, proving presence of pyridine in combination.

The fact that cinchonamine sulphate is quite insoluble in benzene prevents the possibility of there being a benzene sulphate similar to the pyridine sulphate.

The Bisulphate is best prepared by dissolving the sulphate completely in a small quantity of water (not exceeding 1 c.c. for each grm. of sulphate) at the temperature of the boiling water-bath, and stirring in a molecular quantity of dilute sulphuric acid, sufficient to convert  $(\text{C}_{19}\text{H}_{24}\text{N}_2\text{O})_2\text{H}_2\text{SO}_4$  into  $(\text{C}_{19}\text{H}_{24}\text{N}_2\text{O})_2\cdot 2\text{H}_2\text{SO}_4$ , approximately 923 parts by volume of dilute acid, to 1000 parts by weight of cinchonamine sulphate. The solution was cooled and masses of somewhat shapeless crystals were obtained on standing. On removing these and placing the mother liquor in a vacuum, large crystals slowly formed which were well defined octahedra, of a somewhat peculiar shape. At first sight they appeared to be cubical, but on closer examination it was found that two adjacent corners were missing in most cases, but in some crystals two diagonally opposite corners were cut off.

1.3617 grm. gave 0.7927 grm.  $\text{BaSO}_4$ ; percentage of  $\text{SO}_3$  obtained, 20.26 per cent.; Hesse, 20.65 per cent. calculated for  $\text{C}_{19}\text{H}_{24}\text{N}_2\text{O}\cdot\text{H}_2\text{SO}_4$ , 20.30 per cent; this author describes the bisulphate, which he obtained, in a similar manner, as hard and anhydrous prisms, and as he does not mention any octahedral formation, his product was probably identical with the first crystallisation obtained above.

**Cinchonamine Picrate.**—On adding a cold aqueous solution of picric acid to a cold aqueous solution of cinchonamine hydrochloride a yellow flocculent precipitate separates out. The completion of the precipitation is very definite (as in the case of silver chloride). When filtered a yellow amorphous powder (cinchonamine picrate) is obtained. The temperature must not be allowed to rise above  $50^{\circ}\text{C}$ ., or the picrate will melt. The salt thus obtained was dried between filter papers and in a desiccator fitted with a vacuum pump until no further loss of weight occurred. On heating this dried product gently, water was evolved, showing that the salt contained water in the molecule. This water was estimated by heating a weighed quantity to  $100^{\circ}\text{C}$ ., until no further loss of weight occurred. 0.2617 grm. of cinchonamine picrate lost 0.0046 grm., or 1.80 per cent.  $\text{H}_2\text{O}$ .

This amount of loss corresponds to half a molecule of water in the composition of the salt—

$\text{C}_{19}\text{H}_{24}\text{N}_2\text{O}\cdot\text{C}_6\text{H}_2(\text{NO}_2)_3\text{OH}\cdot\frac{1}{2}\text{H}_2\text{O}$  = 1.82 per cent.  $\text{H}_2\text{O}$ . Cinchonamine picrate melts at  $54^{\circ}\text{C}$ ., and after giving off the water it contains, forms a thick, mobile liquid which solidifies on cooling into a semi-crystalline gummy mass.

The authors have failed to obtain a crystalline phosphate or quinate, and Arnaud mentions that he has been unable to obtain a crystalline formate, acetate, or oxalate. In all these cases the product has been obtained only in a gummy mass.

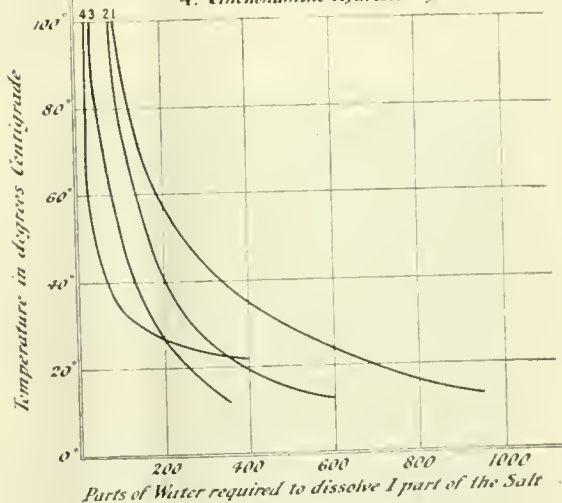
This alkaloid differs very much from the rest of the cinchona group in the extreme insolubility and easy crystallisation of its nitrate, and the great solubility of, and difficulty in obtaining, the sulphate.

With regard to its valency, it has always been found to act as a monad radicle in combination with acids, forming, as described above, only one salt with the halogen acids, and two with sulphuric acid, the normal and acid salts.

Very little light can be thrown on the constitution of the alkaloid from the salts which have been investigated. The authors are now engaged in further work on the cinchonamine derivatives.

### Solubility Curves of Cinchonamine. Halogen Salts.

1. Cinchonamine Hydriodide
2. Cinchonamine Hydrobromide
3. Cinchonamine Hydrochloride
4. Cinchonamine Hydrated Hydrochloride



### DISCUSSION.

Dr. J. C. CAIN said he did not quite follow the advantage of using this base to form the insoluble nitrate as a test for nitric acid. What advantage did it possess over the usual ferrous sulphate test?

Mr. B. F. HOWARD said, in reply, that in certain cases a nitrate which could be readily precipitated might be of use.

### NATURAL GAS IN WESTERN AUSTRALIA.\*

BY E. A. MANN

(Government Analyst and Chief Inspector of Explosives for Western Australia).

Until recently the existence of firedamp was unknown in Western Australia, and strangely enough it made its appearance not in coal mines but in metalliferous

\* Taken as read.

mines. In the Associated Northern Gold Mine, Kalgoolie, on May 14th last, while sinking a diamond drill bore hole from the 1048 ft. level, when the drill reached a depth of 687 ft. a rush of gas occurred which inflamed on contact with a workman's candle, and was with difficulty extinguished. The flow of gas continued in diminishing quantity for about a month and then ceased, work being carried on meanwhile with safety lamps. Samples of the gas collected by the Inspector of Mines were submitted to me and two of the samples gave the following results on analysis:—

*Sample odourless burning with blue flame.*

	1.	2.
Carbon dioxide .....	0.28	0.33
Oxygen .....	5.36	7.70
Methane .....	56.50	42.50
Nitrogen (by difference) .....	37.86	49.47
	100.00	100.00

There was no action by fuming sulphuric acid, cuprous chloride, or palladium black. The absorption by potash after combustion was equivalent to half the contraction. The combustion was effected by an electrically heated platinum spiral.

It is supposed that the occurrence of this gas was in some way connected with the presence of a band of graphite schist in the Kalgoolie formations. The samples analysed are of historic interest as being the first authentic specimens of the gas encountered in Western Australia.

## THE SPIRIT STRENGTH OF ESSENCES.\*

BY E. A. MANN.

Very little information is found in the ordinary textbooks on analysis of food and drugs in connection with the estimation of the true spirit strength of essences and other preparations in which the spirit holds in solution essential oils and other bodies which distil over with the spirit. Owing to the large number of these preparations examined annually in this laboratory, some experiments were made to determine the best and quickest methods of removing the obscuring substances.

Three methods were experimented with:—

1. That of Thorpe and Holmes (this J., 1903. 232). 25 c.c. of sample was taken, 100 c.c. of water added, the whole saturated with common salt, and shaken for five minutes with 70 c.c. of petroleum ether boiling under 60. The aqueous layer was separated and the petroleum ether shaken twice with 25 c.c. of saturated salt solution. The washings were added to the original aqueous solution, and the whole distilled slowly till 100 c.c. had distilled over. Multiply strength of distillate by 4.

2. Allen's method. (Commercial Organic Analysis, 3rd edition, vol. 1., 162.) Sample diluted eight times, calcium chloride and disodium phosphate added, 100 c.c. filtered off and distilled. Spirit strength of distillate multiplied by 8.

3. Method of the Association of Official Agricultural Chemists of America (Bulletin 46, U.S. Department of Agriculture, and "Food Analysis and Inspection" (Leach). Sample diluted four times, 5 grms. magnesium carbonate added, shaken, 100 c.c. filtered off and distilled. Multiply strength of distillate by four.

As Allen's method gives in some instances very dilute distillates, a modification was successfully tried, viz., concentrating the spirit by distillation into half the original bulk.

As a result of the experiments it was found that all the methods gave very concordant results, when the spirit

\* Taken as read.

strength of the distillate was taken with a pycnometer but both the specific gravity balance and Sikes' hydrometer seriously sacrificed accuracy to speed. The American method appears to be preferable in many cases on the score of expedition, but does not in every instance give a clear distillate, and the same objection applies to Allen's method. The latter has been used very successfully for a long time in my laboratory, and the slight opacity sometimes obtained in the distillate does not, in my experience, seriously affect the result. For check purposes, and as a method applicable in all cases, Thorpe's method is undoubtedly the best, but the time necessary is a drawback in a busy laboratory. The use of the American method for ordinary work, and Thorpe's method for check purposes will probably be found an advantage.

## Manchester Section.

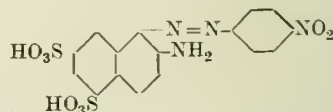
*Meeting held at Manchester on Friday, December 1st, 1905.*

DR. G. H. BAILEY IN THE CHAIR.

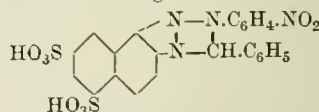
### A NEW INDICATOR.

BY JAMES ROYLE WOODS, B.SC.

If 1 mol. of diazotised *p*-nitraniline is combined with 1 mol. of 2.5.7-aminonaphtholdisulphonic acid, it is known that a substance is formed having the following constitution:—



If now 23 grms. of this compound is boiled with 5.5 grms. of benzaldehyde, 100 grms. of hydrochloric acid (18° B.) and 900 grms. of water, for 15 minutes, the solution becomes colourless, and on cooling a compound crystallises out which has the following constitution:—



I have found that this substance is a very delicate indicator for acid and alkali titrations. It is more sensitive than either phenolphthalein or Methyl Orange, and gives sharper contrast in the colour reaction. In presence of acid the substance is colourless, and in presence of alkali intensely orange.

Another interesting feature is that, by its indication acetic acid can be accurately estimated volumetrically. It is also sensitive to carbonic acid.

## New York Section.

### COKE OVEN GAS.

BY C. G. ATWATER.

(This J., June 15, 1905, pp. 598—599.)

### ERRATUM.

On line 23, col. 1, page 599. for "283,000,000 h.p." read "775,500 h.p."



## Nottingham Section.

Meeting held at Nottingham on Wednesday, November 29th, 1905.

MR. J. M. C. PATON IN THE CHAIR.

### TAINT IN MILK DUE TO CONTAMINATION BY COPPER.

BY JOHN GOLDING, F.I.C., AND ERNEST FEILMANN, B.S.C., PH.D.

On February 2nd, 1905, a sample of milk was brought to the Midland Agricultural and Dairy Institute. The sample was taken from one of many churns which had been from time to time returned from London to Leicestershire with the complaint that a flavour had developed in the milk which was driving away the custom of the retailer. The milk was quite good when sent away, possessed very great keeping qualities, and was not sour when returned. The flavour developed was described as an alkaline mealy flavour, but was not very pronounced, and could not always be detected by persons tasting the milk. Samples of the water and feed-stuffs used were sent for analysis and were followed by several more samples of the milk. On February 8th, one of us went to the farm and took samples into sterile tubes from all the cows, from the milk as it left the cooler, and from the churns in which it was sent to London. The customary advice was given and carried out as to cleaning and disinfecting the cowsheds, &c. The case presented many difficulties, and though the flavour seemed to be due to bacteriological infection after the milk had reached the churns, it could not be produced in other milk, nor could it be developed in sterile milk by any of the many organisms isolated from the samples sent. The milk from the churns developed the flavour, in varying degrees, in about eighteen hours. The trouble was at last traced to the cooler, which was an old one and had much of the tin worn off, exposing the brazing and copper. This cooler even after having been cleaned and boiled for three hours still caused the development of the flavour complained of in samples of milk from different farms which had been run over it. After the installation of a new well-tinned cooler at the farm, there were no further complaints. It was therefore practically proved that the worn cooler was the direct cause of the trouble, but further investigations were needed to clear the matter up.

The first point to investigate was the action of milk on copper. It was also necessary to ascertain if the flavour was due to the copper only, or to the combined action of the copper and other factors. It was found that milk when passed over the cooler took up small quantities of copper (in one case 2.5 parts per million) and though no flavour could ever be detected immediately, the characteristic flavour invariably developed after the milk had stood for about 18 hours at room temperature. Fresh milk (600 c.c.) left standing over a piece of clean copper foil (15 by 11 cms.) for one hour contained 3.5 to 4 parts of copper per million, while copper foil left in milk for 36 hours in an open vessel resulted in a solution of 45 parts of copper per million of milk. It was also found that air greatly aids in the solution of the copper in milk. Clean copper gauze fixed on the surface of some milk in a beaker, and left for one week, resulted in the solution of 121 parts of copper per million, while, in a similar experiment, in which the copper gauze was kept at the bottom of the beaker, only 48 parts of copper per million were found in the milk.

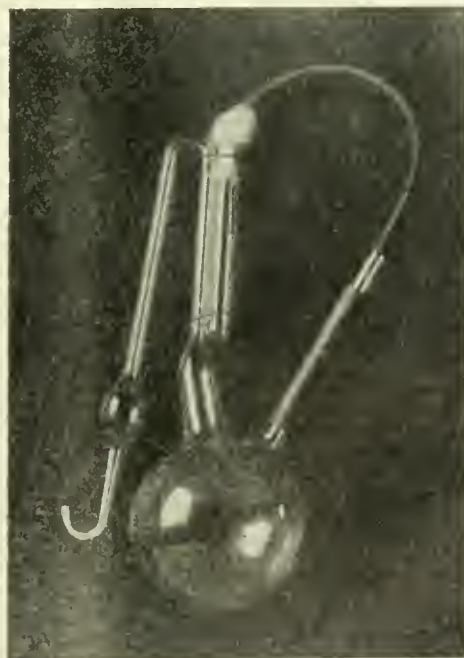
Blowing air through 300 c.c. of milk in contact with 10 grms. of clean copper turnings and leaving the milk in contact with the copper for one week resulted in the solution of 45 parts of copper per million; while in a duplicate experiment, but without air being passed through, 30 parts per million only were dissolved.

In all these cases a similar flavour to the one under investi-

gation developed in 12 to 18 hours; and became more pronounced in the course of a few days. Great keeping properties were also imparted to the milk. In the above-mentioned experiments fresh milk straight from the cow was taken, and clean glass vessels, not dairy utensils, were used. When, however, the milk was run into a vessel containing many lactic ferments no flavour was developed, and the milk went sour. Separated milk containing 0.25 per cent. of lactic acid dissolved 78 parts copper per million with air, and 49 without, in 44 hours. Copper oxide also dissolves in milk in the cold, and the characteristic flavour can develop in such milk. Copper sulphate also when dissolved in small quantities in milk permits of the development of the flavour. The blue colour produced in milk when much copper is in solution from any of the above sources gradually disappears on standing in the open, or on warming, the characteristic flavour becoming very marked. The milk afterwards develops a large number of micro-organisms.

The chemistry of the flavour is still only a matter of speculation, but similar flavours can be produced by other oxidising agents, such as potassium permanganate, ferric chloride and hydrogen peroxide.

*Bacteriological Investigation.*—A large number of organisms were isolated from the different samples of milk which had developed the characteristic flavour; but none of them developed the flavour in milk which had been sterilised by heat. When, however, the influence of the copper had been discovered, the experiments were repeated, and the flavour seemed to be developed by certain organisms, but was rather masked by the well-known taste of the sterilised milk.



In order to test the effect produced in fresh milk taken straight from the cow, two sterile Pasteur flasks were prepared, containing 0.2 grms. and 13 grms. of copper oxide respectively. These flasks were fitted with a milk tube attached to the side tube, so that milk could be taken straight from the cow without coming in contact with the outside air (see figure). The milk having been taken with all precautions, the flasks were removed to the laboratory, and the milk tube replaced by a sterile glass rod. Lengthy experience has shown that milk taken in this way will keep for many months without any heating or chemical treatment. The milk was tasted and

plate cultures were made after two days, six days, and eighteen days, but no mealy flavour had developed, although the copper could be tasted in the flask containing 13 grms. of copper oxide, 118 parts of which had gone into solution per million. In the other flask only about 30 parts per million had gone into solution in 18 days, and the copper flavour could scarcely be detected. Both samples were practically germ free, as shown by plate cultures.

In another experiment of the same kind, no flavour developed in three days, but the flavour had developed strongly in 18 days. Plate cultures, however, revealed the fact that the milk then contained over 100,000 organisms per c.c. Most of them proved to be a yellow, non-liquefying bacillus. A liquefying organism also producing a yellow colour was isolated from the first samples of milk sent for analysis, and this produced the flavour when inoculated into sterile milk containing copper.

The bacteriological investigation of a rather indefinite flavour, which is largely masked in heated milk, cannot be very satisfactory, but it seems certain that micro-organisms are not without influence in some direct or indirect way. It is also clear that if any particular organisms are essential to the production of the flavour they must be very widely distributed, for in all cases where fresh milk exposed to the air was contaminated with copper in our experiments, the flavour developed. It is also certain that the presence of copper is very injurious to the lactic ferments, for, although even when as much as 121 parts of copper were present per million, the milk developed acidity, this only took place after two weeks exposure to the air, in which time all the bluish tinge had vanished. If, however, the milk containing copper was run into a vessel containing many lactic ferments, or even into an ordinary cleaned dairy pail, the flavour did not develop and the milk went sour. This seems to explain the reason why this flavour has not been investigated before and does not seem to be of common occurrence. We have found traces of copper in a sample of milk sold in a town, and we cannot see how such milk can fail to contain small traces of copper when old or untinned coolers are used.

In conclusion, the above experiments clearly show that copper is acted upon by milk, especially in the presence of air, and that small quantities go into solution in the milk (from 1 part to over 100 parts per million). Fresh milk when thus contaminated is very liable to the development of a peculiar mealy flavour in 16 to 18 hours. This flavour seems to be due in part to the development of micro-organisms in the presence of copper, which both checks the development of the lactic organisms and also plays a more direct part in the actual development of the flavour.

The presence of copper from a worn cooler in the case under investigation was the practical cause of the development of the flavour, and the loss and trouble which resulted. There are many points still to be cleared up, but we hope that this paper will serve to arouse interest in the subject.

Our thanks are due to Mr. E. H. Earp, of Staunton Harold, for kindly sending samples of milk &c., for the investigation.

#### DISCUSSION.

Mr. H. DROOP RICHMOND said the taste of milk which led up to this paper had turned up over and over again in recent years. The question was a most important one bristling with difficulties which no one as yet had been able to overcome. He had for some years thought that the taste complained of was not due to copper because it was some time before it came out, but that it was due rather to micro-organisms, but the paper showed that both were active agents. He had succeeded in finding a liquefying micro-organism which he had no doubt was similar to that which the authors had just shown. The taste was chiefly found in milk which had been pasteurised in winter. In the summer it was not so marked. Neither was it so marked in the presence of a large number of lactic organisms. He had succeeded in getting rid of the taste by finding out where the organisms existed. He kept all

the vessels used thoroughly clean, and all the copper utensils were re-tinned when necessary; these precautions had got rid of the taste. By exposing various metals and alloys to the action of milk, all those which contained copper lost weight to extent that agreed with the quantity that the authors had found. The greatest action took place in the case of copper, but he had found the taste present when silver had been used. The paper had cleared up many points of great importance to the milk industry, and he highly appreciated it.

Mr. J. T. WOOD said it seemed to him that the development of the taste might to some extent be explained by the fact that a small amount of copper stimulated the development of certain organisms which did not develop in milk in which no copper was present. A similar case occurred with phenol, very minute quantities of which in solution excited the growth of certain organisms towards which in slightly larger quantities it acted as a powerful antiseptic.

Mr. S. R. TROTMAN called attention to a metallic haze that sometimes occurred in beer, and in which the metal had been found to be a combination with albuminoid. He inquired if the authors had tried the experiments with casein free milk.

Mr. A. L. HIND asked if any experiments had been made as to the action of milk on tin, for he had been informed that it was that metal which gave rise to trouble when using tinned copper vessels with other liquids (beer).

Professor F. S. KIPPING said he wondered why tin was put on the copper at all, unless because it was known that copper was attacked by milk. It seemed to him that the fact that milk acted upon copper was not one which should cause surprise, considering that the milk and copper were brought together in presence of atmospheric oxygen, and it was well known that under such conditions copper was readily acted upon by dilute solutions of salts, acids and alkalis.

Mr. J. GOLDING pointed out that in the winter months the action of the lactic ferments was not so great as in the warm weather, and that, therefore, the flavour-producing organisms would have a better chance of growing. One reason why the tin had gone from the copper was because of continual scrubbing with a hard brush and soda. The milk had been complained of in London as being chalky, and sticking to the glass, as well as having the unusual flavour. They had tried running albumin only over the cooler, but the solution of the copper seemed to be due entirely to the other constituents of the milk, constituents which were not present in beer. The extent to which copper was dissolved in water only was not determined in these experiments, but it was proved that the water and also some of the milk constituents in solution would not dissolve enough copper to be detected by the methods used. He thought that the milk had comparatively little action on tin. When the cooler was all tin there was no flavour produced. It was believed to be the lactic bacteria which caused the non-development of the particular organisms which caused the development of the flavour of the milk. It must have been noticed before that copper had some action on milk, otherwise the coolers would not have been tinned. He did not go so far as to say that the small quantity of copper discoverable had a very injurious effect on people consuming the milk, but at the same time it was a thing to be on the watch against and to prevent if possible. The flavour also was not a very disagreeable one, still it was not a desirable taste to have in milk, and had been the cause of much loss and trouble in the case which had been investigated.



## Yorkshire Section.

*Meeting held at Queen's Hotel, Leeds, on Monday, November 6th, 1905.*

PROF. SMITHELLS IN THE CHAIR.

### THE OXIDATION OF OILS.

#### PART I.

BY H. R. PROCTER AND W. E. HOLMES.

(Contribution from the Leather Industries Laboratory of the University of Leeds).

The experiments which are described in the following paper were undertaken partly with a view to elucidate the chemical changes which take place when oils are oxidised by blowing air through them in a heated condition, and partly in the hope that distinctive curves of change would be obtained of a character useful in recognising different oils, alone, or in mixture with each other. A full discussion of the theoretical bearing of the observations made is hardly possible without further experimental work, and somewhat tedious calculation of results; but may possibly be dealt with in a second paper. Although the expectation of distinctive curves has only been partially fulfilled, certain characteristic differences have been observed, and the behaviour of the various oils is sufficiently interesting to be worth recording without delaying until a more complete discussion is possible.

The method of experiment which was finally adopted was to place 100 c.c. of each of the oils in a large test-tube placed in a water-bath, air being continuously blown through the heated oil by means of a water-pump, and samples being taken at regular intervals for examination. Four samples were generally blown at the same time.

The only detail of the apparatus which is worthy of special description, is the method adopted in order to prevent frothing, which, in the later stages of blowing, is sometimes very troublesome. Near the surface of the oil, and some little distance below the top of the test-tube, a perforated cork was fitted, through which the air-tube was passed, and in addition two small tubes open at both ends, of one of which the lower end was immersed in the oil, and served as a means of conveying oil from the broken froth back into the lower part of the tube, while the second tube did not project below the cork, but was drawn out to an almost capillary point above, through which the froth, if it formed, was obliged to force its way. In coming out through the orifice of this tube the bubbles are burst by the slight difference of pressure and by being drawn out, and the oil collecting upon the cork settles back through the tube first mentioned. The apparatus proved quite effective, though slight trouble was experienced with some very viscid oils with which it became necessary occasionally to interrupt the blowing and break the bubbles with a glass rod.

Of course, it would be desirable that the air-supply should be exactly regulated, and of measured volume, and that the bubbles should be of the same size and number in each case; but to secure these conditions would be extremely difficult, and would have too far complicated experiments which were only intended to be preliminary. In the beginning of the research some samples were blown at a temperature of 60° C. instead of 100°, and the constants of gravity and refractive index were measured at the same temperature. It was, however, found easier, and on the whole more satisfactory, to blow at boiling temperature (at the elevation of the University slightly below 100° C.) and to determine the constants at 15° C., which was about the laboratory temperature.

Without exception, on blowing any oil, the gravity and the refractive index increase as oxygen is absorbed, and at the same time the iodine value, which is a measure of unsaturated linkages, diminishes as these become saturated with oxygen. In no case, however, was it found that in 24 hours' blowing the oil at all approached complete

saturation, and even in commercial-blown and oxidised oils the iodine value shows that saturation is far from total.

The gravity of the oils before and during blowing was taken in a small Sprengel tube, in order to limit, as far as possible, the amount of oil which was withdrawn, and after completing the weighing, the oil used was returned to the bulk in the blowing apparatus as soon as possible.

The refractive index was measured with a Zeiss refractometer (large model) in which the refractive index is read direct on a graduated sector, as figured in Lewkowitsch's "Oils, Fats and Waxes," 2nd edition, page 191. In the ordinary butter-refractometer the prisms are permanently adjusted so as to be achromatic for butter-fat and some other fats such as neatfoot oil, which are of similar dispersion, but many other oils show coloured fringes by white light, sometimes red, sometimes blue, so that sharp readings can only be obtained by the use of a monochromatic soda-flame. In the "large model" instrument a movable compensating prism is provided, by which it can be achromatised for any oil, so that white light can always be used, and from the compensation required the dispersion of the oil (*i.e.*, the difference between the refractive indices for the red C and the blue F line) can be calculated. As, however, the calculation is somewhat tedious, and no important object seemed to be served for the present in giving the absolute dispersions, the observed scale-numbers have been used throughout the series of experiments, but can, of course, at any time be calculated to absolute figures, using the table which Messrs. Zeiss supply with the instrument. It was hoped that marked differences would be observed in different oils, capable of being used in their recognition, but in most cases, the dispersions were almost identical, varying from about 39 to 40 scale-divisions, and either remaining constant during blowing, or rising one or two scale divisions as oxidation proceeded.

The iodine value was determined in all cases by the Hanús method, in which a solution of iodine bromide in glacial acetic acid is employed as the oxidising agent, and this was allowed to act on the oil for one hour, so as to make quite certain of the iodisation, most oils being completely iodised by this method in about ten minutes. The method was found rapid and convenient in use, and very constant in its results, which are somewhat higher than those of Hübl's original method, and slightly lower as a rule than those of Wijs.

Apart from the more theoretical conclusions, which it may be possible to draw later, there are certain practical aspects of the work to which attention may be drawn, though in generalising from so limited a number of experiments, the great difficulty of securing absolutely pure and typical oils, and the possibilities of experimental error must be steadily kept in mind. As regards the former of these points, however, we have good reason to believe in the authenticity of our samples, and our special thanks are due to Mr. W. S. Corder, who supplied us with samples of various fish and fish-liver oils, extracted under his personal supervision, and to Mr. G. W. Slatter, who provided us with samples of several other oils.

Inspection of the tables representing experimental results, leads at once, as was to be expected, to the conclusion that the process of oxidation is a somewhat complicated one. An interesting peculiarity which is striking in several oils (especially Moeller's cod-liver, and pale seal) is that the iodine value remains practically unaffected during the first three or four hours of blowing, though the rise of gravity and refractive index shows that oxygen is being absorbed. This, of course, indicates that the unsaturated linkages which are measured by the iodine absorption are still unopened, and that the oxygen is temporarily retained merely in solution, or in some other way than direct linking on the carbon chain. Usually, when the drop in the iodine value does set in, it proceeds rapidly for a time, as if the oxygen previously absorbed now took its place in the broken linkage. In other cases, as in castor oil, little or no change takes place in any of the constants during the first three hours of blowing, while in the second three it is relatively rapid, reminding of the oxidation of oxalic acid with permanganate, which at first is sluggish, and afterwards very rapid. These peculiarities

seem, as far as can be judged from the limited number of examples before us, to be rather characteristic of the particular sample than of the class of oil, and it may be obviously suggested that it depends on the degree of previous oxidation which the oils have undergone during manufacture or storage.

It is also obvious that, though in general terms it may be stated that the rise of gravity and refractive index, and the fall of iodine value proceed *pari passu*, they do not actually depend on the same chemical or physical change in the fat, since any one of them may increase for a time while another remains nearly or entirely stationary. It is very probable that the calculation of molecular refractions, or even of the "refractive constant,"\* will throw some light on the nature of the changes which actually occur.

If we could assume that the reaction of oxidation was a simple one, taking place in a liquid of uniform constitution, which only changed by the conversion of the original fat into some constant oxidation-product, the curves obtained should obviously, according to the law of mass-action, be of a hyperbolic character, increasing or diminishing rapidly, so long as the oxidation-product formed only a small part of the mixture, and gradually approaching, but never reaching, a horizontal direction and a constant value. Kinks and irregularities such as actually occur can be explained in two ways. Firstly, if an oil (such as olive) consists mainly of olein, with a small percentage of some less saturated fat, say, the triglyceride of linoleic acid, we should expect that, once reaction had set in, the change would be rapid at first, till the whole or the greater part of the more oxidisable fat had been consumed, and should then proceed more nearly as the oxidation of the olein continues. Curves which suggest this frequently occur, as they must do, in oils containing a mixture of fats of different oxidisability. The second, and also probable explanation may be that in unsaturated fats the oxidation proceeds in successive stages, one linkage being attacked after another with different degrees of resistance, or linkages at first hydroxylated becoming oxidised with elimination of water. Polymerisation also undoubtedly takes place, varying the refraction and gravity, but probably not affecting the iodine value, or perhaps the refractive constant, in which the natural relation between refractive power and density is taken into account. At least it may be assumed that an abrupt change in the direction of any curve indicates a corresponding change in the course of the reaction, though it may be hard to ascertain its exact character.

It is already possible from the values and forms of the curves to distinguish very definitely between the more and the less oxidisable oils; and it is probable that, with systematic experiment, a curve might be drawn for any oil, serious deviations from which would indicate adulteration, and perhaps point to its character. It is also probable that such experiments would give useful information in processes which depend on oil-oxidation, such as oil-boiling, linoleum making, and chamoising and the manufacture of dégras; and might throw light on the liability of certain oils to "spic" or resinise when used for currying. It would probably be desirable to carry on the oxidising process for more than 24 hours in many cases, or to increase its intensity by using oxygen instead of air, or by the employment of higher temperatures. Thus in the case of the olive oil examined, changes in the direction of the curve between 21 and 24 hours indicate a change in the character of the oxidation which might have become more marked if the experiment had been carried further; and some of the other curves suggest the same idea.

As regards the changes in dispersion, and its amount, nothing with regard to its bearing on structure can at present be stated, but small as its variations are, they may, in some cases, prove useful in the identification of an oil. So far as can be judged from the oils examined, linseed, and a few of the liver-oils, alone have dispersions less than 40 scale-divisions, and the dispersion always tends to rise

as the iodine value falls on oxidation, so that it may be suggested that it is in some way dependent on unsaturated linkages.

The only oil in which the dispersion is notably high is the whale oil, of which the constants are given in Table IX., of which the original dispersion was 44.5, rising on blowing to 47.5, the other constants being quite normal. The refractive indices and dispersions of three other whale oils given in Table XX. are very constant, beginning at 39.9—40.0, and ending in all cases at 40.8, so that it is evident that high dispersion is not a usual characteristic.

All the oils were blown at 100° C., and the determinations taken at 15° C.

TABLE I.—*Skate Liver Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.926	1.4830	0.3084	39.6	187.0
3	0.926	1.4830	0.3084	39.6	185.0
6	0.926	1.4830	0.3084	39.6	180.0
9	0.927	1.4831	0.3081	39.6	174.0
12	0.929	1.4834	0.3076	39.8	167.0
15	0.929	1.4835	0.3077	39.8	163.0
18	0.930	1.4837	0.3075	39.8	162.0
21	0.933	1.4840	0.3066	39.8	160.0
24	0.937	1.4843	0.3055	39.8	159.0

TABLE II.—*Moller's Cod Liver Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.924	1.4814	0.3082	39.5	163.0
4	0.934	1.4819	0.3057	39.7	163.0
8	0.937	1.4825	0.3045	39.7	139.5
12	0.940	1.4831	0.3039	39.7	131.5
16	0.952	1.4836	0.3003	39.9	127.0
20	0.963	1.4847	0.2975	40.0	122.0
24	0.969	1.4848	0.2957	40.1	117.0

TABLE III.—*Cod Liver Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.930	1.4812	0.3061	39.7	156.0
3	0.930	1.4815	0.3062	39.7	155.0
6	0.935	1.4820	0.3048	39.8	152.0
9	0.937	1.4820	0.3042	39.8	151.0
12	0.938	1.4825	0.3042	39.9	150.0
15	0.940	1.4827	0.3037	39.9	148.0
18	0.943	1.4828	0.3028	39.9	145.0

TABLE IV.—*Cod Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.923	1.4810	0.3083	39.6	154.0
3	0.928	1.4813	0.3063	39.6	143.0
6	0.928	1.4815	0.3069	39.7	148.0
9	0.928	1.4819	0.3071	39.9	146.0
12	0.930	1.4819	0.3065	40.0	144.0
15	0.930	1.4820	0.3065	40.1	143.0
18	0.931	1.4822	0.3063	40.1	143.0
21	0.932	1.4827	0.3062	40.1	142.0
24	0.934	1.4828	0.3057	40.1	141.0

TABLE V.—*Coal Fish Liver Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.921	1.4786	0.3077	39.7	153.0
3	0.921	1.4787	0.3077	39.7	151.0
6	0.921	1.4788	0.3078	39.7	146.0
9	0.922	1.4788	0.3075	39.7	141.0
12	0.923	1.4788	0.3071	39.9	136.0
15	0.923	1.4789	0.3071	39.9	136.0
18	0.924	1.4790	0.3069	39.9	135.0
21	0.927	1.4792	0.3060	39.9	134.0
24	0.931	1.4794	0.3048	39.9	130.0

\* This has been done since the reading of the Paper, and the refractive constants according to the Lorenz formula  $\frac{N^2-1}{N^2+2d}$  have been inserted in the tables, but their discussion is deferred to a future paper.



TABLE VI.—*Herring Refuse Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.923	1.4784	0.3060	40.0	146.0
3	0.923	1.4784	0.3060	40.0	143.0
6	0.924	1.4785	0.3066	40.1	142.0
9	0.925	1.4786	0.3063	40.1	141.0
12	0.926	1.4790	0.3062	40.1	138.0
16	0.927	1.4795	0.3063	40.1	136.0
18	0.928	1.4795	0.3059	40.2	132.0

TABLE VII.—*Fresh Herring Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.923	1.4780	0.3067	40.0	145.0
3	0.923	1.4781	0.3067	40.0	145.0
6	0.923	1.4784	0.3069	40.1	141.0
9	0.926	1.4790	0.3062	40.1	135.0
12	0.927	1.4705	0.3061	40.1	133.0
15	0.930	1.4800	0.3055	40.1	132.0
18	0.932	1.4805	0.3049	40.2	130.0

TABLE VIII.—*Pale Seal Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.932	1.4795	0.3045	39.9	121.5
4	0.944	1.4798	0.3009	39.0	121.5
8	0.955	1.4800	0.2975	40.0	105.5
12	0.956	1.4808	0.2976	40.2	100.0
16	0.961	1.4815	0.2964	40.3	96.5
20	0.964	1.4820	0.2957	40.6	94.5
24	0.968	1.4820	0.2945	40.7	91.5

Saponification value = 216.0.

TABLE IX.—*Whole Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.933	1.4762	0.3024	44.5	121.0
4	0.936	1.4765	0.3016	46.2	112.0
8	0.937	1.4766	0.3013	46.3	97.5
12	0.948	1.4767	0.2978	46.9	89.0
16	0.949	1.4770	0.2978	47.0	87.0
20	0.950	1.4773	0.2976	47.4	86.0
24	0.950	1.4773	0.2976	47.5	86.0

In the dispersion after oil has been blowing 16 hrs. to 24 hrs. it is almost impossible to get a proper or definite dividing line.

TABLE X.—*Shark Liver Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.910	1.4750	0.3094	40.0	120.0
3	0.911	1.4752	0.3092	40.0	119.0
6	0.911	1.4752	0.3092	40.0	117.0
9	0.912	1.4754	0.3089	40.0	111.0
12	0.913	1.4759	0.3089	40.1	110.0
15	0.913	1.4760	0.3089	40.1	108.0
18	0.913	1.4760	0.3089	40.1	105.0
21	0.913	1.4760	0.3089	40.1	104.0
24	0.916	1.4762	0.3080	40.1	103.0

TABLE XI.—*Arctic Sperm Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.885	1.4670	0.3135	40.5	80.0
3	0.887	1.4672	0.3130	40.5	76.0
6	0.887	1.4672	0.3130	40.5	76.0
9	0.887	1.4673	0.3130	40.6	76.0
12	0.887	1.4673	0.3130	40.6	74.0
15	0.888	1.4675	0.3131	40.6	74.0
18	0.890	1.4676	0.3121	40.6	73.0
21	0.891	1.4677	0.3118	40.6	71.0
24	0.892	1.4677	0.3115	40.6	71.0

TABLE XII.—*Linseed Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.932	1.4825	0.3062	39.5	174.0
3	0.933	1.4826	0.3058	39.5	171.0
6	0.935	1.4827	0.3053	39.5	168.0
9	0.935	1.4827	0.3053	39.5	162.0
12	0.936	1.4830	0.3051	39.5	157.0
16	0.936	1.4831	0.3052	39.6	156.0
18	0.936	1.4836	0.3054	39.6	155.0
21	0.942	1.4840	0.3037	39.6	151.0
24	0.944	1.4843	0.3032	39.6	151.0

TABLE XIII.—*Linseed Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.930	1.4817	0.3064	39.6	164.5
4	0.932	1.4820	0.3059	39.6	164.0
8	0.933	1.4820	0.3054	39.6	158.0
12	0.934	1.4827	0.3037	39.6	147.5
16	0.940	1.4834	0.3040	39.7	145.0
20	0.942	1.4840	0.3037	39.8	140.5
24	0.943	1.4840	0.3034	39.8	139.5

TABLE XIV.—*Refined Rape.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.911	1.4748	0.3090	40.0	102.0
3	0.913	1.4749	0.3083	40.0	97.0
6	0.913	1.4750	0.3084	40.0	94.0
9	0.913	1.4750	0.3084	40.0	90.0
12	0.913	1.4751	0.3084	40.0	89.0
15	0.914	1.4754	0.3083	40.0	89.0
18	0.915	1.4756	0.3080	40.0	88.0
21	0.919	1.4756	0.3067	40.0	87.0
24	0.922	1.4758	0.3058	40.0	86.0

TABLE XV.—*Cotton-seed Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.920	1.4745	0.3058	40.0	106.0
3	0.926	1.4745	0.3038	40.0	105.0
6	0.926	1.4746	0.3038	40.0	98.0
9	0.926	1.4750	0.3039	40.0	97.0
12	0.927	1.4751	0.3038	40.0	97.0
15	0.929	1.4752	0.3032	40.0	96.0
18	0.929	1.4757	0.3034	40.0	94.0
21	0.931	1.4758	0.3028	40.0	94.0
24	0.936	1.4759	0.3013	40.0	94.0

TABLE XVI.—*Olive Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.912	1.4695	0.3056	40.1	86.0
3	0.913	1.4696	0.3054	40.1	86.0
6	0.913	1.4697	0.3054	40.1	82.0
9	0.913	1.4698	0.3055	40.1	80.0
12	0.913	1.4699	0.3055	40.1	80.0
15	0.914	1.4700	0.3053	40.2	79.0
18	0.914	1.4700	0.3053	40.2	79.0
21	0.915	1.4700	0.3049	40.2	79.0
24	0.918	1.4701	0.3040	40.2	76.0

TABLE XVII.—*English Pressed Castor Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.958	1.4800	0.2965	40.3	83.0
3	0.958	1.4800	0.2965	40.3	83.0
6	0.958	1.4802	0.2967	40.3	74.0
9	0.958	1.4804	0.2967	40.3	73.0
12	0.961	1.4804	0.2958	40.3	72.0
15	0.962	1.4805	0.2956	40.3	71.0
18	0.965	1.4805	0.2946	40.3	71.0
21	0.966	1.4806	0.2944	40.3	69.0
24	0.967	1.4807	0.2941	40.3	68.0

TABLE XVIII.—*Australian Oleine.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.892	1.4620	0.3082	40.1	88.0
3	0.892	1.4620	0.3082	40.1	87.0
6	0.893	1.4620	0.3079	40.1	84.0
9	0.894	1.4622	0.3076	40.2	84.0
12	0.895	1.4623	0.3073	40.2	82.0
15	0.895	1.4623	0.3073	40.2	77.0
18	0.896	1.4624	0.3070	40.2	74.0
21	0.897	1.4626	0.3068	40.2	74.0
24	0.900	1.4628	0.3059	40.2	73.0

TABLE XIX.—*Lard Oil.*

Blown.	Sp. Gr.	Ref. Ind.	Ref. Const.	Disp.	I. Value.
Hrs.					
0	0.914	1.4697	0.3051	40.0	78.0
3	0.917	1.4699	0.3042	40.1	76.0
6	0.917	1.4700	0.3043	40.2	75.0
9	0.917	1.4705	0.3045	40.2	72.0
12	0.918	1.4707	0.3043	40.2	72.0
15	0.920	1.4708	0.3037	40.2	71.0
18	0.923	1.4709	0.3028	40.2	67.0
21	0.923	1.4710	0.3028	40.3	67.0
24	0.925	1.4713	0.3023	40.4	66.0

TABLE XX.—*Whale Oils. Filtered.*

Blown.	No. 1.		No. 2.		No. 3.	
	Ref. Ind.	Disp.	Ref. Ind.	Disp.	Ref. Ind.	Disp.
Hrs.						
0	1.4740	40.0	1.4740	39.9	1.4732	39.9
3	1.4751	40.1	1.4744	40.0	1.4740	40.0
4	1.4752	40.2	1.4745	40.3	1.4740	40.0
5	1.4753	40.2	1.4747	40.3	1.4750	40.2
6	1.4758	40.3	1.4748	40.4	1.4755	40.3
7	1.4760	40.4	1.4750	40.5	1.4757	40.5
8	1.4762	40.5	1.4754	40.5	1.4759	40.6
9	1.4763	40.5	1.4756	40.5	1.4761	40.6
10	1.4765	40.5	1.4756	40.5	1.4763	40.6
11	1.4768	40.7	1.4757	40.6	1.4768	40.6
12	1.4770	40.7	1.4758	40.6	1.4770	40.7
13	1.4770	40.7	1.4760	40.6	1.4770	40.7
14	1.4771	40.7	1.4760	40.6	1.4771	40.7
15	1.4773	40.7	1.4761	40.7	1.4773	40.7
16	1.4773	40.7	1.4761	40.7	1.4773	40.7
17	1.4773	40.8	1.4762	40.7	1.4773	40.7
18	1.4774	40.8	1.4763	40.7	1.4774	40.7
19	1.4779	40.8	1.4765	40.8	1.4776	40.8
20	1.4780	40.8	1.4765	40.8	1.4776	40.8
21	1.4780	40.8	1.4765	40.8	1.4776	40.8
22	1.4752	40.8	1.4765	40.8	1.4777	40.8
23	1.4782	40.8	1.4765	40.8	1.4777	40.8
24	1.4782	40.8	1.4765	40.8	1.4777	40.8

## DISCUSSION.

Mr. F. W. RICHARDSON said he was specially interested in Prof. Procter's paper as he had done somewhat similar work on the same subject, although not going so far as to attempt to obtain curves. He would like to have heard some mention made about the effect of blowing on the viscosities of the oils. Personally, he found the refractive index agreed with the change in viscosity, and in later experiments he had only thought it necessary to determine the former constant. By using a piston worked by an electric motor with blower, and exposing the oils in a fine layer on a tray, he had been able to improve his method, so that the same result could now be obtained in 10 minutes which formerly required 10 hours. In this case, it was only necessary to use about 5 c.c. of the oil. Other data in the paper seemed to indicate polymerisation, and consequent increase in the refractive indices, specific gravities, &c. Had Prof. Procter tried the dispersion refractometer?

Mr. T. FAIRLEY said that in some recent work he had used oils which were, he believed, extracted by a process in which solvents were used in place of the older methods

of crushing and pressing. He thought, for instance, that rape oil was often now extracted with light petroleum. He would like to ask what effect rise of temperature had on the range of the refractive index. In explanation of the obscure chemical changes which were brought about by the blowing, he suggested that possibly acrolein or other aldehydes were produced in the oil. The tendency of such bodies to polymerise might account for the increased specific gravity.

Mr. F. W. BRANSON said that, from his experience of the manufacture of cod liver oil, it was possible to produce an oil of superior quality without an atmosphere of carbon dioxide, if the extraction were carried on rapidly and at a suitable temperature. Could Prof. Procter give any suggestions for differentiating between genuine cod liver oil and the same when mixed with a moderate proportion of other fish liver oils?

Prof. A. G. GREEN asked if the blowing brought about any saponification. If water took part in the reaction then this seemed probable. He had noticed cases in which hydrogen peroxide produced saponification, and perhaps something of this nature took place in the oils under consideration. It seemed possible that aldehydes might be formed by direct oxidation of double bonds. There was a tendency for unsaturated compounds to be split up, and to give two simpler aldehydes, which might possibly be ultimately further condensed. Was any glycerin eliminated in the process?

Mr. J. E. BEDFORD in his practical experience had found that the oxidation of oils for use in the manufacture of linoleum, and the conversion of linseed oil to the solid state, were accompanied by fall of iodine value and rise of specific gravity. He had also noticed the slow progress of the reaction at first, and the rapid development after a certain point was passed. Brin's patent oxygen plant had been used initially to supply the pure gas, but better results were afterwards obtained by the employment of more dilute oxygen or of air, probably because the nitrogen would sweep out acrolein, glycerin, and other objectionable by-products. To oxidise oils he recommended the "atomising" process instead of blowing, as the oxygen was thus brought into more intimate contact with the particles of oil. He thought polymerisation took place more readily in absence of oxygen and by simple application of heat.

Mr. H. WATSON asked if there was any difference between the volumes of the oils before and after oxidation, or if the increased specific gravity was due solely to chemical changes.

Prof. A. SMITHELLS wished to know if any special precautions had been taken to exclude moisture.

Prof. H. R. PROCTER, in reply, said that it would have been interesting to note the viscosities of the oils operated upon. This would, however, have interfered with the progress of the experiments, since large volumes of oil were required for these determinations. He believed it to be correct that the refractive index varied approximately in the same ratio as the viscosity. On blowing, all oils become more viscous and less soluble in liquids like petroleum ether, but more soluble in absolute alcohol. He was obliged for the suggestion of a piston for the blowing, and the "atomising" method might be good. Speed was not required in his case, however, as it took a considerable amount of time to carry out the other experiments on the oils at the various stages of the process. With regard to new methods of extraction, he thought less viscous oils were more readily expressed than viscous ones, and oxidised oils had different solubilities. Consequently, an oil extracted by crushing and pressing or steam would be very different from one obtained by the use of solvents. Increase in specific gravity was most likely due to absorption of oxygen, but how far polymerisation affected it, was difficult to say. Mr. Branson said that it was unnecessary to have an atmosphere of carbonic acid gas in the case of cod liver oil, if extraction were carried out rapidly at suitable temperatures. He would point out, however, that most careful exclusion of oxygen was necessary, since bodies might be formed which would



cause unpleasant taste or rancidity in the oil. He believed it would not be so difficult as was usually thought to differentiate between cod and other fish liver oils, if the method of obtaining curves was used. In answer to Prof. Green, he said that even if glycerine was produced in these oxidations, they had not attempted to determine it. A large amount would spoil the refractometer readings, by obscuring the sharpness of the division between the dark and light parts of the field, and this effect had been observed in some cases. It had been shown that bodies of an aldehydic nature, such as acrylic aldehyde, were formed by oxidation of oils on skin, as in the preparation of chamois leather, and Mr. A. G. Perkin had observed the formation of higher aldehydes, such as were suggested by Prof. Green, in the oxidation of linseed oil. The very high iodine value of Möller's cod liver oil, as compared with medicinal oils extracted in the ordinary way, seemed to indicate that in the latter case, considerable oxidation

had occurred. He was aware of the fact that polymerisation took place in absence of air, but his present object was not to study polymerisation. It was impossible to measure the volumes of the oils, so no information could be given as to the effect of blowing in this direction. No special precautions were taken to dry the samples, which were known to contain only a small proportion of water.

Mr. FAIRLEY showed a number of lantern slides illustrating the early history of distillation in this and other countries. The process of distillation was not invented by the Arabians, but was conveyed by them from the East where it has been practised from the earliest times. It may have been discovered independently in various countries, but the earliest evidence relating to it comes from China, Hindustan and adjacent countries.

In the British Islands, the knowledge probably came direct into Ireland from the East.

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### I.—PLANT, APPARATUS, AND MACHINERY.

(Continued from page 1218.)

#### ENGLISH PATENTS.

*Vacua; Production of High —, and Cooling by Evaporation.* C. A. Parsons, Newcastle on Tyne. Eng. Pat. 14,042, June 21, 1904.

SEE Fr. Pat. 355,181 of 1905; this J., 1905, 1162.—T.F.B.

*Presses for Expressing Liquids; Impts. in —.* J. Macgregor and G. C. Pearson, Old Charlton, Kent. Eng. Pat. 28,456, Dec. 27, 1904.

Two or more vertical cylinders are rotated eccentrically one within the other, so that the space between the cylinders is wider on one side than on the other. The material to be pressed is fed in at the widest side and is carried round and compressed, being removed by a scraper from the point at which the cylinders approach nearest to one another. If desired, the material under treatment may be submitted to the action of the electric current, by connecting the poles of a source of electric current to the inner and outer cylinder respectively.—W. H. C.

*Scale in Boilers; Means and Method for Removing and Preventing the Formation of —.* I. Klean and F. Laska, Vienna. Eng. Pat. 645, Jan. 12, 1905.

A PERFORATED vessel charged with pieces of red oak bark is suspended in the boiler. The matters extracted from

the bark by the boiling water loosen any scaly deposit already formed on the sides of the boiler and prevent further incrustation. The vessel is removed from the boiler after a time and re-charged as occasion may require. (Reference is directed, under The Patents Act, 1902, to Eng. Pat. 10,423 of 1885; this J., 1886, 454.)

—W. P. S.

*Drying Gelatin, Glue, Paste Goods, Brewer's Grains, Bricks, Woods, Metal Articles and the like; Apparatus for —.* O. Koepff, Goepfingen, Germany. Eng. Pat. 5748, March 18, 1905.

THE invention relates to drying apparatus in which the material to be dried is placed on trays or "hurdles," which are moved alternately backwards and forwards in tiers in a drying chamber. As the trays reach the end of each tier, they are lifted vertically to the tier above, by endless chains, having projections which engage with the trays, or by cranks attached to vertical shafts. By an arrangement of cams and guide rollers, the lateral movement is arrested, and the ropes carrying the trays are displaced, so as not to interfere with the lifting.

—W. H. C.

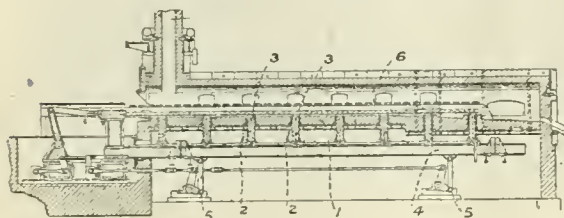
*Separators; Impts. in Centrifugal Liquid —.* C. W. Dawkins, London. From Massey-Harris Co., Ltd., Toronto, Canada. Eng. Pat. 7495, April 8, 1905.

"A LINER for centrifugal liquid separators" is formed by a series of superimposed discs shaped like frustrums of hollow cones. The upper edges of the discs are scalloped and their upper surfaces are provided with a number of

helical ridges forming helical channels between the discs. The liquid is fed from above through holes in the top of the upper disc and it is distributed by vertical channels passing down within the central hollow space.—W. H. C.

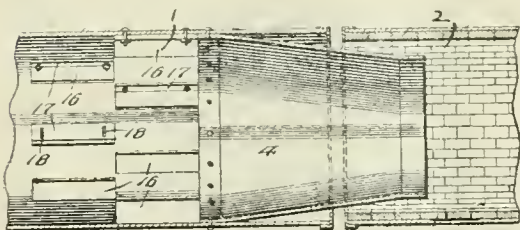
#### UNITED STATES PATENTS.

*Furnace; Heating* — C. P. Turner, McKeesport, Pa. U.S. Pat. 805,041, Nov. 21, 1905.



THE furnace consists of a stationary floor 1, provided with openings 2, 2, through which the plungers 3, 3 pass. An upward and downward motion is imparted to the plungers 3, 3, which are attached to the girder 4, by means of the "bell-cranks" 5, 5. The material to be treated is carried on the horizontally moving support 6. —W. H. C.

*Kiln; Rotary* — J. H. Logan and W. H. Simmons, Fenton, Mich. U.S. Pat. 805,213, Nov. 21, 1905.



THE kiln is formed of two cylinders 1 and 2 arranged in line. The material is fed into the first, which is provided with the agitators 16, 17, 18, and is delivered into the second, from the further end of which it is discharged, when the treatment has been completed. The end 4 of the cylinder 1 is tapered and extended into the second as shown, and the two cylinders can be rotated at different rates of speed.—W. H. C.

#### FRENCH PATENTS.

*Vacuum; Process for Producing and Maintaining* — Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude) and A. J. Levy. Fr. Pat. 350,205. Oct. 4, 1904.

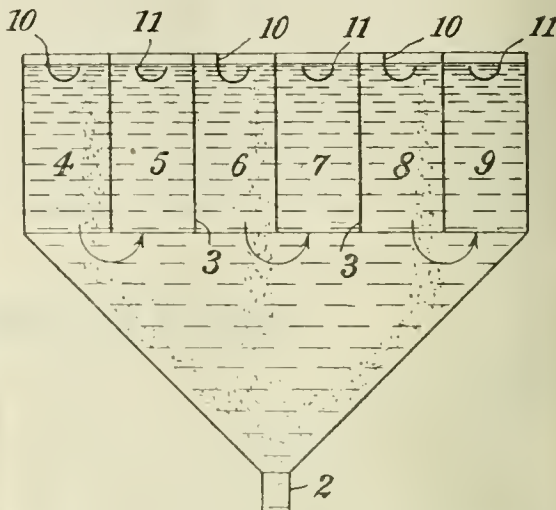
THE process consists in successively connecting the vessel in which a vacuum is desired, to a number of vessels containing an absorbent for the gas, such as charcoal. The absorbing vessels are cooled by being plunged into liquid air or some other suitable refrigerant. When the first absorbing vessel has abstracted as much gas as possible, it is shut off and the next connected, and so on, until the required degree of exhaustion has been attained. The absorbing vessels and their contents may be used several times without being heated, to drive off the absorbed gas, if they are kept in the cooling liquid and used in a systematic order. Claim is also made for maintaining the vacuum in double-walled vessels, by the use of an absorbent, contained in a pocket in communication with the space between the walls, which absorbent is cooled by the liquefied gas contained in the inner space.—W. H. C.

*Separator; Continuous Centrifugal* — E. Pautet. Fr. Pat. 350,225, Oct. 14, 1904.

THE liquid is fed on to horizontal discs having undulating edges which are enclosed in a flattened drum, the whole being rotated by a shaft. The denser portions are thrown

to the inside of the cylindrical walls of the drum, where they are pulverised by an iron ball which is kept to the side of the drum by electro-magnets fixed on the rim. —W. H. C.

*Separation of Bodies in Suspension in Liquids; Process for* — C. Hannig. Fr. Pat. 356,522, July 29, 1905.



THE liquid to be clarified is fed by the gutters 10 into the spaces 4, 6, 8, and after passing below the partitions 3, rises through the spaces 5, 7, 9 and overflows by the gutters 11. By the use of the gutters for the introduction and withdrawal of the liquid, disturbance is avoided, and the solid impurities settle quickly to the bottom, from which they are discharged through the opening 2. By partially closing the bottom opening of the spaces 4, 6, and 8, the deposited solids may be made to act as a filtering layer to assist in the clarification.—W. H. C.

*Vapours of Volatile Liquids; Apparatus for Separating and Condensing* — H. Heymann, H. Hey, J. Smith, H. L. Mitchell, and W. H. Askham. Fr. Pat. 356,678, Aug. 5, 1905. Under Int. Conv., Aug. 10, 1904.

SEE Eng. Pat. 17,435 of 1904; this J., 1905, 1053.—T.F.B.

## II.—FUEL, GAS, AND LIGHT.

(Continued from page 1220.)

*Acetylene; Application of* — in Autogenous Soldering. S. Tranbel. X., page 1308.

#### ENGLISH PATENTS.

*Coke; Manufacture of* — H. Hennebutte, Haine St. Paul, Belgium. Eng. Pat. 22,002, Oct. 12, 1904.

FOR the manufacture of metallurgical coke from lignites, steam coal or close-burning coals, these are pulverised and hydrocarbons rich in carbon are added for the purpose of producing "cementation carbon" in the nascent condition, by the dissociation at a high temperature of the substance added. The latter may consist of molasses or of tar rendered soluble in water by treatment with alkalis. An addition of dry pulverised pitch or resin may be made to coals which give up their hydrocarbons at a very low temperature, in order to raise the point of decomposition. —R. L.

*Coke; Processes for Producing Compressed Non-Porous Blocks or Briquettes of* — A. D. Shrewsbury, Washington, D.C., U.S.A. Eng. Pat. 14,061, July 7, 1905. Under Int. Conv., Aug. 15, 1904.

WHILST in a plastic or "agglutinate" condition, the coke is discharged from the retort into a hopper under-



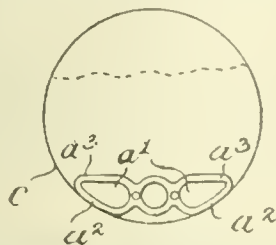
neath, where it is passed between rollers that are recessed to form moulds, in which the coke is compressed to briquettes. The latter are returned to the retort, through a hopper at the top, in order to expel the residual gases they contain, and are afterwards re-compressed as before, the process being repeated if necessary.—C. S.

*Briquettes of Coaldust or Powdered Peat; Manufacture of* —. W. van der Heyden, Paris. Eng. Pat. 19,539, Sept. 27, 1905. Under Int. Conv., Oct. 7, 1901.

SEE Fr. Pat. 346,861 of 1904; this J., 1905, 236.—T.F.B.

*Furnaces; Impts. in* —. G. Wilton, London, and T. Wilton, Beckton. Eng. Pat. 24,785, Nov. 15, 1901.

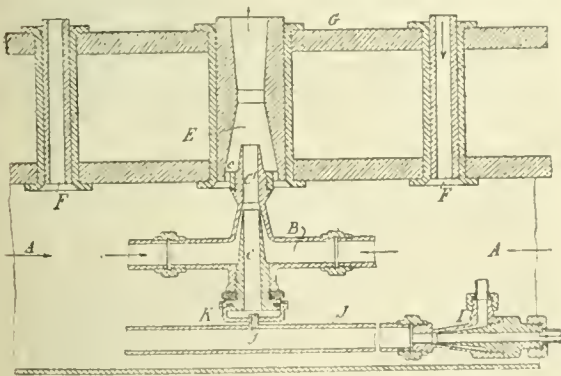
THE claim is for an improvement in the form of the



blast-pipe of furnaces, described in Eng. Pat. 9309 of 1895 (this J., 1895, 710), and consists in constructing the outermost pipes as shown in section at  $a^3$  in the figure, the upper surface  $a^1$  being flat, whilst the lower surface  $a^2$  conforms to the contour of the flue  $c$ . The blast and fuel area is thus enlarged and the burning away of the outer pipes, which were circular in section, by the fuel which lodged between them and the flue wall, is prevented.—W. H. C.

*Furnaces [for Liquid Fuel]; Impts. in* —. E. Scherding, Paris. Eng. Pat. 29,364, Dec. 31, 1904.

A MIXING chamber A is placed in front of the fire-box G and communicates with it by the tuyères E and F. Liquid



fuel is delivered through the injector I, actuated by steam or compressed air, into the distributing pipe J, and passes thence through the small bore pipes  $j$ , held by the stirrup K, into the pipe C. From C the jet of fuel passes through  $C^1$  to the tuyère E, being mixed with a further supply of compressed air or steam delivered by the pipe B. As the jet of fuel and steam or air passes through  $C^1$ , it draws with it, through the apertures  $e$ , a mixture of air and hot gas from the mixing chamber A. The air enters this chamber through the end  $A^1$ , and the hot gas through the tuyères F. Further claim is made for placing air pipes or blowers, actuated by steam, beneath the fire-bars.—W. H. C.

*Furnaces for Burning Producer Gas.* W. L. Harder, Woodlawn, U.S.A. Eng. Pat. 13,263, June 27, 1905.

SEE U.S. Pat. 793,070 of 1905; this J., 1905, 837.—T. F. B.

*Gas-Producing Plants; Impts. in* —. H. J. Grice, Birmingham. Eng. Pat. 1843, Jan. 31, 1905.

THIS patent relates to an arrangement by which gas producers generate their own steam, and is preferably for use in conjunction with the producer plant described in Eng. Pat. 16,067 of 1904 (this J., 1904, 929). On the top of the generator is fixed a hollow metal vessel, which forms the boiler. Into pockets, projecting from this vessel, are inserted "stop-ended" tubes which pass vertically, for any desired distance, into the fuel of the generator below.—W. C. H.

*Carburetted Air; Apparatus for* —. F. W. Howorth, London. From H. Reeser, Courbevoie, France, J. G. Schmidinger, St. Gall, Switzerland, and C. Philippe, Brussels. Eng. Pat. 2770, Feb. 10, 1905.

SEE Fr. Pat. 351,745 of 1905; this J., 1905, 884.—T. F. B.

*Gas Producers.* L. Genty, Marseilles, and Soc. Nouv. des Etablissements de Horme and de la Bure, Lyons, France. Eng. Pat. 8418, April 27, 1905. Under Int. Conv., May 9, 1904.

SEE Fr. Pat. 343,010 of 1904; this J., 1904, 1021.—T.F.B.

*Vaporising Liquids [for Combustible Gas for Explosion Motors]; Devices for* —. A. Hayes, New York. Eng. Pat. 10,404, May 17, 1905.

AN intermittent current of air is passed through a double set of downward and upward spiral passages surrounding a central heating pipe. On reaching the bottom of the device the partly heated air traverses valves communicating with sources of oil and water supply, and arranged in such a manner that, by means of vanes, each valve turns round slightly every time it is lifted and thereby exposes a film of oil or water respectively to the current of air. The resulting mixtures of air with oil and water respectively then ascend through separate spiral passages, which unite at a higher level, and the mixtures are thus heated by the central pipe, so as to complete the vaporisation of the oil and water. Finally the mixture is passed through a similar valve at the top of the apparatus, where it takes up a further quantity of oil in the same manner as before.—C. S.

*Gas Purifying Materials; Treatment of* — for the Recovery of Useful Products, and Apparatus therefor. J. J. M. Bécigneul, Nantes, France. Eng. Pat. 8530, April 20, 1905. Under Int. Conv., July 23, 1904.

SEE Fr. Pat. 345,071 of 1904; this J., 1904, 1216.—T. F. B.

#### UNITED STATES PATENTS.

*Peat; Drying Retort for* —. C. A. Sahlström, Ottawa, Canada. U.S. Pat. 805,030, Nov. 21, 1905.

A NUMBER of horizontal cylinders, communicating with each other by passages between, are mounted, above a source of heat, in an outer structure. Heating flues extend from the source of heat around the entire length of each cylinder, and open into the top cylinder which is also provided with an outlet for the heating gases. The peat is fed into the top cylinder, and is caused to pass through each cylinder in succession, by means of rotating conveyors consisting of shafts provided with longitudinal paddles or blades, and also with spirally-disposed blades secured to and extending between the longitudinal blades. The top cylinder is furnished with a jacket, into which the steam from the lower cylinder is led, means being provided for drawing off the steam and condensed water from the jacket.—A. S.

*Producer Gas Furnace.* P. Schmidt and A. Desgraz, Hanover, Germany. U.S. Pat. 805,235, Nov. 21, 1905.

SEE Fr. Pat. 351,336 of 1905; this J., 1905, 838.—T. F. B.

#### FRENCH PATENTS.

*Combustible [Briquette]; Agglomerated* —. [Utilisation of Waste from Cloth Finishing.] G. Merceron. Fr. Pat. 356,244, July 19, 1905.

CLAIM is made for the use of the residues from the process

of finishing cotton or other cloth, as an agglutinant for making fuel briquettes. The proportions advised are to every 1000 parts of fine coal, from 70 to 100 parts of water and from 50 to 70 parts of agglutinant.—W. H. C.

*Oxygen and Steam; Apparatus for the Production of a Mixture of —, for Supporting Combustion.* G. V. L. Chauveau. Fr. Pat. 350,218, Oct. 12, 1904.

THE apparatus is designed for the production of a mixture of oxygen and steam, to be used instead of air as the supporter of combustion in furnaces, generators, gas engines, &c. Water is fed into a vertical tubular boiler, which is provided with a steam-dome and is heated by the circulation of hot gases (say, the waste gases from a gas engine) round the boiler tubes. Oxygen gas, from a cylinder or other suitable source, is admitted through a pipe into the steam-dome, and is caused to bubble through the water therein, the mixture of steam and oxygen being then led off to the place of consumption. Instead of separate supplies of oxygen and water, oxygenated water may be employed, in which case the liquid is admitted at the foot of the heating tubes; the latter are made in zig-zag form and of very small diameter, to ensure the simultaneous vaporisation of the water and oxygen.

—H. B.

*Combustion in Generator Furnaces for Retort or other Ovens; Process for the Regulation of the Temperature of —.* H. L. Doherty. Fr. Pat. 356,236, July 19, 1905. Under Int. Conv., Oct. 25, 1904.

By the introduction of a mixture of the waste gases of combustion, in suitable proportions, along with air in suitable proportions, beneath a thick bed of incandescent fuel in the generator, the temperature is kept below that at which troublesome clinkering takes place.—W. H. C.

*Combustible Fluid for Explosion Motors.* L. A. A. Hennequin and G. J. B. Cayeux. Fr. Pat. 350,210, Oct. 6, 1904.

SEE Eng. Pat. 11,680 of 1905; this J., 1905, 1006.—T.F.B.

*Gas of High Calorific and, if desired, High Illuminating Value; Process and Apparatus for the Manufacture of —.* P. Sabatier. Fr. Pat. 356,471, June 17, 1905.

STEAM is passed over reduced iron at a temperature of 1000° C., whereby pure hydrogen and oxide of iron are obtained, the hydrogen being collected in a holder. Simultaneously, purified water-gas is passed, at 1000° C., over oxide of iron resulting from a previous operation as above, the gas being thus converted into a mixture of carbon monoxide and dioxide, whilst the reduced iron formed is used to act upon steam in the succeeding operation. The mixture of carbon monoxide and dioxide is passed through a cold alkali carbonate solution, whereby the dioxide is fixed as bicarbonate, the monoxide being utilised in any convenient way. The solution of bicarbonate is heated and the carbon dioxide is expelled and collected in a holder, the carbonate produced being used *de novo* for separating further quantities of the gases. The purified hydrogen and carbon dioxide are now mixed in suitable proportions and passed, at a temperature of 250°–500° C., over metallic iron, nickel or cobalt (reduced from the oxides), whereby methane is produced, according to the equation:  $\text{CO}_2 + 4\text{H}_2 = \text{CH}_4 + 2\text{H}_2\text{O}$ . After condensing the water, the methane can be mixed with hydrogen in any desired proportions, to obtain a gas of high calorific value. If a high lighting power is also desired, the methane and hydrogen are mixed with a small proportion of acetylene and passed over iron, nickel or cobalt at 50°–180° C., at which temperature the methane is unaffected, whilst the acetylene is converted into ethylenic hydrocarbons of high illuminating value. The apparatus is constructed with several heat-interchanging devices whereby the heating and cooling of the gases and liquids are effected without the aid of external sources of heat.—H. B.

*Gaseous Mixtures; Method of Examining —.* Soc. C. Zeiss. Fr. Pat. 356,388, 1905. XXIII., page 1326.

## GERMAN PATENTS.

*Fuels rich in Volatile Substances; Process for Improving — by Treatment with Hot Gases.* O. Hörenz. Ger. Pat. 161,952, Oct. 22, 1903.

It is stated that fuels rich in volatile matter may be transformed into smokeless fuels by expelling the volatile constituents by treatment with hot gases under strong pressure. According to one claim the pressure is produced by the volatile constituents expelled from the fuel, a certain quantity of hot gases being introduced into the vessel containing the fuel, which vessel is then hermetically closed.—A. S.

*Acetylene; Process for the Purification of — by means of Bleaching Powder.* H. Ditz. Ger. Pat. 162,324, March 11, 1903. Under Int. Conv., Dec. 22, 1900.

THE claim is for the use of bleaching powder of the composition represented by the formula:  $\text{CaO} \cdot \text{CaOCl}_2 \cdot \text{H}_2\text{O} + \text{H}_2\text{O}$ , or, in the anhydrous condition,  $\text{CaO} \cdot \text{CaOCl}_2 \cdot \text{H}_2\text{O}$  (see this J., 1901, 247). Bleaching powder of this composition does not evolve chlorine on heating, so that when used for the purification of acetylene, neither nitrogen chloride nor an explosive mixture of chlorine and acetylene can be produced.—A. S.

## III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(Continued from page 1221.)

## ENGLISH PATENTS.

*Saturator for Sulphate of Ammonia and other Salts; Improved "Self-discharging" —.* G. Pettigrew, Middlesbrough-on-Tees. Eng. Pat. 2840, Feb. 11, 1905.

IN a saturator of a circular type, having a hopper-shaped bottom with valved outlet for discharge of the ammonium salt produced, an annular recess is formed inside the hopper, to receive a circular perforated pipe connected to the vertical pipe by which the ammonia gas enters. The circular pipe, thus bedded, presents no obstruction to the descent of the salt for discharge. Alternatively, the channel may be formed externally upon the hopper, in which case the ammonia is led into the channel, and enters the saturator through holes provided in the sides of the same.—E. S.

*Pyridine and Similar Organic Bases; Manufacture and Recovery of —.* R. Lessing and T. Wilton, London. Eng. Pat. 4766, March 7, 1905.

PYRIDINE and similar organic bases, traces of which are usually contained in crude ammoniacal gas liquor, may be recovered by washing the waste gases escaping from ammonium sulphate saturators or the aqueous condensate obtained on cooling these gases, with a tar or other suitable oil, and extracting the bases from the absorbing oil; or the gases or the aqueous condensate may be treated with sulphuric acid to form sulphates of the bases. This can be done directly or by redistilling the condensate in an ammonia-still and receiving the vapours in acid. In certain cases the bases may be extracted by directly washing the crude gas liquor with a suitable oil.—R. L.

*Mineral or Petroleum Oils; Refining —.* T. Macalpine, Chiswick. Eng. Pat. 28,243, Dec. 23, 1904. (See Eng. Pat. 18,728 of 1902; this J., 1903, 944.)

A CLOSED vessel is charged with a supersaturated solution of saline substances, preferably sodium chloride and sodium carbonate in equivalent proportions, and the oil is introduced through a perforated pipe or pipes at the bottom of the vessel, so as to ascend in a finely divided state through the solution and crystals. The oil runs away through an overflow at the top, and after standing, to remove any mechanically conveyed portions of the saline solution, is distilled with the aid of low-temperature.



wet steam and an oxidising agent. (See this J. 1900, 349.) The saline solution may be replaced by broken coke.—C. S.

#### FRENCH PATENT.

*Petroleum and other Liquids: Fractionating* —. V. Huglo. Fr. Pat. 356,152, July 13, 1905.

THE decomposition of the oil by local overheating is prevented by the aid of suitable stirrers, which keep the contents of the still in motion. The distilled vapours are led into a condenser consisting of a bundle of tubes cooled by air from a fan, aided by a water spray. This condenses the heavier fractions, which may be collected or returned to the still, whilst the lighter fractions are condensed in a separate bundle of tubes surrounded by cold water.—C. S.

#### GERMAN PATENTS.

*Paraffin from Tars, especially Lignite Tars, containing the same; Process for Obtaining* —. A. Schultze. Ger. Pat. 162,341, Sept. 3, 1904.

THE oils of lower boiling point are removed from the tar by distillation, the residue is allowed to cool, and the solid portion removed by pressing, or by means of a centrifugal machine, &c. 250 kilos. of lignite tar are heated to 130° C., and steam is blown through it until 30 kilos. of oil have passed over. The residual tar is allowed to stand for 36 hours to crystallise, when it is treated in a centrifugal machine. The higher boiling-point oils are thus removed, leaving the solid paraffin as a cake, which is pressed to remove adherent oil, and refined in the usual manner. This process is stated to give a high yield of solid paraffin, and to reduce the amount of soft paraffin to a minimum.—T. F. B.

*Petroleum; Process for Removing the Sulphurous and Non-Sulphurous Impurities from* —. C. Deichler and R. Lesser. Ger. Pat. 160,717, Jan. 22, 1904.

THE sulphurous and other impurities, including aromatic hydrocarbons, phenols, &c., are removed from petroleum or its distillates by treatment with metallic sodium. In addition to forming sulphides, the sodium is stated to act catalytically; a large proportion of the metal can be recovered after the process, since it only becomes covered with a carbonaceous deposit. 500 kilos. of crude petroleum may be heated for an hour with 5 kilos. of sodium, in a vessel fitted with reflux condenser, and then distilled, with constant agitation.—T. F. B.

### IV.—COLOURING MATTERS AND DYESTUFFS.

(Continued from page 1224.)

*Amino-*p*-dichlorobenzene; Contribution to the Knowledge of* —. F. Noelting and E. Kopp. Ber., 1905, 38, 3506—3515.

2,5-DICHLOROANILINE is a weak base, the salts of which are, to a large extent, decomposed by water. The following method is recommended for diazotising dichloroaniline:—

Sixteen grms. of dichloroaniline ( $\frac{1}{3}$  mol.) are dissolved in a hot mixture of 40 c.c. of sulphuric acid (66° B) with 100 c.c. of water, which is then rapidly cooled with good stirring, so that the base may separate out again in a very finely divided state. After cooling to 5° C. a solution of 7.2 grms. of sodium nitrite in 15 c.c. of water is gradually added. The dichloroaniline gradually disappears and a yellow solution of the diazonium sulphate is obtained. In order to prevent the formation of the diazoamino body at least 7–8 mols. of acid must be used in diazotising. The formation of the diazoamino compound is completely obviated if *p*-chloroaniline (16 grms.) be dissolved hot in 50 c.c. of concentrated sulphuric acid, and the quickly-cooled solution diazotised with a solution of 7.2 grms. of sodium nitrite in 50 c.c. of concentrated sulphuric acid at a temperature not exceeding 20° C. The diazonium sulphate and chloride are very stable in aqueous solution. A dilute solution acidified with hydrochloric

acid was found to have lost practically none of its strength after standing for two weeks. There was no smell of phenol. By boiling the diazonium compound in strongly acid solution for two hours, the authors obtained a 90 per cent. yield of 2,5-dichlorophenol. The more strongly acid the solution, the better is said to be the yield. 2,5-Dichlorophenol is sparingly soluble in water, readily soluble in some organic solvents, and has a strong smell of phenol. The solution in dilute alcohol reddens litmus paper and decomposes alkali carbonates on boiling. It is obtained by distillation in colourless crystals, m.pt. 57° C., b. pt. 211° C. at 744 mm.

The authors combined diazotised dichloroaniline with R-salt, G-salt and H-acid. They found that the dyestuffs produced shades equally strong and equally level but of much yellower tone than those produced by the corresponding aniline combinations, Ponceau 2G, Orange G, and Fast Acid Magenta. The shade of the R-salt combination was practically undistinguishable from that of Orange III. (diazotised *m*-nitraniline+R-salt) and the combination with salicylic acid gave shades almost identical with those of Alizarin Yellow 2G (diazotised *m*-nitraniline+salicylic acid). The two chlorine atoms in 2,5-dichloroaniline thus exercise the same tinctorial influence as the one nitro group in the meta-position.

Tetrachlorodiazaminobenzene was prepared by diazotising dichloroaniline in acetic acid solution. The corresponding aminoazo body was obtained by heating 3.5 grms. of tetrachlorodiazaminobenzene to 105°–110° C. for forty-five minutes with 2 grms. of dichloroaniline hydrochloride and 14 grms. of dichloroaniline. The yield was 2.5 grms. Tetrachloroaminoazobenzene thus prepared, may be easily diazotised by treating its solution in concentrated sulphuric acid with nitrosyl sulphate, and then warming on the water-bath. A garnet-red dyestuff is produced by diluting this diazo solution with ice and combining with alkaline  $\beta$ -naphthol.

1,2,5-Aminodichlorobenzene-4-sulphonic acid was prepared by heating dichloroaniline for about two hours to 170°–180° C. with three times its weight of fuming sulphuric acid containing 18 per cent. of anhydride. On adding nitrite to this sulphonic acid suspended in a finely divided state in dilute hydrochloric acid, the diazonium anhydride is obtained in very stable white needles. This is converted into dichlorophenylhydrazinesulphonic acid on reduction with stannous chloride. From the latter substance a Tartrazine was prepared, which, it is said, dyes a very fine canary-yellow shade.

On nitrating dichloroaniline with fuming nitric acid, a mixture of about 1 part of the *o*- and 5 parts of the *p*-derivative is obtained. (See Beilstein and Kurbatow, Annalen, 196, 222.) The authors find that by nitrating with a mixture of nitric and sulphuric acids at 40° C., the *p*-derivative melting at 145°–146° C. is exclusively obtained. These dichloro-*o*- and -*p*-nitranilines on reduction yield the corresponding dichlorophenylene-diamines, of which the dichloro-*o*-phenylenediamino of m.pt 100° C. is new. It is best purified by sublimation, crystallises in white needles which do not change on keeping, and can be condensed with phenanthraquinone.

—H. L.

*Triphenylmethane Dyestuffs; Action of Sulphurous Acid on* —. K. Dürschnabel and H. Weil. Ber., 1905, 38, 3492—3494.

THE authors treated pararosaniline with sulphur dioxide and obtained the following three distinct substances:—

(1) The acid sulphite  $C_{19}H_{19}N_3O + H_2SO_3$  is prepared by passing gaseous sulphur dioxide into a suspension of 1 gm. of pararosaniline in 40 c.c. of water, until it is completely dissolved to an orange-yellow solution. The excess of sulphur dioxide is then boiled off. The solution, which has turned red, is allowed to cool, and the faintly red crystals of the acid sulphite which separate, are filtered off, and dried at the ordinary temperature. The substance is sparingly soluble in water and alcohol. When heated to 90° C. it loses a molecule of water and passes over into the quinonoid salt.

(2) The neutral sulphite  $(C_{19}H_{17}N_3)_2H_2SO_3$  is obtained by boiling the acid sulphite with 40–50 parts of water. The solution becomes deeply coloured and the acid

sulphite is converted into lustrous metallic green crystals, which are filtered from the hot liquor. The neutral sulphite is very stable; it is not decomposed by prolonged boiling with a solution of sodium carbonate, but it is converted into pararosaniline base by hot caustic soda.

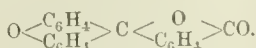
(3) *Triaminotriphenylcarbinol-leucosulphon* acid  $C_{19}H_{19}N_3SO_3 + 3H_2O$  is prepared by treating pararosaniline suspended in very little water with sulphur dioxide until it is completely dissolved. On standing, fine yellow crystals are obtained of the above formula. One molecule of water of crystallisation is lost on keeping.

The substance dissolves for an instant in very dilute sodium carbonate, but is then almost immediately decomposed with separation of the neutral sulphite.

From Malachite Green or Crystal Violet and sulphur dioxide, the authors only obtained in each case one colourless substance, whether "leuco sulphonic acid" or salt, could not be determined.—H. L.

*Rhodamines; Contribution to the Knowledge of —.* E. Noetting and K. Dziewonski. Ber., 1905, 38, 3516—3527.

RHODAMINES are to be regarded as diamino derivatives of fluorane

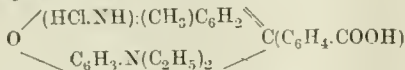


THE colourless bases like fluorane itself and dichloro-fluorane (fluorescein chloride) doubtless possess the lactone formula. The constitution of the salts is uncertain. The authors show that the amino groups in the rhodamine dyestuffs occupy the position para to the fundamental carbon by condensing *o*-amino-*o*-cresol with phthalic anhydride. The dyestuff so obtained, produces shades exceedingly similar to those of typical rhodamines, and a condensation in the *o*-position is in this case impossible.

*Tetramethyl-rhodamine base*  $C_{24}H_{22}N_2O_2 + 2H_2O$  is obtained by treating a solution of the hydrochloride with dilute caustic soda, and is almost insoluble in water or excess of alkali. It is readily soluble in 30–40 per cent. alcohol, from which it crystallises in green metallic leaflets, which contain three mols. of water. These green crystals dissolve in boiling ether, benzene, toluene or xylene to a colourless solution, and crystallise from xylene in colourless needles which contain a molecule of xylene. The xylene is expelled by heating the substance to 130°–150° C. The base free from xylene is colourless, melts at 232° C., and dissolves in concentrated sulphuric acid with orange-yellow colour.

*Tetraethylrhodamine base*  $C_{28}H_{30}N_2O_2 + 4H_2O$  is obtained by heating the hydrochloride with very dilute caustic soda and filtering hot. Green needles are obtained from the filtrate on cooling, which dissolve in alcohol and water with a red colour, possessing a green fluorescence. The solution in benzene, ether, &c., is colourless. The anhydrous base is colourless and melts at 165° C.

*Diethylhomorhodamine hydrochloride*

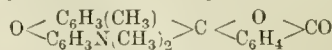


(Friedländer IV. 263) is converted into the free base  $C_{25}H_{24}N_2O_3 + (C_2H_5OH + H_2O)$  containing, as shown, alcohol of crystallisation, by treatment with concentrated ammonia and subsequent recrystallisation of the product from dilute alcohol. It crystallises in green leaflets, which dissolve in boiling xylene to a colourless solution, but crystallise from this solvent on cooling, in red leaflets with a golden lustre, which contain xylene. On heating to 175° C. the xylene is expelled and the base is obtained as an amorphous red substance  $C_{25}H_{24}N_2O_3$ , m. pt. 210° C. It could not be obtained in a colourless modification, the green crystals decomposing before giving up all their water of crystallisation. *Mono-acetyl-diethyl-homorhodamine* crystallises in white needles m. pt. 257°–260° C. It is soluble in hydrochloric acid in the cold, and produces a light red salt which dyes cotton mordanted with tannin a fine yellowish-red shade of equal intensity, but less fast to light than that produced by the non-acetylated substance.

*Symm.-diethylrhodamine base*  $C_{24}H_{22}N_2O_3 + H_2O$  is obtained by treating the hydrochloride with alkali and

recrystallising from dilute alcohol. It crystallises in bluish-red leaflets, which, on drying, become an amorphous olive-green mass. It dissolves in xylene with a faint red colour, and is obtained from this solvent as a dark red crystalline mass, containing no xylene, but still retaining 1 mol. of water. The *diacetyl* compound crystallises in colourless prisms, m. pt. 205° C. It is soluble in dilute alcoholic hydrochloric acid, and the solution but faintly dyes tannin-mordanted cotton.

The authors describe as *Apo-rhodamines* the mono-amino derivatives of fluorane, because of their analogy with the Aposafrafranes. The apo-rhodamine

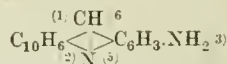


was prepared by heating dimethyl-*m*-aminohydroxybenzoylbenzoic acid and *p*-cresol with concentrated sulphuric acid. The free base  $C_{23}H_{19}O_3N$  dissolves in ether, alcohol, benzene, &c., without coloration, and is obtained in large flat colourless needles, m. pt. 197° C. From xylene it is obtained in colourless crystals which contain ½ mol. of xylene. No coloured aporhodamine bases could be prepared.

The shades produced by the above substances vary from a very bluish to a very yellowish red. The bluest shade is that of the tetra-ethyl compound, then that of the tetramethyl and diethylhomo-compounds. *Symm.-diethyl-rhodamine* follows next, then the acetyl-derivative of homo-rhodamine and finally apo-rhodamine, which gives an exceedingly yellow tone. All produce red shades with 1 per cent. on tannin-mordanted cotton; but apo-rhodamine has very little affinity for silk. The tetra-ethyl compound (Rhodamine B) is alone of technical value; the tetramethyl compound is less soluble and is scarcely used. Diethylhomo-rhodamine and *symm.-diethylrhodamine* are too slightly basic to be of use, but in the form of their esters (Irisamine and Rhodamine 6G) have attained great importance.—H. L.

*Aminonaphthacridines; Syntheses of —.* F. Ullmann and E. Bühler. Z. Farben- u. Text.-Ind., 1905, 4, 521–522.

THE aminonaphthacridine



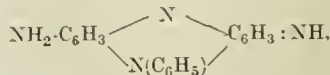
may be produced by heating together *m*-toluylenediamine,  $\beta$ -naphthol and sulphur. (See J. R. Geigy, Ger. Pat. 130,360.) The authors find that the yield so obtained is small; and that the same aminonaphthacridine is formed on heating dihydroxydinaphthyl sulphide or dihydroxydinaphthylmethane with *m*-toluylenediamine and by condensing *m*-phenylenediamine and  $\beta$ -naphthol with formaldehyde.

The best yield 1.6 grms. (2.4 per cent.) of pure aminonaphthacridine was obtained by melting together 4 grms. of  $\beta$ -naphthol, 3 grms. of *m*-phenylenediamine and 2 grms. of trioxymethylene, and then quickly distilling the raw product.

A recipe for preparing dihydroxydinaphthyl sulphide with a yield equal to 88 per cent. of the theoretical is also given.—H. L.

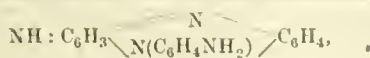
*Phenosafranes; Symmetrical and Unsymmetrical —.* P. Barbier and P. Sisley. Bull. Soc. Chem., 1905, 33, 1190–1198.

By repeatedly crystallising commercial Phenosafranine from dilute hydrochloric acid (20 c.c. per litre), two isomeric hydrochlorides are obtained; the less soluble of these is the unsymmetrical Phenosafranine. Symmetrical phenosafranine is easily obtained by oxidising a mixture of equal molecules of *p*-*p*-diaminodiphenylamine and aniline. The constitution of this



follows from the method of preparation. The unsymmetrical isomeride (preponderating in the commercial dyestuff) which has the constitution

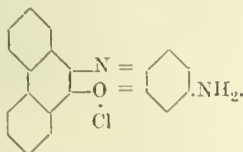




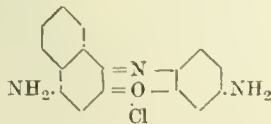
arises from an internal transposition (similar to that of diazoaminobenzene into aminoazobenzene) of the azino compound formed by the oxidation of the mixture of *p*-phenylenediamine with aniline. The symmetrical and unsymmetrical isomerides are designated *Indo*- and *Azo*-phenosafranine respectively, on account of their derivation. The following are the chief points of difference:—The hydrochloride of the symmetrical isomeride crystallises with 1.5 mol., and that of the unsymmetrical with 3 mols. of water. The hydrochloride of the symmetrical variety is much less soluble in water and sodium chloride solution than that of the unsymmetrical variety. Indophenosafranine is more soluble in water and less soluble in alcohol than Azophenosafranine. The tinctorial properties of the two isomerides are somewhat similar, the shade produced by the symmetrical isomerides being the more bluish of the two, at the same time the symmetrical Phenosafranine baths are more completely spent, and the dyeings are a little faster to washing than those of the unsymmetrical variety. The diazotisation of Indophenosafranine is more rapid and more complete than that of its isomeride. (See also this J., 1888, 31 and 116.)—T. F. B.

*Azoxonium Compounds.* F. Kührmann. Ber., 1905, 38, 3604—3607.

2-HYDROXY-1,4-PHENYLENEDIAMINE was condensed with various *o*-quinones. With phenanthraquinone a violet dyestuff was obtained to which the author assigns the formula



With 4-amino-1,2-naphthoquinone a bluish violet dyestuff,

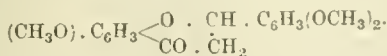


is obtained, and may be looked upon as the mother-substance from which Nile Blue, New Methylene Blue G.G., the Cyanamines and other blue oxazine dyestuffs are derived. This body forms fluorescent solutions, and dyes cotton mordanted with tannin in bluish-violet shades, distinctly redder than those produced by Methyl Violet, fast to soap and moderately fast to light. A black, insoluble by-product is also formed. By the action of 4-anilino- $\beta$ -naphthoquinone a greenish-blue phenyl derivative of the dyestuff described above is obtained.

—E. F.

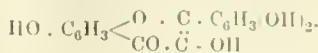
*Fisetin; Synthesis of* —. S. v. Kostanecki and S. Nitkowski. Ber., 1905, 38, 3587—3589.

In the former synthesis of fisetin the monoethyl ether of resacetophenone was used, as resacetophenone was more readily though partially alkylated by ethyl bromide than by methyl iodide. The monomethyl ether ("Pæonol") is, however, readily obtained from resacetophenone by means of dimethyl sulphate. By the action of Pæonol on veratric aldehyde, 2'-hydroxy-4,3,4'-trimethoxychalcone,  $\text{CH}_3\text{O} \cdot \text{C}_6\text{H}_3(\text{OH}) \cdot \text{CO} \cdot \text{CH} : \text{CH} \cdot \text{C}_6\text{H}_3(\text{OCH}_3)_2$ , is obtained. On boiling with alcohol and strong hydrochloric acid, this forms 3,3',4'-trimethoxyflavanone,



By treatment with amyl nitrite and hydrochloric acid this is converted into its  $\alpha$ -isonitroso derivative which dyes in yellow shades on cobalt mordant. On boiling with glacial acetic acid and dilute sulphuric acid this forms 3,3',4'-trimethoxyflavanol which dyes in yellow shades

on alumina mordant. On boiling with hydriodic acid this yields fisetin, 3,3',4'-trihydroxyflavanol.



—E. F.

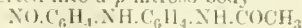
*Cyanine Dyestuffs; Constitution of* —. G. Book. Ber., 1905, 38, 3804—3806.

The author maintains that the formation of a blue dyestuff by the action of alkali on  $\alpha$ - $\gamma$ -dimethylquinolinium salts does not (as stated in Photogr. Corr. 1905, 135; Chem. Centr. 1905, 1, 1564) in any way affect the correctness of Book and Miethe's formula for Cyanine dyestuffs Ber., 1904, 37, 2008, 2821; see this J. 1904, 712, 862). He shows that the dyestuff in the above instance is not formed immediately, but only after atmospheric oxidation of the alkaline solution has taken place. True Cyanine dyestuffs are directly formed in the absence of air; and the substance obtained from  $\alpha$ - $\gamma$ -dimethylquinolinium salts probably belongs to an entirely different series.—H. L.

#### ENGLISH PATENTS.

*Dyestuffs; Manufacture of New Nitroso Bodies and Blue* — *therefrom*. R. B. Rainsford, Upper Norwood. From L. Cassella and Co., Frankfurt a/Main, Germany. Eng. Pat. 25,998, Nov. 29, 1904.

*p*-AMINODIPHENYLAMINE or its sulphonic acid is acetylated by boiling with glacial acetic acid. The acetyl compound is then converted into a *p*-nitroso body



or its sulphonic acid ( $\text{NH} \cdot \text{CO} \cdot \text{CH}_3 : \text{SO}_3\text{H} : 1 : 3$ ) by treatment with sodium nitrite in the presence of alcoholic hydrochloric acid. These nitroso compounds may be condensed with the sulphonic acids of dialkyl-1,3-naphthylenediamine and the new dyestuffs are obtained by the hydrolysis of the reaction products either directly or after previous sulphonation. The preparation of two dyestuffs is described.

(1) 30 kilos. of *p*-nitroso-*p*-acetaminodiphenylamine are introduced at about 60° C. into a solution of 40 kilos. of diphenyl-1,3-naphthylenediamine-7-sulphonic acid, 12 kilos. of caustic soda, 40° B. and 100 litres of alcohol. 20 kilos. of 50 per cent. acetic acid are then added and the whole heated to the boil for three hours. On cooling, the condensation product separates out in crystals. This is dried and powdered; then sulphonated at 80° C. with 5 parts of sulphuric acid monohydrate. The product is diluted with water, and hydrolysed by boiling for seven to eight hours. The product thus prepared dyes wool indigo blue shades stated to be fast to milling and light.

(2) 55 kilos. *p*-nitroso-*p*-acetaminodiphenylamine-*o*-sulphonic acid are condensed in an analogous manner with 51.4 kilos. of diphenyl-1,3-naphthylenediamine-6,8-disulphonic acid. The product is then hydrolysed with hydrochloric acid, and a dyestuff is obtained which is soluble without further sulphonation. It is said to dye wool in bright greenish-blue shades, and to possess most excellent levelling properties, fastness to light and washing.

Similar dyestuffs are obtained from the corresponding ditolyl compounds.—H. L.

*o*-Nitro-derivatives and *o*-Amino-derivatives of certain Aromatic Bases; Manufacture of —. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 27,497, Dec. 16, 1904.

ARYSULPHAMIDES of the aromatic series, which are substituted in the para position to the arylsulphamino-group, are treated with dilute nitric acid, with or without the addition of a suitable solvent. *o*-Nitro-derivatives of the arylsulphamides are thus obtained. If these substances are treated with concentrated sulphuric acid, the arylsulphonic residue is eliminated, with formation of the free *o*-nitro-amino bodies. If they are reduced before hydrolysis, the corresponding *o*-diamines are formed.

Example 1. A mixture of 282 parts of *p*-toluenesulpho-*p*-chloroanilide,  $\text{CH}_3 \cdot \text{C}_6\text{H}_4 \cdot \text{SO}_2 \cdot \text{NH} \cdot \text{C}_6\text{H}_4 \cdot \text{Cl}$ , with 1000 parts of water and 422 parts of dilute nitric acid (sp. gr. 1.18) are heated to about 90° C. for three hours with

good stirring. After cooling, the new product is filtered off, washed and dried. On recrystallisation from alcohol, small yellow needles, m. pt.  $110^{\circ}\text{C}$ ., of the *o*-nitro-product  $\text{CH}_3\cdot\text{C}_6\text{H}_4\cdot\text{SO}_2\cdot\text{NH}\cdot\text{C}_6\text{H}_3(\text{NO}_2)\text{Cl}$  [ $\text{NH}\cdot\text{NO}_2\cdot\text{Cl}=1:2:4$ ] are obtained. The following analogous derivatives, in all of which the nitro group in the ortho and the other substituting group in the para position to the sulphamino group, are also characterised:—

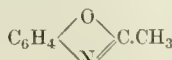
$\text{C}_6\text{H}_5\cdot\text{SO}_2\cdot\text{NH}\cdot\text{C}_6\text{H}_3(\text{NO}_2)\text{CH}_3$ , m. pt.  $89^{\circ}\text{C}$ .;  $\text{C}_6\text{H}_5\cdot\text{SO}_2\cdot\text{NH}\cdot\text{C}_6\text{H}_3(\text{NO}_2)\text{OC}_2\text{H}_5$ , m. pt.  $72^{\circ}\text{C}$ .;  $\text{CH}_3\cdot\text{C}_6\text{H}_4\cdot\text{SO}_2\cdot\text{NH}\cdot\text{C}_6\text{H}_3(\text{NO}_2)\text{CH}_3$ , m. pt.  $98^{\circ}\text{C}$ .;  $\text{CH}_3\cdot\text{C}_6\text{H}_4\cdot\text{SO}_2\cdot\text{N}(\text{C}_2\text{H}_5)_2\cdot\text{C}_6\text{H}_3(\text{NO}_2)\text{CH}_3$ , m. pt.  $127^{\circ}\text{C}$ .; (1)  $\text{NO}_2\cdot\text{C}_{10}\text{H}_6\cdot\text{NH}\cdot\text{SO}_2\cdot\text{C}_6\text{H}_5(2)$ , m. pt.  $156^{\circ}\text{C}$ .; (1)  $\text{NO}_2\cdot\text{C}_{10}\text{H}_6\cdot\text{NH}\cdot\text{SO}_2\cdot\text{C}_6\text{H}_3\cdot\text{CH}_3(2)$ , m. pt.  $159^{\circ}\text{C}$ .

Example 2: *o*-nitro-*p*-toluidine ( $\text{NH}_2:\text{NO}_2:\text{CH}_3=1:2:4$ ) is prepared by dissolving *o*-nitro-*p*-toluenesulpho-*p*-toluidide m.pt.  $98^{\circ}\text{C}$ . (see above) in three parts of concentrated sulphuric acid at the ordinary temperature, pouring the solution on to ice, and neutralising with sodium carbonate.

The new process is stated to be very suitable for the manufacture on a commercial scale because the yields obtained on nitration are nearly the theoretical, and because only one nitro group enters the benzene or naphthalene nucleus and always occupies the *o*-position to the amino group. The *o*-nitroarylsulphamino-, *o*-nitroamino- and *o*-diamino-derivatives produced are all stated to be suitable for the manufacture of dyestuffs. (Compare also Eng. Pat. 6741 of 1904; this J., 1905, 193.) —H. L.

5-Nitro-2-Aminophenol; Improved Manufacture of —. C. D. Abel, London. From Act.-Ges. f. Anilinfabr.. Berlin. Eng. Pat. 7910, April 13, 1905.

THE ethenyl derivative of *o*-aminophenol



(see Ladenburg, Ber., 1876, 9, 1524) is nitrated in the cold with a mixture of nitric acid ( $40^{\circ}\text{B}$ .) and sulphuric acid monohydrate in equal parts, and the nitroethenyl compound obtained is decomposed by treating with warm concentrated hydrochloric or any other suitable acid. The product is stated to be identical with the 5-nitro-2-aminophenol obtained on nitration of diacetyl-*o*-aminophenol.—H. L.

Dyestuffs Derived from 5-Nitro-2-Aminophenol; Manufacture of Azo —. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 7910a., April 13, 1905.

THE dyestuffs claimed are prepared by combining 5-nitro-2-aminophenol, diazotised in the usual way, with a naphthol- or an aminonaphtholsulphonic acid. Thus 2,3-aminonaphthol-6-sulphonic acid in alkaline solution yields a product which dyes chromed wool in blue-black shades, stated to be of remarkable fastness. It may also be dyed on wool from an acid bath and afterwards treated with chrome. The dyestuff prepared from 1,5-aminonaphthol-3,7-disulphonic acid dyes wool from an acid bath in dull Bordeaux shades, which on chroming turn to a greenish-black fast to milling. The combination with 1,5-naphtholsulphonic acid yields a dyestuff, of which the after-chromed dyeings are blue-black.—H. L.

Dyestuffs; Manufacture of New Anthracene —. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9138, May 1, 1905.

SEE Fr. Pat. 354,076 of 1905; this J., 1905, 1061.—T.F.B.

Colouring Matter of the Anthracene Series [Anthracene Dyestuff]; Manufacture of a —. J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 17,242, Aug. 25, 1905.

A CHLOROINDANTHRENE, crystallising in green needles, is prepared by treating indanthrene with antimony pentachloride in the presence of a suitable solvent such as nitrobenzene. The new product is similar to the halogen

indanthrenes described in Eng. Pats. 4035 of 1902 and 23,179 of 1903 (see this J., 1903, 22 and 1904, 898), but is said to produce shades still faster to chlorine.—H. L.

Anthraquinone Derivatives; Manufacture of New —. Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 19,200, Sept. 22, 1905. Under Int. Conv., April 3, 1905.

New dianthraquinonylamines are produced by condensing an acylated 1-amino-4-halogenanthraquinone or a derivative thereof with 1-aminoanthraquinone or a derivative thereof, and then hydrolysing to eliminate the acylid group. The reaction is best carried out in the presence of a diluent such as nitrobenzene or naphthalene. Cuprous or cupric chloride and sodium acetate or another copper salt are suitable condensing agents. The condensation of 1-acetamino-2-methyl-4-chloroanthraquinone with 1-amino-2-methylanthraquinone and also with 1-amino-2-methyl-4-*p*-toluidioanthraquinone is described in detail. Derivatives such as acylid-1,5-diamino-2,4,6,8-tetrachloroanthraquinone may be used instead of acylid-1-amino-2-methylanthraquinone.—H. L.

Indigo White; Production of Halogenated —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 21,746, Oct. 25, 1905.

HALOGENATED indigo is reduced by treatment with a solution of indigo white, preferably in the presence of caustic soda. Indigo is precipitated, and, after filtration, a solution of halogenated indigo-white is obtained which may be directly used for dyeing. The reagents usually employed for reducing indigo remove the halogen from halogenated indigo to some extent, and produce, it is said, a mixture of halogenated and ordinary indigo white. The object of the present invention is to obviate this difficulty. —H. L.

#### FRENCH PATENTS.

*o*-Nitrotoluene; Process for Purifying —. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 350,200, Sept. 29, 1904.

SEE Ger. Pat. 158,219 of 1903; this J., 1905, 796.—T. F. B.

Dyestuffs Susceptible to Chroming and Treatment with Copper on the Fibre; Process of Making Nitro-*o*-hydroxyazo —. Fabr. Coul. d'Aniline et d'Extraits, ci-dev. J. R. Geigy. First Addition, dated Oct. 13, 1904, to Fr. Pat. 350,071, July 21, 1904.

SEE Eng. Pat. 15,982 of 1904; this J., 1905, 724.—T. F. B.

Dyestuffs of the Anthracene Series; Production of New Derivatives and — and their Applications in Dyeing and Printing. Badische Anilin und Soda Fabrik. Fourth Addition, dated June 14, 1905, to Fr. Pat. 349,531, Dec. 21, 1904. Under Int. Conv., Oct. 11, 1904.

SEE U.S. Pat. 796,393 of 1905; this J., 1905, 919.—T. F. B.

Colouring Matters of Plants; Elimination of the — previous to Bleaching for Papermaking. A. Badoil. Fr. Pat. 350,224, Oct. 14, 1904. XIX., page 1320.

#### GERMAN PATENTS.

Chloro- and Bromophthalimide; Process for Preparing —. Badische Anilin und Soda Fabrik. Ger. Pat. 161,340, April 16, 1902.

HYPOCHLOROUS or hypobromous acid acts on phthalimide in aqueous suspension, in the cold, producing the corresponding halogen derivative.—T. F. B.

Monoalkylaminohydroxybenzoylbenzoic Acid; Process of Preparing —. Badische Anilin und Soda Fabrik. Ger. Pat. 162,034, Nov. 15, 1903.

THE benzoylbenzoic acid derivative of monoalkyl-aminophenol is obtained by heating molecular proportions of the alkylaminophenol and phthalimide in presence of boric acid, and saponifying the resulting acid amide. The amide is stated to possess the characters of a basic dyestuff, dyeing brownish-yellow shades on cotton treated



with tannin. The acid is suitable for use in preparing Rhodamines, by condensation with *m*-aminophenol.

—T. F. B.

**Nitroacetdiaminophenol** ( $\text{OH} : \text{NO}_2 : \text{NHCOCH}_3 : \text{NH}_2 = 1 : 4 : 2 : 6$ ); *Process for Preparing* — L. Cassella and Co. Ger. Pat. 161,341, Oct. 14, 1903.

By reducing acetylpicramic acid with aqueous alkali sulphide, 2-acetamido-4-nitro-6-aminophenol is obtained. It is stated to be of value in the production of dyestuffs susceptible to chroming. Other reducing agents act also on the second nitro-group — T. F. B.

**Indophenols; Method of Preparing** — Act.-Ges. f. Anilinfabr. Ger. Pat. 160,710, Jan. 16, 1904.

THE arylsulpho-*p*-phenylenediamines, obtained by reducing the nitro-arylsulphamines described in Eng. Pat. 6741 of 1904 (see this J., 1905, 193), are oxidised together with a phenol having the *p*-position free. The oxidation proceeds satisfactorily by using sodium hypochlorite in alkaline solution. The resulting indophenols are stated to be very stable, and to be suitable for the preparation of dyestuffs. — T. F. B.

**1-Methyl-2-naphthol; Process of Preparing** — Farbwerke vorm. Meister, Lucius und Brüning. Ger. Pat. 161,450, Aug. 21, 1904.

"DINAPHTHOLMETHANE," obtained by condensing formaldehyde with  $\beta$ -naphthol, can be reduced to a mixture of  $\beta$ -naphthol and 1-methyl-2-naphthol. If this mixture is allowed to stand with formaldehyde, a further quantity of the dinaphtholmethane is formed; the solution is precipitated by hydrochloric acid, and the methyl-naphthol removed by washing the precipitate with water. It is a crystalline substance of m. pt.  $112^\circ \text{C}$ ., easily soluble in alcohol, ether and benzene. — T. F. B.

## V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(Continued from page 1227.)

**Vegetable Flosses or "Silk-Cottons"; Indian** — Bull. Imp. Inst., 1905, 3, 221—225.

Two samples of floss from *Cochlospermum Gossypium* and one from *Calotropis gigantea*, all of Indian origin, were examined. The *Cochlospermum* flosses were inferior as regards colour, freedom from seeds, softness and resiliency to the *Calotropis* floss, which was comparable in quality with "kapok," the floss of *Eriodendron anfractuosum*. The *Cochlospermum* flosses yielded only about 46 per cent. of cellulose, whereas the *Calotropis* floss yielded 64.3 per cent., equal to the yield of cellulose from "Kapok." The Javanese "kapok" is superior to the Indian "kapok" in softness and resiliency, owing probably to unsuitable methods employed for freeing the latter from seeds and to excessive pressure in packing. Javanese "kapok" finds a considerable sale in Europe, and is used chiefly for stuffing cushions, bedding, &c. It is characterised by an extreme resistance to wetting by water, and has therefore been employed in the form of mattresses on ships, its buoyancy being such as to enable the mattresses to serve as temporary rafts. The problem of spinning the floss for commercial textile purposes has not yet been satisfactorily solved. In view of the inferior quality of the Indian flosses, the market rates would be lower than that obtainable for the Javanese material. — J. F. B.

**Musa Fibres from East Africa.** Bull. Imp. Inst., 1905, 3, 226—228.

Two species of *Musa*, *M. Ensete* and *M. ulugurensis*—are cultivated in German East Africa for the sake of their fibres. These fibres, though inferior to real Manila hemp (*M. textilis*) are of very good quality. The plants can only be cultivated from seed, and the yield of fibre from *M. ulugurensis* is rather small, but these drawbacks are

largely compensated for by the more rapid growth and by other factors. Two samples of *M. Ensete* were examined; the first-quality fibre was nearly white and had a lustrous appearance, good strength, and a length of 5½ ft. — 6 ft. The second quality was darker in colour and slightly inferior in strength; its length was 4 ft. 4½ ft. The fibre of *M. ulugurensis* was similar in appearance, but less lustrous and harsher to the touch. The following analytical data are recorded:—

	<i>Musa Ensete.</i>		<i>Musa ulugurensis.</i>
	1st Quality.	2nd Quality.	
	Per cent.	Per cent.	Per cent.
Moisture .....	9.7	9.4	10.2
Ash .....	1.5	1.7	1.6
$\alpha$ -Hydrolysis, loss ...	10.3	13.0	22.0
$\beta$ -Hydrolysis, loss ...	15.1	18.3	24.7
Mercerisation, loss ...	11.0	12.7	17.9
Acid purification, loss	0.8	3.7	6.5
Nitration, gain .....	36.5	26.3	37.4
Cellulose .....	78.1	74.5	70.7
Length of ultimate fibre	2.6–5.9 mm.		2.2–4.7 mm.
Average length	th 3.8 mm.		Aver. length 3.1 mm.
Commercial valuation	£50 per ton	£45 per ton	£40 per ton

—J. F. B.

### ENGLISH PATENTS.

**Silk; New Artificial** — H. E. Newton, London. From Farbenfabriken vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,733, Dec. 29, 1904.

A 15 per cent. solution of triacetylcellulose, prepared according to Eng. Pat. 21,628 of 1901 (this J., 1902, 1293) in chloroform, is forced through a capillary tube into a room or space, the atmosphere of which is heated to about the temperature at which the solvent boils. The triacetylcellulose solidifies on coming in contact with the hot air and forms a thread which can be directly drawn and wound, without passing through a coagulating bath. The new artificial silk thus obtained is stated to possess great brilliancy, tensile strength and suppleness; to resist water, alkalis and acids; and to be less inflammable than the collodion product. The claims embrace this substance as a new article of manufacture; the above process for its preparation or any other in use for the manufacture of artificial silk. — H. L.

**Dyeing Furs and "Carrotting" Skins; Machines for** — Soc. Chapal Frères et Cie., Montreuil sous Bois, France. Eng. Pat. 24,456, Nov. 11, 1904. Under Int. Conv., Nov. 14, 1903.

SEE Fr. Pat. 336,714 of 1903; this J., 1904, 369. — T. F. B.

**Aldchyles; Manufacture of Derivatives of** — [Discharging Agents]. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 2348, Feb. 6, 1905.

SEE First Addition, dated Feb. 11, 1905, to Fr. Pat. 350,607 of 1905; this J., 1905, 967. — T. F. B.

**Discharging Agents; Manufacture of** — J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 7592, April 10, 1905.

SEE Second Addition to Fr. Pat. 350,607 of 1905; following these. — T. F. B.

### UNITED STATES PATENT.

**Wool, Hair, Bristles and other Material; Process for Cleansing, Scouring and Removing Oil and Fat from** — A. Born, Berlin. U.S. Pat. 805,407, Nov. 21, 1905.

SEE Eng. Pat. 24,856 of 1901; this J., 1902, 405. — T. F. B.

## FRENCH PATENTS.

*Silk-like Threads and Films; Process of Making* —. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 350,220, Oct. 12, 1904.

SEE U.S. Pat. 779,175 of 1905; this J., 1905, 129.—T. F. B.

*Peat-Fibre; Method of Treating* —. M. Forgeot. Fr. Pat. 355,928, July 5, 1905.

In order to convert peat-fibre into a textile product, the peat, after suitable preliminary treatment, is placed in bundles on a grating and immersed in a hot solution of soft soap. It is then rinsed by means of jets of water at high pressure to completely remove soap, and also to free the material from part of the gum and from incrustations loosened by the first washing. The material is then immersed in a degumming bath, consisting of cold acetic acid, in which it is moved to and fro. The fibrous peat is then dried, the liquid being run off in such a manner that the fibres all lie in a parallel position, as though they had been combed.—E. F.

*Cellulose Threads; Manufacture of Brilliant* —. Soc. Gen. de la Soie Artificielle Linkmeyer, Soc. Anon. Fr. Pat. 356,402, July 25, 1905. Under Int. Conv., Aug. 26, 1904.

SEE Eng. Pat. 4761 of 1905; this J., 1905, 671.—T. F. B.

*Threads [Casein] for Use as Silk, Horsehair and Fabrics; Process for Making Artificial* —. F. Todtenhaupt. Fr. Pat. 356,404, July 25, 1905.

SEE Eng. Pat. 25,296 of 1904; this J., 1905, 1063.—T. F. B.

*Wool and Other Textiles; Method and Apparatus for Removing the Grease and other Impurities from* —. H. Heymann, H. Hey, J. Smith, H. L. Mitchell and W. H. Askham. Fr. Pat. 356,677, Aug. 5, 1905. Under Int. Conv., Aug. 10, 1904.

SEE Eng. Pat. 17,437 of 1904; this J., 1905, 1063.—T. F. B.

*Wool and other Animal and Vegetable Fibres; Process for Scouring* —. A. P. Quackenbos. Fr. Pat. 356,747, Aug. 8, 1905.

SEE U.S. Pat. 796,530 of 1905; this J., 1905, 966.—T. F. B.

*Wool and Half-Wool on Bobbins; Method of Treating for the Purposes of Dyeing, Bleaching, Degreasing and Impregnating*. H. Giesler. Fr. Pat. 355,753, June 29, 1905. Under Int. Conv., June 3, 1905.

It is not possible to dye wool and half-wool on the ordinary perforated sheet-iron bobbins employed in the case of cotton, since acid liquids must be used, and these would attack the iron; also wool and half-wool cannot be satisfactorily wound on to a metal bobbin and would deteriorate by storage in contact with the metal. According to the present invention, the wool or half-wool is wound on to the usual paper bobbins, which are then fixed into a wooden block and the bobbin and wool, or half-wool, dried. The paper bobbin can now be removed by means of a wooden implement without disturbing the fibre surrounding it. A perforated bobbin of metal, or of other material resistant to the chemicals to be used, is now inserted and the yarn is dyed, bleached or otherwise treated by forcing the necessary liquids through.

—E. F.

*Shaded Effects on Dyed Fabrics; Method of Producing* —. Rheinische Webstuhl- und Appreturmaschinenfabrik, G.m.b.H. Fr. Pat. 355,887, July 5, 1905. Under Int. Conv., Jan. 6, 1905.

THE fabric, 2, is suspended from one selvage above the vat, 14, being either folded lengthwise (see Fig. 2) or wound into a spiral (Fig. 1). It is then slowly and regularly immersed in the dye-vat, and finally quickly raised out of the liquid. By this means, the lower selvage of the fabric being immersed for the longest period, is most deeply dyed, and the shade diminishes uniformly in intensity towards the upper selvage. If the piece be required dyed

FIG. 1.

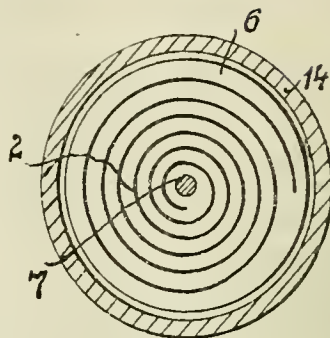
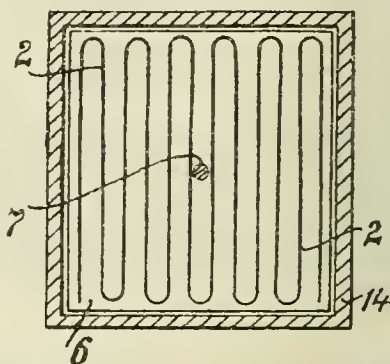


FIG. 2.



deeply in the centre, shading off towards both selvages, it is folded along its whole length, suspended from the two selvages, and the process continued as described above. Analogously other and similar effects may be obtained. An apparatus for carrying out the process is described. The fabric is suspended from a frame, 6, which may be mounted on a spindle, 7, connected with a hydraulic plunger. This plunger is allowed to slowly fall during dyeing, by allowing the water in the cylinder to slowly flow out, and the fabric is thus gradually immersed in the dye-vat, 14. Water is then quickly admitted into the cylinder, causing the plunger to rise rapidly, carrying the fabric with it. The fabric is kept stretched during these operations by the weight of a second frame attached below.—E. F.

*Printing; Revolving Brushes for* — [Utilisation of Waste from Photographic Films]. Soc. Anon. des Plaques et Papiers Photographiques, A. Lumière et ses fils. Fr. Pat. 350,187, Sept. 24, 1904.

REVOLVING brushes used in printing textile fabrics are usually covered with horse-hair or other similar material. According to the present patent this may be advantageously replaced by long narrow strips cut from photographic films made from nitrocellulose. The waste chippings from film manufacture may be usefully employed in this manner.—E. F.

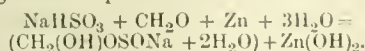
*Hydrosulphurous Acid and another Acid; Preparation and Utilisation of Double Salts of* —. J. Harding. Fr. Pat. 350,189, Sept. 24, 1904. VII., page 1303.

*Aldehydic Derivatives. Production of* —, and their Application as Discharging Agents. Badische Anilin und Soda Fabrik. Second Addition, dated June 24, 1905, to Fr. Pat. 350,607, Jan. 7, 1905.

THE original patent (this J., 1905, 727) described methods of preparing salts of formaldehyde-sulphoxylic acid. According to the present addition, salts of aldehyde-sulphoxylic acids may be prepared by the action of zinc,



in the absence of free mineral acids, on aldehyde-sulphurous or aldehyde-hydrosulphurous acids, their zinc or ammonium salts. Instead of the prepared aldehyde-sulphurous or aldehyde-hydrosulphurous acids, equimolecular quantities of an aldehyde and sulphurous acid, or of an aldehyde and a zinc, ammonium, or alkali hydrosulphite, neutral sulphite or bisulphite may be used. The zinc may also be replaced by other reducing metals, of which iron has been found the most suitable. In all these cases heat is finally applied in order to complete the reaction. The zinc aldehyde-sulphoxylates are not very soluble and may be converted into more soluble alkali salts by double decomposition with an alkali sulphite, or other alkali salt which precipitates zinc, or an alkali hydroxide. In the case where formaldehyde, an alkali bisulphite and zinc are used, the reaction takes place according to the equation:—



More than 80 per cent. of bisulphite may thus be converted into sulphoxylate. If the sodium bisulphite be replaced by zinc bisulphite, the latter is completely converted into aldehyde-sulphoxylate. Example: 540 kilos. of zinc bisulphite of 25° B., 75 kilos. of 40 per cent. formaldehyde, 2000 litres of water and 120 kilos. of zinc dust are boiled together for two to three hours. The resultant liquid, containing zinc formalddehyde-sulphoxylate, is then treated with sodium carbonate or sulphide, filtered from zinc compounds and concentrated *in vacuo*. Solid sodium formalddehyde-sulphoxylate is so obtained which has lost part of its water of crystallisation and contains 91 per cent. of  $(\text{NaHSO}_2 + \text{CH}_2\text{O})$ .—E. F.

*Combustible [Briquette]; Agglomerated* ——. [*Utilisation of Waste from Cloth Finishing*]. G. Merceron, Fr. Pat. 356,244, July 19, 1905. II., page 1233.

## VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(Continued from page 1228.)

### ENGLISH PATENT.

*Ink; A New or Improved Writing* ——. A. M. Flack, London. From J. W. Williams, Darby, Connecticut, U.S.A. Eng. Pat. 25,092, Nov. 18, 1904.

This invention relates to a writing ink consisting of a suitable carbon, such as lampblack, or Prussian blue, or like pigment, or a mixture of these, ground in oil, and dissolved in an essential oil or similar hydrocarbon, such as turpentine.—B. N.

## VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(Continued from page 1232.)

*Chamber Process; Use of the Fan in the* ——. G. Schliebs. Z. angew. Chem., 1905, 18, 1900—1902.

THE source of draught in the chamber process is immaterial, provided there is a sufficiency; to secure this with "natural" draught, requires careful attention to the dimensions of all the details of the system, which must be so arranged that the difference in pressure between the two ends of the system does not exceed a few millimetres of water column. If this cannot be achieved (which is particularly the case when complicated dust-chambers and filters, or highly resisting plate towers are introduced) recourse must be had to artificial draught. The three places where a fan may be introduced are: 1, Between the burners and the Glover tower; 2, Immediately before or between the Gay Lussac towers; 3, Between the Glover tower and the first chamber. Falding has reported favourable results from a fan in the first position, and the author has found it to answer well, provided the temperature was high enough to prevent condensation of arsenious oxide; if that happened, however, troublesome and

disturbing cleanings were necessary. A disadvantage of this position is that the volume of gas to be dealt with by the fan is greater than in the second position. The author considers the second position the least favourable. He quotes the case of two works. One, with excellent natural draught, was making 6.7 kilos. of chamber acid per cb. m. per day, and burning 54 kilos. of pyrites per sq. m. in the burners. A fan was introduced at the end of the system, but no increase of production or lessening of nitre-consumption ensued, so the fan was taken out again. The second system had a fan in position 3, and one in position 2, and worked excellently; when that in position 2 was used alone, the production sank by 20 per cent., and the nitre-consumption increased by 30—40 per cent., but when that in position 3 was used alone, and a damper built in the place of the other fan, the production rose to the normal, and the nitre-consumption even fell below that with two fans. The second fan was taken out, and did excellent work in another system in position 3. This position, the author considers, is the best; the draught in the burners, dust chambers, and Glover tower can be regulated at will, and either *plus* or *minus* pressure can be established in the chambers as the draught is regulated by the fan, or by the end damper. The author has never discovered any difference, however, in the working of chambers, due to *plus* or *minus* pressure existing in them. Hard lead is the best material for fans, and if the fan be properly worked, and not driven at too high a speed, there is but little corrosion.

The author had experience of a work in which the arrangement described by Lütj (this J., 1905, 921) was introduced. No increase in production resulted however, and the arrangement had the disadvantage of lessened concentration in the Glover. High production depends not only on the ventilation, but on the form of the chambers and the removal of the surplus heat of reaction. Falding's tangential system in Baltimore, working without fan, plate-towers, or spray, yielded 10 kilos. of chamber acid per cb. m. Lütj claims that a fan at the end of the system is rapidly destroyed, but that the introduction of a plate-tower immediately before it greatly prolongs its life; the author worked with one in this position, without a tower, for five years, and it was then removed to position 3 in another system, where it still continues to work. Lütj also says that water-spray works best in high chambers, but gives no figures to support the statement; the author has had experience of it in three systems, in which the heights are respectively 12.8, 7.0, and 5.9 m.; in all it has worked well, but has given the best results in the last.—J. T. D.

*Nitrification; Intensive* ——. A. Müntz and E. Lainé. Comptes rend., 1905, 141, 861—867.

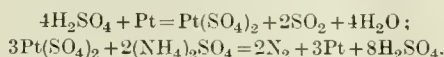
THE authors have investigated the nitrification of ammonium salts. They find that granulated animal charcoal forms a better soil for the nitrifying organisms than coke breeze; the highest yield of nitrate being obtained from a solution of ammonium sulphate containing 7½ grms. per litre. At 30° C., 10 cb. dm. of charcoal were found capable of nitrifying, practically completely, 960 c.c. of this solution daily. The cost of evaporating the dilute solution of nitre so obtained, however, is very considerable, and the authors are investigating the possibility of passing the same liquid several times through the nitrifying beds, each time dissolving in it fresh ammonium sulphate.

They have also experimented with natural soils, kept in a constant condition of moisture, and at temperatures of 15°—22° C., and dug or stirred from time to time. Vegetable moulds and composts, watered with solutions of 1—2 grms. of ammonium sulphate per litre, thus gave 0.350—0.630 grm. of nitrates per kilo. per day, or on a field of 1 hectare, in a layer 50 cm. deep, 650 to 1200 tons per annum. This formation of nitre will go on in the same soil when watered with fresh portions of ammonium salt, to an extent the limit of which the authors have not yet reached, though they have produced soils containing 27—33 grms. of nitre per kilo. The water in these soils must have contained 55—157 grms. per litre. Methodical lexivation of these soils would yield a solution from which the nitre could be recovered at comparatively small cost;

and in the event of war, nitrates could in this way be produced in quantities commensurate with military requirements.—J. T. D.

*Ammonium Salts; Decomposition of*—by Hot Sulphuric Acid in presence of Platinum. M. Delépine. *Comptes rend.*, 1905, **141**, 886—889.

TROUBLED by losses of nitrogen when spongy platinum is added to prevent bumping in the Kjeldahl process, the author has investigated the question, and finds that when ammonium sulphate is heated with sulphuric acid and spongy platinum added, there is a steady evolution of nitrogen and of sulphur dioxide, the more rapid as the temperature is higher. With 30 c.c. of strong sulphuric acid, 20 grms. of potassium sulphate and 30 grms. of ammonium sulphate, to which 0.03 gm. of spongy platinum was added, the loss of nitrogen in an hour was 8 mgrms. The cause of this may be either the decomposition of the sulphuric acid, aided catalytically by the platinum, at the high temperature ( $\text{H}_2\text{SO}_4 = \text{H}_2\text{O} + \text{SO}_2 + \text{O}$ ), and the reaction of the oxygen on the ammonium compound; or the attack of the platinum by the sulphuric acid, and reaction of the sulphate on the ammonium salt:—



The second is the true explanation; sulphuric acid does attack and dissolve platinum sponge when heated with it. Moreover, spongy gold or iridium, which are not attacked by sulphuric acid, do not cause a loss of nitrogen from ammonium salts in the same way as spongy platinum.

—J. T. D.

*Sodium Hydrosulphite; Contribution to the Knowledge of*—, A. Binz and W. Sondag. *Ber.*, 1905, **38**, 3830—3834.

FOR the analysis of the sodium hydrosulphite used in the experiments, the following procedure was adopted and proved very satisfactory:—

*Hydrosulphite*.—0.3005 gm. was titrated, in an atmosphere of carbon dioxide, with a solution of potassium ferricyanide (80 grms. per litre; 1 c.c. = 0.2114 gm. of sodium hydrosulphite). (See Ekker, *Rec. trav. chim. Pays-Bas*, 1894, **13**, 36.)

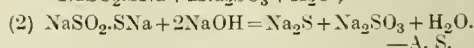
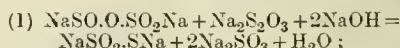
*Sulphate*.—5.21 grms. were boiled with hydrochloric acid, with passage of a current of carbon dioxide, to expel sulphur dioxide, and in the filtered solution, the sulphuric acid was determined as barium sulphate.

*Thiosulphate*.—A solution of 20 grms. of the sample in 500 c.c. of a 1.7 per cent. solution of sodium hydroxide was shaken with air, till the liquid no longer had a reducing action on an acetic acid solution of Indigo Carmine. In 100 c.c. of the solution, neutralised with magnesium chloride, the thiosulphate was determined by Feld's method (this J., 1898, 1186).

*Sulphite*.—In another 10 c.c. of the oxidised solution, the thiosulphate was decomposed by means of mercuric chloride and the sulphite determined by Feld's method (*loc. cit.*). Since, however, in the atmospheric oxidation of hydrosulphites besides sulphite, a little sulphate is also formed (this J., 1903, 492), this latter must also be determined in a portion of the oxidised solution after expelling the sulphur dioxide. By adding together the results of these two determinations and subtracting the values for hydrosulphite and sulphate, the amount of sulphite was obtained. The specimen of hydrosulphite used in the experiments had been kept in an exsiccator over sulphuric acid since Dec., 1904, and its composition in the original condition, and, as used, is shown in the following table:—

Sulphur in the form of:	Dec., 1904.	Sept., 1905.
	Per cent.	Per cent.
Hydrosulphite .....	32.59	29.52
Sulphite .....	2.06	4.60
Thiosulphate .....	0.89	0.67
Sulphate .....	0.52	0.93

1.066 grms. of the hydrosulphite were heated to 57°—62° C. with 2.818 grms. of sodium thiosulphate, and 9 grms. of a 20 per cent. solution of sodium hydroxide for five hours with exclusion of air, and then after standing for twelve hours, the whole was made up to 100 c.c. with boiled water. In the solution the sulphate was determined by precipitation with barium chloride, and the sulphite, sulphide and thiosulphate by Feld's method (*loc. cit.*). The analytical results show that by the action of sodium thiosulphate on sodium hydrosulphite, the latter adds on one atom of sulphur in the sulfoxyl portion of its molecule, and then decomposes into sulphide and sulphite, an unstable thiosulphite being formed as an intermediate product, just as in the reaction between sodium hydrosulphite and sodium polysulphide (this J., 1905, 800). The reactions may be expressed by the equations:—



—A. S.

*Formaldehyde and [Organic] Nitrogen Compounds containing Oxygen; A Very Sensitive Reaction of*— which is also a Colour Reaction for Albuminoid Substances. E. Voisenet. *XXIII.*, page 1326.

*Sulphates; Determination of*—by means of Benzidine Hydrochloride in the presence of Thiosulphates, Sulphites, and Sulphides. O. Huber. *XXIII.*, page 1325.

*Chromium Sulphate; Role of Lead Peroxide as Anode in the Electrolytic Oxidation of*—to Chromic Acid. E. Müller and M. Solter. *XLI.*, page 1311.

*Ozone; Quantitative Determination of*—, F. P. Treadwell and E. Anneler. *XXIII.*, page 1325.

#### ENGLISH PATENTS.

*Arsenious Acid; Process and Apparatus for the Extraction of*—from Ores. E. Biguet, Paris. Eng. Pat. 14,409, July 12, 1905. Under Int. Conv., July 23, 1904.

SEE Fr. Pat. 345,063 of 1904; this J., 1904, 1215.—T.F.B.

*Saturator for Sulphate of Ammonia and other Salts; Improved "Self-discharging"*—, G. Pettigrew. Eng. Pat. 2840, Feb. 11, 1905. *III.*, page 1294.

*Chrome-iron Ore; Decomposition of*—by Alkaline Carbonates [Manufacture of Bichromates]. P. Römer, Bernburg a/S., Germany. Eng. Pat. 8642, April 22, 1905.

SEE U.S. Pat. 797,323 of 1905; this J., 1905, 969.—T. F. B.

#### UNITED STATES PATENTS.

*Iron Pyrites; Preparing*—for Desulphurisation. W. Wedge, Ardmore, Pa. U.S. Pat. 804,690, Nov. 14, 1905.

PYRITES "smalls" or "fines," composed in part of powder, are mixed with a binding agent, such as a metallic sulphate, ferrous sulphate being specified, and the mixture is granulated, and subjected to heat insufficient to expel sulphur from the pyrites; and is then heated with agitation upon the hearth of a desulphurising furnace. (See U.S. Pat. 757,531 of 1904; this J., 1904, 545.)—E. S.

*Iron Pyrites Charge for Desulphurising Furnaces, and Method of Preparing same.* W. Wedge, Ardmore, Pa. U.S. Pat. 804,691, Nov. 14, 1905.

PYRITES "fines" are mixed with a "binder" containing a sodium salt, such as sodium sulphate, and ferrous sulphate; or with iron oxide mixed with acid sodium sulphate; or with sodium sulphate and nitrate and ferrous sulphate. Or the "binder" may be produced by charging iron oxide into the nitre pot of sulphuric acid apparatus



containing a sodium salt and sulphuric acid. The pyrites mixture is then made into lumps, blocks, or briquettes.

—E. S.

*Iron Pyrites: Treating* ——. *for Desulphurisation*. W. Wedge, Ardmore, Pa. U.S. Pat. 804,785, Nov. 14, 1905.

PYRITES "fines" are prepared for desulphurisation by mixing them with a "binder" containing sodium nitrate, with or without ferrous sulphate.—E. S.

*Hydrochloric Acid: Process of Making* ——. W. E. Everett, Tacoma, Wash. U.S. Pat. 805,009, Nov. 21, 1905.

A MIXTURE of water, chlorine gas, and compressed air, with or without an alkali chloride, is brought to an intensely cold condition by liquid air, and whilst in this state, is caused to make impact against intensely heated silica, whereby, it is stated, "the nitrogen and oxygen are liberated, while the chlorine combines with a portion of the liberated hydrogen to form hydrochloric acid gas," which gas is dissolved in water for commercial use.—E. S.

*Phosphorus: Process of Making Red* ——. R. Schenek and P. Marquart, Assignors to The Firm of Chem. Fabr. Bettenhausen Marquart and Schulz, Bettenhausen-Cassel, Germany. U.S. Pat. 804,553, Nov. 14, 1905.

WHITE phosphorus is added to phosphorus tribromide, or to other good solvent of white phosphorus capable of acting catalytically, and free from all inert diluting solvent, and the mixture is heated to produce "bright red" phosphorus. (See also this J., 1903, 494, 1225.)—E. S.

#### FRENCH PATENTS.

*Lime Kilns: Construction of* ——. [Application of the Carbon Dioxide in Sugar Manufacture]. Soc. van Cauwelaert Frères et Cie. Fr. Pat. 356,172, July 17, 1905.

THE calcined lime falls into a receptacle at the lower part of the kiln, communicating by radial inclined channels, with side openings, furnished with doors, for the discharge of the lime. Other radial channels, intermediate with the former, are provided, each with a fireplace and door, from which air is admitted to the kiln above the level of the central receptacle. The dome to the kiln has a central hopper, for admission of the charge, and side openings into a channel for passage of carbon dioxide, which is either led to a recipient, or is utilised directly for the carbonation of beetroot juice, this application of the invention in connection with sugar manufacture being specially named.

—E. S.

*Sodium and Potassium Salts: Use of [the Ash of] Mangrove [Trees] for the Production of* ——. V. Quaintenne. Fr. Pat. 339,255, Dec. 24, 1903.

THE ash from the burning of Mangrove trees growing in salt marshes is stated to be relatively rich in sodium salts; and that of those growing in marshes, where the water is soft, to be correspondingly rich in potassium salts, to recover and utilise which salts is, as stated in the claim, the object of the invention.—E. S.

*Hydrosulphurous Acid and Another Acid: Preparation and Utilisation of Double Salts of* ——. J. Harding. Fr. Pat. 350,189, Sept. 24, 1904.

THE compounds are obtained by acting with solutions of hydrosulphites on neutral salts in fine powder or concentrated solution either in theoretical proportion or in excess and allowing the products to crystallise. The formation of the double salts is favoured by physical means, such as cooling, or the addition of liquids miscible with water, or of any other substance which decreases the solubility of such compounds in the mother-liquor. Double salts of zinc hydrosulphite with ammonium and sodium chlorides, ammonium fluoride and sodium bromide may be obtained in this way. For example, to 1 litre of a solution of hydrosulphite obtained from zinc dust and sulphurous acid solution, 8 litres of which reduce 1 kilo. of indigotin, 50–100 grms. of ammonium chloride or fluoride are added. Crystals of the probable formula

$\text{ZnS}_2\text{O}_4 \cdot \text{NH}_4\text{Cl}$  or  $\text{ZnS}_2\text{O}_4 \cdot \text{NH}_4\text{F}$ , either anhydrous or hydrated, are formed, and may be obtained as a paste, as a dry solid or in fine powder. The products are remarkably stable in the air and at a high temperature. When dry, most of them are not decomposed by glacial acetic acid. Their applications are claimed in chemical operations for dyeing and printing, and also more particularly as reducing, decolorising and disinfecting agent in refining and purifying glycerin, sugars, tanning materials and food-stuffs.—E. F.

*Chlorine: Employment of Gaseous Hydrochloric Acid for the Manufacture of* ——. *by Electrolysis of its Solution Regenerated Continuously*. E. F. Côté and J. F. Febvre. Fr. Pat. 355,115, July 12, 1905. XI.A., page 1312.

## VIII.—GLASS, POTTERY, AND ENAMELS.

(Continued from page 1233.)

*Clays: Emanations from* ——. *during Firing*. A. Hopwood. Trans. Eng. Ceramic Soc., 1904—5, 34—41.

THE vegetation in the neighbourhood of clayware kilns has in many cases been seriously affected by the gaseous products of the kilns. In one case investigated, Ramann and Wislicenus (Tonind.-Zeit., 1902, 1254–1259) attributed this to the presence of fluorine in the clays burned, but many clays devoid of fluorine have, within the author's experience, caused destruction of vegetation. This paper deals with the results of the dry distillation, distillation in presence of the chief kiln gases, of 32 clays of known origin, and with the nature of sublimes and distillates obtained. During the firing of a clayware kiln, the following gaseous products have to be considered:—Nitrogen, oxygen, carbon dioxide, hydrogen, steam, carbon monoxide, ammonia, hydrocarbons, and sulphur compounds. The emanations depend upon the volatile constituents of the clay, the nature of the gas present, and the temperature employed. The clays experimented upon were:—

Ten Red Tile Clays.—Tunstall, 6; Ruabon, 2; Wetley Moor, 1; Longport, 1.

Four Red Brick Clays.—Burslem, 1; Hanley, 1; Tunstall, 1; Accrington, 1.

Ten Fireclays.—Ruabon, 3; Stourbridge, 2; Burslem, 1; Hanley, 1; Goldendale, 1; Tunstall, 1; Coatbridge, 1.

Two Stoneware Clays.—Burslem, 1; Ruabon, 1.

Three Ball Clays.—Newton Abbott, 1; Torrington, 1; Corfe Castle, 1.

Three China Clays.—St. Austell, 3.

The Wetley Moor, red brick, fire, stoneware and ball clays contained moderate or large amounts of organic matter. The dried clays yielded large amounts of water at 350° C. All were free from fluorides, nitrates, nitrites, and arsenates, but, with a few exceptions, contained varying amounts of phosphates, sulphates, sulphides, ammonia and chlorides.

All clays were found to give larger or smaller sublimes of ammonium salts on heating in a glass tube. The ball, stoneware, fire and red brick clays gave yellow, turbid, oily liquids, of pungent odour, and containing much organic matter, which were alkaline to litmus.

The products obtained on heating the clays, under different conditions, never contained sulphites, nitrates, nitrites, arsenates or fluorides, although sulphates, ammonia, chlorides, organic matter and sulphides, or free sulphur or free sulphuric acid, were always present. The emanations from clays heated in the presence of oxidising gases are generally acid, but under other conditions are alkaline, and free sulphuric acid is fortunately neutralised in many cases by the ammonia produced.

—W. C. II.

*Clay: Note on an Efflux from Saggar* ——. C. E. Ramsden. Trans. Eng. Ceramic Soc., 1904—5, 72—73.

THE efflux consisted of an opaque vesicular glass, reddish-brown to purple or black, the variation in colour probably being due to differences in the oven atmosphere. It

formed on the exterior of saggars made from a plastic ferruginous marl, often containing nodules of iron pyrites. In one instance, when fired in a muffle kiln at 1050° C., the efflux appeared as a clear yellow glass round a small cavity. The analysis of a sample was:—

Silica, 26.58; alumina, 34.89; total iron as ferric oxide, 24.41; lime, 2.30; magnesia, 1.52; alkalis, 10.30.

Another sample contained 7 per cent. of ferrous iron. The author concludes that the efflux is a mixture of ferrous silicate, alkali silicates with alumina and free ferric oxide, magnetic oxide and metallic iron.—W. C. H.

*China; The Fluxing Effect of Bone in English* —. W. Jackson and A. D. Holdcroft. Trans. Eng. Ceramic Soc., 1904-5, 6-23.

The experiments described were made to determine the nature, and the amount, of the effect of bone in a china body.

The materials were weighed out dry, and ground together in a mortar. In some cases a "slip" was made, passed through a 120's sieve, and dried on a plaster bat until in a workable condition. In other cases the materials were passed through a 60's sieve dry, sufficient water added, and the mixture well kneaded. Small cones, similar to Seger cones, were made as test pieces, and these were set up on supports of the same composition as the cones, as pieces of saggars were in some cases affected by the mixtures. The cones were dried over a flame, and fired either in a Heinecke gas muffle furnace, working up to about 1350° C., or in a Fletcher's injector gas furnace (up to 1500° C.).

A mixture was made of equal parts of china clay and Cornish stone, and cones were made of some of this mixture with increasing percentages of bone. The softest contained about 17 per cent. of bone (and 41.5 of clay, and 41.5 of stone). The calculated molecular formula of this compound was:  $\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2 \cdot \frac{1}{3}\text{P}_2\text{O}_5$ .

A series of trials with whiting in place of bone, though they contained approximately the same percentages of lime, showed that the most fusible mixture was 60 per cent. of whiting, 20 per cent. of china clay, and 20 per cent. of Cornish stone, corresponding with the formula,  $3\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2$ . A similar test piece was made, but 17 per cent. of the whiting was replaced by bone, and the fusibility of this mixture showed that the composition of the mixture when saturated with lime up to 17 per cent. was such that it could still take up a further amount if presented in the free state, as it would be in whiting, but apparently could not displace the phosphoric acid.

From the above formula, it appears that the flux is unable to displace phosphoric acid from bone when the acidity of the mixture is below that represented by eight atoms of oxygen in the acid radical  $\text{SiO}_2$ , to four atoms of oxygen in the bases, but can take up lime in the free state (e.g., from limestone) until the corresponding ratio is 8:6.

A series of trials was made with 50 per cent. of bone, and 50 per cent. of mixtures of china clay and Cornish stone; decrease of the proportion of the latter constituent was accompanied by increase of fusibility, and showed how the fusibility of a china body can be varied without altering the proportion of bone. By the addition of alumina to the least fusible mixture, it became fusible, and flint fluxed with the more fusible. A series of calcium aluminium silicates was compounded with an increase of one molecular part of silica in each member in ascending order from one to seven, and the most fusible was found to be  $\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2$ , which confirmed the results obtained by varying the amount of bone in a china body, the most fusible mixture obtained in that case corresponding with the formula given, neglecting the phosphoric acid.—W. C. H.

*Pottery; Crystallisation in* —. J. W. Mellor, Trans. Eng. Ceramic Soc., 1904-5, 49-65.

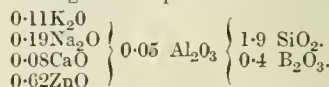
This paper deals principally with the effect of temperature on crystallisation, and the distinction is drawn between the crystalline effect produced when crystals separate from a molten glaze, and when the glaze crystallises *en masse*. A *resumé* is given of the phenomena of solution,

such as eutectic mixtures, supersaturation, rate of cooling, &c.

Aventurine glaze is presumably due to iron oxide dissolved from the body by the glaze, and rejected again in the crystalline state on cooling. A thin glaze generally gives better results. The explanation of this may be: if crystallisation starts in the zone between the glaze and the body, it is possible that it may not have time to spread from below to the upper parts of the thick glaze; or the iron dissolved from the body may not have time to diffuse uniformly throughout the whole mass so that the upper parts are never saturated with iron oxide, or possibly not sufficient iron may be dissolved from the body to saturate the whole glaze.

The solvent action of the glaze on the body may be very vigorous at high temperatures, and enough may be dissolved to dilute the saturated crystallisable solution to an unsaturated, non-crystallisable solution. New combinations may be produced by the interaction of the substance in solution with the materials derived from the body. Again, essential constituents may be volatilised at higher temperatures and so impoverish the glaze.

It is important of course to know the composition of the crystals produced, in order to "feed up" the glaze with the necessary constituents. The analysis of one crystal for example, corresponded closely with the formula  $2\text{ZnO} \cdot \text{SiO}_2$ . Also characteristic stellate crystals were obtained from a glaze compounded from the formula:—

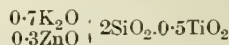


A glaze containing 0.5 per cent. of cobalt oxide, and 5 per cent. of titanium oxide, gave lanceolate "cobalt blue" crystals in a pale yellow glaze of titanium oxide. Sections through some lanceolate and stellate crystals showed that the "arms" consisted of a great number of "threads," which give a soft silk-like appearance to the crystals.

Crystalline compounds that separate from a glaze may at higher temperatures be resolved into non-crystallisable combinations, so that too high a temperature would be fatal to the development of the crystals required.

The separation of crystals usually ceases when the glaze has solidified, although the glaze itself slowly passes into a crystalline condition, or devitrifies. Matt glazes are those in which devitrification has been prevented. A diagram is given, illustrating the effect of temperature on the rate of crystallisation of hippuric acid, which increases to a maximum at about 100° C., and then again decreases.

In the discussion, A. Heath said he had made crystalline glazes of the formula:—



The titanium did not appear to dissolve when the mixture was fritted. It was fired first in a glost oven, then in an earthenware biscuit kiln, afterwards in a china biscuit kiln, and the best results were obtained in a Jasper oven, with a period of five weeks' cooling.—W. C. H.

*Glazes; China and Earthenware* —. H. W. Edwards, W. Edwards, and S. T. Wilson. Trans. Eng. Ceramic Soc., 1904-5, 24-33.

This paper gives the record of experiments made to ascertain the influence of variation of composition on the properties of a glaze. Six trials were made of each glaze; two were fired in an ordinary earthenware glost oven, one in the hardest and the other in the easiest place; the other four were fired, one hard and one easy in two separate china glost ovens. The glazes were ground and passed through 140's lawn. A glaze was taken of the composition:—

Fritt.	Mill.	which corresponds to	
100 Borax	420 Fritt	0.274 $\text{Al}_2\text{O}_3$	$\left\{ \begin{array}{l} 3.2 \text{ SiO}_2 \\ 0.461 \text{ B}_2\text{O}_3 \end{array} \right.$
50 Flint	208 Stone		
50 Stone	28 Flint		
40 Whiting	180 White lead		
		0.347 $(\text{NaK})_2\text{O}$	
		0.379 $\text{CaO}$	
		0.274 $\text{PbO}$	
20 China clay			



No of Glaze	Composition.				Formula							Ratio. $\frac{B_2O_3}{SiO_2}$	Results
	Fritt.	Stone.	Flint	White Lead.	Alkalis	CaO.	PbO	Al <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub> .	B <sub>2</sub> O <sub>3</sub>			
I. 1	420	240	96	180	0.353	0.377	0.260	0.291	3.044	0.454	1:0.8	Bright and hard.	
2	420	272	64	180	0.350	0.375	0.266	0.307	2.970	0.447	1:0.6		
3	420	304	32	180	0.345	0.373	0.261	0.323	2.878	0.440	1:0.5		
4	420	336	0	180	0.371	0.371	0.258	0.339	2.781	0.434	1:0.4		
II. 5	420	156	180	180	0.336	0.383	0.280	0.245	3.372	0.473	1:7.1	Dull.	
6	420	104	232	180	0.324	0.387	0.288	0.214	3.563	0.486	1:7.3	Dull and blistered	
7	420	52	284	180	0.312	0.391	0.296	0.182	3.765	0.5	1:7.5	"	
8	420	0	336	180	0.3	0.395	0.304	0.147	3.978	0.513	1:7.7	Devitrified	
		Felspar.											
III. 9	420	208	128	180	0.397	0.34	0.262	0.267	2.964	0.44	1:6.7	Good and bright.	
10	420	272	64	180	0.422	0.326	0.251	0.297	2.678	0.423	1:6.3	"	
11	420	304	32	180	0.434	0.320	0.245	0.311	2.585	0.414	1:6.2	"	
12	420	336	0	180	0.445	0.313	0.241	0.325	2.471	0.406	1:6.1	"	
IV. 13	420	156	180	180	0.375	0.353	0.272	0.24	3.19	0.457	1:7.0	Dull and blistered.	
14	420	104	232	180	0.352	0.365	0.282	0.21	3.457	0.474	1:7.2	"	
15	420	52	284	180	0.327	0.380	0.293	0.18	3.695	0.493	1:7.5	Devitrified.	
V. 16	420	253	128	135	0.444	0.353	0.203	0.308	3.263	0.457	1:7.1	Dull, but require a higher temperature for maturity.	
17	420	298	128	90	0.493	0.366	0.141	0.352	3.579	0.474	1:7.5		
18	420	343	128	45	0.546	0.380	0.072	0.4	3.925	0.493	1:7.9		
		Stone.											
VI. 20	420	208	128	135	0.373	0.407	0.219	0.204	3.429	0.495	1:6.9	Bright in hardest, dull in easiest fire.	
21	420	208	128	0	0.402	0.430	0.158	0.316	3.698	0.534	1:6.9		
22	420	208	128	45	0.437	0.477	0.085	0.345	4.018	0.581	1:6.9		
		Felspar.											
VII. 23	420	208	128	135	0.426	0.364	0.209	0.286	3.174	0.472	1:6.7	Good glaze.	
24	420	208	128	0	0.458	0.391	0.15	0.307	3.410	0.507	1:6.7	"	
25	420	208	128	45	0.495	0.423	0.081	0.332	3.685	0.548	1:6.7	Dull and milky.	
		Stone.											
VIII. 26	420	208	128	225	0.325	0.355	0.319	0.256	2.99	0.432	1:6.9	Brilliant rich glaze.	
27	420	208	128	270	0.311	0.321	0.367	0.246	2.864	0.414	1:7.0	"	
28	420	208	128	315	0.288	0.315	0.396	0.227	2.651	0.383	1:7.0	Brilliant rich glaze, badly run down.	
		Felspar.											
IX. 29	420	208	96	45	0.495	0.423	0.081	0.332	3.53	0.549	1:6.4	Brilliant hard glazes, all more or less milky; No. 32 the worst.	
30	420	208	64	45	0.495	0.423	0.081	0.332	3.053	0.549	1:5.5		
31	420	208	32	45	0.495	0.423	0.081	0.332	2.945	0.549	1:5.3		
32	420	208	0	45	0.495	0.423	0.081	0.332	2.697	0.549	1:4.9		
		Whiting											
X. 34	420	208	20	45	0.455	0.47	0.074	0.305	2.529	0.504	1:5.0	All easy-fired trials were dull. In enamel kiln, all the china trials spit out slightly and earthenware trials devitrified. No. 36 was the worst. The china trials were better than the earthenware.	
35	420	208	40	45	0.417	0.514	0.068	0.28	2.273	0.463	1:4.9		
36	420	208	60	45	0.387	0.549	0.063	0.26	2.107	0.429	1:4.9		

The variations in composition and the results are collected in the table.

From the results obtained the authors draw the following conclusions:—

(1) *Lime*.—From three earthenware trials it was evident that whiting must not be added raw to a glaze fired at a comparatively low temperature, but should be fritted. With the china trials, fired "two bars higher," the results were better.

(2) *Lead Oxide*.—This gives brilliancy, may be used within wide limits, and has a wide range of firing temperatures. In excess it gives a yellow colour, and softens the body.

(3) *Alumina*.—This plays an important part, and while it stiffens the glazes and raises the firing point, it prevents devitrification and gives brilliant glazes which are hard and durable.

(4) *Silica*.—By increasing the amount of silica the glaze is stiffened and made viscons. When in excess of a tri-silicate, it causes devitrification, unless neutralised by alumina, and when decreased below a di-silicate, the glaze "crazes."

(5) *Boric Acid* may replace silica to a certain extent, and thus lower the temperature required for firing. When the ratio of  $B_2O_3$  to  $SiO_2$  is above 1:6.5, the glazes are milky, and when below 1:5, quite opalescent. Boric acid makes the glaze hard and brilliant.

From the experiments, peeling seems to be more a fault of the body than of the glaze, and a high acidity causes devitrification rather than peeling.—W. C. H.

*Glaze; Notes on the Crimson Chromium-Tin*.—F. J. Rodgers and J. W. Mellor. Trans. Eng. Ceramic Soc., 1904-5, 66—71.

I. *Effects of Chromium obtained from different sources*.—The tint obtained is practically independent of the source of the chromium. This was shown by heating up to about

1260° C. a mixture of:—Stannic oxide, 50 parts; whiting, 25 parts; flint, 18 parts; borax, 4 parts; white lead, 4 parts, with 1.5 part of chromic acid or its equivalent in potassium chromate, potassium bichromate, potassium trichromate, potassium tetrachromate, tin chromate, calcium chromate. Chromic oxide is more convenient than the potassium chromate usually employed, and since it is practically insoluble in water, removes the difficulty of crystallisation in subsequent operations, though with a soluble chromate it is possible to get a more uniform mixture.

II. *Influence of Zinc Chromate*.—This added to the crimson stain with the ordinary lead glaze deepens the tint, diminishes the tendency to "milky" or "dull" surface, increases the range of temperature in firing, gives as a rule, a more brilliant surface, and in quantities below 1 per cent. does not interfere with the transparency.

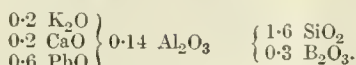
III. *The effect of Lime*.—The colour will bear a higher temperature the greater the proportion of lime up to 25 per cent. of whiting, and can be obtained at a lower temperature if lime be present; in other words, the temperature range of stability is extended.

IV. *Can Alumina replace Stannic Oxide?*—The glaze which the authors obtained by replacing stannic oxide with alumina, and firing in a saggar along with the ordinary crimson glazes had a fine yellow colour in daylight, with a green tinge in gas-light, and they have not yet succeeded in producing a crimson or pink chromium glaze without stannic oxide.

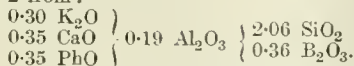
V. *Can a Pink be obtained without Chromium?*—The pink colours obtained with pure calcium carbonate and pure stannic oxide, the authors attribute to coloration from volatilised chromic oxide from colours in other parts of the saggar, and qualitative analysis showed that chromium was always present in those test-pieces, where the pink colour was developed.

Two photomicrographs of transverse sections through two tiles covered with the crimson glaze accompany the

paper. The glaze No. 1 was compounded from the formula:—



and No. 2 from:—



Both contained the same amount of stain and were fired at the same temperature. By reflected light the glaze appears as a yellow glass in which a few red particles are suspended. In No. 1 the surface is smooth, the glaze clear and transparent, and the colour inclines to redness. The glaze contained a few air-bubbles and was inclined to craze, and had better solvent properties than No. 2, which was richer in lime and poorer in lead. In No. 2 the surface was not so smooth, and the glaze lacked the depth and transparency of No. 1, whilst the colour inclined to purple.—W. C. H.

#### ENGLISH PATENTS.

*Glass; Production of Sheet* — G. C. Marks, London.  
From I. W. Colburn, Franklin, Pa., U.S.A. Eng. Pat.  
13,788, July 4, 1905.

By this invention the sheet is drawn from a mass of molten glass, and simultaneously a lateral movement is given to the molten glass at or near the points at which the edges of the sheet emerge. Means are provided for imparting sufficient heat to the surface in the working chamber to break up any surface waves. The drawn sheet is heated sufficiently to allow of bending and scoring operations being performed, while at the same time the glass is kept hard enough to avoid injury to its fire-finish. The scored sheet is passed into a cooling chamber, where, whilst protected from exterior blasts of cold air, its temperature is gradually lowered. Means are provided for carrying out mechanically the various stages of the process—fixing the "bait," drawing the sheet, and imparting the lateral movement to the surface, and for adjusting the revolving bodies, heating the surface to break up waves, and scoring and severing the sections whilst the drawing operation is being carried on.—W. C. H.

*Enamelling Metal Work; Impts. in* — W. R. Comings,  
Wimbledon Park, Surrey. Eng. Pat. 28,930, Dec. 30,  
1904.

ACCORDING to this process the surface of the metal to be enamelled is thoroughly cleaned, and before it has time to oxidise, the piece is placed in a highly heated bath of enamel and allowed to remain therein till it has reached as nearly as possible the same temperature as the bath. It is then removed, and the enamel baked or dried while the metal is cooling and contracting. The enamel is said thus to become firmly united with the surface of the metal. As an alternative, the metal may be heated in an atmosphere of non-oxidising gas such as nitrogen or hydrogen. The best results are obtained when the heating bath is hotter than the drying bath, say, 300°—350° F. for the former, and 200°—300° F. for the latter.—W. C. H.

#### UNITED STATES PATENTS.

*Glass; Manufacture of Sheet* — H. K. Hitchcock,  
Akron, Ohio, Assignor to C. W. Brown, Pittsburg, Pa.  
U.S. Pat. 805,064, Nov. 21, 1905.

THE molten glass is forced from a receptacle through an upwardly-discharging slot or orifice outside the receptacle. Means are arranged by which the glass is held in tension and pulled away from the slot at approximately the same rate as that at which it is fed through the slot. Rotatable blades are operated at certain intervals by the pulling mechanism for severing or cracking the glass beyond the point at which it is held in tension, and means are provided whereby the severed glass is delivered to a heated chamber.—A. G. L.

*Glass Articles; Manufacture of* — H. K. Hitchcock,  
Akron, Ohio, Assignor to C. W. Brown, Pittsburg, Pa.  
U.S. Pat. 805,065, Nov. 21, 1905.

MOLTEN glass is forced to a point near the end of an orifice having a shape similar to that of the finished article, the surface of the glass being cooled at this point by contact with the enveloping orifice. Tension is applied to pull away the cooler glass from the orifice, whilst glass at a higher temperature is caused to flow up and into this envelope of cooler glass, which prevents the spreading out or narrowing of the molten glass. Means for severing the glass at intervals are also provided.—A. G. L.

*Kiln for Annealing Glass*. H. K. Hitchcock, Tarentum,  
Pa. U.S. Pat., 805,069, Nov. 21, 1905.

THE glass to be annealed is moved through a series of ovens, each of which is heated to a temperature equal to, or slightly higher than, that of the preceding oven before the glass is moved from the latter. In each oven the hearth and crown are constructed to form free radiating surfaces of equal thickness, so that the dissipation of heat from all parts of the hearth and crown may be approximately equal. Vertical passages are arranged in the side walls of each oven, which are heated by gas burners, the products of combustion escaping through a valved outlet. The sill of each oven is movable, and means are arranged for shifting it.—A. G. L.

*Glass; Manufacture of* — H. K. Hitchcock, Walton,  
Pa., Assignor to C. W. Brown, Pittsburg, Pa. U.S.  
Pat. 805,139, Nov. 21, 1905.

THE lime and silica are heated to a temperature at which the less refractory materials can act on them in order to eliminate impurities, and the vapour of the fluxing alkali salt is then forced through the heated mass, the glass formed being subjected to a "reduced surface-pressure."

—A. G. L.

*Quartz Glass free from Air Bubbles; Producing* —  
R. Küch, Assignor to W. C. Heraeus, Hanau, Germany.  
U.S. Pat. 805,302, Nov. 21, 1905.

SEE Eng. Pat. 3906 of 1905; this J., 1905, 498.—T. F. B.

*Quartz Glass Articles; Producing Hollow* — R. Küch,  
Assignor to W. C. Heraeus, Hanau, Germany. U.S.  
Pat. 805,303, Nov. 21, 1905.

SEE Eng. Pat. 4663 of 1905; this J., 1905, 498.—T. F. B.

*Quartz-Glass Vessels; Method of Protecting* — R. Küch,  
Assignor to W. C. Heraeus, both of Hanau, Germany.  
U.S. Pat. 805,304, Nov. 21, 1905.

To prevent the breaking of quartz-glass vessels filled with metals solid at the ordinary temperature, the inside of the vessel in contact with the metal is coated with carbon, by passing a current of gaseous hydrocarbon, e.g., ordinary illuminating gas, through the vessel and heating the walls of the vessel, from without, to their softening point.

—A. G. L.

#### FRENCH PATENTS.

*Glasses; Manufacture of Tinted Optical* — J. J.  
Davignon. Fr. Pat. 356,322, July 21, 1905.

THIS invention relates to the manufacture of optical glasses tinted bluish-green, the tints varying from light to dark, from substances specified, requiring eight to ten hours for "founding," for which during the first two hours, the temperature is about 1200°, and for the following five hours it is raised to a maximum of 1400°—1450° C. Such tinted glasses are claimed as new products. The substances specified are sand, rock crystal, dry sodium carbonate, and calcium carbonate, together with proportions according to the tint required, of copper sulphate, ferric oxide, calcined borax, saltpetre, calcined bone, cobalt oxide (or carbonate), zinc oxide and alumina, with uranium oxide for dark blue green.—W. C. H.



*Ceramic or other Bodies ; Process of Instantaneous Firing, Enamelling, and Decoration of —, and of Cooling and Tempering Glass-ware.* F. Garros. Fr. Pat. 356,545, July 31, 1905. Under Int. Conv., Aug. 4, 1904.

THIS invention relates to a new method of firing, enamelling and decorating, so to speak, instantaneously, ceramic objects (porcelain, faience, gr. s., earthenware), the practically instantaneous cooling of glass, by which a new kind of tempering is possible, and of avoiding air-blasts in enamelling and the superficial "vitrification" of metals. The method consists in enclosing the objects in boxes, composed of material which is a good conductor of heat, and has a low specific heat. In many cases in practice, the boxes need not be covered.—W. C. H.

#### GERMAN PATENT.

*Glass Metal ; Process for the Decolorisation of —.* J. Kersten. Ger. Pat. 162,607, Feb. 20, 1903.

THE use of titanium compounds either alone or in conjunction with other agents for the decolorisation of glass, is claimed. It is stated that by the use of titanium compounds, white glass can be produced either in melting-pots or in tank-furnaces.—A. S.

### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(Continued from page 1233.)

*Portland Cement ; Detecting Injurious Quantities of Gypsum in —.* Gresly. Tonind. Zeit., 1905, 29, 1679; Chem.-Zeit., 1905, 29, Rep., 360.

THE formation of calcium sulphaluminate occurs more rapidly in the test blocks of Portland cement mortar, and the resulting cracks become sooner apparent when the plates have been exposed for a short time to dry heat (over 100° C.) before being placed under water. The author found that overheated samples retained their good appearance after 14 days under water, when the gypsum content was as high as 10 per cent., whilst heated cakes containing 6 per cent. of gypsum exhibited fine cracks on the under surface after five days' immersion, small concentric cracks forming by the seventh day and the edges crumbling by the tenth day. Further tests showed that the beneficial effects of the heating treatment in revealing the presence of gypsum are nullified by subsequent boiling, but are restored by reheating. The higher the heating temperature, the sooner is the presence of gypsum revealed. A useful manner of applying the test is to heat the hardened bloc s of pure cement at 200°—300° C. for six hours, and observe their behaviour while immersed in cold water. In the case of Roman cement moist heat is as effective as dry. Slag cements will bear an unusually large addition of gypsum, but the author does not believe that Portland cements rich in gypsum can be prevented from crumbling under water by the addition of blast-furnace slag.—C. S.

*Cement-Concrete ; Notes on the Destruction of Building Materials made of —.* W. Thörner. Chem.-Zeit., 1905, 29, 1243—1248.

I. *Destruction of a Large Drain made of Cement-Concrete by the Action of Moor Water Containing Sulphuric Acid.*—The author describes a case in which a concrete drain showed signs of failure after having been in use for six months. The concrete was coloured dark green or brownish-red and was so soft in places that it could be cut with a knife. A great part of the cement had been converted into calcium sulphate. The signs of failure were especially marked in those portions of the drain between the extreme levels of the water in it. Investigation showed the materials used in building the drain to have been of excellent quality. The failure was due to the fact that the moor contained considerable quantities of pyrites. The building of the drain had promoted rapid oxidation of the pyrites, so that the moor water contained considerable quantities of ferrous sulphate (up to

1152.6 mgrms. per litre) as well as other sulphates, besides free sulphuric acid (up to 86.9 mgrms. per litre), which had interacted with the cement of the concrete. Direct experiments showed that synthetic solutions, similar in composition to the moor water, cause rapid destruction of cement. Various means of protection are discussed, such as surrounding the drain with a layer of pieces of limestone, or with clay; but from his experiments the author is of opinion that at the worst places, at least, the drain should be altogether replaced by one composed of acid-resisting bricks bedded in asphalt.

II. *Destruction of Concrete Slabs and Pipes owing to the Use of Rhine Gravel Containing Particles of Coal.* These concrete slabs and pipes showed brown discoloration, in places accompanied by cracks; occasionally a small piece had cracked off altogether. In each of these cracks small dark particles were found, which, on analysis, proved to be coal, which probably came from the Rhine sand used, the contamination of the sand being due to the practice on the Rhine steamers of simply throwing their ashes, containing some unburnt material, overboard into the river.—A. G. L.

*Fermentation Squares ; Large Cement —.* W. Windisch. XVII., page 1317.

#### ENGLISH PATENTS.

*Stone ; Manufacture of Artificial —.* F. N. Reavell, Leytonstone, Essex. Eng. Pat. 21,233, Oct. 4, 1904.

CRUSHED granite, slag, &c., is freed from dust by means of an air-blast before being mixed with the cement and water, both blowing and mixing being done whilst the gravel falls down a vertical tube. The mixture is moulded under pressure; the moulded mass is turned out of the mould before its surface has set hard and scratched or stippled with file-carding or similar substance, after which sodium silicate solution is sprayed over the surface.—A. G. L.

*Drying Gelatin, Glue, Paste Goods, Brewers' Grains, Bricks, Woods, Metal Articles and the like ; Apparatus for —.* O. Koepff. Eng. Pat. 5748, March 18, 1905. I., page 1291.

#### UNITED STATES PATENT.

*Quartz Brick or Block ; Fireproof —.* E. Stöffler, Zurich, Switzerland. U.S. Pat. 805,242, Nov. 21, 1905. SEE Eng. Pat. 11,258 of 1904; this J., 1905, 985.—T. F. B.

#### FRENCH PATENTS.

*Macadam ; Preservation and Improvement of — by Preventing the Formation of Dust Resulting from the Surface Disintegration.* E. D. de Liebhäber. Fr. Pat. 356,330, July 22, 1905. Under Int. Conv., July 25, 1904.

THE inventor claims the use of calcium chloride or other similar deliquescent salts, especially magnesium chloride, in concentrated solution, to secure the homogeneity, improvement and preservation of roadways, streets and other surfaces, and also to prevent or diminish the disintegration of the surfaces, and the resulting formation of dust. (See also Eng. Pat. 16,993 of 1904; this J., 1905, 802.)—W. C. H.

*Roads ; Process for Preparing a Liquid to Prevent the Formation of Dust and Ice on —.* G. J. C. M. de Liebhäber. Fr. Pat. 356,331, July 22, 1905. Under Int. Conv., Aug. 3, 1904.

SEE Eng. Pat. 16,993 of 1904; this J., 1905, 802.—T. F. B.

*Slag ; Process for the Transformation of Blast-Furnace — into Cement.* H. Colloseus. Fr. Pat. 356,276, July 12, 1905.

By this process, blast-furnace slag is converted into cement by treating the molten slag, in a finely divided condition, with aqueous solutions of salts of calcium, aluminium and magnesium soluble in water. (See also Eng. Pat. 13,886 of 1905; this J., 1905, 971.)—W. C. H.

*Slag ; Process for Dissolving Solid Fluxes in Molten —.*

F. C. W. Timm. Fr. Pat. 356,252, July 20, 1905.  
Under Int. Conv., July 29, 1904.

THE process is intended for dissolving fluxes (lime, manganese dioxide, iron oxide, &c.) in molten blast-furnace slag, in the manufacture from the latter of cement, slag-wood, artificial stone, and the like. The solid flux mixed with coke is charged into a tall vessel or shaft, provided at the bottom with tuyères, through which is forced a blast of air to burn the coke and heat the mixture to incandescence. Or, the shaft may be charged with the flux alone, and the latter heated to incandescence by means of gaseous or liquid fuel injected with the air through the tuyères. The molten slag from the furnace enters the top of the shaft and flows down through the incandescent mass, dissolving the flux to a homogeneous solution, which is drawn off at the bottom.—A. S.

**X.—METALLURGY.**

(Continued from page 123.)

*Silicon Chloride ; Action of —, on Iron.* E. Vigouroux. Comptes rend., 1905, 141, 828—830.

WHEN the vapour of silicon chloride is passed over iron, reaction begins below a red heat, and is represented by the equation:  $\text{SiCl}_4 + 4\text{Fe} = \text{Fe}_2\text{Si} + 2\text{FeCl}_2$ . No lower chloride of silicon is formed, and no farther action of silicon chloride upon the silicide (which would produce a silicide containing more silicon) occurs.—J. T. D.

*Cuprosilicon ; Industrial —.* P. Lebeau. Comptes rend., 1905, 141, 889—891.

MICROGRAPHIC examination of a sample of cuprosilicon, as well as extraction of the constituents by solvents, showed it to be a mixture of silicide and free silicon. The substance was not homogeneous, the silicon content varying from 56 to 60 per cent. The extracted silicide contained 10.5 per cent. of silicon, corresponding nearly with the formula  $\text{SiCu}_4$ . It thus appears that, even in presence of an excess of silicon, the higher compound  $\text{SiCu}_2$  is not formed in these alloys.—J. T. D.

*Zinc ; Properties of Sheet — and Influence of Impurities.*

O. Meyer. Oesterr. Z. Berg.-Hütt., 1905, 53, 522—527; 538—541. Chem. Centr., 1905, 2, 1576.

ON etching rolled sheet zinc containing small amounts of other metals (cadmium, lead), with 5 per cent. nitric acid for 10 minutes, the thickness is considerably reduced, but unlike in the case of iron, the elasticity and crystalline structure of the metal shows no alteration; the results of bending tests are indeed slightly higher after the treatment than before. On heating rolled zinc to about 145° C., or, in many cases, somewhat higher, however, the mechanical properties are injured, the most marked effect being the increase of brittleness.

An addition of 0.2 per cent. of cadmium improves the quality of zinc, the transformation temperature being raised and the mechanical properties of the metal improved. The addition of lead or of 0.4 per cent. or more of cadmium proved of no influence in some cases, unfavourable in others, and did not, in any case, improve the qualities of the zinc. The presence of cadmium and lead together in the zinc is distinctly injurious. (See also Novak, this J., 1905, 1237.)—A. S.

*Antimony ; Modification of —.* A. Stock and W. Siebert. Ber., 1905, 38, 3837—3844.

BESIDES ordinary antimony, a black and a yellow modification exist. The black modification is obtained by rapid cooling of the vapour of the ordinary form, by reacting with oxygen on liquid stibine at temperatures above —90° C., or by molecular transformation of the yellow form. The apparatus used to prepare yellow arsenic (this J., 1905, 28, but the authors now prefer a platinum wire resistance wrapped round a porcelain tube to the cryptol there described) is filled with pure stibine, which is decomposed by heat so that its metal is deposited on the inner tube, the little beaker having been removed. The

apparatus is exhausted, immersed in liquid air, and the antimony volatilised at the lowest possible temperature (300° C.), when it forms a black deposit on the walls.

Should the temperature rise too high, ordinary grey antimony is deposited. Or, oxygen in as small bubbles as possible, is passed through liquid stibine at —40° C., when black antimony is deposited. Only small amounts are obtainable in either way, and the third-mentioned process yields more minute quantities still. Black antimony is amorphous, has a sp. gr. of 5.3, is more volatile than grey antimony, into which it is slowly converted at 100° C., and instantaneously, with heat evolution at 400° C. It is chemically active, oxidising in air at the ordinary temperature, sometimes so energetically as to catch fire. It seems to be formed (along with grey antimony) in several reactions, as reduction of antimonious chloride by aluminium, decomposition of sodium antimonide by water or magnesium antimonide by hydrochloric acid, &c.

Yellow antimony is obtained by passing oxygen through liquid stibine at —90° C. The reaction is very slow, and though slightly quickened by presence of a trace of ozone in the oxygen, yielded only 3 or 4 mgrms. of product; after that, the substance blackens, and then farther reaction produces the black form. It can be obtained in slightly larger amounts by the reaction at —100° C. of solutions in liquid ethane of chlorine and of stibine. Direct analysis has not yet proved this yellow substance to be antimony, but it is highly probable that it is so—it contains no hydrogen, no water, and no chlorine. It is exceedingly unstable, blackening as soon as its temperature rises above —90° C., even in the dark. It seems not to be soluble in carbon bisulphide, but to form a colloidal suspension, looking like a yellow solution. Possibly black antimony may be identical with the  $\alpha$ -antimony which Cohen assumes to be the modification causing "explosive antimony."—J. T. D.

*Soldering ; Application of Acetylene, in Autogenous —.*

S. Traubel. J. f. Gasbeleucht., 1905, 48, 1069—1070.

ATTEMPTS to substitute acetylene for hydrogen in autogenous soldering have not been very successful, as the acetylene has been used under pressure. In the Fouché system, it is used at the ordinary pressure of a few mm. of water column above the atmosphere, and the construct on of the burner prevents any flashing back. In the case both of hydrogen and acetylene, it is found desirable in practice to use for soldering a deficiency of oxygen—0.25 instead of 0.5 volumes for one volume of hydrogen, and 1.7 instead of 2.5 volumes for one volume of acetylene. The amounts of heat evolved by 1 cb. m. of each of these mixtures are 2072 and 5375 calories respectively. More over, the oxyhydrogen flame is much larger than the oxy-acetylene, and the heat is in the latter concentrated much more in a particular part, so that the temperature is much higher than in the oxy-hydrogen flame. Add to this that the outer part of the flame consists of reducing gases, hydrogen and carbon monoxide, and the advantages of acetylene are manifest. The author calculates the cost of soldering plates of different thicknesses, with hydrogen, oxygen, and acetylene costing 1.25, 4 and 1 mark per 1000 litres respectively, as follows:—

Thickness of Plate.	Cost per Metre.	
	Hydrogen.	Acetylene.
mm.	Marks.	Marks.
1	0.115	0.05
2	0.28	0.132
3	0.562	0.275
5	too costly	0.468
7	"	0.682
9	"	1.63

With thick plates it is desirable, for economy, to heat up first with an ordinary blow-pipe.—J. T. D.

*Explosives ; Aluminium in —.* C. E. Bichel. XXII., page 1324.



## ENGLISH PATENTS.

*Metals: Separation of — from their Ores.* J. D. Wolf, London. Eng. Pat. 17,407, Aug. 10, 1904.

THE ore mixed with water to form a wet pulp is fed on to the upper end of an inclined belt of stout canvas, moving over two rollers from the lower to the upper one. The belt has a ridge on each side to prevent the wet pulp from running off sideways, and is supplied with oil or grease of high viscosity and cohesion, e.g., heavy hydrocarbon oils treated with sulphur chloride, or residual oils, which causes the ore particles to adhere and be carried upwards with the belt, whilst the gangue and water flow down, and off the belt past the lower roller. Near the upper roller is a water-spray which washes off any loosely adhering particles of gangue; the belt then meets a scraper, which removes oil and ore particles; after which it comes in contact with an oiling device, and again passes over the lower roller.—A. G. L.

*Ore Washing Machinery; Impts. in —.* C. W. Denison, Denver, Colo., U.S.A. Eng. Pat. 4388, March 3, 1905.

THE invention consists of a buddle in which a hollow vertical shaft is mounted, so that it may be rotated in a step bearing. This shaft or independent shafts carry two conical tables, consisting of duck or other similar material spread over wide-meshed wire netting. An annular trough is placed around the circumference of each table, and is fitted with suitable partitions and shoots to carry away material. Water is caused to flow through the hollow shaft, emerging by arms placed over the tables, which arms distribute the water evenly. The rotation of the shaft may be effected by the back-pressure of the water leaving these arms, or, where water is scarce, may be effected by machinery. The material to be treated is fed on to the upper and larger table; the lower and smaller table serves to wash the fine gold or the like, which is removed from the upper one at intervals, a second time.—A. G. L.

*Smelting Ores and Separating Mattes and Recovering Mineral Values from Slag.* R. Baggaley, Pittsburg, Pa., C. M. Allen, Lo Lo, Mont., and E. W. Lindquist, Chicago, Ill., U.S.A. Eng. Pat. 8386, Apr. 19, 1905.

SMALL ore charges are continuously or intermittently introduced into a closed converter, which is supplied with an initial charge of molten matte. After Bessemerising, the matte and slag are discharged into a covered forehearth, the temperature of which is maintained as high as possible. In their passage along this forehearth, which is about 20 ft. long, the matte and slag are perfectly protected against the chilling effect of the air, and consequently the matte separates out practically completely. (Compare U.S. Pat. 789,648 of 1905; this J., 1905, 624.) —A. G. L.

*Iron Ores; [Magnetic] Treatment of —.* The Hernadthalser Ung. Eisenindustrie Act.-Ges. and E. Primosigh both of Budapest, Hungary. Eng. Pat. 16,643, Aug. 16, 1905.

CYLINDRICAL bell magnets are mounted on, and rotate around, a horizontal shaft, the annular poles of these magnets being directed towards each other. The material to be treated is fed in between these annular poles, with the result that the non-magnetic particles are at once ejected by centrifugal force, the feebly magnetic particles adhering for a time and falling between suitably placed partitions, whilst the strongly magnetic particles are carried nearly all the way round and are only removed by a stripping device.—A. G. L.

*Iron and Steel with Other Metals; Method of Uniting or Coating —, and Fluxes employed for that purpose.* E. L. Davies and W. G. Clark, both of Wessels Nek, Natal. Eng. Pat. 17,660, Aug. 13, 1904.

IRON or steel is covered with copper, gold, silver, or their alloys by heating the iron or steel to a temperature at which it oxidises readily, but which is below the boiling point of the other metal, covering the surface of the metal with a flux, cleaning the surface by means of scrapers passing across it, and then adding the other metal in the

molten condition, and agitating it so as to cover the whole of the surface, after which the flux is removed and the whole allowed to cool. The flux consists of silica, sodium carbonate, and sodium borate in about equal proportions, to which is added 1 per cent. of sodium phosphate or bone ash, but the proportions may be varied somewhat.—A. G. L.

*Iron or Steel Surfaces; Removal of Copper and Nickel from —.* W. R. Hodgkinson, London. Eng. Pat. 3225, Feb. 16, 1905.

SOLUTIONS containing ammonia in conjunction with an amide or an organic ammonium salt, with or without the addition of nickel or copper chloride, are used to remove nickel or copper from steel or iron surfaces without injuring the latter. Suitable solutions, which may be used repeatedly are: (1) A saturated solution of urea in cold glycerin to which are added 5 per cent. of strong ammonia solution and 0.1 per cent. of nickel or copper chloride. (2) Formic acid, 375 c.c.; ammonia, sp. gr. 0.880, 1875 c.c.; cuprous chloride, 60 grms.; water, 6000 c.c. A solution which is quicker in its action than either of the above, but can only be used once, consists of 1 lb. of ammonium persulphate dissolved in 1 gall. of ammonia (sp. gr. 0.880).—A. G. L.

*Iron and Steel; Manufacture of Charcoal —.* J. J. Hudson, Philadelphia. Eng. Pat. 5367, March 14, 1905.

SEE U.S. Pat. 785,002 of 1905; this J., 1905, 336.—T. F. B.

*Steel for Railway and Tramway Rails; Manufacture of —.* C. P. Sandberg, London. Eng. Pat. 7698, April 11, 1905.

THE crude steel is freed as far as possible from silicon, as in the manufacture of tool steel, and a material rich in silicon, e.g., silicious spiegel or ferro-silicon, is then added in such proportion that the final product contains 0.25 to 0.5 per cent. of silicon.—A. G. L.

*Amalgamators; Impts. in —.* D. Draper and G. A. Hay, both of Johannesburg, Transvaal. Eng. Pat. 4744, March 7, 1905.

THE amalgamator consists essentially of a rotating drum, with horizontal axis, the periphery of the drum being the amalgamated surface. The drum is enclosed in a casing, and ore-pulp is delivered on its surface from a pipe in a direction opposed to that of rotation. The gold and concentrates being caught by the amalgam, the tailings flow out through a pipe near the bottom of the casing. The concentrates are then washed off by a water-spray inside the casing, and fall into a recess in the latter, from which they are removed. A revolving brush for cleaning the amalgam is placed in the upper part of the casing so that its action can be watched through a glass plate fixed in the latter. The amalgam is scraped off from time to time by a scraper placed in the lower part of the casing, and which may be made to traverse the whole of the surface of the drum longitudinally. The action of the amalgamator is continuous or practically so.—A. G. L.

*Furnaces; Crucible —.* F. Forster, Gröze, Switzerland. Eng. Pat. 12,300, June 13, 1905.

SEE Fr. Pat. 355,155 of 1905; this J., 1905, 1239.—T. F. B.

*Furnaces; Hearths of Roasting and like —.* J. E. Greenawalt, Denver, U.S.A. Eng. Pat. 12,320, June 13, 1905.

SEE Fr. Pat. 355,312 of 1905; this J., 1905, 1239.—T. F. B.

*Furnaces; Tilting —.* F. H. Treat, Pittsburg, U.S.A. Eng. Pat. 15,296, July 25, 1905.

SEE U.S. Pat. 802,151 of 1905; this J., 1905, 1177.—T. F. B.

*Drying Gelatin, Glue, Paste Goods, Brewers' Grains Bricks, Woods, Metal Articles and the like; Apparatus for —.* O. Koepff. Eng. Pat. 5748, March 18, 1905. I., page 1291.

## UNITED STATES PATENTS.

*Furnace; Combined Smelting and Refining* —. C. C. Medbery, New York. U.S. Pat. 804,330, Nov. 14, 1905.

THE furnace consists of a cylindrical heating chamber lined with firebrick or other refractory material, and mounted so that it can be rotated and also tilted to any desired position. The chamber has a central opening at each end. At one end, in which two or more tapping holes are provided, the opening is closed by a muffle-door, whilst the opening at the other end of the chamber carries a hollow bearing which supports a "slip-joint" connected to a fuel-supply device and to a chimney. Cooling water is circulated in the hollow bearing. By means of this slip-joint, fuel can be supplied to, and the products of combustion discharged from the chamber, while the latter is being rotated. The fuel-supply device consists of a burner nozzle with suitable pipes for supplying the fuel (oil) and compressed air.—A. S.

*Furnace; Roasting* —. A. W. Chase, Avoca, Iowa, Assignor to The Chase Furnace Co., Philadelphia, Pa. U.S. Pat. 804,379, Nov. 14, 1905.

A SERIES of troughs, one above the other, composed of U-shaped fire-clay sections, is supported between the end walls of the furnace. Conveyors, mounted on hollow shafts, are rotated in the troughs and feed the material from each trough to the one below. The conveyors are driven at different speeds, increasing from the top one downwards, and the hollow shaft is supplied with a cooling fluid. Plates having circular openings and slots are fitted over openings in the end walls of the furnace, and to these plates are affixed other removable plates made in two sections, fitting round the conveyor shafts, and adapted to close the openings in the fixed plates.—A. S.

*Furnace; Roasting* —. A. R. Meyer, Assignor to The United Zinc and Chemical Company, Kansas City, Mo. U.S. Pat. 804,751, Nov. 14, 1905.

THE furnace comprises a hollow vertical shaft through which passes a central rod, whilst hollow stirring arms extend in pairs from hollow bosses disposed at intervals in opposite sides of the shaft. There are partitions extending across the shaft and centrally through the hollow bosses and stirring arms, and other partitions dividing the shaft into compartments, alternate ones of which carry the stirring arms. Water is fed in at the top of the shaft and flows down in contact with the inner face thereof, collecting in gutters between the partitions, and flowing from one gutter to the next below, through valved pipes passing through the partitions. A cooling fluid (air) is supplied to the bottom of the shaft and escapes at the top.—A. S.

*Furnace; Roasting* —. A. R. Meyer, Assignor to The United Zinc and Chemical Co., Kansas City, Mo. U.S. Pat. 804,752, Nov. 14, 1905.

A HOLLOW pipe or shaft carries, on opposite sides, a series of arms, which extend through bosses on the shaft, and have their inner ends interlocked within the shaft. Ports are provided in the bosses communicating with outlet ports in the arms, the latter in turn being connected with a discharge flue down which water is made to flow. The arms are also provided, nearer their inner ends, with inlet ports communicating with a supply flue to which air is admitted. Water is fed in at the top of the shaft and is held at different points within the shaft by gutters, which have perforations inclined to discharge the water towards the inner face of the shaft.—A. S.

*Iron Oxide; Preparing* —, for use in Blast Furnaces. U. Wedge, Ardmore, Pa. U.S. Pat. 804,692 and 804,693, Nov. 14, 1905.

IRON oxide in small particles is prepared for use in a blast-furnace, by mixing it with powdered argillaceous matter, or with the flue-dust of Portland cement-burning furnaces, or with the cement itself, and subjecting the mixture, with agitation, to sufficient heat to fuse the iron oxide particles.—E. S.

*Metallurgical Process.* W. E. Everette, Tacoma, Wash. U.S. Pat. 804,936, Nov. 21, 1905.

THE pulverised materials are treated with liquid oxygen, whereby they become "extremely frigid" and occlude a portion of the oxygen, and are then forced into and through a suitable melt, which has been previously prepared and heated to incandescence. The metal and slag produced are drawn off at different levels. It is stated that the metals contained in the charge, are largely freed from sulphur and phosphorus, and are rapidly fused.—A. S.

*Metal-Leaching Process.* T. B. Joseph, San Francisco, Cal. U.S. Pat. 805,017, Nov. 21, 1905.

THE process is for the extraction of metals, such as gold, silver, copper and nickel, from ores, by extracting the latter with a solution containing water, sodium cyanide and ammonium carbonate, with the addition, in certain cases, of one or more of the following substances:—Ammonium nitrate, calcium hydroxide, sodium bicarbonate. The amount of ammonium carbonate used is in excess of that of sodium cyanide and the extraction may be accelerated by the use of compressed air. The metals are precipitated from the solution by known methods.—A. S.

*Zinc and Aluminium Plates for Printing Purposes; Process for Preparing* —. E. O. Schmiel, Leipsic, Germany. U.S. Pat. 805,031, Nov. 21, 1905.

ZINC and aluminium plates are prepared for printing by rubbing them over with acetic acid before the drawing or the like is applied. After applying the drawing, the plates are etched with a saturated solution containing equal parts of acid oxalate of potassium and gum-arabic.—A. S.

*Amalgamator.* C. W. Patten, Lynn, Mass. U.S. Pat. 805,090, Nov. 21, 1905.

THE apparatus consists of a trough containing mercury, having a shallow portion of uniform depth, with a weir at the discharge end of this shallow portion, and a pit or well of greater depth at the opposite end of the trough. One or more "submerging-drums" are disposed in the well or deep end of the trough, and a rotating water-supply pipe extends transversely across the trough, having jet orifices, through which water is discharged on to the surface of the mercury between the weir and the drums.—A. S.

*[Iron] Metal; Method of Making Oxide-coated Sheet* —. A. Ridd, Newport, Ky. U.S. Pat. 805,095, Nov. 21, 1905.

SHEET iron is rendered rust-proof by heating it in an annealing or heating furnace, applying a heavy, uniform layer of dry, powdered iron oxide to its surface, then passing between heated rollers, and afterwards annealing.—A. S.

*Iridium; Art of Producing Metallic* —. H. C. Parker, New York, Assignor to Parker-Clark Electric Co., Jersey City, N.J. U.S. Pat. 805,316, Nov. 21, 1905.

IRIDIUM-AMMONIUM chloride in the form of powder is mixed with excess of a reducing agent, such as ammonium chloride, the mixture is placed on or "confined in" a refractory substance, and heated to drive off the volatile matter, whereby coherent, metallic iridium is produced.—A. S.

*Ores; Process of Concentrating* —. W. M. Sanders, Iola, Kans. U.S. Pat. 805,382, Nov. 21, 1905.

ZINC sulphide ores are treated with a non-acid solution containing a sulphate of an earth metal, and capable of reacting with the ore with evolution of gas, and the particles that are sustained by the evolved gas are separated.—A. S.

## FRENCH PATENTS.

*[Alloys] Metal in another Metal; Process permitting of the Incorporation of a — Without Fusion of the latter.* H. L. Herrenschildt. Fr. Pat. 350,232, Oct. 18, 1904.

THE invention has mainly in view the incorporation of vanadium, titanium, manganese, aluminium, molyb-



denum, &c., with copper, without fusion of the latter. Any one of the metals named may be presented to the previously-heated copper, while in a fused and highly-heated state. The cementation may be effected by the aluminothermal process, or by aid of the electric furnace, or other wise. As an example, in effecting the cementation of vanadium with copper, vanadic acid is mixed with the proportion of aluminium necessary for the reduction, and the rod of copper is plunged into the mixture, which, being lighted, gives a nodule of vanadium, whilst the copper, without having been fused, has absorbed vanadium, together with a little aluminium. In some cases the bar or piece of copper to be cemented, is heated to from 600° to 900° C. before being brought into contact (as in the electric furnace) with the fused and highly-heated metal with which it is to be cemented.—E. S.

*Chemical Reaction; Process and Apparatus for Promoting Energetic* — C. G. P. de Laval. Fr. Pat. 356,096, July 12, 1905. Under Int. Conv., July 19, 1904.

FIG. 1.

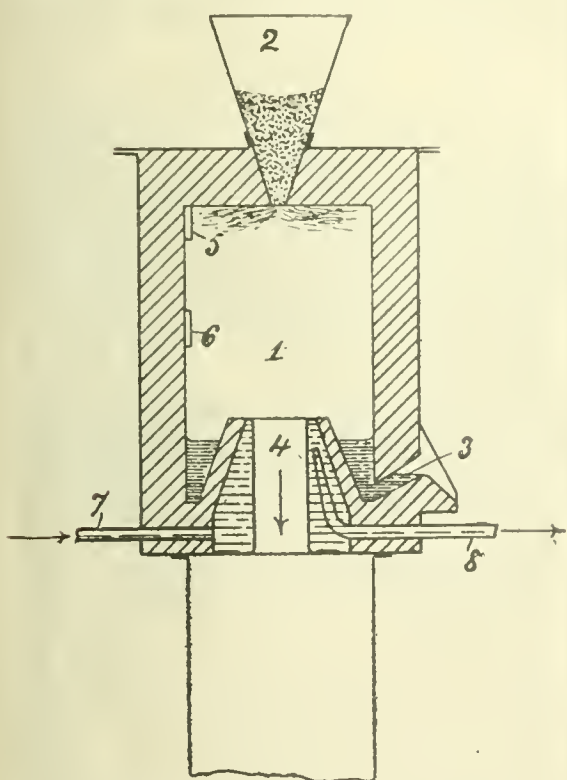
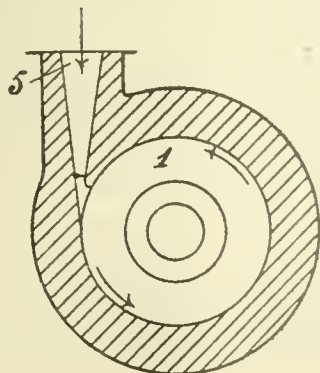


FIG. 2.



The reactions between gases and solid, liquid or gaseous substances, are brought about in a chamber 1 provided with tangential tuyères at 5 and 6 (see figures). The material to be treated is introduced at the top of the chamber from the hopper 2, whilst the gases passing through the tuyères cause a rapid mixing and rotation of the contents. Owing to the centrifugal action the liquid and solid products pass towards the sides and are collected in the annular receptacle at the base of the furnace, from which they are removed at 3. The gaseous products, on the other hand, pass out through the central exit 4, which may be cooled by water circulating through the pipes 7, 8. An oxidising or reducing action can be produced according to the nature of the gases introduced, or the furnace may have oxidising and reducing zones by using two tuyères with injection of reducing or oxidising gases.—P. S. H.

*Zinc, or Oxide of Zinc; Process of Extracting* — C. G. P. de Laval. Fr. Pat. 356,097, July 12, 1905.

The powdered charge of mineral, mixed with the necessary flux and reducing material, is introduced into a furnace of the type described in the preceding abstract. Air or other gases are introduced through the tangential tuyères and cause the rapid spiral rotation of the contents. The vapours of zinc or oxide of zinc pass out through the exit (4) and are condensed by any suitable process.—R. S. H.

*Iron; Extraction of — from its Minerals.* C. G. P. de Laval. Fr. Pat. 356,098, July 12, 1905.

As in the two specifications abstracted above, the charge of mineral mixed with flux and reducing material is introduced through a central hopper and air or gases through tangential tuyères. The iron collects in the annular chamber at the base of the furnace, whilst the gaseous products of the reaction pass through the central exit. The walls of this exit are water-cooled to prevent the dust carried by the gases from blocking the passage.—R. S. H.

*Tin Plate; Impts. relating to the De-Tinning of Cuttings of* — T. Goldschmidt. Fr. Pat. 356,228, July 18, 1905.

The cuttings are strongly pressed, for example, in wire baskets, and placed in a closed vessel, in which they are treated with gaseous chlorine or an anhydrous liquid containing chlorine under a varying, preferably increasing pressure; the tin is dissolved, and the stannic chloride formed, flows into a receptacle at the bottom of the closed vessel. When the tin is completely dissolved, the residual chlorine is removed by means of a current of an inert gas, and the de-tinned iron is washed with water and an alkaline lye.—A. S.

*Metalliferous Substances; Process for Purifying and Forming into Nodules* — T. C. King. Fr. Pat. 356,413, July 25, 1905. Under Int. Conv., Nov. 14, 1904.

SEE U.S. Pat. 794,673 of 1904; this J., 1904, 891.—T.F.B.

*Slag; Process for Dissolving Solid Fluxes in Molten* — F. C. W. Timm. Fr. Pat. 356,252, July 20, 1905. IX., page 1308.

## XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(Continued from page 1212.)

### (A.)—ELECTRO-CHEMISTRY.

*Chromium Sulphate; Role of Lead Peroxide as Anode in the Electrolytic Oxidation of — to Chromic Acid.* E. Müller and M. Soller. Z. Elektrochem., 1905, 11, 863—872.

Uron bright platinum anodes a solution of chrome alum in normal sulphuric acid gives practically no chromic acid on electrolysis. In presence of mere traces of lead the reaction is greatly favoured and the formation of peroxide of lead on the anodes is noticed under these conditions. The authors also confirm the fact that the electrolytic

regeneration of chromic acid progresses rapidly and with good efficiency when lead electrodes are employed. With platinised platinum electrodes, oxidation of the chromium sulphate is also observed, but the efficiency is only about one-third of that with lead electrodes under otherwise similar conditions. In attempting to account for these observations, it has been found that the oxidation is to be ascribed to the "catalytic action of lead peroxide" rather than to any marked "over-voltage" at lead and platinum anodes respectively. In confirmation of this, it is noted that chromic salts are also oxidised so as to yield chromic acid by lead peroxide, without any intervention of electrolysis.—R. S. H.

#### ENGLISH PATENTS.

*Insulating Material; A New —, and Process for Preparing the same.* J. Meyenberg, Baar, Switzerland. Eng. Pat. 12,105, June 9, 1905.

ANIMAL fibres, such as hair, wool, sponge cuttings, or the like, are cut up, collected in heaps, and subjected to the action of moisture at a temperature of from 20° to 27° C., until they become soft. The mass is then mixed with an alkaline lye, until it is homogeneous, and treated with, for instance solution of an acid chromium salt, whereby the "natural cement" (such as gelatin) is dissolved out. The flocculent precipitate formed is collected. The mass is then freed from the neutralised remains of the alkaline solution, and the filaments and "natural cements" thus "chemically separated," are subjected to a "mechanical combination," preferably by the use of a centrifugal separator. The mixture is worked up with a mixture of ozokerite, carnauba wax, colophony and linseed or almond oil in stated proportions, and is subjected in plates to very high pressure at a temperature of at least 80° C. Finally, to protect the plates of the insulating material against combustion, and to render them moisture-resisting, they are impregnated with a silicate solution and with hydrocarbons.—E. S.

*Nitric Acid; Process for Producing — by Electricity.* W. P. Thompson, London. From Westdeutsche Thomasphosphatwerke, G.m.b.H., Berlin. Eng. Pat. 25,010, Nov. 17, 1904.

SEE FL. Pat. 348,189 of 1904; this J., 1905, 441.—T. F. B.

*Carbon Bisulphide; [Electrical] Process for the Production of —.* A. Augier, Paris. Eng. Pat. 10,927, May 25, 1905. Under Int. Conv., May 31, 1904.

SEE FR. Pat., 353,028 of 1905; this J., 1905, 1021.—T. F. B.

#### UNITED STATES PATENT.

*Electrolytical Decomposition; Apparatus for —.* G. E. Cassel, Stockholm, Sweden. U.S. Pat. 804,931, Nov. 21, 1905.

THIS invention relates to an electrode composed of two end plates of conducting material, with superposed plates upwardly inclined between the end plates, and approximately half the width of the latter; the superposed plates are also inclined towards each other with spaces between their adjacent edges. A closed hood, over the spaces and over all the inclined plates, is provided with an eduction pipe extending from one end plate to the other.—B. N.

#### FRENCH PATENTS.

*Generator of Electricity; Thermo-Chemical —.* L. P. Basset. Fr. Pat. 356,442, July 27, 1905.

A GAS-TIGHT vessel is divided into compartments by walls constructed alternately of carbon and of porous material. Through alternate compartments a dilute solution of sulphurous acid, or other oxidisable compound, is passed, whilst the other compartments are traversed by a dilute solution of sulphuric acid containing bromine, or other suitable dilute solution to which is added a body capable of fixing hydrogen. The end carbons are connected to the positive and negative terminals of an external circuit, through which passes the current generated in the vessel; the sulphurous acid is oxidised with simultaneous formation of hydrobromic acid. By means of an external

source of heat, and an appropriate arrangement, the active products are regenerated by the interaction of the sulphuric and hydrobromic acids, and the active products are passed back into their respective receptacles.—B. N.

*Insulating Material and Process for Making the same; Electrical —.* Soc. Anon. Matthey et Cie. Fr. Pat. 356,819, Aug. 11, 1905.

SEE Eng. Pat. 18,920 of 1904; this J., 1905, 850.—T. F. B.

*Chlorine; Employment of Gaseous Hydrochloric Acid for the Manufacture of —, by Electrolysis of its Solution Regenerated Continuously.* E. F. Côte and J. B. Febvre. Fr. Pat. 356,115, July 12, 1905.

THE electrolytic cell is divided into two chambers. The solutions from the anode and cathode chambers are independently circulated and brought in contact with gaseous hydrochloric acid so as to continuously maintain their concentration. In this way danger of contact between the anode-liquid charged with chlorine and the cathode liquid charged with hydrogen is avoided.

Means are also provided for cooling the electrolyte and for observing the level of the liquid in the two chambers of the cell.—R. S. H.

#### GERMAN PATENTS.

*Lead Peroxide; Process for the Electrolytic Preparation of — from Lead Sulphide.* F. R. Steigelmann. Ger. Pat. 162,107, Jan. 16, 1903.

LEAD sulphide is used as the anode, whilst the electrolyte consists of water, to which only sufficient sulphuric acid (less than 1 per cent.) is added to render the water a good conductor, whilst excluding the formation of sulphuretted hydrogen and lead sulphate.—A. S.

*Electrodes of Alkaline Secondary Batteries; Process for the Preparation of Active Material for the Negative — from Iron "Hammer-Scale."* M. Roloff. Ger. Pat. 162,199, Aug. 13, 1903.

FOR the preparation of the active material, only ferro-ferric oxide,  $\text{Fe}_3\text{O}_4$ , separated from the "hammer-scale" by magnetic means, is employed. It is claimed that plates prepared with the pure magnetic oxide are much superior to those prepared with the crude "hammer-scale," and this difference of quality becomes more pronounced after the cell has been in operation some time.—A. S.

*Electrode for Secondary Batteries, composed of Active Material enclosed in a Finely Perforated Casing of Conducting Material.* H. Wehrlin. Ger. Pat. 162,200, Aug. 23, 1903.

CLAIM is made for the interposition of a membrane (not more than 0.001 mm. thick) of a metal insoluble in the electrolyte, between the active material and the perforated casing. This film of metal closes the fine openings in the casing, but allows the current to pass through without any appreciable difference of potential.—A. S.

*Electrode Materials of Badly-conducting Metallic Oxides or Hydroxides; Process for Increasing the Activity of — in Secondary Batteries with Unalterable Electrodes.* Kölner Akkumulatorenwerke G. Hagen. Ger. Pat. 161,802, Nov. 13, 1903.

THE powdered oxide or hydroxide is intimately mixed with finely-pulverised, chemically-pure graphite, and to the mixture is added crystalline scales of pure graphite. Suitable proportions are:—Nickel hydroxide, 32; chemically pure graphite in powder, 4; and pure graphite in crystalline scales, 14 parts.—A. S.

#### (B.)—ELECTRO-METALLURGY.

*Copper; Distillation of —.* H. Moissan. Comptes rend., 1905, 141, 853—857.

COPPER can be readily distilled in the electric furnace; the author has distilled quantities up to nearly 250 grms. When the vapour is condensed on a cold surface, it forms a felted mass of filiform crystals, which has a low density



(8-16), probably due to the presence of occluded gas, but has all the chemical characters of ordinary copper. At the boiling point copper dissolves graphite, and on cooling, the graphite separates in more or less well-defined crystals.—J. T. D.

*Lead and Copper; Electrolytic Assay of* ——. G. A. Guess. XXIII., page 1325.

Kind of Oil.	Fatty acids obtained from lead salts insoluble in ether.			
	Total amount.	Amount soluble in petroleum ether.	Amount insoluble in petroleum ether.	
	Per cent.*	Per cent.*	Per cent.*	Per cent.*
Commercial blown rape oil .....	1.2	1.21		
Blown rape oil prepared by author .....	14.5	5.7	8.8	
Commercial blown cotton-seed oil .....	20.6	8.7	11.9	
Blown cotton-seed oil prepared by author .....	32.0	23.3	9.6	
	45.8	32.5	13.3	

\* The percentages refer to the weight of oil used for the preparation of the lead salts of the fatty acids.—A.S.

#### ENGLISH PATENT.

*Metallic Wall Coverings; Production of* ——. [*Electrolytically*], and *Apparatus therefor*. S. O. Cowper-Coles. London. Eng. Pat. 24,904, Nov. 16, 1904.

METALLIC wall coverings are produced by the electro-deposition of a metal upon a cathode, the latter having upon its surface the pattern to be reproduced. A hollow cylinder of lead, or lead alloy, is cast with the pattern upon its outer surface, and the cylinder is then mounted on a mandrel which is partially immersed in an electrolyte, and in which it almost floats. The anode bars are arranged concentrically with and near to the immersed portion of the cathode, and are made adjustable in order to bring them nearer to the drum as they dissolve away. Between the anode bars are located perforated lead pipes connected to a pump, so that a stream of electrolyte is continually directed on to the cathode. The latter is slowly rotated by a revolving supporting trunnion in the upper portion of the tank, suitable cams giving a reciprocating lateral motion to the cathode, so that the whole of the surface is operated upon by the jets of electrolyte. A high current density combined with a low voltage is used, the speed of the cathode being such that the metal is deposited during the passage of the cathode through the electrolyte, and the deposited metal is stripped from the cylinder as it emerges from the electrolyte. The mandrel may be heated with superheated steam, if necessary, so as to produce a rapid "convexular" motion in the electrolyte in contact with the cylinder.—B. N.

#### FRENCH PATENT.

*Furnaces; Impts. in Electric* ——. H. Aubry. Fr. Pat. 356,483, July 18, 1905.

This invention relates to the oscillating type of electric furnace supported on trunnions. The latter are placed out of the centre, and a little behind the vertical axis of the furnace, so that the furnace is in a state of unstable equilibrium with a constant tendency to overturn. A bar placed under the furnace engages in hooks fixed to the framework, and maintains the furnace in its normal position.—B. N.

## XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(Continued from page 1232.)

*Fatty Oils; Detection of "Blown"* ——. in *Mixtures with Mineral Oil*. J. Marcusson. Chem. Rev. Fett-u. Harz-Ind., 1905, 12, 290—293.

AFTER describing the usual methods for the detection of "blown" oils in lubricating oils, the author proposes a method for distinguishing whether the "blown" oil has been prepared from rape oil or cottonseed oil, the two oils

stated to be most commonly used for the preparation of "blown" oils for lubricating purposes. The method is based on the different behaviour of the lead salts of the fatty acids from the two oxidised oils towards ether, and also on the behaviour towards petroleum ether of the fatty acids separated from the lead salts insoluble in ether. Some results obtained by this method are shown in the following table:—

Fatty acids obtained from lead salts insoluble in ether.			
Total amount.	Amount soluble in petroleum ether.	Amount insoluble in petroleum ether.	
Per cent.*	Per cent.*	Per cent.*	Per cent.*
1.2	1.21		
14.5	5.7	8.8	
20.6	8.7	11.9	
32.0	23.3	9.6	
45.8	32.5	13.3	

*Sodium Palmitate; Hydrolysis of* ——. R. Cohn. XXIII., page 1326.

#### UNITED STATES PATENTS.

*Oil; Apparatus for Extracting* ——. V. D. Anderson. Cleveland, Ohio. U.S. Pat. 805,112, Nov. 21, 1905.

CLAIM is made for an apparatus combining a grinding-mill, a "tempering trough," in which the material is heated and mechanically agitated whilst being conveyed to the press, an expelling press which works continuously, and means for separating solid matter from the oil as it leaves the press.—C. A. M.

*Dissolver [for Soap, &c.]*. W. J. Flitton, Chicago, Ill. U.S. Pat. 805,276, Nov. 21, 1905.

THE soap or other substance is placed on a perforated support within a vessel and is dissolved by means of steam from a pipe coil. There is also a pipe for the introduction of water and a float to control the valve, so that the water is maintained at a constant level below the support to receive the dissolved substance. The solution is discharged through a gate or through a pipe communicating with the lower part of a cylinder from which a given quantity may be expelled by means of a piston controlled by a handle.—C. A. M.

#### FRENCH PATENT.

*Hydrosulphurous Acid and another Acid; Preparation and Utilisation of Double Salts of* ——. J. Harding. Fr. Pat. 350,189, Sept. 24, 1904. VII., page 1303.

## XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(Continued from page 1245.)

(B.)—RESINS, VARNISHES.

*Lac Industry of India; The* ——. G. Watt. Pharm. J., 1905, 75, 646—652.

THE subject is treated under the following heads:—(1) *History of lac* (including the discovery of cochineal). (2) *Origin of lac*. (3) *The production of lac*. Here it is pointed out that it has not yet been proved whether the old lac from which the larvae have escaped ("phunki") is really inferior to lac containing the larvae, as is generally supposed. The great fluctuations in the price of Indian lac are commented on. It is thought possible that the different grades of lac may be due to different species of insect. (4) *Manufacture of lac*. The twigs encrusted with lac are collected from the trees in May to June, and in October to November: they are known as stick lac, and are dried in the shade, when the wood shrinks, leaving the

lac as hollow tubes to which a certain amount of wood adheres. When crushed and reduced to roundish pieces it is known as seed lac; the dust produced on sifting this is called "khud." The purified seed lac is then washed in stone troughs and left to stand, covered with water, for 24 hours; the wood floats to the top and is removed. A man now enters the trough and presses the lac with his feet against the sides, thus breaking up the lac into finer particles. The water, which is of a deep claret colour, is run off, and the lac is washed again until the washings are colourless. These are evaporated and the residue pressed into cakes, forming lac dye, when this is required. The washed seed lac is sifted into two qualities, dust ("gaud") and granular. The seed lac is occasionally washed or boiled either with a solution of sodium carbonate or with a solution of sodium or potassium carbonate and borax, or with borax alone, or with alum. After several such treatments it is said to become almost white. In most of the larger factories, however, this treatment is dispensed with, the seed lac being simply washed repeatedly with water. In either case the seed lac is spread out on specially arranged floors and exposed to light and air, whereby it is thoroughly dried and further bleached. It is then fused with orpiment or rosin, according to the purpose for which it is intended: the mixture is placed in long, narrow bags, which are placed in front of a long open fire in such a way that they may be twisted whilst being moved slowly along. The top of the bag is twisted round, the bottom being held, so that the fused lac is gradually squeezed through the bag: it is scraped from this with an iron scraper, and allowed to drop on the floor in front of the fire, which is kept cool by sprinkling with water; this is thought to produce some allotropic modification of the lac. If the lac is not sufficiently heated, it is scraped from the floor and returned into the top of the bag. For the manufacture of shellac, a mass of molten lac is spread on a zinc or earthen tube, filled with hot water, by means of a ribbon of palm leaf, to a thickness of about  $\frac{1}{8}$  in. This sheet or skin is now clipped from the tube, trimmed to rectangular form, and stretched in front of a fire, to three or four times its original size, when it is the thickness of tissue paper. It is now laid on a mat and allowed to cool gradually. The sheets are assorted according to colour, and the impurities and darker coloured portions removed. In the production of garnet lac, the sheets are taken from the hot tubes, no further stretching being necessary. For preparing button lac, the molten lac is simply allowed to drop on to a smooth surface. Garnet and button lacs contain no arsenic as a rule. The refuse from the melting bags is made into large circular cakes, which are sold to manufacturers of sealing wax, toys, &c., and to cabinet makers, who use them to cover up cracks in wood. During the five years ending 1903, the average number of factories registered was 102, employing about 7,000 persons. (5) *The uses of lac.* (6) *The trade in lac.* The first recorded exports from India were in 1607; in 1805, 2377 cwt. of shellac, valued at 12,978*l.*, were exported, and the amount increased slowly, being 7226 cwt. of "lac-resin" and 4756 cwt. of lac dye in 1839. In 1868—1869 the value of shellac sent to Europe was about 80,000*l.*, and of lac dye 53,300*l.*, since when the trade in shellac has increased to 1,400,000*l.* while that of lac dye has disappeared. The bulk of Indian shellac goes to the United Kingdom, and the United States, the amounts shipped to the two countries in 1903—4 being 73,269 cwt., and 81,817 cwt. respectively. (See also this J., 1905, 1134.)—T. F. B.

## UNITED STATES PATENT.

*Lacquer or Varnish; Compound suitable as* —. L. Lederer, Sulzbach, Germany. U.S. Pat. 804,960, Nov. 21, 1905.

SEE Fr. Pat. 352,897 of 1905; this J., 1905, 978.—T. F. B.

## (C)—INDIA-RUBBER, Etc.

*Rubbers from Burmese Climbers.* Bull. Imp. Inst., 1905, 3, 230—233.

VERY small quantities of latex from two climbers or vines from Burma were examined.

*Ecdysanthera micrantha*, A.Dc.—This vine occurs in Southern Asia from Assam to Indo-China and is exploited in the French territories for its rubber. Experiments showed that the latex could be very readily coagulated by the application of gentle heat. A yield of about 25 per cent. of rubber was obtained from the latex and the product appeared to be of very fair quality, free from stickiness, and exhibiting fairly good elasticity and tenacity. The dried rubber showed on analysis:—Caoutchouc, 84.1; resin, 11.5; insoluble matter, 4.4 per cent.

*Parameria pedunculosa*, Benth.—This vine is stated to yield very good rubber in Java and Sumatra, but the latex received from Burma did not confirm this statement; steps should be taken to verify the identity of the samples. The latex coagulates very shortly after collection; the sample examined was in the form of a pinkish-white curd, drying to a friable powder of very little commercial value. Analysis showed:—Caoutchouc, 10.7; resin, 88.5; insoluble matter, 0.8 per cent., including 0.3 per cent. of ash.—J. F. B.

## ENGLISH PATENT.

*Rubber and the like; Means and Appliances for Making Articles of* — such as Stamps. A. S. Bowley, Putney, and T. W. Hanmer, Uckfield. Eng. Pat. 17,239A, Aug. 8, 1904.

SEE Fr. Pat. 353,798 of 1905; this J., 1905, 1245.—T. F. B.

## UNITED STATES PATENTS.

*Rubber Bodies; Article of Manufacture, Comprising Leather and* —. C. L. Ireson, Boston, Mass. U.S. Pat. 804,550, Nov. 21, 1905.

THE product consists of tanned leather containing sulphur, rubber previously vulcanised by heat, and an intermediate connecting layer between the two and cold-vulcanised with them.—C. S.

*Rubber; Method of Attaching* — to Leather. C. L. Ireson, Boston, Mass. U.S. Pat. 804,551, Nov. 21, 1905.

THE surfaces of the leather (which is tanned, and contains sulphur) and the rubber (which has been previously vulcanised by heat) are coated thinly with ordinary rubber cement and then with an agent capable of vulcanising the rubber cement and its adjacent sections, the whole being afterwards subjected to pressure at ordinary temperature, for vulcanisation to ensue. The vulcanising agent consists of sulphur protochloride and naphtha or benzene.—C. S.

*Rubber; Method of Attachment of* — and Leather. C. L. Ireson, Boston, Mass. U.S. Pat. 804,553, Nov. 21, 1905.

LEATHER, freed from oils or other substances capable of injuring rubber, is treated with an element of a vulcanisable compound, and is then united with a body of rubber or rubber compound, under heat and pressure, by means of an interposed sheet of vulcanisable rubber compound chemically and mechanically united to both. —C. S.

## FRENCH PATENT.

*Caoutchouc from Rubber-yielding Plants; Process for the Extraction of Pure Raw* —. K. von Stechow. First Addition, dated July 10, 1905, to Fr. Pat. 355,611, June 5, 1905 (this J., 1905, 1245.)

THE present addition relates to the extraction of pure caoutchouc from the crude product by extracting the latter with a mixture of acetone and amyl, methyl and ethyl alcohols.—A. S.

## XIV.—TANNING, LEATHER, GLUE, SIZE.

(Continued from page 1245.)

## ENGLISH PATENT.

*Drying Gelatin, Glue, Paste Goods, Brewers' Grains, Bricks, Woods, Metal Articles and the like; Apparatus for* —. O. Koepf. Eng. Pat. 5748, March 18, 1905. I., page 1291.



## UNITED STATES PATENTS.

*Tanning Process.* J. Campbell, Chicago, Ill. U.S. Pat. 804,450, Nov. 14, 1905.

HIDES are tanned by soaking them in a solution containing a vegetable tanning material and sodium nitrate.  
—A. S.

*Rubber Bodies; Article of Manufacture comprising Leather and —.* C. L. Ireson. U.S. Pat. 804,850, Nov. 21, 1905. XIII C., see preceding page.

*Rubber; Method of Attaching — to Leather.* C. L. Ireson. U.S. Pat. 804,851, Nov. 21, 1905. XIII C., see preceding page.

*Rubber; Method of Attachment of — and Leather.* C. L. Ireson. U.S. Pat. 804,853, Nov. 21, 1905. XIII C., see preceding page.

## FRENCH PATENTS.

*Hydrosulphurous Acid and another Acid; Preparation and Utilisation of Double Salts of —.* J. Harding. Fr. Pat. 350,189, Sept. 24, 1904. VII., page 1303.

*Casein; Composition with a Basis of — and its Application for Sealing Vessels of Metal, Glass, Porcelain, &c.* C. Jovignot. Fr. Pat. 356,541, July 31, 1905.

CASEIN is treated with a hot aqueous solution of sodium phosphate, ammonium fluoride and glycerin, the whole being then heated on the water bath until it is homogeneous and viscous. This product is employed for hermetically sealing bottles of metal, glass, porcelain, &c., by applying it in a warm state to the edge of the vessel or cover, and then treating it with formaldehyde or the like.  
—C. S.

## XV.—MANURES, Etc.

(Continued from page 1245.)

*Nitrification; Intensive —.* A. Müntz and E. Lainé. VII., page 1301.

## FRENCH PATENT.

*Manure; Manufacture of a —.* Soc. Aktieselskabet det Norske Kvaestofkompagni. Fr. Pat. 356,077, July 11, 1905.

CALCIUM nitrate is mixed with calcium oxide, or with calcium sulphate, or with equivalent matter, capable of chemically retaining water, and the mixture is calcined to constitute a non-hygroscopic manure, which, when powdered, is readily applicable to the soil.—E. S.

## XVI.—SUGAR, STARCH, GUM, Etc.

(Continued from page 1246.)

*Carbostyryl as a Deposit in a Vinasse Furnace.* E. O. von Lippmann. Ber., 1905, 38, 3829–3830.

IN dismantling a furnace which had been used for the incineration of residues from the recovery of sugar from molasses, a crystalline deposit was found in a deep fissure in the strongly corroded masonry of the flue. Apart from tarry and other substances, the main bulk of this deposit consisted of a crystalline body easily soluble in alcohol and ether. After purification from alcohol, this body was obtained in the form of white prisms, m. pt. 200° C., having a composition corresponding to the formula  $C_9H_7NO$ . It was identified as carbostyryl (py-2- $\alpha$ -hydroxyquinoline) by means of its silver compound.  
—J. F. B.

*Amylum [Starch], Amylodextrin and Erythrodextrin; Behaviour of — towards Chromic Acid.* E. O. Harz. Beihft z. Botan. Cntrall., 1905; through Woch. für Brau., 1905, 22, 721–722.

THE author has studied the action of chromic acid at various concentrations and of mixtures of chromic acid

and sulphuric acid on starch, allowing the materials to remain in contact for 24 hours and then washing off with cold water. The colours obtained with chromic acid alone varied according to the concentration from yellowish greyish green to olive green, and finally golden yellow; the products from the treatment with chromic and sulphuric acid mixtures showed different shades of green. The different kinds of starch varied greatly in their behaviour, as did also the different granules of the same kind of starch. Starch cannot be regarded as a physically uniform substance, consisting of granules differing from each other according to the denser or looser constitution of their ultimate complexes. The nature of the union between chromic acid and starch is analogous to that existing between iodine and starch. The ratio of chromic oxide,  $Cr_2O_3$ , to starch is 1:5.7, corresponding to a stoichiometrical ratio of  $(C_6H_{10}O_5)_6Cr_2O_3$ . Amylodextrin (soluble starch) showed a similar behaviour to starch, i.e., it did not behave as a uniform substance, but appeared to consist of several kinds of molecular groups differing in the density or complexity of their internal structure. The same was observed with erythrodextrin II., prepared by the action of a 5 per cent. alcoholic solution of hydrochloric acid on starch. Only when the achroodextrin stage of degradation was reached did the starch products approach an apparently uniform state of internal aggregation.—J. F. B.

## ENGLISH PATENT.

*Masseccuite; Treatment of — and Apparatus therefor.* H. Roy, Paris. Eng. Pat. 10,273, May 16, 1905. Under Int. Conv., May 16, 1904.

SEE Fr. Pat. 343,194 of 1904; this J., 1904, 1037.—T. F. B.

## UNITED STATES PATENTS.

*Vegetable [Sugar] Juices; Process of Treating —.* T. von Lewicki, Warsaw, Russia. U.S. Pat. 805,981, Nov. 21, 1905.

SEE Fr. Pat. 350,627 of 1905; this J., 1905, 811.—T. F. B.

*Gum; Apparatus for Straining —.* S. B. Adams, Portland, Me. U.S. Pat. 804,911, Nov. 21, 1905.

THE apparatus consists of a closed retort into which steam can be admitted. Inside the retort is a series of shallow metal trays with perforated bottoms arranged one above the other. The solution of gum is placed in the trays and percolates through the perforations, falling on to conical diaphragms placed between each of the trays, and arranged in such a manner that the gum falling on them flows down the slope and is delivered clear of the system of trays at the sides of the retort, being finally collected at the bottom.—J. F. B.

## FRENCH PATENTS.

*Saccharine Liquids; Separation of Foreign Matters from the Sugar in —.* F. Ilavati. Fr. Pat. 356,631, March 21, 1905.

THERE is added to the diffusing water a quantity of a soluble sulphate, capable of being precipitated by lime, equivalent to the alkali salts present in the juice. After carbonation and saturation, aluminium sulphate is added to the juice until the reaction is acid, together with a quantity of finely divided metal (e.g., aluminium, zinc or iron, &c.) sufficient to convert the aluminium sulphate into the hydroxide. After concentration to a syrup of 20° to 35° B., the liquid is filtered, and an argillaceous material such as bauxite is added, together with barium hydroxide or strontium hydroxide. At the same time, milk of lime is added, and a quantity of an ammonium salt equivalent to the chlorides present in the syrup. The syrup is then saturated with sulphur dioxide, until a filtered sample is no longer rendered turbid, on addition of ammonium oxalate. It is then filtered, and boiled to masseccuite. The spun syrup is treated with a sulphate, the base of which is capable of being precipitated by lime or by a finely divided metal [see above], and with the finely divided metal, and when the syrup is decolorised it is mixed with fresh juice. It is explained that when as the

salt employed, this happens to be copper sulphate, then zinc or iron powder will be preferable for subsequent use to remove excess of copper; when aluminium sulphate is used, then the metal may be iron, zinc or aluminium in powder.—J. F. B.

*Vegetable Juices; Process and Apparatus for the Continuous Lixivation of Chopped Material for the Extraction of —.* C. Steffen. Fr. Pat. 356,636. May 9, 1905.

THE apparatus consists of a series of several reservoirs, one behind the other, in which the material is agitated with an excess of liquid. The solid matter is collected and pressed at the exit end of each reservoir by an Archimedean screw which delivers the solid, between press-rolls if desired, into the inlet end of the next reservoir, where it is mixed with a more dilute solvent. The solvent liquid is circulated in each reservoir independently through an external pipe, the liquid being sucked from the exit end and delivered to the inlet end. The excess of liquid from each reservoir is delivered into the next one behind in a counter direction to the passage of the solid material, so that water is fed in at one end of the series and concentrated liquor is discharged at the other.—J. F. B.

*Hydrosulphurous Acid and another Acid; Preparation and Utilisation of Double Salts of —.* J. Harding. Fr. Pat. 350,189, Sept. 24, 1904. VII., page 1,003.

*Lime Kilns; Construction of —.* [Application of the Carbon Dioxide in Sugar Manufacture.] Soc. van Cauwelaert Frères et Cie. Fr. Pat. 356,172, July 17, 1905. VII., page 1303.

#### GERMAN PATENTS.

*Agitating Device, especially for Sugar Solutions.* P. Ehrhardt. Ger. Pat. 161,937, Nov. 30, 1904.

THE invention relates to an apparatus for agitating solutions by means of compressed air. It consists in disposing near to and slightly above each outlet, *a* (see Figs.) of the compressed-air tubes, inclined plates *b*, spaces *i* and *o* respectively being left between the plates

Fig. 1.

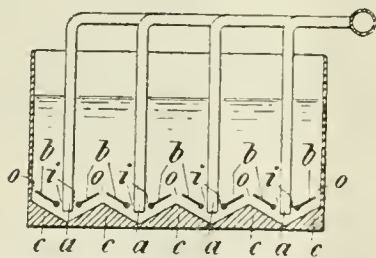
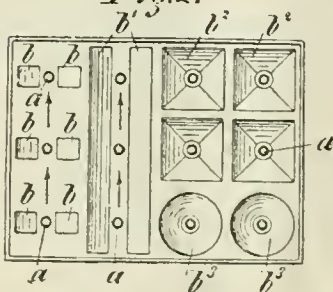


Fig. 2.



and the tubes, and between adjoining plates or between the plates and the walls of the evaporating vessel. The bottom of the evaporating vessel may be provided with projections *c*, with sides parallel to the inclined plates. The

inclined plates may have the form of movable flaps *b*, or may be united to form one long plate *b'* (Fig. 2), or they may be made funnel-shaped *b''*, *b'''* (Fig. 2).—A. S.

*Beet Sugar; Process for Obtaining — without Separation of By-products.* W. O. Luther. Ger. Pat. 162,955, Jan. 19, 1905.

THE fresh chips are treated in a hot solution containing tannin, obtained by purification of the mother liquor from the "first product" with excess of tannin substances. The chips are macerated and pressed, and the juice obtained is worked up in the usual manner. In carrying out the process, the mother liquor from the "first product" at a strength of 6°–8° Brix, is mixed with spent tan liquor. The tannin substances are decolorised, and the other soluble constituents of the tan liquor cause a separation of saline substances from the sugar solution. The precipitate is filtered off, and in the filtrate, the beet chips are macerated at a temperature of 85°–90° C.—A. S.

## XVII.—BREWING, WINES, SPIRITS, Etc.

(Continued from page 1248.)

*Yeast; Quantitative Action of Poisonous Substances on —.* T. Bokorny. Allg. Brauer- und Hopfen-Zeit., 1905, 1053. Z. Spiritusind., 1905, 28, 445.

THE quantities of various poisons necessary for killing 20 grms. of yeast are as follow: formaldehyde, 0.05–0.1 gm.; sulphuric acid, 0.05–0.1 gm.; lactic acid, 0.1–0.2 gm.; sulphurous acid when allowed to act for 24 hours, either in 0.1 or 0.01 per cent. solution, 0.002 gm.; hydrofluoric acid, 0.02–0.05 gm.; sodium fluoride, more than 0.05 gm.; copper sulphate, 0.002–0.005 gm.; mercuric chloride, about 0.006 gm. The effective degrees of dilution of the individual poisons vary between 0.1 and 0.00001 per cent. The poisoning action depends upon a quantitative chemical reaction, in which the albumin of the plasma of the yeast cell combines with the poison, and thus loses the properties of living matter: the death of the cell takes place when a certain proportion of the plasma has undergone this change.—T. H. P.

*Acetifying Bacteria; The Oxydase of —.* E. Buchner and R. Gaunt. Woch. für Brau., 1905, 22, 709–710.

THE production of acetic acid from alcohol is effected by an oxidising enzyme secreted by the acetifying bacteria, and capable of exerting its specific activity after the death of the cells (see this J., 1903, 374 and 1905, 981). The authors have made a further study of this enzyme, working with preparations made chiefly from *B. oeti*, Hansen, by the acetone process ["*Daueressigsbakterien*"]. The bacteria were cultivated in diluted wort containing 4 per cent. of alcohol and 1 per cent. of acetic acid. This liquid was infected by means of a culture of the organism in beer, and incubated at 28° C. The bacterial growth was separated and washed in a centrifugal machine: it then contained 70 per cent. of moisture. This product was either treated with acetone direct or else dried first on porous plates, and then treated with acetone. In the former case entire freedom from living organisms is ensured, but the enzyme is not very active, whereas in the latter case, the enzyme is about four times more active, but a few living cells survive. The experiments were conducted by adding 15–20 grms. of the "Dauer" preparations to a 4 per cent. solution of alcohol in presence of calcium carbonate and excess of toluene; a current of sterilised air was supplied, and the mixtures were maintained at 30° C. for three days. Yields of acetic acid ranging from 0.08 to 0.35 gm. of acetic acid were obtained from the different preparations. Similar experiments with propyl alcohol showed that propionic acid was produced by the same enzyme. Preparations made from bacteria cultivated in beer were found to be inactive, owing probably to the defective nutrition afforded by that medium.

—J. F. B.



*Sarcina*; An Obligatory Anaerobic Fermentation —. W. Beijerinck and N. Gosling. Verh. d. K. Akad. Wiss. Amsterdam, 1905; through Z. Spiritusind., 1905, 28, 435.

THE authors have prepared pure cultures of an organism which they regard as identical with *Sarcina maxima* and have studied its properties. In order to isolate this, bouillon containing 3–10 per cent. of dextrose or malt wort is acidified with phosphoric acid until the total acidity corresponds to about 8 c.c. of N/1 acid per 100 c.c. A bottle, in which a layer of 5–7 mm. of finely sifted garden soil has been placed, is then filled up to the top with the culture liquid, and is closed by a cork with a small hole. The preparation is incubated at 37° C.; fermentation starts after 12 hours and continues for 24–36 hours. The sedimentary layer shows a nearly pure growth of packet *sarcina*. The individual cell elements measure 3.5  $\mu$  in diameter, and show the cellulose reaction; the packets are irregular in form. A mucous scum is formed during fermentation, consisting of matter eliminated from the cell walls. The gas evolved is a mixture of 75 per cent. of carbon dioxide, and 25 per cent. of hydrogen; no methane is formed. A considerable quantity of acid is produced—a liquid starting at 6 c.c. of normal acid per 100 c.c. finished at 12 c.c.—if this acid, as is probably the case, should prove to be lactic acid, this N/1 is by far the most powerful lactic acid ferment yet known. It is essential that the quantity of air should be very restricted, but a little air lends vigour to the cells. This *sarcina* will grow in media containing no acid; the high proportion of acid in the medium, the high temperature of incubation, and the exclusion of air ensures the practical purity of the cultures. The development of acid destroys the power of growing sub cultures; these must, therefore, be taken before fermentation has ceased. This *sarcina* is probably identical with the intestinal *sarcina*.

—J. F. B.

*Sarcina*; Notes on Beijerinck's Paper on a Strictly Anaerobic —. P. Lindner. Z. Spiritusind. 1905, 28, 435. (See preceding Abstract.)

THE author has not found that *Sarcina maxima* gives the cellulose reaction, though this is furnished by *S. ventricula*; but has observed that the organism appears in greater numbers when the access of air to the medium is checked. Neither has he succeeded in detecting it in lactic acid mash at 40–45° C., its development being probably prevented by the presence of air. He does not consider it proved that the fermentation recorded is really due to the large cells, nor that this form can be changed into small cells, having found that the packets gradually break up into their component cells, the lustre of which is then masked by a highly granular structure.—C. S.

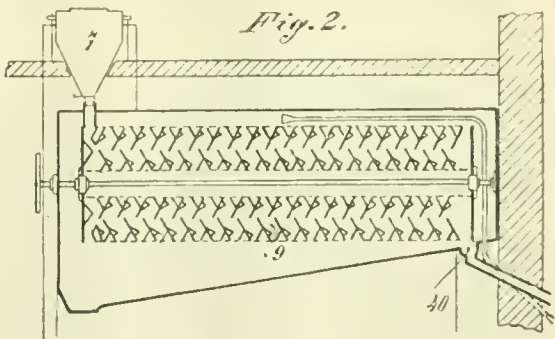
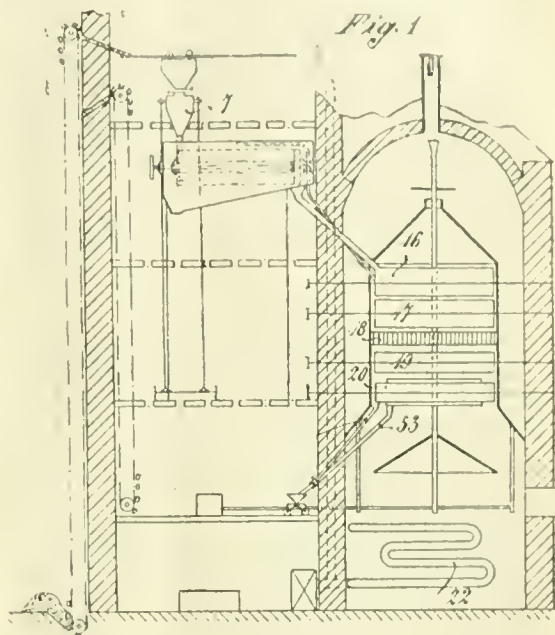
*Fermentation Squares*; Large Cement —. W. Windisch. Woch. f. Brau. 1905, 22, 645–646.

HITHERTO it has been the custom in Germany to use only wooden fermentation tuns of relatively small size; recently, however, Doornkaat has been working very successfully with large cement squares constructed in the following manner.—The standing masonry of the building is covered with well tarred cork plates nailed to the mortar; the concrete walls of the vat are then built against this elastic layer. The walls of the vat are constructed of iron rods embedded in a concrete composed of river pebbles, sand and cement; a similar concrete is stamped on the foundation prepared for the bottom of the vat. The whole of the inside of the vat is covered with a layer of pure cement so worked with the trowel that it presents a perfectly smooth, non-porous surface. The cement vat is kept moist for 14 days, and then full of water for four weeks. After that it is emptied and dried by the careful application of a hand soldering lamp until the whole vat is warm to the touch. Then melted paraffin, at a temperature of 120° C., is applied all over with a brush, the paraffin is driven into the pores of the cement by fusion with the hand lamp, then a second coat is applied, and finished off smooth with the lamp.—J. F. B.

# ENGLISH PATENTS.

*Malt Kilns*; Impts. in —, J. Hornof, Hollerschau, Austria. Eng. Pat. 22,704, Oct. 21, 1904.

THE green malt is fed through a hopper, 7, into the cleansing drum 9 (Fig. 2), consisting of an annular space between two perforated cylinders, this space being divided



up by four radial partitions. In the compartments so formed are disposed a large number of perforated inclined surfaces attached to both the cylindrical walls and so arranged that, during the rotation, the malt is thrown alternately from the inner surface of the annular space to the outer surface and back again, receiving simultaneously a forward shovelling motion. This drum is surrounded by a casing into which hot air from the kiln is delivered. The green malt thus broken up and thoroughly prepared, then passes by the pipe 40 into the kilning drums proper, 16–20 (Fig. 1). These consist of four series of four superposed drums diminishing in diameter from the top to the bottom of the series, only one series being shown in the figure. They are constructed internally on the same principle as the cleansing drum, the malt being tossed to and fro and shovelled forward from the inlet to the outlet of each drum, the walls of which are perforated. The drums are situated in a casing, as shown, and the malt is exposed to an ascending current of hot air heated by the coils 22; a temperature regulator 18, divides the curing drums from the drying drums, and serves for the admission of cool air. The perforations in the last drum 20 are

made large enough to allow the germs to pass through; the malt is delivered by the pipe adjoining 53, and entering it below, and the germs by the pipe 53.—J. F. B.

*Malt; Art of Producing* — W. P. Rice, Chicago. U.S. Pat. 14,103, July 8, 1905.

THE steeped grain is spread in layers of suitable depth on superposed, closely spaced shelves, several of which form what is termed a malting unit. Air passages are provided on opposite sides of a row of malting units by which air is delivered to and withdrawn from the grain disposed on the shelves; the latter may also be perforated, and the air may be drawn through the bed of grain. The trays are constructed to be drawn out from the unit and to empty their contents automatically outside for redistribution on the same or other trays, or else on a conveyor which transports the grain to the drying units, which are constructed on a similar principle.—J. F. B.

*Brewing; Art of* — J. Schneible, Weehawken, U.S.A. U.S. Pat. 15,250, July 25, 1905. Under Int. Conv., Aug. 1, 1904.

SEE U.S. Pat. 799,407 of 1905; this J., 1905, 1079.—T.F.B.

*Beer; Non-alcoholic Beverages resembling* — K. Scholvien, Mühlhausen, Germany. Eng. Pat. 16,478, Aug. 14, 1905. Under Int. Conv., Aug. 13, 1904.

A STERILE wort of 8 per cent. strength, which may be either hopped or unhopped, is inoculated with a pure culture of *Citromyces* in a sterilised and closed vessel, the liquid is stirred and maintained, with the exclusion of air, at a temperature of about 18° C. until the fungus is sufficiently developed. At this stage the liquid has the aroma of beer and contains only a little citric acid. It may then be impregnated with carbon dioxide and filtered and may be pasteurised if desired. The fungus spores are obtained from lemons.—J. F. B.

*Drying Gelatin, Gluc, Paste Goods, Brewers' Grains, Bricks, Woods, Metal Articles and the like; Apparatus for* — O. Koepff. Eng. Pat. 5748, March 18, 1905. I., page 1291.

#### UNITED STATES PATENTS.

*Grain; Method of Drying and Roasting* — V. Lapp. U.S. Pat. 805,367, Nov. 21, 1905.

THE grain is placed in a suitable drying chamber on a metallic grid and a current of heated air is introduced from above and withdrawn by suction through the grain from below. This direction of the air current is maintained for the first two-thirds of the whole operation, after which the current of hot air is passed in the reverse direction for the remaining one-third of the time. During this latter period, external heat is applied to the floor of the apparatus in order to facilitate the roasting of the grain. The condensation of moisture on the walls of the chamber is minimised by regulating the temperature of the walls by means of external heating coils.—J. F. B.

*Brewing Apparatus*. C. Rach, New York. U.S. Pat. 804,979, Nov. 21, 1905.

THE brewing apparatus consists of two vessels and a "diastase kettle," each provided with means for heating and means for applying pressure. Two pipes are arranged, each having a series of valved branches connecting the body of one vessel with the top of the other vessel, and also with the top of the diastase kettle; valved pipes also connect the bottom of the kettle with the tops of the two vessels. There is also a filtering tub and a valved branch from each of the pipes to the filtering tub.—J. F. B.

#### FRENCH PATENTS.

*Grain; Process and Apparatus for Malting* — Berliner A. G. für Eisengiess. u. Maschinenfab. Fr. Pat. 356,234, July 19, 1905.

IN malting, the germination or development of the radicles and plumules is suspended without arresting the action of the enzymes, so that an intermediate phase, called "the

phase of modification of the grain," is inserted between the germination proper and the removal of the moisture and the withering of the germs. This phase is obtained by shutting off the supply of fresh air and substituting a supply of a mixture of carbon dioxide and air whilst cooling to the desired temperature. A suitable mixture is present in the apparatus at the end of the germination; this mixture is circulated several times through the apparatus and is cooled each time before being returned through the grain.—J. F. B.

*Malted Grain for Use in Brewing; Preparation of* — J. Schneible. Fr. Pat. 356,399, July 25, 1905. Under Int. Conv., Aug. 1, 1904.

SEE U.S. Pat. 799,407 of 1905; this J., 1905, 1079.—T.F.B.

*Carbonic Acid [of Fermentation]; Process and Apparatus for the Solidification of* — H. S. Elworthy. First Addition, of March 27, 1905, to Fr. Pat. 355,503, of Jan. 31, 1905 (this J., 1905, 1231).

THE application of the process and apparatus described in the main patent is especially claimed in respect to the carbon dioxide gas hitherto wasted, occurring in processes of fermentation, the manufacture of yeast, &c., which, by the process of solidification, is rendered readily transportable.—E. S.

*Spirits [Eaux-de-vie] from Beetroots; Manufacture of Fine* — E. A. Barbet. Fr. Pat. 350,196, Sept. 28, 1904.

BET juice is purified in exactly the same manner as is employed in the manufacture of sugar. The boiled massecuite is drained in a centrifugal machine of special construction, which is closed and in which provision is made for collecting the spun syrups separately. The crude molasses are denitrated and fermented to produce industrial spirits. The claire syrups are returned to the vacuum pan. The purified sugar is dissolved in the centrifugal itself by means of water boiling under pressure at a temperature of 110°–120° C. This pure syrup is mixed with vinasses from the distillation of good, genuine wines, and is fermented by pure cultures of high-quality wine yeasts. The fermented wash is distilled in brandy stills without rectification, and constitutes an artificial brandy. An alternative method for purifying the beet juice by means of lead acetate, followed by sulphitation, is described, in which case it is not boiled to massecuite.

—J. F. B.

## XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(Continued from page 1250.)

### (A.)—FOODS.

*Casein; Glycocoll and Alanine from* — Z. H. Skraup. Monatsh. f. Chem., 1905, 26, 1343–1349.

THE earlier statements by the author (see this J., 1904, 619; 1905, 338) that among the products of hydrolysis of casein and gelatin are diaminoglutaric and diaminoadipic acids have been found to be incorrect. The compounds isolated are really glycocoll and *d*-alanine respectively. Further experiments have now given the surprising result that whilst one commercial specimen of pure milk-casein (Merck) yields more glycocoll than *d*-alanine, another (Meister, Lucius und Brünig) yields *d*-alanine but no glycocoll among the products of hydrolysis.—A. S.

*Formaldehyde and [Organic] Nitrogen Compounds containing Oxygen; A Very Sensitive Reaction of* — which is also a Colour Reaction for Albuminoid Substances. E. Voisenet. XXIII., page 1326.



## ENGLISH PATENTS.

*Eggs and Egg-containing Substances in Dry Form, and Process for Obtaining same.* J. R. Hatmaker, Paris. Eng. Pat. 28, Jan. 2, 1905.

Eggs, parts of eggs, or mixtures of the same with other substances, may be obtained in a dry, sterile, porous form by exposing them in a very thin film upon a suitable surface, heated to a temperature above 212° F., such as the hot roller apparatus described in Eng. Pat. 8743 of 1903 (this J., 1903, 815).—W. P. S.

*Malt Food; Manufacture of a —.* S. Fränkel, Strassburg, Germany. Eng. Pat. 6457, March 27, 1905.

KILNED malt is freed, with as little loss of farinaceous substance as possible, from its sharp points; it is then treated, after superficial wetting, in suitable beard-removing and polishing apparatus, so as to remove as much husk as possible, leaving only sufficient to maintain the cohesion of the farinaceous substance of the grain. The malt is then heated in a moist state at a temperature between 37° and 70° C. in order to produce a partial conversion of the starch into sugar. The prepared malt is then rapidly heated in a steam digester at a temperature of 110° C., so as to render the albumin and starch soluble and to agglutinate the latter. The product is finally dried and used as a foodstuff.—J. F. B.

*Dehydrating Animal and Vegetable Substances [Foodstuffs]; Process and Apparatus for —.* E. W. Cooke and J. F. Kelly, New York. Eng. Pat. 14,854, July 19, 1905.

THE materials are dehydrated by passing the trays on which they are placed, intermittently and at predetermined intervals through a series of chambers. The chambers are separated by partitions provided with openings through which the trays pass, the openings having flexible flaps to close the space. The distance between successive partitions is equal to the length of one or more of the trays. A current of heated air, delivered into each chamber, alternately above and below the trays, passes through the material and leaves by an opening also alternately above and below. The temperature of the air can be controlled by the admission of cold air through a damper placed at the inlet to each chamber.—W. H. C.

*Dehydrating Animal and Vegetable Products [Foodstuffs]; Process and Apparatus for —.* E. W. Cooke and J. F. Kelly, New York. Eng. Pat. 14,855, July 19, 1905.

THE invention is similar in character to the preceding, with the exception that the current of warm air is passed alternately backwards and forwards through the whole series of chambers except the last, which is fed with a fresh supply of warm air.—W. H. C.

## FRENCH PATENTS.

*Gluten; Process and Apparatus for Drying and Bleaching —.* L. A. Morel. First Addition, dated July 6, 1905, to Fr. Pat. 344,631, July 6, 1904 (this J., 1904, 1232).

THE process described in the original specification is arranged so that the water in the gluten is frozen before it is evaporated. The gluten is placed in moulds on metal plates under the receiver of a vacuum pump, vessels containing a water-absorbing substance, e.g., sulphuric acid being also present. The pressure is reduced to 1–0.5 mm., which causes the mass of gluten to expand and become spongy. At the same time, the rapid evaporation and absorption of the aqueous vapour, causes such an absorption of heat that the water in the gluten congeals, and the mass assumes the appearance of snow. Heat is then applied by electrical resistances beneath the plates, and the further evaporation takes place with such rapidity that the conversion of the water from the solid to the gaseous state is practically instantaneous, and the gluten is dried without losing its snowy consistency.—J. F. B.

*Flour; Process and Apparatus for Treating — with Carbonic Acid or other Inert Gas or Mixed with an Oxidising or De-oxidising Agent.* M. A. Eybert and C. P. Eybert. First Addition dated July 18, 1905, to Fr. Pat. 353,179, April 10, 1905. (This J., 1905, 1027.)

AN inert gas such as carbon dioxide or air, pure or mixed together, is aspirated through drying chambers containing quicklime and calcium chloride, then through refrigerating pipes surrounded by cold water, and is then distributed to the various machines in the flour mill. If desired, a gaseous bleaching agent may be mixed with the current of gas. The various operations being performed in a cold dry atmosphere, yield flour of better quality than usual.—J. F. B.

*Drying Vegetable Foodstuffs; Process for —.* F. Zündel-Donati. Fr. Pat. 356,335, July 22, 1905.

THE materials to be dried are placed on trays or sieves arranged in tiers in a chamber, which is heated and through which a current of cool air is passed. The materials are thus exposed to the action of both heat and cool air at the same time, and many valuable properties are said to be retained.—W. H. C.

*Hydrosulphurous Acid and another Acid; Preparation and Utilisation of Double Salts of —.* J. Harding. Fr. Pat. 350,189, Sept. 24, 1904. VII., page 1303.

## (B.)—SANITATION; WATER PURIFICATION.

*Clays; Emanations from — during Firing.* A. Hopwood. VIII., page 1303.

*Cement-Concrete; Notes on the Destruction of Building Materials made of —.* W. Thörner. IX., page 1307.

*Formaldehyde and [Organic] Nitrogen Compounds containing Oxygen; A Very Sensitive Reaction of —, which is also a Colour Reaction of Albuminoid Substances.* E. Voisenet. XXIII., page 1326.

## FRENCH PATENT.

*Water; Process and Apparatus for Purifying —.* American Water Purifying Co. Fr. Pat. 356,762, Aug. 8, 1905.

THE apparatus described, serves for the preparation of distilled water on the multiple effect principle. Steam from a boiler is purified in a coke tower and passed into a series of generator and condenser vessels, in which constant differences of temperature and pressure are maintained by means of automatic valves. The supply of crude water may be arranged either in parallel or in series. The steam from each generator is condensed in the succeeding generator in such a manner that its gaseous impurities are obliged to escape from the condensation chamber, and the absorption of volatile impurities is prevented by maintaining the surface of the condensed water at a maximum temperature by direct contact with steam. The steam from each generator is purified by coke, and the cooled distilled water is finally passed through wood charcoal.—J. F. B.

## (C.)—DISINFECTANTS.

## FRENCH PATENT.

*Hydrosulphurous Acid and another Acid; Preparation and Utilisation of Double Salts of —.* J. Harding. Fr. Pat. 350,189, Sept. 24, 1904. VII., page 1303.

## XIX.—PAPER, PASTEBOARD, Etc.

(Continued from page 1252.)

*Paper; Process of Manufacturing —.* W. G. Heys, Manchester. From Gen.-Direction der Grafen H. L. A. Hencel von Donnersmarck-Benthen, Carlshof, Germany. Eng. Pat. 9832, May 10, 1905.

SEE Fr. Pat. 353,997 of 1905; this J., 1905, 1081.—T. F. B.

## ENGLISH PATENTS.

*Paper; Watermarking of* — [Dandy-roll]. W. K. Trotman, London. Eng. Pat. 13,184, June 26, 1905.

IN a dandy-roll of the ordinary type, a certain section of the circumference, viz., that portion on which the watermarking device is fixed, is made removable, so that this section may be replaced by another similar section bearing another device. The removable sections are constructed of longitudinal rods stiffened by ribs which are constructed so as to form a portion of the circumference of the complete cylinder. The removable sections are covered with a backing sheet and wire gauze similar to those covering the rest of the roll, and capable of making a continuous cylindrical surface with the latter when the section is in position. The sections are secured by hooks and slots in the end ribs which engage with similar devices in the ends of the dandy-roll.—J. F. B.

*Silk; New Artificial* — H. E. Newton. From Farbenfabr. vorm. F. Bayer und Co. Eng. Pat. 28,733, Dec. 29, 1904. V., page 1299.

*Cellulose; Manufacture of Films, Threads or other Forms of* — A. G. Bloxam, London. From Verein. Glanzstoff-Fabr., A.-G. Elberfeld, Mülhausen, Germany. Eng. Pat. 1745, Jan. 28, 1905.

SEE Fr. Pat. 351,207 of 1905; this J., 1905, 856.—T. F. B.

## UNITED STATES PATENT.

*Paper Characterised by its Impervious Nature and Strength.* C. I. Goessmann, Worcester, Mass. Assignor to Vellumoid Paper Co., Amherst, Mass. U.S. Pat. 804,808, Nov. 14, 1905.

PAPER is impregnated with a glutinous substance treated with formaldehyde, which "sets" before drying. After drying, the paper is softened or "tempered" by hydration.—J. F. B.

## FRENCH PATENTS.

*Papermaking; Elimination of the Colouring Matters of Plants previous to Bleaching for* — A. Badoil. Fr. Pat. 350,224, Oct. 14, 1904.

THE stems of plants, more especially those of the daffodil, which present a problem similar to but more simple than that of ramie, are passed through decorticating machines with smooth rollers. The cortex has an immediate industrial value. The fibres, containing about 40 per cent. of non-fibrous matter, are treated with alkali, preferably in the cold, or are boiled under pressure with a lye containing about 20 per cent. of their weight of caustic soda.—J. F. B.

*Size for Paper; Manufacture of* — A. Mitscherlich. Fr. Pat. 356,269, June 15, 1905.

A SMALL proportion of rosin (about 17.5 per cent. of the total quantity it is intended to employ) is dissolved in the whole of the sodium carbonate to be employed. In this solution, or else in a solution of the sodium carbonate without the rosin, horn shavings are dissolved at a temperature below 100° C. In order to prevent the colour becoming too dark, sulphurous acid or a sulphite is added during the process of solution. Lastly the remainder of the rosin is incorporated with the size. This size is added to the pulp, and is precipitated there by waste sulphite wood liquor. This liquor is prepared by neutralising the crude liquor with sodium carbonate, concentrating the solution to a suitable degree and adding sodium sulphate equivalent to the calcium and magnesium salts present. In order to obtain a paler colour, it is advantageous to treat both the size and the wood liquor with zinc dust.—J. F. B.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

(Continued from page 1255.)

*Abies alba* Cones, Essential Oil of — Schimmel's Report, Nov., 1905, 59.

THE essential oil distilled from the fresh cones of *Abies alba* had the following characters:—Sp. gr. 0.8551 at 15° C.;  $d_4^{20} = -76^{\circ} 58'$ ; ester value, 2.44, equivalent to 0.85 per cent. of bornyl acetate; solubility in 90 per cent. alcohol, 1:7 and more.—J. O. B.

*Artemisia frigida*, *A. leudoviciana*, and *A. caudata*; Essential Oils of — A. Rabak. Pharm. Review, 1905, 23, 128; through Schimmel's Report, Nov., 1905, 12—13.

*Artemisia frigida* oil.—The fresh herb, collected in South Dakota in August, yielded 0.41 per cent. of a greenish essential oil, with an odour of cineol. Sp. gr. 0.927 at 22° C.;  $d_4^{20} = -24^{\circ} 48'$ ; acid value, 1.2; ester value, 31.8. The dried herb yielded only 0.07 per cent. of a darker oil; sp. gr. 0.930 at 22° C.; acid value, 4.7; ester value, 40. The aqueous distillate accompanying the latter oil gave, when shaken out with light petroleum spirit, a further quantity of darker oil, having the sp. gr. 0.916 at 22° C.; acid value, 5.3; ester value, 25.

*Artemisia leudoviciana* oil.—The fresh herb yielded 0.38 per cent. of greenish-yellow, aromatic essential oil; sp. gr. 0.929 at 22° C.;  $d_4^{20} = -16^{\circ} 14'$ ; acid value, 4; ester value, 10.

*Artemisia caudata* oil.—The fresh herb yielded 0.24 per cent. of yellow essential oil with a sweetish odour, indicating the presence of methyl-chavicol or of anethol:—Sp. gr. 0.920 at 22° C.;  $d_4^{20} = -12^{\circ} 30'$ ; acid value, 0; ester value, 17.—J. O. B.

*Betula lenta* [Sweet Birch] and *Gaultheria procumbens* [Wintergreen]; Essential Oils of — E. F. Ziegeimann. Schimmel's Report, Nov., 1905, 71—72.

As both drugs yield the essential oil through the action of a ferment on a glucoside, it is found that maceration in water for 12 hours previous to distillation gives a better yield, in both cases, than when distillation is performed at once.

*Wintergreen* oil.—When distilled in small quantities, a yield of 1.57 per cent. was obtained. With large quantities only 0.633 per cent. resulted, of which 0.288 per cent. was obtained direct and 0.344 per cent. by cohobation; sp. gr. 1.175 to 1.185; esters, 96.20 to 97.13 per cent.

*Sweet birch bark* oil.—Small quantities of bark gave 0.62 per cent.; on the large scale 0.306 per cent. was obtained direct and 0.076 by cohobation; sp. gr. 1.1502 to 1.171; esters, from 90.2 to 97.83 per cent.

The oils are alike in their solubility in alcohol.—J. O. B.

*Citronella*; Essential Oil of — Adulterated with Alcohol and with Lemon Oil Terpenes. Schimmel's Report, Nov., 1905, 19—20.

A SPECIMEN, suspected of sophistication from its low sp. gr. was found to be adulterated with 11.2 per cent. of alcohol, as shown by treatment with brine solution.

Another sample, containing only 29.6 per cent. of geraniol, and having the sp. gr. 0.8852;  $d_4^{20} = +11^{\circ} 44'$ ;  $n_D^{20} = 1.47235$ , insoluble 1:10 in 80 per cent. alcohol, was found to be adulterated with lemon oil terpenes.—J. O. B.

*Citronella and Patchouli Oils from Perak (Malay States).* Bull. Imp. Inst., 1905, 3, 226—230.

*Citronella* oil.—This oil had a pale yellow colour and the characteristic odour of citronellal; it was valued at about 2s. per lb. The chemical examination, recorded below, shows that it more nearly resembles the Javan oil than the Ceylon oil:—Sp. gr. at 15° C., 0.8948; index of refraction at 24° C., 1.4858; rotation in 100 mm. tube at 24° C. =  $-1^{\circ} 34'$ ; soluble in an equal volume (or more) of 80 per cent. alcohol; geraniol, 32.7 per cent.; citronellal (by difference) 55.3 per cent.



**Patchouli oil.**—The sample had a dark yellow colour, and possessed the strong persistent odour of patchouli. Commercial valuation showed that it was of fairly good quality and probably worth about 16s. per lb. at the present rates. Chemical examination showed. Sp. gr., 0.9525; rotation in 100 mm. tube =  $-13^{\circ} 31'$ ; refractive index, 1.5063; soluble in 7.4 times its volume of 90 per cent. alcohol.—J. F. B.

**Patchouli Oil** [*Change of Characters on Keeping*]. J. Rodié. Chem. Zeit., 1905, 29, Rep. 92; Schimmel's Report, Nov., 1905, 52.

In the course of time patchouli oil undergoes considerable changes, from which it becomes more valuable for use in perfumery, since the odour improves and the solubility in 80 per cent. alcohol increases.—J. O. B.

**Erigeron canadense; Essential Oil of** —. F. Rabak Pharm. Rev. i w, 1905, 23, 81; through Schimmel's Report, Nov., 1905, 23—24.

**Essential oil of the fresh herb.**—Fresh Canadian fireweed yielded 0.66 per cent. of bright yellow essential oil with a peculiar odour recalling that of caraway. It had the following characters:—Sp. gr. at  $22^{\circ} \text{C}$ , 0.8614;  $n_D^{20} = +67^{\circ} 16'$ ; acid value, nil; ester value, 108; acetyl value, 180; aldehyde, calculated as citronellal, 0.77 per cent. On exposure to the air, the oil formed crystals, which were recrystallised from alcohol.

**Essential oil of dried herb.**—The yield from the dry herb was 0.26 per cent. of a darker coloured oil than the above, with a powerful aromatic odour. It gave no crystals when left exposed to the air. It had the following characters:—Sp. gr. at  $22^{\circ} \text{C}$ , 0.8610;  $n_D^{20} = +76^{\circ} 37'$ ; acid value, 0; ester value, 52; acetyl value, 86; aldehyde, calculated as citronellal, 0.44 per cent. Free alcohols were present only in the oil of the dried herb, and calculated as terpineol were equivalent to 10.9 per cent. This supports the view that the terpineol found in *Erigeron* oil is a decomposition product.—J. O. B.

**Eryngium campestre; Essential Oil of** —. Schimmel's Report, Nov., 1905, 73.

The oil distilled from fresh plants in the South of France, was obtained in a yield of 0.088 per cent. The colour is faintly yellow and the odour pleasant, recalling that of ambrette [*Hibiscus abelmoschus*] seeds; sp. gr. 0.9043 at  $15^{\circ} \text{C}$ ;  $n_D^{20} = -5^{\circ} 42'$ ;  $n_D^{25} = 1.48518$  ester value, 10.17; solubility in 90 per cent. alcohol 1:1 and more; with 80 per cent. alcohol, insoluble 1:10.—J. O. B.

**Ginger; Essential Oil of African** —. Schimmel's Report, Nov., 1905, 38—39.

In addition to the known constituents of this oil, cineol, eucal, borneol, and another alcohol, probably geraniol, are also found to be present.—J. O. B.

**Lavandula stœchas; Essential Oil of** —. Schimmel's Report, Nov., 1905, 40.

The dried flowers of *Lavandula stœchas* have yielded 0.755 per cent. of yellowish-brown oil with a camphoraceous odour; sp. gr. 0.9620 at  $15^{\circ} \text{C}$ ;  $n_D^{20} = +35^{\circ} 30'$ ;  $n_D^{25} = 1.47909$ ; acid value, 5.16; ester value, 13.1; solubility in 70 per cent. alcohol 1:2, the solution becoming opalescent on dilution, owing to separation of paraffin. It contains dextro-camphor.—J. O. B.

**Lemon Oil; Californian** —. Schimmel's Report, Nov., 1905, 28.

It is possible that California may, in course of time, become a centre for the commercial production of lemon oil. A specimen of hand-pressed oil of good aroma from ripe Californian lemons had the following characters:—Sp. gr., 0.8598;  $n_D^{20} = +55^{\circ} 56'$ ;  $n_D^{25}$  of the first 10 per cent. fraction =  $+48^{\circ} 42'$ ;  $n_D^{25} = 1.47490$ ; residue on evaporation, 3.6 per cent. It is possible that the relatively low optical rotation of the oil may be due to the ripeness of the fruits from which it was derived.—J. O. B.

**Lemon Grass; Essential Oil of** —. *Adulterated with Coconut Fat*. Schimmel's Report, Nov., 1905, 44.

Two specimens of lemon grass oil have recently been met with adulterated with 10 and 15 per cent. of coconut fat.—J. O. B.

**Pinus montana; Adulteration of the Essential Oil of** —. Schimmel's Report, Nov., 1905, 59.

A SPECIMEN of cheap oil of *Pinus montana* has been found to be largely adulterated with American turpentine oil, 34 per cent. of it distilling up to  $160^{\circ} \text{C}$ . at normal pressure. With the pure oil, practically nothing distills at that temperature.—J. O. B.

**Sage; Essential Oil of Large-leaved** —. O. Wallach. Nachr. Kais. Ges. Wiss. Goettingen, 1905 [1], 1; through Schimmel's Report, Nov., 1905, 62.

The essential oil of the large-leaved sage contains no thujone, differing in this respect from the oil of the common sage, *Salvia officinalis*, which contains dextro- $\alpha$ - and dextro- $\beta$ -thujone. On the other hand, it yields much levo-camphor, as well as pinene, cineol, and on treatment with nitrous acid, a crystalline body, m. pt.  $85^{\circ}$ — $86^{\circ} \text{C}$ ., which differs from the known phellandrene nitrites.—J. O. B.

**Sandal Wood Oil; Optical Rotation of East Indian** —. Schimmel's Report, Nov., 1905, 64.

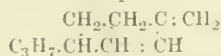
ALTHOUGH hitherto the minimum optical rotation for pure sandal-wood oil has been given as  $-17^{\circ}$ , a large bulk of wood has lately yielded oil having the  $n_D^{20} = -16^{\circ} 30'$ . The higher rotation can therefore no longer be insisted on as the limit.—J. O. B.

**Turpentine; Indian** —. *from Pinus longifolia*. F. Rabak. Pharm. Review, 1905, 25, 229; through Schimmel's Report, Nov., 1905, 68.

INDIAN turpentine is white, opaque, viscid and granular, probably from separation of crystals of a resin acid; its odour is pleasant, recalling that of limonene. It yielded 18.5 per cent. of oil on steam distillation; the oil had the odour of pinene and of limonene. The oleoresin had the following characters:—Sp. gr., 0.960;  $n_D^{20} = -7^{\circ} 42'$ ; acid value, 129; ester value, 11. The essential oil had the sp. gr. 0.866;  $n_D^{20} = +2^{\circ} 48'$ . On fractionation at normal pressure, 56 per cent. passed over between  $165^{\circ}$  and  $170^{\circ} \text{C}$ ; 20 per cent. from  $170^{\circ}$ — $175^{\circ} \text{C}$ ; 9 per cent. at  $175^{\circ}$ — $180^{\circ} \text{C}$ ., and 15 per cent. at  $180^{\circ}$  and higher. The resin showed  $n_D^{20} = -1^{\circ} 11'$  [100 mm. tube, 10 per cent. solution]; acid value, 142; ester value, 13.—J. O. B.

**Terpenes and Essential Oils; 73rd Communication.** [Methene Compounds and  $\beta$ -Phellandrene.] O. Wallach. Annalen, 1905, 343, 28—40. (See this J., 1905, 749.)

The name methene is proposed for the methylene group ( $\text{CH}_2$ ) in a semi-cyclic grouping as it differs in its behaviour from methylene in other hydrocarbons.  $\beta$ -Phellandrene is an example of a methene compound:—



and would be named  $\Delta_3$ -methene-(1)-isopropyl-(4)-cyclohexene or methene-(1-)-isopropyl-(4)-tetrahydrobenzene.  $\beta$ -Phellandrene was oxidised by shaking with water and oxygen for several days. From the oxidation product a semi-carbazone, m. pt.  $183^{\circ}$ — $184^{\circ} \text{C}$ . was produced. This, on decomposition, yielded an unsaturated ketone,  $\text{C}_9\text{H}_{14}\text{O}$  boiling between  $103^{\circ}$  and  $106^{\circ} \text{C}$ . at 15 mm., and between  $220^{\circ}$  and  $224^{\circ} \text{C}$ . at ordinary pressure, with sp. gr. 0.9387, and  $[n]_D^{20} = 1.4788$  at  $26^{\circ} \text{C}$ . With hydrogen sulphide it formed an addition compound soluble in chloroform and melting at  $121^{\circ}$ — $122^{\circ} \text{C}$ . This ketone was reduced with sodium in alcohol to a saturated alcohol. This was cautiously oxidised with permanganate and a semicarbazone,  $\text{C}_9\text{H}_{16}\text{N}_2 \cdot \text{NH} \cdot \text{CONH}_2$ , melting at  $188^{\circ} \text{C}$  was isolated. The ketone from this was oxidised with chromic acid and yielded crystals of  $\beta$ -isopropyladipinic acid,  $\text{C}_3\text{H}_7 \cdot \text{CH}(\text{CH}_2 \cdot \text{COOH}) \cdot \text{CH}_2 \cdot \text{CH}_2 \cdot \text{COOH}$ , melting at  $70^{\circ} \text{C}$ . The author considers that in the first stage of the gaseous oxidation, two atoms of oxygen become attached to the methene group to form a superoxide, which decom-

poses into the ketone. With permanganate a glycol is formed in the first stage of the oxidation. An attempt was made to prove the presence of  $\beta$ -phellandrene in the oil of *Eucalyptus amygdalina* by oxidation with gaseous oxygen, but no satisfactory evidence of its presence was obtained. It is clear that tetrahydrocuminic aldehyde is a natural constituent of water-fennel oil, and is not an oxidation product due to the air.—F. S.

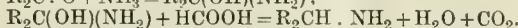
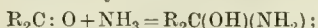
*Terpenes and Essential Oils. 74th Communication.*  
O. Wallach. *Annalen*, 1905, **343**, 40—53.

This article relates to a study of cyclohexanone, the work being treated under the following headings:—(1) Bromine substitution products of cyclohexanone; (2) cyclohexanone-isoxine and its reduction products; (3) hexene acids from  $\alpha$ -leucine; (4) cyclohexene-(tetrahydrobenzene-)nitroso-chloride; (5) synthetic preparation of 1,2-methylcyclohexanone; (6) cyclohexene-acetic acid.

—A. S.

*Terpenes and Essential Oils. 75th Communication. Conversion of Ketones and Aldehydes into Bases.* O. Wallach with K. Hüttner, and J. Altenberg. *Annalen*, 1905, **343**, 54—74.

It was shown by Leuckart (*J. prakt. Chem.*, 1890, **41**, 330) that on heating ketones or aldehydes with ammonium formate, bases, generally as formyl compounds, were produced. The authors consider that at a high temperature (100°—200° C.) the ammonium formate dissociates into ammonia and the free acid. The ammonia, attaches itself to the carboxyl group and the hydroxyl thus formed is reduced by the formic acid:—



The reaction is complicated by the fact that the primary bases formed, react upon the still unchanged ketone or aldehyde, producing a mixture of secondary and tertiary bases. The production of this mixture can be avoided and the reaction controlled by the presence of a free acid such as formic or acetic acid during the reaction. Instead of ammonia, salts of primary or secondary substituted bases can be used, thus giving a new and direct method for the production of secondary and tertiary bases. As the temperature of the reaction is lower, the bases are obtained assalts with aliphatic compounds. But with aromatic compounds the bases usually appear as their formyl derivatives. Quaternary bases are not produced in these reactions. The following examples show the applicability of the reaction. Benzylcyclohexylamine can be formed in two ways (1) By heating benzaldehyde with hexylamine formate in the presence of acetic acid. (2) By heating hexanone with benzylamine formate. Mono-ethylbenzylamine can be formed by heating benzaldehyde with ethylamine formate; benzylpiperidine by heating benzaldehyde, piperidine and formic acid. The formyl compound of menthylamine is produced by heating menthone and ammonium formate with some acetic acid.—F. S.

*Fenchone Semicarbazone.* O. Wallach. *Nachr. K. Ges. Wiss. Goettingen*, 1905 [1], 6; through Schimmel's Report, Nov., 1905, 115.

FENCHONE semicarbazone, which has not been obtained directly before, is thus prepared. Ten grms. of semicarbazide hydrochloride and 10 grms. of sodium acetate are dissolved in 20 c.c. of water, and mixed with a solution of 10 grms. of fenchone in 50 c.c. of alcohol. The mixture is set aside for at least a fortnight, then steam distilled, when the semicarbazone remains as the non-volatile residue. It crystallises well from dilute alcohol; it softens at 174° C. and melts at 182° C. A racemic mixture of dextro- and levo-fenchone semicarbazones crystallises less readily.—J. O. B.

*Caryophyllin.* H. Meyer and O. Hoenigschmid. *Monatsh. Chem.*, 1905, **26**, 379; and J. Herzog. *Ber. Pharm.*, 1905, **15**, 121, through Schimmel's Report, Nov., 1905, 20—22.

H. MEYER and O. Hoenigschmid confirm the empirical formula  $C_{40}H_{64}O$ , previously given by other workers to caryophyllin, but their researches show that the molecule

is a multiple of four of this simple expression,  $C_{40}H_{64}O_4$ . Pure caryophyllin melts at 295° C. in a sealed tube, and sublimes without decomposition *in vacuo*. The acetyl product  $C_{40}H_{60}(O.COCH_3)_4$  has the m. pt. 268°—271° C. Caryophyllinic acid, obtained by the action of fuming nitric acid on caryophyllin, is proved to contain four carboxyl groups, and yields a tetramethyl ester  $C_{40}H_{60}O_4(OCH_3)_4$ , m. pt. 155°—160° C. J. Herzog has obtained a diphenylurethane from caryophyllin  $C_{40}H_{63}O_4 \cdot CO \cdot N(C_6H_5)_2$  m. pt. 137—138. He was only able to obtain a diacetyl-, and not a tetracetyl-compound on acetylating caryophyllin. Contrary to Meyer and Hoenigschmid's experience, he found that caryophyllin cannot be obtained pure by mere recrystallisation from alcohol. The product so obtained was not wholly soluble in ether, and the portion soluble therein, gave less carbon, when burnt, than agrees with the above formula. He also found that caryophyllin forms crystalline alkali-salts. Caryophyllin forms a benzoyl compound which melts at 173° to 185° C.—J. O. B.

*Amyl Alcohol; Preparation of Inactive* —. P. Freundler and E. Damond. *Comptes rend.*, 1905, **141**, 830—831.

METHYL-ETHYL ketone is reduced at 140° C., according to the directions of Sabatier and Senderens (this J., 1903, 1012), and the secondary butyl alcohol formed is separated from the untouched ketone by fractional distillation. The alcohol is cooled to 0° C., phosphorus tribromide (1 mol. to 2 mols. of alcohol) slowly dropped in, the mixture left for 10 hours in the cold, and then heated on the water-bath till no more hydrobromic acid is evolved. Water is added, the bromide separated from the aqueous phosphoric acid, washed, dried, and rectified. (Yield over 83 per cent. of theory.) From the bromide, the magnesium derivative is prepared (adding to the ethereal solution a few drops of carbon bisulphide, which moderates the violence of the reaction of the magnesium, and practically prevents the formation of butane or butylene), and this is treated at once with the theoretical quantity of trioxymethylene (this J., 1902, 286), which has been thoroughly dried at 100° C. *in vacuo*, and heated for 24 hours on the water-bath. The yield is about 73 per cent. of the amyl alcohol, and 7 per cent. of the corresponding formal  $CH_2(OC_5H_{11})_2$   
 $C_2H_5 \cdot CO \cdot CH_3 + H_2 = C_2H_5 \cdot CH(OH) \cdot CH_3$   
 $C_2H_5 \cdot CH(MgBr)CH_3 + CH_2O$   
 $= C_2H_5 \cdot CH(CH_2O \cdot MgBr)CH_3$   
 $C_2H_5 \cdot CH(CH_2O \cdot MgBr)CH_3 + OH_2$   
 $= C_2H_5 \cdot CH(CH_2OH)CH_3 + BrMgOH.$

The retarding action of carbon bisulphide and similar substances, favourable in this case, is sometimes prejudicial where the reaction is not originally violent; in preparing triphenylcarbinol, for instance, commercial ether contains substances (removable only by treatment with sulphuric acid) which entirely prevent the reaction of the magnesium on the halide.—J. T. D.

*Esters; Influence of Water and Alcohols on the Boiling Point of* —. 1. A Modification of Markownikoff's Method of Preparation. J. Wade. *Chem. Soc. Trans.*, 1905, **87**, 1656—1668.

ACCORDING to Markownikoff (*Ber.*, 1873, **6**, 1177), who devised the so-called "continuous" modification of Scheele's method for the preparation of esters, interaction between alcohol and acetic acid in presence of concentrated sulphuric acid, does not take place below 130° C. On continuing the addition of alcohol and acid, however, as in Markownikoff's process, the action usually slackens gradually, and finally stops, owing to the accumulation of the liberated water. The author has found that under certain conditions the process becomes really continuous. An excess of alcohol must be employed, and the reaction flask must be immersed as completely as possible in the water-bath, so that condensation in its neck shall be minimised. The presence of sulphuric acid is essential, but there is no advantage in using a large quantity; the best results are obtained when 10 or 20 c.c. are employed. The sulphuric acid is mixed in the distilling flask with twice its volume of the mixture of alcohol and acid (in the case of ethyl acetate, for example, 3 vols. of ethyl alcohol to 2 vols. of acetic acid), and



heated on the water-bath until the action commences. The mixed alcohol and acid are then delivered at a suitable rate beneath the surface of the liquid in the distilling flask, preferably through a dropping funnel, the stem of which is drawn out to a moderately fine point. A relatively large heating surface is essential for rapid action. All the simple aliphatic esters and many of the more complex and aromatic esters may be prepared in this manner, the operation being carried on under reduced pressure in the case of the less volatile products.

In the preparation of ethyl acetate, most of the products obtained by the "slow" continuous process, that is, with the distilling flask only partly immersed in the water-bath—boiled, after re-distillation, almost constantly at 70°–71°C., namely, 6° below ethyl acetate, and it seemed probable, therefore, that they contained a mixture of constant boiling point. Direct experiments with pure alcohol, ethyl acetate, and water confirmed this view, and the following mixtures of constant boiling point were isolated.

Composition.			Sp. Gr.	B. pt. °C.
Ethyl acetate.	Alcohol.	Water.		
83.2	9.0	7.8	0.9085	70.3
69.4	30.6	—	0.8682	71.8
91.4	—	8.6	—	70.45
—	95.5	4.5	0.8075	78.15

In the "slow" continuous process, practically the ternary mixture of ester, alcohol and water is obtained, a certain amount of water and acetic acid also passing over. In the "fast" process, however, (with the distilling flask well immersed in the water-bath), the temperature of the distilled vapours approximates to 81° C., and the distillates consist of the ternary mixture and the binary mixture of alcohol and water. The method most frequently quoted for the purification of crude ethyl acetate, consists in washing with a strong solution of calcium chloride or brine, and drying with calcium chloride, but this method is quite useless. Indeed, Le Canu (Comptes rend., 1885, 100, 40) has shown that calcium chloride is freely soluble in ethyl acetate, and decomposes when heated with it. The method used by the author consists in floating the crude product on water, when the alcohol becomes distributed between the two layers, and on distilling the mixture from a water-bath, the ternary mixture of ester, alcohol and water, and the binary mixture of ester and water pass over practically uncontaminated with the excess of alcohol, until the ester is exhausted. On repeating this operation once, a distillate is obtained containing only about 1 per cent. of alcohol. The remaining alcohol and water may be removed by fractionation through a very efficient still-head, when they are eliminated as ternary and ester-water mixtures (the water should be in slight excess, as the ester-alcohol mixture is difficult to separate); or by drying roughly with potassium carbonate and distilling over phosphorus pentoxide. The last traces of impurities can only be removed by careful fractionation, either of the dry ester, or better, the ester with 0.5 per cent. of water.—A. S.

*Vanillin; Determination of* —. J. Hanus. XXIII., page 1326.

*1:2-Naphthoquinone-4-sulphonic Acid; Condensations with* —. (Ehrlich-Herter's Reaction). F. Sachs and M. Craveri. XXIV., page 1327.

#### ENGLISH PATENTS.

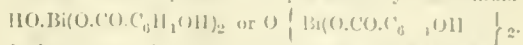
*Dialkylbarbituric Acids; Manufacture of* —. G. B. Ellis, London. From E. Merck, Darmstadt, Germany. Eng. Pat. 5353, March 14, 1905.

SEE Fr. Pat. 354,452 of 1905; this J., 1905, 1125.—T. F. B.

*Salicylic Acid Compound; Manufacture of a New* —. G. B. Ellis, London. From Chem. Fabr. von Heyden Act.-Ges., Radebeul, Saxony. Eng. Pat. 19,375, Sept. 25, 1905.

By the action of a bismuth salt on sodium salicylate, a

mixture of a bismuth disalicylate and salicylic acid is obtained; this is neutralised (or the salicylic acid extracted with an indifferent solvent), and the product washed with cold water. Its composition is represented by the formula:



It is decomposed by boiling with water into salicylic acid and the known bismuth monosalicylate.—T. F. B.

#### GERMAN PATENTS.

*Chlorinating Organic Substances with Sulphuryl Chloride; Process of* —. A. Wohl. Ger. Pats. 160,102, Jan. 31, 1902, and 162,394, Jan. 21, 1903.

The substance to be chlorinated is heated with sulphuryl chloride, and the evolved gases are passed into fuming sulphuric acid, from which sulphuryl chloride may be regenerated. The second patent describes a modification for use when the substances are very volatile, the acid gases being, in this case, passed through a body of the substance to be chlorinated, which can subsequently be treated with sulphuryl chloride; this avoids possible decomposition of the product by the fuming sulphuric acid.—T. F. B.

*Anhydrides of Monobasic Organic Acids; Process for Preparing* —. Verein f. Chem. Industrie. Ger. Pat. 161,882, March 30, 1902.

ANHYDRIDES of monobasic organic acids can be obtained in good yield, and free from the acid chloride, by the action of sulphuryl chloride on a mixture of an alkaline-earth salt of the acid with 10 or 15 per cent. of an alkali salt of the acid. The reaction is stated to proceed as easily as when the alkali salt alone is employed.—T. F. B.

*Methylolamides; Process of Preparing* —. A. Einhorn. Ger. Pat. 162,395, May 19, 1903. Addition to Ger. Pat. 158,088, Sept. 23, 1902. (See this J., 1905, 615.)

THE substitution of halogenated fatty acid amides for aromatic acid amides in the principal patent enables certain methylolamides to be prepared which could not be obtained previously. The preparation of the methylolamides from mono- and trichloroacetamide, monobromo- and monoiodo-acetamide and  $\alpha$ -bromopropionic acid amide are described.—T. F. B.

*Aldehydes [and Ketones] with Negatively Substituted Methyl- or Methylene Compounds; Process for Preparing Condensation Products of* —. E. Knoevenagel. Ger. Pats. 161,171, Dec. 1, 1903, and 162,281, June 10, 1904.

ALDEHYDES and ketones can be condensed with negatively substituted methyl or methylene compounds by means of salts of ammonium or of primary or secondary amines. Compounds of acid character can be condensed by this means, in fact, the presence of an acid rather assists the reaction. Thus benzaldehyde and cyanoacetic esters give benzalcyanooacetic esters; salicylic aldehyde and malonic acid produce coumarincarboxylic acid; acetone and malonic acid give  $\beta$ , $\beta$ -dimethylacrylic acid (by using ammonium malonate), &c.—T. F. B.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(Continued from page 1255.)

#### FRENCH PATENT.

*Printing; Revolving Brushes for* —. [Utilisation of Waste from Photographic Films.] Soc. Anon. des Plaques et Papiers Photographiques, A. Lumière et ses Fils. Fr. Pat. 350,187, Sept. 24, 1904, V., page 1276.

## XXII.—EXPLOSIVES, MATCHES, Etc.

(Continued from page 1856.)

*Explosives; Aluminium in* —. C. E. Bichel. Z. angew. Chem., 1905, 18, 1889—1892.

A NUMBER of patents have been taken out for the addition to ammonium nitrate explosives of aluminium, the contention being that the force of explosion is thus greatly increased. This contention is based on the results of trials in the lead block, which does undoubtedly show a much greater enlargement of the cavity with the explosive containing aluminium than with the corresponding explosive without it. Yet actual use in the mine has demonstrated that the increase in efficiency due to the addition of aluminium is so slight as to be hardly noticeable. The author considers that the lead block test is unsuitable for comparing explosives except those of the same class, and he measures instead the "shock effect," which is proportional to the square of the detonation-speed and to the amount of gas produced, and the "pressure effect" of the explosion of the substance in its own volume, which is proportional to the amount of gas produced, the temperature of explosion, and the density of the explosive. He compares two explosives (See Führer, this J., 1901, 68), consisting of (1) ammonium nitrate, 95.5; charcoal, 4.5; and (2) Ammonium nitrate, 72.0; aluminium powder, 23.5; charcoal, 4.5. In the lead block, No. 1 gave an enlargement of 250. No. 2 of 329 c.c.; an increase of 31.6 per cent. The detonation-speeds of the two were respectively 3380 and 3450 m. per second; a scarcely noticeable difference, and consequently little difference in the shock effect. The densities of the two were 0.8652 and 0.9003, or the specific volumes 1.156 and 1.1131. per kilo.; the heats of explosion were 727 and 1600.5 calories, and hence the temperatures of explosion (calculated from these figures and the composition of the products) 1710° and 3914° C. The volumes of gas produced by the explosion of 1 kilo., calculated to N.T.P. were 977 and 594 litres; and the volumes into which these gases were compressed were 1.156 litres and 0.996 litre (1.113—0.115, the volume of the alumina produced) respectively. Consequently the pressure of these gases at 0° C., 863 and 616 kilos. per sq. cm., would be, at the temperature of the explosion in each case, 6338 and 9425 kilos. per sq. cm., or the addition of the aluminium has raised the pressure by nearly 50 per cent. But this increased pressure is due to the much higher temperature of explosion; and while this is effective in melting and softening the lead of the block it does not affect the sides of the borehole, and the temperature there falls so rapidly that there is not much effective difference between the two mixtures. The calculated increase of pressure was shown experimentally when 100 grms. were exploded in a space of 15 litres; instead of 48.84 and 62.85, the observed pressures were 40.6 and 54.42 kilos. per sq. cm. The absolute pressures were low, from incompleteness of the detonation; but the differences are almost alike.

Commercially, it can only pay to add aluminium when it is cheap, as the increase of lifting power actually attained is so small; and it is useless to add it where greater shattering power is aimed at. Moreover, it can only be added economically to those explosives which have low temperatures of explosion; with others, the comparatively small rise of temperature gained, is more than counterbalanced by the lessened volume of gas produced. The readiness with which aluminium (especially when finely powdered) oxidises in air is also prejudicial to its use in explosives.—J. T. D.

*Magazine; Circumstances attending the Destruction of a Factory* — at the Factory of the Thames Storage (Explosives) Co., Ltd., at St. Mary's Marshes, in the Hundred of Hoo, in the County of Kent, on July 29, 1905. By Captain A. P. H. Desborough, H.M. Inspector of Explosives.

A MAGAZINE containing 9,730 lb. of powder was totally destroyed by fire under circumstances which indicated that spontaneous ignition of the contents had taken place,

and the grass on the surrounding mound was also ignited but easily extinguished. The powder consisted of:—

800 lb. normal rifle powder imported 1896	
1280 " " " " " 1896	
50 " " flameless, " " 1901	
900 " " cannon " " 1902	
4000 " " sporting " " 1904	
200 " Walsrode K.O. " " 1899	
2500 " " K.L. " " 1901.	

In the case of all, except the powder imported in 1896, the importation licenses containing the reports of Dr. Dupré, were traced, which showed these powders to have a heat test of 20—30 minutes. With regard to the importation of normal rifle powder in 1896, Dr. Dupré's reports for that year show that in all but one case, that of a small sample showing a heat test of 8½ minutes, the quality was satisfactory. This exception, however, renders it probable that, owing to insufficient purification, the 1896 powder possessed a slight degree of instability, which, after nine years' storage, had augmented so as to produce spontaneous decomposition. A certain amount of suspicion must also be attached to the Walsrode powder owing to the fact that the fire first broke through the roof in that part of the building in which this powder was stored.

Attention is called to the necessity of carrying out periodical tests on powders stored in magazines for a long time, and also to the danger of allowing long grass to grow in the neighbourhood. In addition it is suggested, without reference, however, to the case in question, that magazines should be so constructed, that when the maximum quantity of explosive is stored, there is sufficient space to arrange the contents so that that of old manufacture shall be issued first.

The practice, which is not uncommon, of allowing damaged or defective blasting cartridges to accumulate in magazines, is condemned as a source of danger.—B. J. S.

### ENGLISH PATENT.

*Safety Explosives; Manufacturing Mine-Gas-Proof* —. The Castropoer Sicherheitssprengstoff Akt.-Ges., Dortmund, Germany. Eng. Pat. 18,275, Sept. 9, 1905. Under Int. Conv., Sept. 10, 1904.

THE fundamental explosive mixture is treated with an addition of ammonium salts—preferably chloride—and metallic salts of organic acids (especially salts of the fixed alkalis or alkaline earths), a portion of these latter being sometimes replaced by salts yielding oxygen, such as nitrates, chlorates, perchlorates, chromates, bichromates, permanganates, &c.—C.S.

### UNITED STATES PATENT.

*Phosphorus; Process of Making Red* —. R. Schenck and P. Marquart, Assignors to The Firm of Chem. Fabr. Bettenhausen Marquart and Schulz. U.S. Pat. 804,555, Nov. 14, 1905. VII., page 1303.

### FRENCH PATENT.

*Matches; Manufacture of Wax* —. M. Bals. Fr. Pat. 350,213, Oct. 8, 1904.

PLAITED yarn, preferably three-ply jute, is first drawn through an alcoholic solution of resinous matter, the impregnation serving to mask the smell of the fibre when burning, prevent glowing after extinction, and facilitate the adherence and minimise the absorption of the materials taken up in the subsequent baths. The plait is next passed through powdered magnesium carbonate or other suitable substance, which acts as a filler, economises wax, and improves the colour of the matches. After drying, the plait is coated with the usual mixture of paraffin, stearin, Carnauba wax, &c., in a molten condition, and when sufficiently cooled, is polished between grooved milling rollers, cut into match lengths, and dipped in the ordinary manner.—C. S.



## GERMAN PATENT.

*Match-Sticks from Fir and Pine Wood; Process for the Manufacture of —.* R. C. J. Falek. Ger. Pat. 162,025, March 10, 1903.

The fir or pine wood is treated with an emulsion containing about 20 parts of benzine (petroleum spirit), 20 parts of oil of turpentine and 1000 parts of water. It is stated that after this treatment, the wood can be readily impregnated with paraffin wax, and burns with a calm, odourless flame.—A. S.

## XXIII.—ANALYTICAL CHEMISTRY.

(Continued from page 1259.)

## APPARATUS, Etc.

*Porous Bodies as Permeable Substances for Gases; Different Applications of —.* Porous Contact. K. Prytz. Overs. o. d. Kgl. Danske Vidensk. Selsk. Forh., 1905, 293—306. Chem. Centr., 1905, 2, 1569—1570.

The author deals with the use of substances the pores of which allow gas, but not mercury, to pass through, for making gas-tight connections and stoppers. For example, an open tube with an enlargement at its upper end, is provided with a plaster of Paris stopper just below the enlargement, and mercury is introduced above the porous stopper. The lower end of the tube dips into mercury, and the tube is thus rendered gas-tight. If another tube carrying a plaster of Paris stopper at its lower end, and from which the air has been exhausted, be dipped into the mercury in the upper part of the first tube, until the two porous stoppers come in contact, the gas rises from the first into the second tube. Stoppers of fire-clay (a material which allows gases to pass freely, but is quite impermeable to mercury) are stated to be even better than plaster of Paris stoppers. Numerous applications of this method of using porous stoppers are described in the original.—A. S.

## UNITED STATES PATENT.

*Burette.* A. M. Söderlund, Göteborg, Sweden. Assignor to G. G. G. Oxenstierna, Philadelphia, Pa. U.S. Pat. 804,894, Nov. 21, 1905.

The burette, graduated from the zero line downwards, is combined with a reservoir and a pipe connection (fitted with a two-way tap), as well as with an open pipe, fitting air-tight in the reservoir and cut off obliquely at the lower end, so that the upper edge of the orifice is on a level with the zero line on the burette, in order to maintain the fluid level automatically.—C. S.

*Sulphates; Determination of — by means of Benzidine Hydrochloride in the Presence of Thiosulphates, Sulphites, and Sulphides.* O. Huber. Chem.-Zeit., 1905, 29, 1227—1229.

In testing the volumetric method of Müller and Dürkes (this J., 1903, 1104, also 883, 925) the author has closely followed the original directions with the exception of using potassium hydroxide in place of sodium hydroxide solution. The results obtained with solutions of pure sulphates were in close agreement with the theoretical amounts, and confirmed the accuracy of the method in this respect. It was found, however, that benzidine hydrochloride yielded precipitates also with sodium thiosulphate, sulphite and sulphide, and that the method was, therefore, inapplicable in the presence of these salts. Attempts to destroy them by means of hydrochloric acid proving unsatisfactory, the following method was subsequently adopted:—(1) The solution containing the four salts was treated with bromine in order to oxidise the thiosulphate, sulphite and sulphide to sulphate, the total amount of which was then titrated with benzidine hydrochloride after removal of the bromine and cooling the solution. (2) Another portion of the original solution was run from a burette into a N/10 solution of iodine acidified with hydrochloric acid, and the excess of iodine titrated with N/10 thiosulphate solution.

The amount of iodine consumed by the solution corresponded to the amount of thiosulphate, sulphite and sulphide. (3) A third portion of the original solution was heated to the boiling point, the sulphide thrown down by means of freshly-precipitated cadmium carbonate, and the liquid cooled, made up to 250 c.c., shaken, and filtered. (a) 100 c.c. of the clear filtrate were used for a determination by means of iodine as in (2), the result giving the thiosulphate and sulphite. (3) Another portion (100 c.c.) of the filtrate from (3) was mixed with 10 c.c. of 2N-acetic acid and 30 c.c. of 2N-sodium acetate solution, and the mixture boiled for 20 to 25 minutes, after which the flame was removed, and the solution treated with about 1 gm. of potassium chlorate, allowed to cool, and titrated with N/10 iodine solution, the result giving the amount of thiosulphate. The addition of acetic acid was made with the object of expelling the sulphurous acid from the sulphite, whilst the potassium chlorate was intended to oxidise the last traces of sulphur dioxide. The thiosulphate remained unchanged in these operations in spite of the presence of a large amount of ammonium acetate.

The different results were calculated into the corresponding amounts of sulphates and deducted from the total sulphates found in (1), the difference giving the amount of sulphates in the original solution. The results thus obtained were somewhat higher than the amounts of sulphates taken, which the author attributed, in the main, to the very considerable solubility of benzidine sulphate. In his opinion, the preliminary heating of the solution before the precipitation, is not advisable, for the adsorption phenomena mentioned by Müller and Dürkes have, he asserts, much less bearing upon the results than the solubility of the precipitate.—C. A. M.

*Ozone; Quantitative Determination of —.* F. P. Treadwell and E. Anneler. Z. anorg. Chem., 1905, 48, 86—97.

The authors review the methods that have been proposed for the determination of ozone (compare this J., 1899, 1150; 1900, 561, 776, 1146; 1901, 749), and, after giving the results of comparative experiments with different processes, recommend for use in works the following modification of Ladenburg and Quasig's method (this J., 1901, 749). A glass bulb of known capacity (300—400 c.c.) is filled with distilled water, and the latter is displaced by the gas to be examined. From 10 to 20 c.c. of a 5 per cent. solution of potassium iodide are then forced into the bulb, and after 20—30 minutes the liberated iodine is titrated with N/10 thiosulphate solution. If the volume of gas contained in the bulb be  $v$  c.c. when referred to 0° C. and 760 mm., and the number of c.c. of thiosulphate solution used be  $n$ , then the percentage by weight of the ozone in the gaseous mixture is represented by the formula:

$$\frac{168 \times n}{v + 0.56 \times n}$$

whilst the percentage by volume is given by the expression:

$$\frac{112 \times n}{v}$$

—A. S.

*Lead and Copper; Electrolytic Assay of —.* G. A. Guess. Bull. Amer. Inst. Mining Eng., 1905, Nov., 1239—1243.

For greater speed and economy of labour in making daily assays of ores, &c., containing small quantities of lead or copper, the author has devised the following modifications of electrolytic methods, and has equipped a laboratory plant of some 60 cells:—

The electrodes are corrugated sheets of thin, roughened, platinum foil provided with tags, which are clamped in terminal holders on the wall. These electrodes, one cathode sheet of 50 sq. cm. surface between two smaller anode sheets, are suspended in beakers containing the solution of the material to be assayed.

In the case of lead, a nitric acid solution of the ore is employed and is found to give reliable results, the metal being deposited as peroxide on the anode and 45 determinations being made daily.

In the case of copper a nitric acid solution is also employed; but it has been found possible to work with a

much higher current density (5 ampères for cathodes as above) than that usually employed, thus considerably shortening the duration of the analysis. This is effected by adding to the electrolyte a reagent which is stated to be a nitro-compound made from hard mineral oil. Di-nitro- $\alpha$ -naphthalene also gives similar results, but apparently requires more care. —R. S. H.

*Ammonium Salts; Decomposition of — by Hot Sulphuric Acid in presence of Platinum.* M. Delépine. VII., page 1302.

*Sodium Hydrosulphite; Contribution to the Knowledge of —.* A. Binz and W. Sondag. VII., page 1302.

#### ORGANIC—QUALITATIVE.

*Formaldehyde and [Organic] Nitrogen Compounds Containing Oxygen; A very Sensitive Reaction of —, which is also a Colour Reaction of Albuminoid Substances.* E. Voisenet. Bull. Soc. Chim., 1905, 33, 1198—1214.

WHEN an albuminoid substance is treated with formaldehyde and dilute sulphuric or (preferably) hydrochloric acid, containing a small quantity of nitrous acid, a violet coloration is produced, especially if the mixture be warmed to about 50° C. The reaction is stated to be sensitive to 1 part of formaldehyde per million: the intensity of the colour produced, increases, with increase of formaldehyde, to a maximum, and then decreases until no longer apparent when the solution contains 20 per cent. of formaldehyde. An excess of nitrous acid also prevents the reaction. It is found preferable to use hydrochloric acid containing 0.005 and 0.01 grm. of nitrous acid per litre, the latter being used when the formaldehyde exceeds 1 part per 100,000. The coloration is caused by the oxidation of the condensation products of formaldehyde with the decomposition products of albuminoids, and can be reproduced by substituting indole or skatole for albumin. Gelatin, keratin, and pure peptone do not give this reaction, but most of the other proteid compounds do so: since "purely pepsic" peptones do not give the reaction whilst tryptic peptones show it clearly, this reaction is suggested for differentiating these compounds. Aldehydes in general cannot be substituted for formaldehyde; acrolein and benzaldehyde give an indigo blue coloration, but phenolic aldehydes produce the same result as formaldehyde. Other oxidising agents than nitrous acid also give the reaction, e.g., nitric acid, hydrogen peroxide, ferric salts. It is stated that 1 part of nitric acid in two million parts will produce a coloration. The following applications are suggested:—(1) Detection and determination of formaldehyde in milk: 15 c.c. of hydrochloric acid containing nitrous acid (see above) of both strengths is added to 5 c.c. of milk, and the mixture is warmed to 50° C., and allowed to stand for two hours or more if no colour appears. The determination of formaldehyde is carried out colorimetrically against samples containing known quantities of formaldehyde. (2) Detection of nitrous products in hydrochloric or sulphuric acid. (3) Detection of nitrates in water. (4) Detection of dilution of milk by determining amount of nitrates present, contained in the water. (5) Determination of albumin in urine or liquids containing only traces of it.

—T. F. B.

*(Ehrlich-Herter's Reaction.) 1,2-Naphthoquinone-4-Sulphonic Acid; Condensations with —.* F. Sachs and M. Craveri. XXIV., page 1327.

#### ORGANIC—QUANTITATIVE.

##### FRENCH PATENT.

*Gaseous Mixtures; Method of Examining —.* Soc. C. Zeiss. Fr. Pat. 356,388, July 25, 1905. Under Int. Conv., Aug. 8, 1904.

THE quantitative composition of gaseous mixtures is determined by measuring or registering photographically the refraction of light rays at the point where they pass from the said mixture into the medium used for comparison, or *vice versa*, or during their alternate and suc-

cessive passage from the one medium into the other. The rays are assumed to fall at an oblique angle on the plane of separation between the two media.—C. S.

*Sodium Palmitate; Hydrolysis of —.* R. Cohn. Ber., 1905, 38, 3781—3784.

SCHWARZ (Z. öffentl. Chem., 1905, 6, 301) asserted that it was impossible to obtain sharp determinations of fatty acids by titrating the excess of alkali with aqueous acid unless sufficient alcohol had been added to prevent the hydrolysis of the soap. Against this, the author points out that correct saponification values are obtained in the case of beeswax without such addition, and he also shows that they are possible in the titration of free fatty acids. When pure palmitic acid is dissolved in an excess of hot N/2 sodium hydroxide solution and the excess of alkali titrated back with N/2 aqueous hydrochloric acid, with phenolphthalein as indicator, neutrality is reached when the deep red colour of the liquid changes to faint pink. In test experiments, the amounts of palmitic acid thus determined, ranged from 99.5 to 100.4 per cent. of the quantities taken, and it is stated that with practice, the error need not exceed 0.5 per cent. of the theoretical amount. If now, after neutralisation, the addition of acid to the hot liquid be continued, the pink colour remains for a long time unchanged owing to the hydrolysis of the soap, and the solution then suddenly becomes colourless when the palmitic acid separates out. It was this point that Schwarz regarded as the end of the reaction, with the result that in some of his experiments, he found only 56 per cent. of the theoretical amount of palmitic acid. It is impossible with phenolphthalein as indicator to continue the titration to a quantitative end of the hydrolysis of the soap, but this can be done when methyl orange is used as indicator, the sodium palmitate then showing a quantitative hydrolysis into palmitic acid and sodium chloride. Hence, the behaviour of sodium palmitate on titration is completely analogous to that of sodium carbonate, when methyl orange is used as indicator. So long as free palmitic acid ions derived from the hydrolytic dissociation of the soap remain in solution, the reaction continues alkaline, in spite of the addition of acid; and it is not until the whole of the palmitic acid has separated out in an insoluble form that the free hydrogen ions can come into solution, the colour of the methyl orange being then immediately changed to red.

—C. A. M.

*Vanillin; Determination of —.* J. Hanus. Z. Unters. Nahr. Genussm., 1905, 10, 585—591.

THE method proposed is based on the precipitation of vanillin by means of *m*-nitrobenzhydrazide. For the determination of vanillin in vanilla, 3 grms. of the latter are extracted for three hours with ether. The ethereal solution is evaporated at a temperature of 60° C.; the residue is dissolved in a small quantity of ether, filtered into an Erlenmeyer flask, washed with ether, and the solution again evaporated. The residue is now dissolved in 50 c.c. of water, the mixture being carefully heated and shaken to aid solution, and the emulsion so obtained, precipitated by the addition of 0.2 grm. of *m*-nitrobenzhydrazide dissolved in 10 c.c. of hot water. The flask is placed on the water-bath for 30 minutes and then allowed to stand for 24 hours at the ordinary temperature. After removing fat by shaking out the mixture with petroleum ether, the latter together with the aqueous portion is poured through a weighed filter and the precipitate washed first with water, then with petroleum spirit, and the filter and its contents dried and weighed. The weight of precipitate multiplied by the factor 0.4829 gives the quantity of vanillin.—W. P. S.

#### XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(Continued from page 1260.)

*Light; Chemical Action of —.* X. G. Ciamician and P. Silber. Ber., 1905, 38, 3813—3824. (See this J., 1901, 844, 943; 1902, 876, 1477; 1903, 50, 764; 1904, 138, 341; 1905, 461, 641.)

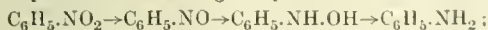
It has been shown previously that nitrobenzene in alcoholic



solution is reduced to aniline by the action of light, quinoline being also formed owing to a further condensation process. Further experiments have now been made on the action of light on solutions of nitrobenzene in ethyl, propyl and isoamyl alcohols. In methyl alcoholic solution, there was practically no change. The solutions were exposed to the light for several months. The chief products were basic substances, the yield in the form of hydrochlorides being—in methyl alcohol, 0.2 grm.; ethyl alcohol, 6.8 grms.; propyl alcohol, 8.5 grms.; and isoamyl alcohol, 6.6 grms.; in each case from 100 grms. of nitrobenzene.

The chief constituent of the basic products was in each case aniline, but other bases were also present, viz., quinoline,  $\alpha\beta$ -ethylmethylquinoline and  $\alpha\beta$ -isobutylisopropylquinoline from the ethyl, propyl and isoamyl alcohol solutions respectively. Also, in all three cases, very small quantities of a basic substance,  $C_6H_7O_2N$ ; and in the experiments with propyl alcohol, a basic substance,  $C_{12}H_{15}ON$ , were obtained. The portion of the reaction products soluble in alkali contained in all three cases *p*-aminophenol. Experiments were also made with respect to the action of light on nitrobenzene in presence of aromatic aldehydes. Satisfactory results were only obtained with anisaldehyde, the products obtained corresponding exactly to those obtained when benzaldehyde was used. The chief reaction products were anisic acid, dianisoylphenyl hydroxylamine, anisoylaniline, azoxybenzene and *o*-hydroxyazobenzene.

It will be seen that the decomposition of nitrobenzene, in presence of aromatic aldehydes, on exposure to the light, proceeds in the stages represented as follows:—



the different compounds, however, can only be isolated in the form of transformation products or derivatives, for example, nitrosobenzene in the form of azoxybenzene and *o*-hydroxyazobenzene, and phenylhydroxylamine and aniline in the form of benzoyl and other acyl derivatives. In the presence of aliphatic alcohols, the action of light on nitrobenzene is more energetic, as although phenylhydroxylamine (in the form of its transformation product, *p*-aminophenol) and aniline are obtained, no nitrosobenzene nor compounds derived from the same, can be isolated from the products of the reaction in this case.

—A. S.

**1,2-Naphthoquinone-4-Sulphonic Acid; Condensations with — (Ehrlich-Herter's Reaction).** F. Sachs and M. Craveri. Ber., 1905, 38, 3685–3696.

It is known (Böninger, Ber., 1894, 27, 95) that 1,2-naphthoquinone-4-sulphonic acid reacts with aniline to form a deeply coloured substance  $C_{16}H_{12}O_2 \cdot NHC_6H_5$  [O : O :  $NHC_6H_5$  = 1 : 2 : 4]. The sulphonic group is eliminated and replaced by the aniline residue. This reaction is very delicate. A fiery cinnabar-red precipitate is at once obtained in the cold by adding a solution of aniline in water (containing only 1 part in 300,000 parts) to a neutral solution of 1,2-naphthoquinone-4-sulphonate of sodium. All primary amines of the benzene or naphthalene series, aminoazo bodies, phenylenediamines, aminophenols, aminosulphonic and aminocarboxylic acids react in a similar way in neutral or acetic acid solution, and yield sparingly soluble precipitates. P. Ehrlich and C. A. Herter, Z. physiol. Chem., 1904, 41, 379) and C. A. Herter (J. experim. med., 1905, 7, No. 1) recently described new and characteristic colour reactions of 1,2-naphthoquinone-4-sulphonic acid with a large number of other substances, including many of physiological importance, which are obtained as readily as the condensation products with primary amines. The following of the colorations described by Ehrlich and Herter are cited:—nitromethane, deep-violet; trinitrotoluene and acetylacetone, reddish brown; acetoacetic ether, orange-red; cyano-acetamide, deep reddish violet; phenylpyrazolone, greenish-blue; methyl-phenylpyrazolone, bluish-green; rhodanic acid, deep blue-violet; resorcinol, violet; phloroglucinol, brownish-violet; pyrrol, purplish-violet; piperidine, scarlet; piperazine, red.

The present work deals with the constitution of the

coloured products obtained by the action of 1,2-naphthoquinone-4-sulphonic acid on the following substances containing a "negative" methylene group, viz.:—benzylamide, *p*-nitrobenzylamide, malonitrile, cyanoacetic ether (violet colorations), and ethyl malonate (cherry-red coloration).

The authors find that the reaction which takes place is strictly analogous to the aniline condensation. The sulphonic group is expelled and replaced by the organic radical. They consider that 1,2-naphthoquinone-4-sulphonic acid is very useful for characterising bodies containing "negative" methylene groups, owing to the ease with which they can be converted into well defined, sparingly soluble condensation products with this substance.—H. L.

## New Books.

COAL TABLES, 1904. [295.] Wyman and Sons, Ltd., London. Price 6d.

This is the eleventh number of a publication annually prepared in the Commercial, Labour and Statistical Department of the Board of Trade, showing the production and consumption of coal in the principal countries of the world during each of the years from 1883 to 1904, or to the most recent years for which the figures are available. In addition to statistics of production and consumption, particulars are also given of the average value per ton at the collieries, the number of persons employed in coal mining, coal imports and exports, &c.; statistics of lignite production and petroleum production in certain countries are also contained in the return. Tables relating to the consumption of coal, have been amplified by the inclusion of statistics with regard to the principal British Colonies.

An article on the coal production and consumption of the principal countries of the world, based on this return, appears on next page.

## Trade Report.

### I.—GENERAL.

CHIMNEYS; COMPARISON OF FACTORY AND DOMESTIC—.

*Chem. Trade J.*, 1905, 37, 526.

Of the 250 million tons of coal mined per annum, 19 per cent. is used for general steam-raising purposes and 15 per cent. for domestic purposes. From tests of the products of combustion: (1) passing through a factory chimney (in connection with a steam-raising plant), and (2) from an ordinary open grate, the following comparison is made.

*Products of Combustion per Ton of Coal Burned.*

	Factory.	Domestic.
	lb.	lb.
Soot .....	5.8	8.0
Hydrocarbons .....	nil	8.0
Sulphuric acid ( $H_2SO_4$ ) .....	48.0	65.0

Accepting this basis of comparison, the absolute weight of impurities produced in one year is as follows:—

	Factory.*	Domestic.†
	Tons.	Tons.
Soot and volatile hydrocarbons	121,000	132,000
Sulphuric acid ( $H_2SO_4$ ) .....	1,000,000	1,070,000

\* 47 million tons of coal burned.

† 37 million tons of coal burned.

—A. S.

## II.—FUEL, GAS, AND LIGHT.

## COAL PRODUCTION AND CONSUMPTION IN THE PRINCIPAL COUNTRIES OF THE WORLD.

*Bd. of Trade J., Nov. 30, 1905.*

The production of coal in the five principal coal-producing countries of the world in 1902, 1903 and 1904, was as follows:—

Countries.	1902.	1903.	1904.
	Tons.	Tons.	Tons
United Kingdom	227 095,000*	230,334,000*	232,428,000*
Germany .....	107 474,000†	116,638,000†	120,816,000†
France .....	29,365,000†	34,216 000†	33,838,000†
Belgium .....	23,877,000†	23,797,000†	23,507,000†
United States of America .....	269,277,000*	319,068,000*	314,563,000*

\* Tons of 2,240 lbs. † Metric tons of 2,204 lb.  
‡ Provisional figures.

The production of coal in 1904 in the United Kingdom and Germany was greater than in any previous year, but in France, Belgium, and the United States it did not reach the high figures of 1903. The production of the United States exceeds that of the United Kingdom, but the production of Germany represents only about a half, and that of France and Belgium together about a quarter of the production of this country.

The total known coal production of the world (exclusive of brown coal or lignite), is now about 790 million tons (of 2,240 lb.) per annum, of which the United Kingdom produces rather less, and the United States rather more than a third.

The following statement shows the production of coal in the principal British Colonies and Possessions in the year 1903, with comparative figures for the preceding year. The amounts are in every case stated in tons of 2,240 lb.:—

Country.	1902.	1903.
	Tons.	Tons.
British India .....	7,424,000	7,438,000
Australian Commonwealth .....	6,860,000	7,112,000
New Zealand .....	1,363,000	1,420,000
Canada .....	6,422,000	6,825,000
Transvaal .....	1,420,000	2,012,000
Cape of Good Hope .....	166,000	185,000
Natal .....	593,000	714,000

All the 1903 figures are greater than those for 1902. Nearly the whole of the output of the Australian Commonwealth is produced in New South Wales.

The consumption of coal in some of the chief consuming countries is shown in the following statement, in which the countries are given in the order of importance as coal consumers:—

	1902.	1903.	1904.
	Tons.	Tons.	Tons.
United States ....	265,694,000	314,114,000	307,610,000*
United Kingdom	166,698,000	166,532,000	166,606,000
Germany .....	95,363,000	103,114,000	107,160,000*
France .....	41,989,000	46,442,000	45,559,000*
Russia .....	19,732,000	21,223,000	22,953,000*
Belgium .....	20,799,000	21,317,000	21,106,000*
Austria-Hungary	17,595,000	18,123,000	Not available

\* Provisional Figures.

The statistics of lignite production show that the principal producing countries are Germany, Austria, and Hungary, which in 1903 produced 45,819,000 metric tons, 22,153,000 metric tons, and 5,272,000 metric tons respectively, whilst the provisional figures available for the German output in 1904 indicate an increased production of 48,633,000 tons. In Austria the output of lignite for 1904 was 21,988,000 tons, a decrease, compared with 1903, of nearly 200,000 tons. The quantity of lignite produced in the

United States is included in the figures for the production of coal already given. The latest available figures showing the production of lignite separately relate to 1903, when it amounted to 5,977,000 tons. In 1892 the production of lignite was only 1,422,000 tons. In no other country does the quantity produced reach one million tons. In the United Kingdom it has for some years been nil.

## III.—TAR PRODUCTS, PETROLEUM, Etc.

## [PETROLEUM] OIL FIELD; THE ALBERTA —.

*Petroleum Review, 1905, 13, 443.*

The Alberta oil field is situated in the extreme south-western corner of the province of Alberta, Canada. The first well was sunk in Sept., 1901, and a flow of petroleum amounting to over 300 barrels per day was struck at a depth of 1020 ft. A larger (12 in.) hole has since been sunk, and a large oil-basin has been tapped at a depth of 1100 ft. The oil, which is stated to burn equally well in the crude as in the refined condition, contains 76 per cent. of illuminating oil and 23 per cent. of gasoline; it is quite free from sulphur. There are stated to be good supplies of water, timber, building sand, stone, granite and lime in the neighbourhood of the oil deposit.—A. S.

## VII.—ACIDS, ALKALIS, Etc.

## GRAPHITE TRADE OF HAMBURG.

*Cham. of Com. J., Dec., 1905.*

The Hamburg graphite trade increased in 1904, as regards the imports by sea, to 58,162 quintals, valued at 2,549,000 marks, compared with 41,800 quintals, valued at 1,927,000 marks, in the previous year. This increase was chiefly due to exceptional shipments of Ceylon graphite, which rose from 29,674 quintals in 1903 to 47,821 quintals in 1904. The arrivals by rail and river showed a fall from 47,051 quintals, valued at 941,920 marks, in 1903 to 32,358 quintals, valued at 744,329 marks, in 1904. The average value of the graphite imported by sea was 44 marks per quintal, and of that imported from inland 23 marks per quintal. The price of most of the Ceylon graphite imported was slightly under the average of the imports by sea, and the average price also fell by 2 marks for the over-sea imports and 3 marks for the Ceylon graphite below the prices in 1903. The exports of graphite from Hamburg by sea fell from 57,935 quintals, valued at 1,164,000 marks, in 1903 to 50,038 quintals, valued at 1,149,000 marks, in 1904, and especially exports to Great Britain fell from 27,369 quintals to 17,030 quintals. The average price of the graphite sent inland fell to 44 marks (from 46 marks in 1903) whilst the average price of the exports by sea rose to 23 marks (from 20 marks in 1903).

## IX.—BUILDING MATERIALS, Etc.

## LITHOGRAPHIC STONE TRADE OF BAVARIA.

*Bd. of Trade J., Nov. 30, 1905.*

The lithographic stone quarries of the parishes of Solenhofen, Moersheim and Langenaltheim supply the best stones. The yearly produce of the quarries is about 12,000 tons, valued at about 2,000,000 marks, of which about 6,000 tons (value 1,000,000 marks) were exported in 1903, and 7,000 tons (1,250,000 marks) in 1904, the remainder being required for the home trade.

As regards the export trade, the United States of America were the largest buyers, purchasing, of the best qualities, 1,250 tons (540,000 marks) in 1903, and 1,500 tons (650,000 marks) in 1904. France comes next, for value if not for quantity, having imported 600 tons (100,000 marks) in 1903, and 650 tons (120,000 marks) in 1904. Great Britain follows with 500 tons (50,000 marks) in 1903 and 800 tons (80,000 marks) in 1904.

The export to Great Britain, after gradually declining from 1900 to 1903, showed a slight increase in 1904, but it was considerably less than during the years 1897 to 1899, when, roughly estimated, it averaged yearly about 1,500 tons, valued at 150,000 marks.

Lithographic stones are also exported from the above



district to Austria-Hungary, Italy, Russia, Switzerland, Spain, Portugal, Belgium, Holland, Norway, Sweden, Finland, the Balkan States, South America, Australia, India and Japan. The demand from the two last-mentioned countries is said to be increasing considerably.

NOTE.—All values mentioned are to be taken as values at Solenhofen.

### X.—METALLURGY.

#### SILVER PRODUCTION OF THE WORLD.

*Eng. and Mining J.*, Nov. 25, 1905.

In the first of the accompanying tables is given a comparative statement of the silver production of the world in the years 1903 and 1904. The returns of Germany are defective in that they do not discriminate between silver won from foreign ores and that obtained from ores mined in the country. As Germany is a large importer of base bullion, there is no doubt that the greater part of its silver product is from foreign ores, and should not properly be credited to the country.

#### Silver Production of the World.

	1903. Troy Oz. Fine.	1904. Troy Oz. Fine.
America, North—		
United States .....	54,300,000	57,786,100
Canada .....	3,198,581	3,718,668
Mexico .....	67,832,700	60,808,870
Central America .....	2,100,000	655,357
America, South—		
Argentina .....	50,000	66,153
Bolivia .....	6,614,957	6,083,333
Chile .....	1,650,000	868,667
Colombia .....	2,000,000	940,066
Ecuador .....	40,000	—
Peru .....	5,491,349	4,667,047
Uruguay .....	1,000	1,093
Europe—		
Austria .....	1,270,972	1,254,888
Hungary .....	610,877	643,000
France .....	751,890	609,638
Germany .....	6,830,000	12,532,938
Greece .....	1,090,367	895,172
Italy .....	784,084	757,777
Norway .....	240,898	257,200
Russia .....	260,776	172,912
Spain .....	4,000,000	4,876,076
Sweden .....	32,298	20,923
Turkey .....	486,297	564,685
United Kingdom .....	174,896	174,517
Asia—		
Dutch East Indies .....	124,678	175,479
Japan .....	1,770,152	3,208,620
Australia .....	11,909,040	14,558,892
Africa .....	450,000	486,408
Other countries .....	48,226	50,000
Total .....	173,222,088	176,840,014

In the second table is given the world's production of silver from 1875 to the present date. From 1895 to the present time the production has not varied greatly, fluctuating from year to year but in no startling fashion. At the present time, outside of Mexico and Bolivia, silver is very largely a by-product, and the quantity obtained, therefore, does not vary directly with the demand for the metal itself, but rather with the demand for the metals of construction with which it is associated.

Year.	Troy Oz. Fine.	Year.	Troy Oz. Fine.
1875 .....	63,317,014	1900 .....	180,093,364
1880 .....	79,731,936	1901 .....	174,851,391
1885 .....	96,250,831	1902 .....	164,560,358
1890 .....	134,404,104	1903 .....	173,222,088
1895 .....	182,220,228	1904 .....	176,840,014

The total production shows an increase of 3,617,926 oz., or 2.1 per cent., over that of 1903. This gain was made in spite of a decrease of over 7,000,000 oz. in the Mexican output, and was due to the advance made in production in the United States, Australia, Spain, and nominally in

Germany. The decrease in 1904 from the year of maximum production, which, during the period covered by records was 1895, is not great, amounting only to 5,380,214 oz.

### XII.—FATS, FATTY OILS, Etc.

#### COCO-NUT PALM PRODUCTS FROM CEYLON. EXPORTS OF—

*Bull. Imp. Inst.*, 1905, 3, 217.

The following table gives the value of the exports of coco-nut products from Ceylon during the last few years.

	1901.	1902.	1903.
	Rs.	Rs.	Rs.
Arrack .....	72,082	100,332	129,064
Coco-nuts .....	773,391	711,918	640,635
Coco-nuts, desiccated .....	2,314,708	2,870,549	3,104,609
Coin fibre .....	700,603	778,174	793,134
Coin, manufactured ..	10,561	11,559	9,575
Coin and rope .....	137,462	160,500	207,070
Coin yarn .....	854,538	799,705	945,357
Copra .....	4,540,693	4,098,947	7,531,540
Coco-nut oil .....	7,601,233	10,007,860	11,022,596
Coco-nut shells .....	27,060	32,623	51,993
Poonac (oil cake) .....	937,474	1,293,204	1,400,820
Quills, coco-nut leaf ..	150	—	—
Total .....	Rs. 17,970,835 £ 1,198,055	20,861,491 1,390,700	25,945,893 1,729,726

—J. F. B.

### XVII.—BREWING, WINES, SPIRITS, Etc.

#### ALCOHOL FROM SAWDUST.

*Chem. and Drug.*, 1905, 67, 871—872.

The Board of Inland Revenue has removed the restrictions which have hitherto been placed on the manufacture of industrial alcohol from sawdust (see this J., 1901, 734, 1008). In this process, glucose is formed as an intermediate product, but if the duty (2s. 9d. per cwt.) were paid on this, the manufacture would become unprofitable. The Excise authorities have now accepted the process as a continuous one, whereby the difficulty with respect to glucose being a dutiable article has been overcome.—A. S.

#### WINE PRODUCTION OF NON-BRITISH COUNTRIES.

*Cham. of Com. J.*, Dec., 1905.

The estimated production of wine by other than British countries in 1905 is given by the "Revue Vinicole," as follows:—

Hectolitres.	Hectolitres.
France, including Algiers and Tunis .....	72,000,000
Italy .....	38,200,000
Spain .....	28,750,000
Russia .....	8,500,000
Roumania .....	8,400,000
Chile .....	2,790,000
United States .....	2,300,000
Germany .....	2,200,000
Bulgaria .....	2,100,000
Portugal .....	2,100,000
Austria .....	1,900,000
Turkey and Cyprus .....	1,900,000
Argentina .....	1,600,000
Peru .....	1,500,000
Switzerland .....	1,200,000
Greece .....	1,100,000
Total .....	*176,450,000

\* The hectolitre = 22 galls., making the total production 3,881,900,000 galls.

### XX.—FINE CHEMICALS, Etc.

#### ESSENTIAL OILS.

*Schimmel's Report*, Nov., 1905.

*Almond Oil [Fixed].*—Reports from Syria indicate that this year's harvest of Damascene apricot kernels is a poor one. Not more than 2,000 to 2,500 bales are expected to be available, compared with 5,500 bales in 1904, and 8000 bales in a good year. High prices are anticipated, at least 90 francs per 100 kilos. being attained, but at present no business has been transacted at that figure. A demand has arisen for inferior Mersina kernels up to 70 francs, and for Aleppo kernels up to 75 francs. Better grade Tripoli kernels are said to have changed hands at 77 to 80 francs.

During the past year the demand for pure apricot

kernel oil has been slack. On the other hand the demand for the essential oil has been brisk.

*Anise Oil, Russian.*—The anise harvest is expected to yield about 80,000 poods this year, compared with 120,000 poods in 1904. Old stocks of seeds are small, and high prices will probably prevail.

*Star-Anise Oil.*—An improvement in the price of star-anise oil is probable. The import into Hamburg during 1904 amounted to 52,040 kilos.; in 1903 it was 30,000 kilos. The shipments during 1905 show a decided falling off.

*Bergamot Oil.*—The fall in the price of this oil, predicted last spring, has taken place. Holders of stock, induced by the promise of a heavy crop, have placed their reserve on the market. Heavy purchases have been made by foreign buyers who have not been slow to take advantage of the low rate. The exhaustion of the reserve stock has, therefore, caused a slight rise which will probably be maintained until the new season's oil is available. Present stock in hand does not probably exceed 2,500 to 3,000 kilos, which will certainly be exhausted before the new oil arrives on the market. Although a good harvest was generally predicted this has not been realised over the whole bergamot producing area. The crop south of Reggio is still considered to be fairly good; but to the north, and in the more elevated plantations, the trees have suffered much from the inclement weather of the past summer. The harvest, as a whole, will probably be a medium one. Prices for new oil will probably rule somewhat lower than last year, at the commencement of the season.

*Cajeput Oil.*—The price of this oil has now fallen to a normal figure. The total shipments from Macassar for the first five months of the present year amounted to about 35,500 kilos. The United States continue to take the largest portion of this export, and the demand for the oil there is increasing; in Germany the consumption appears to be on the decline.

*Caraway Oil.*—The Dutch caraway harvest, estimated at 30,000 bales, is only one-third of the crop of last year. Owing to the great drought of last year a large portion of the land usually devoted to caraway culture has been cropped with beet, so that probably the area under caraway will be considerably below the normal next year also. The yield of oil by the seeds of this year's harvest is also poor. The export from Holland to Germany during 1904 amounted to 35,456 bales. A further marked advance in the price of caraway seeds and oil is, therefore, imminent.

*Cassia Oil.*—During the last 20 years the price of cassia oil has varied from 5.80 marks per kilo. in 1887, to 17 marks in 1896. During the past three years it has remained comparatively steady at 7.20, 7.40, and 7 marks per kilo. These figures relate only to high grade oils assaying 80–85 per cent. of cinnamic aldehyde. The oil now arrives upon the market in a state of greater purity than formerly; many parcels pass the lead acetate test for colophony of the Ph. C. IV. It is, however, still necessary to check the reputed quality of the oil by the determination of the percentage of cinnamic aldehyde.

*Cinnamon Bark Oil.*—A fall of 10 per cent. in the price of cinnamon chips has taken place since the beginning of the year. Germany now occupies the position of chief consumer, with an import of 882,980 lb.; America took 591,924 lb.; Spain, 489,500 lb.; and the United Kingdom 320,893 lb., out of a total export of 2,645,397 lb. A further fall in the already abnormally low price is not improbable.

*Citronella Oil.*—There has been only a very slight reduction in the price of citronella oil during the past six months, and that only for future autumn shipments. From Jan. 1 to July 31, 1905, the total shipments from Ceylon amounted to 682,443 lb. The United Kingdom took 249,490 lb.; America, 320,908 lb.; and Germany, 54,555 lb. From experiments conducted in the Royal Botanical Gardens of Ceylon, the following interesting data on the yield of grass and of oil distilled therefrom have been obtained. One acre planted with "maha paugiri" grass in July, 1902, gave 10,809 lb. of cut grass, yielding 48 lb. of oil in March, 1904, and another 8,511 lb., yielding 36 lb. of oil

in Aug., 1904; or a total of about 84 lb. The yield is therefore 1 lb. of oil from 230 lb. of grass. Other experiments tend to show that, considering the low value of land, and the cheapness of labour in Ceylon, the citronella industry is not so unremunerative as is sometimes stated.

*Clove Oil.*—The clove crop in 1904 was exceptionally good, attaining 14,447,600 lb., against 5,532,700 lb. in 1903, and 7,462,300 lb. in 1902. The high prices ruling rendered the crop most remunerative to the growers. The harvest having proved to be greater than anticipated, a fall in price took place to 22 florins; but, owing to speculation in the drug, the price soon rose to 37 florins per 50 kilos. The position of the clove market cannot be predicted with any certainty, since it is not influenced by the normal factors of supply and demand, but by the fictitious prices caused by the operations of speculative buyers.

*Sicilian and Calabrian Oils.*—The shipments of the aurantiaceous essential oils have somewhat fallen off during the first eight months of the present year, showing a total of 523,458 kilos, against 612,737 kilos, for the corresponding period last year. This is attributed to the large stocks held abroad, chiefly in America. That country has taken about 63,200 kilos, less, the United Kingdom 20,800 kilos, and France 2,500 kilos, less; whereas, the export to Austria for Germany shows an increase of 12,300 kilos.

*Eucalyptus Oils.*—Australia is again the chief source of eucalyptus oils rich in cineol; no other country can compete permanently against such an enormous output. Portugal furnishes a few thousand kilos, of oil, but Algeria has been completely supplanted in the market, and only sends out a very small quantity. The present money value of the best rectified oils of the *globulus* class, with a guaranteed cineol content of 60 per cent. is very low.

No other country can compete with Australia in the production of eucalyptus oils containing phellandrene, but at present the use of these is limited.

*Geranium Oil.*—Algerian geranium oil has reached an unprecedented low price. This has been brought about by the competition of Reunion oil, which is now produced in very large quantities and is shipped to Europe without regard to the state of the market. At present, the price of the oil cannot cover the cost of production. The amount exported from Reunion during the first eight months of 1905, amounted to no less than 280,000 kilos., which alone is probably in excess of all demands.

*Lemon Oil.*—The operations of the syndicate of growers and manufacturers have caused an artificial fluctuation in prices on the lemon oil market. Having succeeded in raising the price from 4.40 marks per kilo. to 5.25 marks, a further advance to 5.75 marks was forced. When the most pressing engagements for oil had been met at this figure, buyers entirely withdrew, causing a decline almost to the original low price. In July, a second attempt was made by the syndicate to force the price to 5.25 and 5.75 marks; but again the effort failed, and values dropped to 5 or 5.25 marks per kilo.; while the syndicate withdrew from the market a stock of oil estimated at 60,000 kilos. A further stock of 40,000 kilos, is reported to be held by the growers, so that the efforts of the syndicate have not been very successful, and have given rise to dissensions among its members. No detailed information is at present available on the coming lemon harvest. In Sicily, a medium crop is anticipated; but since the Spanish lemon crop has fallen short, a large export of fruit in cases is expected; the price for fruit on the trees, therefore, rules high. Probably part of the oil in stock will be carried over to the next season. Prices are expected to lie between 4.50 and 5 marks per kilo. for the new oil.

*Lemongrass Oil.*—Prices for lemongrass oil have ruled steady; the total shipments from Ceylon from July 1, 1904, to June 30, 1905, amounted to 1882½ cases against 2222½ in the preceding year, so that any material change in price is not probable. The high price realised for the oil has stimulated interest in its cultivation, and fresh land is being cropped with it. In some districts, the cultivation of lemongrass has been neglected in favour of citronella,



but at present prices the former would be very remunerative, since it is now four times as high as it was five years ago. This is due to the consumption of the oil in the new ethral and ionone industry.

*Neroli Oil.*—This year's orange flower harvest has been a very poor one owing to severe damage by frost and rain. Blooms were therefore very dear, and a corresponding high price obtains for the oil. The price of blossoms has also been influenced by a syndicate, and out of a crop of flowers estimated at 900,000 kilos., about 700,000 kilos. are said to have been in its possession. In normal years, the amount of blooms amounts to more than double this quantity.

*Bitter Orange Oil.*—Prices have remained firm during the summer, although the demand has been small. The present stock in Sicily is believed to be about 1,000 kilos. The prospects of the coming crop are unfavourable; it is estimated at about three-fifths of last year's production. Prices are, therefore likely to be maintained. Although fluctuations in price occurred last year, the quality of the oil was good.

*Sweet Orange Oil.*—A brisk demand in May, and unfavourable reports on the blooming of the trees caused a gradual advance in price up to 15.50 marks, but in July and August a fall to 14.50 and 14.25 marks per kilo. took place, due to a slackening in the demand. Stocks of oil in hand are short, and are estimated at 2,500 to 3,000 kilos. The prospects of the new harvest are bad; the trees in Calabria having suffered from the severe frosts in the winter, not more than half the quantity of fruit of the previous year is expected. In Sicily, appearances were at first more promising, but became less favourable during the summer, owing to the great loss by dropping of the immature fruit. The failure of the orange crop in Spain, owing to winter frosts, will also probably create a demand for the fruit for export in cases from Sicily, so that much of the harvest may be sold at good prices on the trees.

*Orris Root and Oil.*—The abnormally low prices for Florentine orris root and its preparations are likely to prevail, since the output is more than equal to the demand, and large stocks appear to be held abroad. The area under orris cultivation in the Verona district is diminishing, in consequence of the low prices obtained. A few years back 600 tons per annum was produced, but this year the crop will not exceed 80 tons. But this has not affected the price, the roots only fetching one-fourth the amount obtainable ten years ago. Yet Verona orris is used by preference in the United States, and if a fair demand were to arise the price would doubtless improve.

*Peppermint Oil, American.*—A larger area in Wayne county has been cropped with peppermint, as a result of the good prices obtained in 1904, but no definite opinion as to the yield of oil can yet be given. Certain districts are said to have been adversely affected by weather and insects. Old stocks of oil in producers' hands are said not to exceed 3000 lb. In the low-lying districts of Michigan the weather has been unpropitious for the peppermint crop. On the higher ground the prospects of the crop are excellent. The probable yield is estimated at about 25 lb. per acre. In Indiana about twice as much land is cropped with peppermint as last year, and it is believed that a yield of 35 lb. per acre will be attained. The area devoted to peppermint growing in Wayne County is estimated at about 933 acres; in Michigan, at 7375 acres; in Indiana, at 1000 acres. The total American output will probably approach 232,700 lb. Consequently, high prices are not likely to obtain.

*Peppermint Oil Industry.*—The total area under cultivation with peppermint plants in Japan in 1905 was 10,221 acres, as against 11,189 acres in 1904; the 1905 crop of oil is estimated at 476,226 lb. The first crop in Binga Bitchin has been short, but this is no criterion for the whole harvest, the chief factors in which are the second crop in September, and the third in November. As, however, large stocks of the oil are

now held in London, Hamburg and in Japan itself, these will have the effect of checking a rise in price. The decline in American peppermint oil will also have the same effect. Probably, therefore, if any rise in price takes place, it will only be temporary. The total shipments of menthol and peppermint oil from Japan during the first six months of 1905 have amounted to 3803 cases, or about 228,180 lb., which is more than any previously recorded export. More than half of the total export of Japanese peppermint oil during 1904 was shipped to Hamburg.

*Peppermint Oil; Mitcham.*—The oil obtained in this year's distillation is of exceptionally fine quality, but the area under cultivation is smaller than previously, consequently the supply of oil is limited. The English peppermint industry is seriously affected by the practice of applying the name "Mitcham" peppermint to mixtures of all kinds of inferior oils.

*Pine-Needles; Essential Oil of.*—The large demand which has arisen for pine-needle oil, from *Pinus montana*, for medicinal purposes, and the small supply available from Switzerland, has placed the market in a critical position. Possibly this may lead to the distillation being undertaken in other districts, such as on the Carpathians, where, at one time, it was proposed to establish distilling works. The Siberian product is said to be available in sufficient quantity.

*Rose Oil (Otto of Rose).*—The yield of otto of rose in Bulgaria this year is estimated at about 4150 kilos., compared with 5000 kilos. in 1904 and 6200 kilos. in 1903. The tendency of prices is upward, as it is believed that stocks will soon be exhausted.

*Sandal-wood, East Indian.*—The value of sandal-wood oil has remained fairly steady; the demand for the wood continues to increase steadily, not only among Western nations, but also in China, to which country the quantity exported has nearly quadrupled since 1900. The total export of wood from India during the season 1904—1905 amounted to 31,744 cwt. in 1903—1904 it was 30,448 cwt. The effect of the "spike" disease is now stated to be less serious than was at one time feared. Considerable quantities of Australian sandal-wood continue to be shipped to Chinese and East Indian ports; in 1903 the value of this amounted to 37,913*l.*, and in 1902, 61,771*l.*

—J. O. B.

#### QUININE; ITALIAN STATE —.

*Chem. and Drug.*, Dec. 9, 1905.

The "Bollettino-Chemico Farmaceutico" says that the figures relative to the great increase in the sale of State quinine during the last working year have just been published. From July 1, 1903, to June 30, 1904, the sales amounted to 6,174 kilos., value 672,927.40 lire, with a profit of 183,038 lire; while for the year 1904—5 now quoted, the sales weighed 14,061 kilos. quinine, value 1,150,597.85 lire, with a profit of 183,382.47 lire, which has been allocated to the fund for combating the malaria. The sales of the current year up to now have again increased by one-third.

## Patent List.

(Continued from page 1270.)

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

### I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 24,566. Brunner. Furnaces. Nov. 28.

„ 24,602. Herrick. Apparatus for promoting combustion.\* Nov. 28.

- [A.] 24,734. Davidson. Drying chambers. Nov. 29.  
 „ 24,737. Fallor. Boiling apparatus for liquids containing or depositing solid substances.\* Nov. 29.  
 „ 24,739. Pollak. Process for making extracts for baking, pharmaceutical and technical purposes. Nov. 29.  
 „ 24,872. Malmendier and Stühler. Mixing apparatus for saturating liquids with gases. Nov. 30.  
 „ 25,404. Schröder. Method of manufacturing homogeneous products from liquids or liquefied substances and apparatus therefor.\* Dec. 6.  
 „ 25,461. Lane. Hydro-extractors. Dec. 7.  
 „ 25,552. Grove. Apparatus for evaporating liquids.\* Dec. 8.  
 „ 25,576. Trotman and Hackford. Apparatus for automatically regulating the temperature of ovens, dyeing vats or the like, and for controlling the supply of fuel to a steam generator, or the like. Dec. 8.  
 „ 25,609. Chavanne and Ollagnier. Method of grinding and apparatus therefor. [Fr. Appl., May 29, 1905.]\* Dec. 8.  
 „ 25,610. Chavanne and Ollagnier. Grinding mills. [Fr. Appl., Sept. 27, 1905.]\* Dec. 8.  
 [C.S.] 28,197 (1904). Claridge. Apparatus for heating, cooling, and similar purposes. Dec. 13.  
 „ 29,358 (1904). Hencke. Apparatus for separating solid substances from liquids. Dec. 6.  
 „ 13,763 (1905). Lane. Furnaces. Dec. 6.  
 „ 16,087 (1905). Hausmann. *See under X.*  
 „ 20,653 (1905). Oxley. Apparatus for use in ascertaining the extent to which materials lose or gain in weight in being subjected to drying, or exposure to moisture, or other treatment tending to cause gain or loss in weight. Dec. 13.

## II.—FUEL, GAS, AND LIGHT.

- [A.] 24,443. Hutchins and Wilkie. Gas producer apparatus. Nov. 27.  
 „ 24,634. Still and Adamson. Incandescent gas mantles and the manufacture thereof. Nov. 28.  
 „ 24,680. Van Vriesland. Treatment of the woven tubes and of the yarns used in the manufacture of incandescent mantles. Nov. 29.  
 „ 24,786. Wilkinson. Producing and utilising mixtures of coal gas and air for lighting, heating and power purposes. Nov. 30.  
 „ 24,828. Carpenter. Burner for testing gas.\* Nov. 30.  
 „ 24,949. Lake (Deutsche Gasglühlicht A.-G.). Incandescing bodies or mantles for incandescent gas lighting. Dec. 1.  
 „ 25,045. Heckert. Introduction of steam or gas into a gas retort. Dec. 2.  
 „ 25,046. McRae and Ingram. Manufacture of acetylene gas. Dec. 2.  
 „ 25,275. Wilton. Manufacture of gas from carbonaceous materials.\* Dec. 5.  
 „ 25,313. Atkinson. Suction gas producers. Dec. 6.  
 „ 25,437. Weatherhogg. Hydrocarbon fuel burners. Dec. 7.  
 „ 25,466. Schatz. *See under XXIII.*  
 „ 24,574. Simpson. Process of and apparatus for the desulphurisation of coke. Dec. 8.  
 „ 25,596. Lake (Selas Ges.m.b.H.). Manufacture of a mixture of gas and air for illuminating purposes. Dec. 8.  
 „ 25,663. Lake (Selas Ges.m.b.H.). Manufacture of a mixture of gas and air for illuminating purposes. Dec. 9.

- [A.] 25,665. Elsenbans. Processes and apparatus for purifying gases. [Ger. Appl., Dec. 13, 1904.]\* Dec. 9.  
 [C.S.] 29,360 (1904). Schwarz. Purification of furnace gases. Dec. 6.  
 „ 1947 (1905). Strenge, Strenge, Strenge and Strenge. Manufacture of peat briquettes and the like. Dec. 13.  
 „ 3420 (1905). Hesketh and Willeox. Treating air for supply to blast furnaces, converters and the like. Dec. 6.

## III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

- [A.] 24,503. Otto Hilgenstock Coke Oven Co. (Otto und Co.). Carbonising coal for increasing the yield of ammonia. Nov. 27.  
 [C.S.] 7630 (1905). Henderson. Apparatus for treating paraffin wax. Dec. 6.  
 „ 19,540 (1905). Van der Heyden. Solidification of hydrocarbons such as petroleum and benzine. Dec. 6.

## IV.—COLOURING MATTERS AND DYESTUFFS.

- [A.] 25,498. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of dyestuffs of the triphenylmethane series. Dec. 7.  
 [C.S.] 3819 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of new compounds of the a thracene series and of colouring matters therefrom. Dec. 6.  
 „ 8744 (1905). Meyenberg, Weizmann, and Clayton Aniline Co., Ltd. Manufacture of anthracene derivatives and dyestuffs therefrom. Dec. 13.  
 „ 9074 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of nitro-derivatives of certain aromatic bases. Dec. 13.  
 „ 10,101 (1905). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new sulphurised dyestuffs. Dec. 6.  
 „ 11,196 (1905). Newton (Bayer und Co.). Manufacture of anthraquinone derivatives. Dec. 6.  
 „ 12,757 (1905). Newton (Bayer und Co.). Manufacture of a new anthracene derivative. Dec. 6.  
 „ 19,132 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthracene derivatives and of colouring matters therefrom. Dec. 6.  
 „ 19,199 (1905). Badische Anilin und Soda Fabrik. Manufacture of anthracene derivatives. Dec. 6.  
 „ 23,122 (1905). Johnson (Badische Anilin und Soda Fabrik). Manufacture of solid stable salts of indigo white. Dec. 6.

## V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

- [A.] 24,565. Bunzl and Brandt. Manufacture of silk-like threads. Nov. 28.  
 „ 24,762. Livesey. Apparatus for opening, guiding and spreading woven fabrics in bleaching, scouring, dyeing, printing, and like processes. Nov. 30.  
 „ 24,895. Marsden. Hawking machines for dyeing textile fabrics. Dec. 1.  
 „ 24,977. Fletcher. Finishing textile goods and apparatus therefor. Dec. 1.  
 „ 25,030. Proude. *See under XII.*  
 „ 25,054. Lake (Comp. Manuf. Fluminense). Machines for printing fabrics and wall papers.\* Dec. 2.



- [A.] 25,088. Calico Printers' Assoc., Ltd., Kay and Warr. Fixation of certain finishes or effects on woven piece goods. Dec. 4.
- " 25,537. The British Algin Co., Ltd., Ingham and Bunzl. Treatment of textiles, paper, leather and other absorbent materials with compounds of alginic acid. Dec. 8.
- " 25,538. Owens and Lowe. Apparatus for treating fibrous materials with dye or other liquors. Dec. 8.
- " 25,545. Lawson. Method of producing fancy printed fabrics. Dec. 8.
- " 25,576. Trotman and Hackford. *See under I.*
- " 25,586. Thornber. Manufacture of sizing, thickening, stiffening or finishing, or waterproofing material for textiles and other fabrics. Dec. 8.
- " 25,602. Ellis (Chem. Fabr. von Heyden, A.-G.). Manufacture of aldehyde hydrosulphito salts.\* Dec. 8.
- " 25,681. Baudot. Treatment of raw wool. [Fr. Appl., Dec. 13, 1904.]\* Dec. 9.
- [C.S.] 26,287 (1904). Bernhardt. Washing and rinsing machine for fibrous materials. Dec. 13.
- " 6230 (1905). Duckworth. Manufacture of coloured polished yarns. Dec. 13.
- " 16,726 (1905). Maurel. Waterproofing of soft felt hats. Dec. 13.

#### VII.—ACIDS, ALKALIS, AND SALTS.

- [A.] 24,458. Majert and Majert. Method of making artificial carbonic acid baths. [Ger. Appl., Nov. 26, 1904.]\* Nov. 27.
- " 24,503. Otto-Hilgenstock Coke Oven Co. (Otto and Co.). *See under III.*
- " 24,507. Teichner. *See under XI.*
- " 24,733. Roberts. Manufacture of hydrochloric acid.\* Nov. 29.
- " 24,849. Harris. Apparatus for the generation of ozone. Nov. 30.
- " 25,477. Muth. Production of aluminium oxide from bauxite. Dec. 7.
- [C.S.] 2174 (1905). De Stuekl. Apparatus for the manufacture of alkali, or alkali hydrates and zinc sulphides. Dec. 13.

#### VIII.—GLASS, POTTERY, AND ENAMELS.

- [A.] 24,913. Gottlieb. Process for the decoration of enamel, porcelain, majolica, glass, and the like. Dec. 1.
- " 25,639. Thornton, Sharp, Ingle and Stanley. Kilns for burning or fixing the colours or glaze on glass or earthenware. Dec. 9.

#### IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

- [A.] 24,924. Noble, Greaves and Wilson. Method of manufacturing artificial marble. Dec. 1.
- " 25,051. Paulsen. Impregnation of wood. Dec. 2.
- " 25,389. Schliekum. Process for the production of polished artificial stone.\* Dec. 6.
- [C.S.] 26,465 (1904). Illemann. Manufacture of insulating coverings for steam pipes, boilers, and the like. Dec. 12.

#### X.—METALLURGY.

- [A.] 24,486. Hybinette. Process of refining copper nickel matte.\* Nov. 27.
- " 24,647. Sterne. Desiccation of air for metallurgical operations. Nov. 28.
- " 24,655. Kalinowsky. Process for disintegrating basic slag. [Ger. Appl., Nov. 29, 1904.]\* Nov. 28.
- " 25,004. Brayshaw. Process of hardening steel. Dec. 2.

- [A.] 25,120. Rodda, Rodda and Rodda. Machinery for extracting the metals from tin and other pulverised ores.\* Dec. 4.
- " 25,122. Hybinette. Process of separating metals.\* Dec. 4.
- " 25,245. Fyfe. Ore-roasting furnaces. Dec. 5.
- " 25,371. Boulton (Brown). Treatment of sulphide and other ores.\* Dec. 6.
- " 25,672. Turton. Extraction of metals from their ores.\* Dec. 9.
- [C.S.] 20,282 (1904). Elmore. Apparatus for separating certain constituents of subdivided ores, &c. Dec. 6.
- " 3420 (1905). Hesketh and Willcox. *See under II.*
- " 12,652 (1905). Campbell. Treatment of chromiferous iron. Dec. 6.
- " 15,649 (1905). Cothias. Process of casting articles in aluminium or its alloys. Dec. 6.
- " 16,087 (1905). Hausmann. Crucible furnaces. Dec. 13.

#### XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

- [A.] 6790A. Potthoff. Apparatus for electro-plating.\* Dec. 1.
- " 24,507. Teichner. Process for electrolytically producing peroxide of hydrogen.\* Nov. 27.
- " 24,538. Howorth (Kellner). Electrodes for electrolytic apparatus. Nov. 27.
- " 25,174. Soc. Anon. Electrometallurgique (Proc. P. Girod). Electric furnaces. [Fr. Appl., Jan. 4, 1905.]\* Dec. 4.
- " 25,670. N.S. Electric Storage Co., and Niblett. Secondary or storage batteries. Dec. 9.
- [C.S.] 6872 (1905). Wood-Smith. Ozonisers and like apparatus for treating gases electrically. Dec. 6.
- " 11,301 (1905). Cie. Thermo-Electrique (Systeme Hermite). Couples for sulphide of copper thermoelectric generators. Dec. 6.
- " 22,460 (1905). Yasuda. Electrodes. Dec. 6.

#### XII.—FATTY OILS, FATS, WAXES, AND SOAP.

- [A.] 24,935. Oelwerke Stern-Sonneborn A.-G. Manufacture of ricinus oil product. [Ger. Appl., Dec. 9, 1904.]\* Dec. 1.
- " 24,936. Oelwerke Stern-Sonneborn A.-G. Manufacture of ricinus oil product. [Ger. Appl., Dec. 9, 1904.]\* Dec. 1.
- " 25,030. Proude. Soap for use in finishing woollen goods.\* Dec. 2.
- " 25,068. Lehfeldt. Purifying butter, oils, fats, lard, and the like. Dec. 2.
- " 25,204. Kessler. Soaps, ointments, and the like. Dec. 5.
- " 25,425. Burley and Burley. Manufacture of soap. Dec. 6.
- " 25,680. Verein. Chemische Werke A.-G. Manufacture of fatty acids from fatty acid esters. [Ger. Appl., Jan. 25, 1905.]\* Dec. 9.
- [C.S.] 29,558 (1904). Mayor, Aldermen and Citizens of Bradford, Garfield and Grossmann. *See under XVIII.*
- " 12,525 (1905). De Hemptinne. Process for eliminating the odour of fish oil. Dec. 13.

#### XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

##### (A.)—PIGMENTS, PAINTS.

- [A.] 9017A. Chatillon. Preparation of products of antimony for painting and other purposes.\* Dec. 9.
- [C.S.] 13,647 (1905). Tomlins and Bowley. Self-cleansing compositions for prevention of fouling of ship's bottoms. Dec. 13.
- " 16,490A (1905). Brunet. Manufacture of a white antimony pigment. Dec. 6.

## (B.)—RESINS, VARNISHES.

- [A.] 25,042. Nairn. Manufacture of inlaid materials. Dec. 2.

## (C.)—INDIA-RUBBER.

- [A.] 25,291. Bloxam (Bamber). Manufacture of india-rubber. Dec. 5.

## XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

- [A.] 24,487. Oakes. Process of treating hides. [U.S. Appl., Dec. 12, 1904.]\* Nov. 27.  
 „ 24,488. Oakes. Process of treating hides. [U.S. Appl., Dec. 12, 1904.]\* Nov. 27.  
 „ 24,984. Sandikoff. Purification of glue.\* Dec. 1.  
 „ 25,187. The British Algin Co., Ltd., and Ingham. Manufacture of a product from seaweed. Dec. 5.  
 „ 25,467. Inrig. Treatment of waste leather. Dec. 7.  
 „ 25,537. The British Algin Co., Ltd., Ingham and Bunzl. *See under V.*

## XVI.—SUGAR, STARCH, GUM, Etc.

- [C.S.] 28,547A (1904). Lichtenstein. *See under XVII.*  
 „ 425 (1905). Uhlend. Washing starch out of disintegrated materials. Dec. 6.

## XVII.—BREWING, WINES, SPIRITS, Etc.

- [A.] 25,005. Bratby and Hinchliffe, Ltd., and Lang. Apparatus for the aeration of liquids. Dec. 2.  
 „ 25,495. Loew. Processes for pasteurising beer and apparatus therefor.\* Dec. 7.  
 [C.S.] 17,419 (1904). Stanz- und Emailirwerke vorm. C. Thiel und Söhne. Pasteurising beer in bottles. Dec. 6.  
 „ 28,547A (1904). Lichtenstein. Preparation of caramel and its application as a colouring matter in the production of fermented liquors, &c. Dec. 13.  
 „ 2317 (1905). Chambers and Archibald. Cooling and aerating beer and like beverages. Dec. 13.  
 „ 5360 (1905). West and Webster. Process for conditioning, cooling and freeing from fermentable matter, beer and other like liquids. Dec. 13.

## XVIII.—FOODS; SANITATION, WATER PURIFICATION; &amp; DISINFECTANTS.

## (A.)—FOODS.

- [A.] 24,739. Pollak. *See under I.*  
 „ 25,010. Zimmermann and Buchenau. Process for bleaching and sterilising corn and its products. Dec. 2.  
 „ 25,068. Lehfeldt. *See under XII.*  
 „ 25,653. Héritte. Preservation of organic substances. Dec. 9.  
 [C.S.] 27,597 (1904). Livingstone. Manufacture of food for animals. Dec. 6.  
 „ 27,854 (1904). Thompson (Gsell). Process for making cream poor in fat and adapted to be whipped. Dec. 6.  
 „ 2020 (1905). Simpson and Jackson. Milk products and process and apparatus for producing the same. Dec. 13.

## (B.)—SANITATION; WATER PURIFICATION.

- [A.] 25,016. Stephenson. Apparatus for purifying water or other liquids. Dec. 2.  
 „ 25,290. Normandy. Stills for producing fresh water from sea water. Dec. 5.  
 [C.S.] 29,558 (1904). Mayor, Aldeimen and Citizens of Bradford, Garfield and Grossmann. Method and apparatus for recovering fatty and oily matters from sewage sludge. Dec. 13.

## (C.)—DISINFECTANTS.

- [A.] 24,618. England. Antiseptic or disinfecting compounds. Nov. 28.  
 „ 24,798. Smith and Davis. Disinfectants and deodorisers. Nov. 30.  
 [C.S.] 28,813 (1904). King. Disinfecting and deodorising apparatus. Dec. 6.

## XIX.—PAPER, PASTEBOARD, Etc.

- [A.] 24,563. Pearson. Process for rendering paper impervious to oil and grease. Nov. 28.  
 „ 25,081. Cocking, and Kynoch, Ltd. *See under XXII.*  
 „ 25,480. Post. Copying paper. Dec. 7.  
 „ 25,537. The British Algin Co., Ltd., Ingham and Bunzl. *See under V.*  
 [C.S.] 1727 (1905). Bertram and Milne. Apparatus for the treatment of fibrous materials to be used in the manufacture of paper. Dec. 6.

## XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

- [A.] 21,529A. Abelli. Manufacture of certain amidic derivatives of carbonic acids. Nov. 28.  
 „ 24,729. Pollak. *See under I.*  
 „ 25,571. Newton (Bayer und Co.). Manufacture of new pharmaceutical compounds. Dec. 8.  
 „ 25,680. Verein. Chem. Werke, A.-G. *See under XII.*  
 [C.S.] 9008 (1905). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of camphor. Dec. 13.  
 „ 18,992 (1905). Fritzsche, Fritzsche and Fritzsche. Process for manufacturing protocatechuic aldehyde. Dec. 13.

## XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

- [A.] 24,586. Wagner. Process of printing photographs in colours. Nov. 28.  
 „ 24,875. Krebs. Process for the simplified correction of the chemical effect of the spectrum in reference to photographic purposes.\* Nov. 30.  
 [C.S.] 27,023 (1904). Zander. Photo-mechanical colour reproduction. Dec. 13.  
 „ 8616 (1905). Lange. Process of copying webs of photographic paper and apparatus therefor. Dec. 6.  
 „ 8616A (1905). Lange. Process for developing, fixing and drying webs of photographic paper. Dec. 6.  
 „ 9116 (1905). Abel (Act.-Ges. f. Anilinfabr.). Developing and finishing photographic plates, films or the like, and photographic developers for use therein. Dec. 13.  
 „ 11,239 (1905). Schaack. Production of collotype plates. Dec. 13.  
 „ 20,372 (1905). Neue Photographische Ges., A.-G. Reproduction of pictures and the like with aid of catalysis. Dec. 13.

## XXII.—EXPLOSIVES, MATCHES, Etc.

- [A.] 24,884. Upton. Explosive mixture. Dec. 1.  
 „ 20,081. Cocking, and Kynoch, Ltd. Solvents for nitrocellulose. Dec. 4.  
 „ 25,239. Boyd. Explosive compositions. Dec. 5.  
 [C.S.] 20,350 (1905). Bokmayer and Swoboda. Match compositions. Dec. 13.

## XXIII.—GENERAL ANALYTICAL CHEMISTRY.

- [A.] 25,466. Schatz. Apparatus for use in analysing gas. [Ger. Appl., Dec. 7, 1904.]\* Dec. 7.  
 [C.S.] 11,067 (1905). Martin. Estimation of the quantity of oil contained in feed water. Dec. 6.



# LIST OF COUNCIL AND OFFICERS.

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London, W.

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E. Grant Hooper, 16, Royal Avenue, Sloane Square,  
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Dr. F. B. Power, 6, King Street, Snow Hill, London, E.C.

Sir Wm. Ramsay, K.C.B., D.Sc., LL.D., F.R.S., 19, Chester  
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Square, Manchester.

Oscar Guttman, 12, Mark Lane, London, E.C.

Henry Hemingway, Marsh Gate Lane, Stratford, E.

Prof. W. R. Lang, The University, Toronto, Canada.

Dr. J. Lewkowsch, 71, Priory Road, London, N.W.

N. H. Martin, Northumberland Road, Newcastle-on-Tyne.

B. E. R. Newlands, 2, St. Dunstan's Hill, London, E.C.

Prof. W. J. Pope, F.R.S., 16, Hope Street, Higher  
Broughton, Manchester.

Dr. Boverton Redwood, 4, Bishopsgate Street Within,  
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Walter F. Reid, Fieldside, Addlestone, Surrey.

Frank Scudder, Mersey and Irwell Joint Committee,  
44, Mosley Street, Manchester.

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London, N.W.

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Toronto, Canada.

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Canada.

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ings, Haekins Hey, Liverpool.

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Secretary .. Dr. H. Schweitzer, 40, Stone Street, New  
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Chairman .. J. T. Wood, 62, Park Road, Nottingham.

Secretary .. S. R. Trotman, King's Walk Chambers,  
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## *Honorary Foreign Secretary.*

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Park, London, N.W.

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Chas. G. Cresswell, Palace Chambers, Westminster, S.W.  
(Telegraphic address :—59, Palatable, London.)

## *Editor.*

Watson Smith, 34, Upper Park Road, Haverstock Hill  
London, N.W.

## LIST OF MEMBERS.

TOTAL MEMBERSHIP ON FEBRUARY 28TH, 1905 = 4137.

## A

1897. Ablett, A. W., P.O. Box 91, Germiston, near Johannesburg, Transvaal, S. Africa, Cyanide Works Manager.
1903. Abraham, Herbert, 13, West 89th Street, New York City, U.S.A., Chemist.
1902. Acker, Chas. E., Acker Process Co., Niagara Falls, N.Y., U.S.A., Manufacturer.
1903. Ackermann, Franz W., 86, Pierrepont Street, Brooklyn, N.Y., U.S.A., Chemist.
1900. Ackroyd, Wm., Borough Laboratory, and (communications) Crossley Street, Halifax, Yorks, Analytical Chemist.
1903. Acton, J. Rowland, Wicklewood, Maze Road, Kew, S.W., Civil Servant.
1892. Adams, Arthur, Kelvin House, Edgbaston Road, Smethwick, near Birmingham, Science Lecturer.
1884. Adams, M. A., "The Kulk," Bearsted, near Maidstone, Kent, Public Analyst.
1902. Adams, O. Gore, School of Mines, Thames, Auckland, New Zealand, Director.
1897. Adams, Thos. H., 107, Crewe Street, Derby, Analyst.
1895. Adamson, G. P., 233, Reeder Street, Easton, Pa., U.S.A., Manufacturing Chemist.
1891. Adcock, S. R., St. Helens Smelting Co., Atlas Court, St. Helens, Lancashire, Analytical Chemist.
1901. Addison, Leonard, c/o Messrs. Burt, Boulton, and Haywood, Selzaete, Belgium, Chemist.
1901. Addison, Dr. Wm. L. T., Wm. Davies Co., Ltd., Front Street East, and (Journals) 513, Markham Street, Toronto, Canada, Chemist.
1898. Adgate, M., Naugatuck, Conn., U.S.A., Chemist.
1898. Adiassewich, Alex. V., 6, Camden Gardens, Shepherd's Bush, London, W., Oil Engineer.
1896. Adler, Dr. Leon N., Adler Colour and Chemical Works, 100, William Street, New York City, U.S.A., Manufacturing Chemist.
1888. Adriance, Dr. John S., 105, East 39th Street, New York City, U.S.A., Analytical Chemist.
1899. Adrot, Léon, 15, Rue de Neuilly, Rosny sous bois (Seine), France, Chemist.
- O.M. Affleck, Dr. J., Highfield, Woodend Park, Grassendale, near Liverpool, Alkali Inspector.
1903. Aicher, Chas. P., Camp Bird Mills, Ouray, Colo., U.S.A., Mill Manager.
1886. Aitken, J. B., Gerard's Fold Chemical Works, Widnes, Chemical Manufacturer.
1884. Akitt, Thos., Mijnbouw Maatschappij Katahoen, Lebong Soelit, Benkoelen, Sumatra, Chemist.
1883. Albright, G. S., Bromesborough Place, Ledbury, Chemical Manufacturer.
- O.M. Albright, W. A., Mariemont, Edgbaston, Birmingham, Chemical Manufacturer.
1891. Alcock, Jno. W., Central Brewery, Mott Street, Birmingham, Maltster and Brewer.
1902. Alden, Frederick, 342, 22nd Avenue, Milwaukee, Wis., U.S.A., Chemist.
1898. Alden, John, Chemical Laboratory, Pacific Mills, Lawrence, Mass., U.S.A., Chemist.
1900. Aldrich, Roger C., c/o F. H. Kalbfleisch Co., White and Boerum Streets, Brooklyn, N.Y., U.S.A., Mechanical Engineer.
1890. Aldrick, Edwin John, 53, Alpha Road, West Ferry Road, Millwall, E., Chemical Works Clerk.
1899. Alexander, D. Basil W., 1020, Date Street, Los Angeles, Cal., U.S.A., Chemist.
1900. Alexander, Jerome, c/o National Gum and Mica Co., 502-510, West 45th Street, New York City, U.S.A., Chemist.
1883. Alexander, W. T., Crummock, Eccles, Manchester, Drysalter.
1891. Allan, F. H., Tielke, Portobello House, Wakefield, Analytical Chemist.
1898. Allan, John, Chemist.
1902. Allbright, Wm. B., 5133, Lexington Avenue, Chicago, Ill., U.S.A., Chemical Engineer.
- O.M. Alldred, C. H., S. St. Margaret's Road, Plumstead Common, Kent, Analytical Chemist.
1898. Alleman, Dr. Gellert, Swarthmore College, Swarthmore, Pa., U.S.A., Professor of Chemistry.
1903. Allen, Chas. A., 188, Harwood Street, Darwin, Lancs., Chemist.
1902. Allen, Chas. D., jun., 475, 4th Street, Brooklyn, N.Y., U.S.A., Chemist.
1891. Allen, E. W., Lea Mount, Glossop, Paperstainers' Manager.
- O.M. Allen, J., 164, Upper North Street, Poplar, E., Manufacturing Chemist.
1901. Allen, R. F., 1241, South 47th Street, Philadelphia, Pa., U.S.A., Chemist.
1889. Allen, R. L., Crewe Road, Sandbach, Cheshire, Analytical Chemist.
1904. Allen, Thos. E., c/o American Aristotype Co., Jamestown, N.Y., U.S.A., Chemist.
1900. Allen, Wilfrid T., c/o Hugh Wallace and Co., Ltd., 5, Fenchurch Street, London, E.C., Director.
1904. Allen, Wm. R., c/o Watson, Jack & Co., Montreal, Canada, Dyestuff and Chemical Manufacturer.
1893. Allerton, Rt. Hon. Lord, F.R.S. (Journals), Allerton Hall, near Leeds: and c/o W. L. Jackson and Sons, Ltd., Buslingthorpe, Leeds, Tanner.
- O.M. Allhusen, A., Gateshead-on-Tyne, Chemical Manufacturer.
1886. Allibon, G. H., 35, Eglantine Avenue, Belfast, Ireland, Chemical Works Manager.
1887. Alliot, J. B., Messrs. Manlove, Alliot, and Co., Ltd., Nottingham, Mechanical Engineer.
1895. Allison, Wm. O., 100, William Street, New York City, U.S.A., Publisher of "Oil Paint and Drug Reporter."
1904. Alpers, Wm. C., 4 & 6, White Street, New York City, U.S.A., Manufacturing Chemist.
1889. Alpiar, Agop, Smyrna, Asia Minor, Morphia Manufacturer.
1899. Alsop, Wm. K., 30, Ferry Street, New York City, U.S.A., Chemist.
1901. Alston, Robt., A., New Rietfontein Estates Gold Mines, Ltd., P.O. Knights, Rietfontein, Transvaal, Mining Engineer.
1904. Alton, W. Lester, "Dungarvan," Putney Heath, S.W., Chemist.
1898. Ambler, Chas. Taaffe, Dharhara Station, E.I. Ry., Bengal, India, Mine Owner and Contractor.
1897. Amend, Otto P., 205-211, Third Avenue, New York City, U.S.A., Chemist.
1900. Anderson, Jas. W., The Paddock, Halling, near Rochester, Kent, Analytical Chemist.
1889. Anderson, Robt. T. R., 80, Seedhill Road, Paisley, Technical Chemist.
1894. Anderson, Dr. W. Carriek, 7, Scott Street, Garnet Hill, Glasgow, University Lecturer.
- O.M. Anderton, G. H., Howendyke, Howden, Yorks, Chemical Manufacturer.



Let  $\mathcal{L}$  be a language.

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1898. Bailey, Henry, 18, Lavender Sweep, Lavender Hill, S.W., Analytical Chemist.
1888. Bailey, Dr. T. Lewis, Gas Street, Runcorn, Chemist.
1888. Bailey, Sir W. H., Albion Works, Salford, Manchester, Chemical Engineer.
1888. Bailey, Walter P., Fabrica de Productos Amoniacales, 2a. Aguada, Cadiz, Spain, Manufacturing Chemist.
1902. Bain, Jas. Watson, 90, Charles Street, Toronto, Ont., Canada, Chemist.
1890. Baird, H. Harper, 14, Cross Street, Hattou Garden, London, E.C., Laboratory Furnisher.
1902. Baird, Dr. Julian W., Massachusetts College of Pharmacy, Boston, Mass., U.S.A., Professor of Chemistry.
1891. Baird, Wm., c/o Lewis Berger and Sons, Ltd., Homerton, N.E., Technical Chemist.
1895. Baird, W. Raymond, 271, Broadway, New York City, U.S.A., Patent Lawyer.
1890. Bairstow, John, Burley, Queen's Park, Chester, Chemical Works Manager.
1903. Baker, Arthur, 90, Blackburn Road, Darwen, Lanes., Chemist.
1902. Baker, Chas. F., Technical College, Sunderland, Lecturer in Chemistry.
1901. Baker, F. Guy Stirling, Marryatt's Lodge, The Forest, Snaresbrook, Essex, Student.
1883. Baker, Harry, Epworth House, Moughland Lane, Runcorn, Analytical Chemist.
1899. Baker, H. Fenimore, c/o Thomsen Chemical Co., Baltimore, Md., U.S.A., President.
1904. Baker, John T., Easton, Pa., U.S.A., Manufacturing Chemist.
1892. Baker, Julian L., 7, Addison Road, Bedford Park, W., Sugar Chemist.
1886. Baker, Theodore, c/o G. Henry, Pompton Lakes, N.J., U.S.A., Analytical Chemist.
1898. Baldwin, Abram T., Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Manufacturer.
1903. Baldwin, F. H., Bergenport Chemical Works, Bayonne, N.J., U.S.A., Superintendent.
1903. Baldwin, Dr. H. B., 9-11, Franklin Street, Newark, N.J., U.S.A., Chemist (Dept. of Public Health).
1901. Ball, Edward, c/o B. Young and Co., 24, Dunlop Place, Spa Road, Bermondsey, S.E., Glue and Size Manufacturer.
1903. Ball, S. F., Hull Avenue and 209th Street, Bronx Borough, New York City, U.S.A., Analytical Chemist.
1889. Ballantyne, H., 75, Chancery Lane, London, W.C., Analytical Chemist.
1903. Ballantyne, W. H., 111, Hatton Garden, London, E.C., Patent Agent's Assistant.
1892. Ballard, Ernest, Colwall, Great Malvern, Malt Vinegar Brewer.
1891. Ballinger, Jno., Free Library, Cardiff, Librarian.
1903. Baltzly, E. B., c/o Somet Solvay Co., Syracuse, N.Y., U.S.A., Chemist and Superintendent.
- O.M. Bamber, H. K., 9, Victoria Street, London, S.W., Consulting Chemist.
1894. Bamber, H. K. G., Ingress House, Greenhithe, Kent, Cement Works Chemist and Manager.
1898. Bamford, Harry, 70, Dneckworth Terrace, Bradford, Yorks., Dyer.
- O.M. Bamister, H. C., Elmhurst, Blundellsands, near Liverpool, Chemical Works Manager.
1890. Banks, Jno. H., c/o Ricketts and Banks, 104, John Street, New York City, U.S.A., Mining Engineer.
1895. Bannan, John F., 59, Court Street, North Andover, Mass., U.S.A., Chemist (Woollen Mill).
1885. Banner, Samuel, 4, Ivanhoe Road, Liverpool, Petroleum Merchant.
- O.M. Bannister, R., 59, Tregunter Road, South Kensington, S.W., Analytical Chemist.
- O.M. Bannister, W., Victoria Lodge, Cork, Ireland, Manufacturing Chemist.
1901. Barber, René R., Georgetown, Ont., Canada, Analytical Chemist.
1892. Barden, Alf., Far Bank, Shelley, near Huddersfield, Glue and Size Maker.
1886. Bardsley, Robt., Messrs. Jewsbury and Brown, Ardwick Green, Manchester, Mineral Water Manufacturer.
1895. Bardwell, Fred. L., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Assistant Professor of Chemistry.
1903. Baringer, Fred. J., Eagle White Lead Works, 1020, Broadway, Cincinnati, Ohio, U.S.A., Chemist.
1902. Barker, Hugh S., 32, Cumberland Avenue, Sefton Park, Liverpool, Laboratory Furnisher.
1895. Barlow, Clinton W., 103-105, Greene Street, New York City, U.S.A., Merchant.
1901. Barlow, John J., 177, Manchester Road, Accrington, Calico Printer's Chemist.
1899. Barlow, Wm., 311, Market Street, Droydsden, near Manchester, Analytical Chemist.
1891. Barnes, Edward A., Dynamite Works, Modderfontein, Transvaal, Technical Chemist.
1901. Barnes, Fred., 46, Park Road, Sittingbourne, Kent, Paper Mill Chemist.
1884. Barnes, H. J., Phoenix Chemical Works, Hackney Wick, N.E., Manufacturing Chemist.
1884. Barnes, Jonathan, 301, Great Clowes Street, Manchester, Analytical Chemist.
- O.M. Barnes, Jos., Green Vale, Westhoughton, near Bolton, Lancashire, Analytical Chemist.
1902. Barnett, Marcus S., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Sugar Works Chemist.
1897. Barnett, Robt. E., 9, Virginia Road, Leeds, Headmaster (Leeds Technical School).
1898. Barnicott, Jas. A., Messrs. May and Baker, Ltd., Garden Wharf, Church Road, Battersea, S.W., Chemical Manufacturer.
1904. Baron, Wm. Briscoe, Manchester Steam Users' Association, 9, Mount Street, Manchester, Chemist.
1901. Barr, Geo., Manchester Mills, Manchester, N.H., U.S.A., Calico Printer.
- O.M. Barr, J., Dinting Vale, Dinting, near Manchester, Chemical Manager.
1890. Barraclough, Wm. H., Mortomley, near Sheffield, Analytical Chemist.
1896. Barratt, J. Treeby, Bronheulog, Mostyn, North Wales, Chemist and Manager.
1903. Barreto, Ignacio de Barros, Engenho do Meis Vergea, Pernambuco, Brazil, Manager (Sugar Factory).
1890. Barrett, Arthur A., 5, Strada del Pozzo Leone, Messina, Sicily, Manufacturer of Essential Oils.
1890. Barrie, D. McLaurin, P.O. Box 193, Germiston, Transvaal, Analytical Chemist.
1900. Barrow, Jos., 13, The Grove, Bebbington, Cheshire, Chemist.
1893. Barton, G. E., c/o Whitall, Tatum, and Co., Flint Glass Works, Millville, N.J., U.S.A., Technical Chemist.
1900. Barton, L. Edward, 283-285, Broadway, Albany, N.Y., U.S.A., Chemist.
1903. Bartripp, Geo. F., 51, Pulteney Road, South Woodford, Essex, Analytical Chemist.
1904. Bartsch, Chas. A., 6803, Woodland Avenue, Philadelphia, Pa., U.S.A., Chemist.
1895. Baskerville, Dr. Chas., College of the City of New York, New York, U.S.A., Professor of Chemistry.
1884. Bassett, H., 26, Belitha Villas, Barnsbury, N.
1899. Bassett, Wm. H., Torrington, Conn., U.S.A., Chemist.
1890. Bate, William, c/o National Explosives Co., Ltd., and (Journals) "Ladbroke," Hayle, Cornwall, Technical Chemist.
1903. Bateman, A. H., 34, Bridge Avenue, Hammersmith, W., Chemist.
1903. Bates, C. O., c/o Coe College Library, Cedar Rapids, Iowa, U.S.A., Teacher of Chemistry.
1884. Bateson, Percy, Cuckoo Lane, Gateacre, near Liverpool, Technical Chemist.
1885. Batty, R. B., Wharfedale, Erdington, near Birmingham, Nickel Works Manager.
1903. Baty, E. J., Nunclose, Prince's Avenue, West Kirby, Liverpool, Chemical Student.



1903. Bauer, Geo. W., 632, Sacramento Street, San Francisco, Cal., U.S.A., Vice-President and Chemist (Hop and Malt Co.).
1900. Baur, Jacob, 67, Wells Street, Chicago, Ill., U.S.A., Liquid Carbonic Acid Manufacturer.
1898. Baxter, John G., Nine Elms Cement Works, Cliffe, Kent.
- O.M. Baxter, W. H., Nuthurst, Streatham, S.W., Brewery Director.
1899. Bayly, Francis W., Royal Mint, Sydney, N.S.W., Australia, Assayer.
1904. Bayly, Harold G., 65, Fulham Park Gardens, London, S.W., Analytical Chemist.
- O.M. Baynes, J., Royal Chambers, Scale Lane, Hull, County and Borough Analyst.
1897. Beadle, Alec A., Greenhays, Granville Road, High Barnet, Herts., Electro-Chemist.
1886. Beadle, Clayton, Halewood, Sidcup, Kent, Consulting Chemist.
1890. Bealey, Adam C., c/o A. C. Bealey and Sons, Radcliffe, Lancashire, Bleacher and Alkali Manufacturer.
1904. Bean, Percy, 10, Marsden Street, Manchester, Analytical Chemist.
- O.M. Beanes, E., Moatlands, Paddock Wood, Kent, Manufacturing Chemist.
1905. Beasley, Jno. K. (Journals), c/o The Duff Development Co., Ltd., Kelantan, Federated Malay States, and (communications) 29, Lamont Road, Chelsea, S.W., Metallurgical Chemist.
1883. Beaven, E. S., 5, Borcham Terrace, Warminster, Wilts, Maltster.
1897. Beaver, Chas. J., Stanmore, Cecil Road, Hale, Cheshire, Chemist.
1895. Beehi, G. de H., Walton's Parade, Preston, Lanes., Chemical Engineer.
1898. Beck, Herbert H., 105, South Queen Street, Lancaster, Pa., U.S.A., Chemist.
- O.M. Beckett, G. H., Hartford, South Beach Avenue, Ardrossan, Scotland, Analytical Chemist.
1898. Beckett, Jos. H., 3, Greasboro' Road, Parkgate, near Rotherham, Analytical Chemist.
1903. Beekwith, Edw., Pierpont, Garrison on the Hudson, N.Y., U.S.A., Chemist.
1899. Bedford, Alf. C., 26, Broadway, New York City, U.S.A., Chemical Merchant.
1891. Bedford, Chas. S., Rocella, Westwood, Headdingley, Leeds, Manufacturing Chemist.
1891. Bedford, Jas. E., Messrs. Wood and Bedford, Airedale Chemical Works, Leeds, Manufacturing Chemist.
- O.M. Bedson, Prof. P. Phillips, Armstrong College, Newcastle-on-Tyne, Professor of Chemistry.
1901. Beebe, Murray C., 2210, Farmer's Bank, Pittsburg, Pa., U.S.A., Engineer.
1901. Beevers, Clifford J., c/o Brotherton and Co., Ltd., Holmes Street, Dewsbury Road, Leeds, Analyst.
1899. Behr, Dr. Arno, Pasadena, Cal., U.S.A., Chemist.
1903. Behrend, F., 54, Front Street, New York City, U.S.A., Importer of Chemical Stoneware.
1902. Behrend, Dr. Otto F., Hammermill Paper Co., Erie, Pa., U.S.A., Vice President.
- O.M. Beilby, G., H. University Gardens, Glasgow, Chemical Engineer.
1902. Bek, Lars P., Goondi, Johnston River, North Queensland, Australia, Analytical Chemist.
1902. Bell, Edwin L., Vida' Dyes Syndicate, Ltd., West Ferry Road, Millwall, E., Manager.
1884. Bell, Sir Hugh, Bart., Middlesbrough-on-Tees, Soda and Iron Manufacturer.
1900. Bell, Hugh P., 3, Mining Lane, London, E.C., Chemist.
- O.M. Bell, J. Carter, Bank House, The Cliff, Higher Broughton, Manchester, Public Analyst.
1886. Bell, J. Ferguson, Derby Gas Light and Coke Co., Derby, Gas Engineer.
1905. Bell, Miss M. M., Tulane University Library, New Orleans, La., U.S.A., Librarian.
1903. Bell, P. Carter, Milburn, N.J., U.S.A., Chemical Manufacturer.
1902. Bement, Alburto, 218, La Salle Street, Chicago, Ill., U.S.A., Chemical Engineer.
- O.M. Bendix, D., The British Alizarin Co., Limited, Silvertown, Victoria Docks, E.; Journals to 371, Romford Road, Forest Gate, E., Managing Chemist.
1897. Benfey, Dr. Hans, 2, Sunnyside Terrace, Clayton, Manchester, Manufacturing Chemist.
1903. Benham, Keith, Deans Hill, Stafford, Analytical and Consulting Chemist.
1902. Benjamin, Albert, c/o Thos. Hardecastle and Sons, Ltd., Firwood Works, Bolton, Colarist and Dyer.
- O.M. Benjamin, Dr. M., Smithsonian Institution, Washington, D.C., U.S.A., Consulting Chemist, A.M.
1901. Benn, R. H. D., 16, Springfield Avenue, Westmount, Montreal, Canada, Analytical Chemist.
1899. Bennett, Alex. H., Chemical Laboratory, 39, Lime Street, E.C., Chemist.
1901. Bennett, Arnold, c/o Saml. Osborn and Co., Clyde Steelworks, Sheffield, Chemist.
1884. Bennett, Thos., Birch Vale, near Stockport, Calico Printer.
1902. Bennie, P. McN., Fitzgerald and Bennie Laboratories P.O. Box 118, Niagara Falls, N.Y., U.S.A., Consulting Chemist.
1901. Bentley, Wm. H., 6, Woodbine Terrace, Irlam, near Manchester, Technical Chemist.
1890. Bentz, Ernest, 107, Shaw Lane, Dinting, near Manchester, Lecturer on Dyeing.
1897. Berg, Julius, Dürrenbach, bei Wörth a/S, Elsass, Germany, Oil Refinery Manager.
1884. Berringer, J. J., Basset Road, Camborne, Cornwall, Metallurgist.
1893. Berk, Fred. W., 1, Fenchurch Avenue, London, E.C., Chemical Manufacturer.
1903. Berkeley, Dr. Wm. N., Box 466, San Juan, Puerto Rico, U.S. West Indies, Chemist.
1900. Bermingham, Jno., jun., California Powder Works, Pinole, Contra Costa Co., Cal., U.S.A., Superintendent.
1889. Bernard, Jas., jun., Casal das Rolas, Olivaes, near Lisbon, Portugal, Chemical Works Manager.
- O.M. Bernays, J., 96, Newgate Street, London, E.C., Civil Engineer.
1900. Berolzheimer, D. D., 1, West 92nd Street, New York City, U.S.A., Chemist.
1897. Berry, Albert E., 62, Claremont Road, Forest Gate, Essex, Works Manager.
1883. Berry, E. E., Bordighera, Italy, Technical Chemist.
1889. Berry, G. F., Atlas Chemical Works, West Ferry Road, Millwall, E., Manager.
1903. Berry, W. G., 329, West 83rd Street, Manhattan Borough, New York City, U.S.A., Chemist.
1886. Best, Dr. T. T., Hardshaw Brook Chemical Works, St. Helens, Lancashire, Technical Chemist.
1901. Betts, Anson G., Troy, N.Y., U.S.A., Chemist.
- O.M. Bevan, E. J., 4, New Court, Lincoln's Inn, London, W.C., Public Analyst and Consulting Chemist.
1900. Bevan, Jno. W., Risedale, St. James' Crescent, Swansea, Manager of Metallurgical Works.
- O.M. Beveridge, Jas., c/o Miramichi Pulp and Paper Co., Ltd., Chatham, N.B., Canada, Pulp and Paper Manufacturer.
1900. Bevington, Col. S. B., 42, St. Thomas Street, Southwark, S.E., Leather Dresser.
1893. Bhaduri, Prof. K., Canning College, Lucknow, India, Professor of Chemistry.
1898. Bhattacharyya, Haripada, Fumdry and Shell Factory, Cossipore, Calcutta, India, Chemist.
1896. Bibby, John, c/o J. Bibby & Sons, Formby Street, Liverpool, Student.
- O.M. Bickerdike, W. E., Bryer's Croft, Wiltshire, near Blackburn, Manufacturing Chemist.
1901. Bielecki, Dr. Jan, "Chemic Polski," 118, Marszałkowska Street, Warsaw, Poland, Chemist.
1903. Bierwirth, L. W., Dover, N.J., U.S.A., Civil Engineer Latin and Rand Powder Co.).
1884. Biggart, J. Wm., 29, Cathcart Street, Greenock, N.B., Analytical Chemist.

1891. Biggart, Wm. L., Woodbine, Bridge of Weir, N.B., Public Analyst.
- O.M. Biggs, B., 110, Cannon Street, London, E.C., Chemical Merchant.
- O.M. Billing, H. S., 11, Devon Terrace, Ford Park, Plymouth, Analytical and Managing Chemist.
1896. Billings, Edgar F., 64, Federal Street, Boston, Mass., U.S.A., Manufacturing Chemist.
1896. Billington, Chas., jun., Studleigh, Longport, Staffordshire, Metallurgist.
1898. Binney, Harold, Washington Life Building, 141, Broadway, New York City, U.S.A., Patent Lawyer.
1902. Binning, Stevenson, 101, Shooter's Hill Road, Blackheath, S.E., Technical Chemist.
1903. Binns, John H., Thornfield, Mystic Pond, Methuen, Mass., U.S.A., Dyer and Finisher.
1896. Bird, Arthur W., 10, Norfolk Square, London, W., Works Engineer.
1896. Bird, Jno. B., Minver House, 61, Bateman Street, Cambridge, Manure Manufacturer.
1903. Bird, Thos., 59a, Brook Street, Grosvenor Square, London, W., Surgeon.
1902. Bird, W. Robt., 217, Newport Road, Cardiff, Oil Merchant.
1895. Bird, Wm. R., (communications) 125, Goddard Avenue; (Journals) Laboratory, G.W.R. Works, Swindon, Wilts, Analytical Chemist.
1885. Birley, R. K., c/o Chas. Macintosh and Co., Ltd., Cambridge Street, Manchester, India-rubber Manufacturer.
1883. Bishop, A. Conway, Three Mills Lane, Bromley-by-Bow, E., Manufacturing Chemist.
1884. Bishop, Fred, c/o Burmah Oil Co., Rangoon, Burmah, Technical Chemist.
- O.M. Bishop, G. A., 38, Sherbrooke Avenue, Maxwell Park, Glasgow, Mining Engineer.
1903. Bishop, Howard B., 609, Greene Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1903. Bishop, J. T. F., Chemical Club, Manchester, Secretary.
1905. Bjerregaard, August P., c/o Emil Calman & Co., Long Island City, N.Y., U.S.A., Varnish Chemist.
1904. Black, J. Wyclif, 20, Mardale Crescent, Edinburgh, Analytical Chemist.
1902. Black, W. Geoffrey, 9, Ronth Road, Wandsworth Common, S.W., and (Journals) Malvern, Bradford Street, Bocking, near Braintree, Chemist.
1894. Blackmore, H. S., 206, South Ninth Avenue, Mount Vernon, N.Y., U.S.A., Chemist (Pure Aluminium and Chemical Company).
1899. Blackwell, G. G., 44-47, The Albany, Liverpool, Mineral and Metal Merchant.
1896. Blagden, Victor, 50-51, Lime Street, London, E.C., Chemical Merchant.
1883. Blagden, W. G., The Manor House, Harting, near Petersfield, Chemical Merchant.
1897. Blair, Andrew A., 406, Locust Street, Philadelphia, Pa., U.S.A., Analytical Chemist.
1884. Blake, Jas., Thames Sugar Refinery, Silvertown, E., Manager.
1902. Blakemore, Geo. H., Great Cobar Copper Mine, Cobar, N.S.W., Australia, Metallurgist.
1890. Blakey, A. J., Dudbridge Mills, Stroud, Gloucestershire, Dyer.
1891. Blass, Edw., Essen (Ruhr), Germany, Civil Engineer.
1904. Bleakley, Wm., Dean's Mill, Swinton, Lanes., Cotton Mill Manager.
1893. Blears, John, c/o Langworthy Bros. and Co., Ltd., Greengate Mills, Salford, Dyer and Calico Printer.
- O.M. Bles, A. J. S., 32, Chorlton Street, Manchester, Chemical Merchant.
1889. Bloede, Victor G., Station D., Baltimore, Md., U.S.A., Manufacturing Chemist.
1891. Bloomer, Fred. J., Penpont, Clydach, R.S.O., Glamorgan, Nickel Works Manager.
1886. Blount, Bertram, Laboratory, 76 and 78, York Street, Westminster, S.W., Analytical Chemist.
1888. Bloxam, A. G., Birkbeck Bank Chambers, Chancery Lane, W.C., Chemist and Patent Agent.
1890. Bloxam, W. Popplewell, 25, Upper Bedford Place, London, W.C., Research Chemist.
1903. Blumenthal, Lionel, 25, Lever Street, Picadilly, Manchester, Chemist.
1886. Blundstone, E. R., Heathfield, Park Road, Hampton Hill, Middlesex, Consulting Chemist.
1905. Blyth, Thomas R., Uphall Chemical Works, Ilford, Essex, Analytical Chemist.
- O.M. Boake, A., Warton Road, Stratford, E., Manufacturing Chemist.
1883. Boake, Edmund J., Aberffraw, Nursery Road, Loughton, Essex, Manufacturing Chemist.
1885. Board, J. T., Cheese Lane, Bristol, and (Journals) Roseneath, Willsbridge, near Bristol, Distiller.
1899. Boehm, Fred., 16, Jewry Street, London, E.C., Chemical Agent and Merchant.
1905. Bogardus, Chas. E., 90, Columbia Street, Seattle, Wash., U.S.A., Assayer and Chemist.
1898. Bogert, Prof. Marston T., Department of Organic Chemistry, Columbia University, New York City, U.S.A., Instructor in Organic Chemistry.
1903. Boissevain, Chas. E. H., 92, van Egghenstraat, Amsterdam, Holland, Chemical Manufacturer.
1903. Bolam, Dr. H. W., 2, Summerfield, Leith, N.B., Lecturer on Chemistry.
1901. Bolton, E. Richards, 16, Flanchford Road, Ravenscourt Park, W., Manufacturing Chemist.
1905. Bond, John, Crowlands, Southport, Engineer.
1892. Bookman, Dr. S., 9, East 62nd Street, New York City, U.S.A., Chemist.
1888. Boor, Leonard G., 39, Mincing Lane, London, E.C., Chemical Merchant.
1896. Boot, John C., Klatten, Java, Netherlands Indies, Chemist.
1904. Booth, N. Parr, Laboratory, Cadbury Bros., Ltd., Bournville, near Birmingham, Chemist.
1894. Booth, Robt., 110, Cannon Street, London, E.C., Engineer.
1891. Boothby, Chas., 70, Bedford Court Mansions, Bedford Square, London, W.C., Chemist.
1903. Boral, Robin, Rhodes Mount, Rhodes, near Manchester, Works Manager.
1897. Borland, C. R., P.O. Box 683, Concord, Mass., U.S.A., Smokeless Powder Manufacturer.
- O.M. Borland, W.D., Beacon Lodge, Bean, *via* Dartford, Kent, Explosives Chemist.
1903. Boroschek, Dr. L., 149, East 56th Street, New York City, U.S.A., Chemist.
1903. Bossi, Dr. Arnold L., Arnold Print Works, North Adams, Mass., U.S.A., Assistant Manager.
1890. Bost, W. D., Ashton, Cartvale Chemical Works, Paisley, N.B., Chemical Manufacturer.
- O.M. Bothamley, C. H., Tanglewood, Southside, Weston-super-Mare, Somerset, County Director of Technical Instruction.
1890. Bott, Dr. W. Norman, 16, St. Helen's Place, London, E.C., Consulting Chemist.
1884. Böttinger, Dr. H. T., Elberfeld, Germany; and (subs.) c/o The Bayer Co., Ltd., 19, St. Dunstan's Hill, E.C., Colour Manufacturer.
- O.M. Bottle, Alex., 4, Godwyne Road, Dover, Pharmaceutical Chemist.
1901. Bottomley, Dr. J. Frank, 21, Wentworth Place, Newcastle-on-Tyne, Consulting Chemist.
- O.M. Boulton, H. E., 64, Cannon Street, London, E.C., Chemical Manufacturer.
1890. Boulton, James, Crayford, Mills, Stratford, E., Manufacturing Chemist.
- O.M. Boulton, S. B., 64, Cannon Street, London, E.C., Chemical Manufacturer.
1883. Boulton, T. S., 14, Freegrove Road, Caledonian Road, N., Manager.
1900. Bourcoud, Augustin E., Comp. General de Produits Químicos del Abafío, Gijón, Spain, Civil Engineer.
1902. Bousfield, E. G. P., c/o Ozonised Oxygen Co., Ltd., 20, Mount Street, Manchester, Electro-Chemist.
1884. Bow, R. H., 7, South Gray Street, Edinburgh, Civil Engineer.



1904. Bowden, Thos., Starring Grove, Stubley, Littleborough, Lancs., Dyer and Chemist.
1905. Bowen, Henry, c/o St. Louis Chemical Co., St. Louis, Mich., U.S.A., Secretary.
1885. Bowen, S. B., Brickfield Chemical Works, Llanelli, South Wales, Chemical Manufacturer.
1899. Bowen, Wm., Rockingham, Cecil Road, Erdington, Birmingham, Chemist.
1888. Bower, Frank, Brewery House, Spitalfields, E., Analytical Chemist.
1897. Bower, Wm. H., 29th Street and Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemical Manufacturer.
1892. Bowes, Harry, 40, Radford Street, Blackley, Manchester, Analytical Chemist.
1903. Bowey, John, jun., 567, Dufferin Avenue, London, Ont., Canada, Chemist.
1889. Bowing, Jno., 101, North Street, Wandsworth, S.W., Consulting Chemist.
1883. Bowley, Jos. John, Wellington Works, Battersea Bridge, and (Journals) 64, Redcliffe Gardens, London, S.W., Chemical Manufacturer.
1899. Bowley, J. Plunkett, 1, Wellington Road, Battersea, and (Journals) 64, Redcliffe Gardens, London, S.W., Varnish Manufacturer.
1883. Bowman, Dr. F. H., Spinningfield, Deansgate, Manchester, Chemical Manufacturer.
1894. Bowman, Jas. H., Canada Chemical Manufacturing Co., London, Ont., Canada, Chemist.
1884. Bowman, R., Cynwyd, near Corwen, N. Wales, Chemical Manufacturer.
1896. Bowman, Walker, 39, Cortlandt Street, New York City, U.S.A., Chemist.
1904. Boyce, Framroze H., City of Bombay Manufacturing Co., Ltd., 39, Hornby Road, Bombay, India, Technical Chemist.
1893. Boyce, Frank, c/o Goodall, Backhouse, and Co., White Horse Street, Leeds, Technical Chemist.
1884. Boyd, Pythagoras, 17, Union Street, North Adams, Mass., U.S.A., Print Works Superintendent.
- O.M. Boyd, W., P.O. Box 143, Germiston, Transvaal, Technical Chemist.
1899. Boyes, Herb. J., Alameda, Barao de Piracicaba, Sao Paulo, Brazil, Chemist.
1902. Brach, Dr. Ludwig K., Chemist and Colourist.
1885. Bradburn, J. A., Chemical Engineer.
1883. Bradbury, A., Queen Buildings, 11, Dale Street, Liverpool, Chemical Broker.
1902. Bradbury, S., Thornham New Road, Castleton, Manchester, Chemist.
1895. Bradford, Henry, c/o W. H. Goringe, Southampton House, Southwick, near Brighton, Analytical Chemist.
1904. Brading, R. W., Casella, Sandal Road, New Malden, Surrey, Builder.
1896. Bragg, Everett B., 1745, Chicago Avenue, Evanston, Ill., U.S.A., Manufacturing Chemist.
1891. Braithwaite, Isaac, Kendal, Westmoreland, Dry-salter.
1897. Braithwaite, Jno. O., Hilika, Warren Road, Chingford, Essex, Pharmaceutical Research Chemist.
1904. Braman, Winfred W., State College, Pennsylvania, U.S.A., Assistant Instructor.
1903. Brame, J. S. S., 5, Coleraine Road, Blackheath, S.E., Demonstrator in Chemistry.
- O.M. Bramham, W., 86, Bow Road, London, E., and (communications) 115, Broadhurst Gardens, West Hampstead, N.W., Chemical Engineer.
- O.M. Bramwell, Major E., Chemical Works, St. Helens, Lancashire, Chemical Manufacturer.
- O.M. Bramwell, G. H., Cowley Hill, St. Helens, Lancashire, Alkali Manufacturer.
1904. Brandeis, R., Oesterreichischer Verein f. Chem. und Metall. Production, Aussig, Austria, Chemical Manufacturer.
1902. Branegan, Jas. Aug., 4523 North Uber Street, Philadelphia, Pa., U.S.A., Chemical Salesman.
- O.M. Branson, F. W., Wynneholme, Far Headingley, Leeds, Pharmaceutical Chemist.
1903. Brassard, Fred. A., 46, Vicar Lane, Bradford, Yorks., Aniline Colour Importer.
1901. Brearley, Harry, Salamander Stahlwerke, Jaegel, Riga, Russia, Analytical Chemist.
1888. Breffitt, Wm., Glasshoughton, Cuthbert, Yorks., Glass Manufacturer.
1888. Bressey, Edw., 209, Romford Road, Stratford, E., Gold and Silver Refiner.
1901. Brewer, Dr. C. E., Wake Forest, N.C., U.S.A., Professor of Chemistry.
1900. Brewis, E. Theodora, 21, Belgrave Road, Leyton, E., Chemist.
1894. Breyer, Theodor, c/o Warner Sugar Refining Co., Waukegan, Ill., U.S.A., Chemist.
1885. Briant, L., 24, Holborn Viaduct, London, E.C., Analytical Chemist.
1890. Brierley, J. T., Highfield, Golden Hill, Leyland, near Preston, Lancs., Analytical Chemist.
1894. Briggs, J. Burnett, Vauxhall Soap Works, 6, Blackstock Street, Liverpool, Soap Manufacturer.
1893. Briggs, J. F., 2, Frankfort Road, Herne Hill, S.E., Sugar Works Chemist.
1885. Briggs, T. Lynton, 188, Central Avenue, Flushing, Long Island, N.Y., U.S.A., Technical Chemist.
1886. Briggs, Wm., 13, Panmure Street, Dundee, Manufacturing Chemist.
1890. Brindley, G. F., c/o Niagara Electro-Chemical Co., Niagara Falls, N.Y., U.S.A., Chemical Engineer.
1886. Bristow, G. W., 10, Philpot Lane, London, E.C., Chemical Manager.
1887. Broadbent, H., c/o Goodall, Backhouse, and Co., Sovereign Street, Leeds, Chemist.
1896. Broadhurst, W. Homer, 290, Lafayette Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1889. Brock, Arthur, Firework Factory, Sutton, Surrey, Firework Manufacturer.
- O.M. Brock, J., Gwern-Tyno, Colwyn Bay, North Wales, Chairman of United Alkali Co., Ltd.
1896. Brooke, C. B., jun., Colne House, Brantham, near Manningtree, Xylonite Manufacturer.
1900. Brooke, Jno. R., Chemical Laboratory, 20, Cullum Street, London, E.C., Chemist.
1884. Brookes, E. A., c/o The Chilian Mills Co., Ltd., Chiguayante, Concepcion, Chile, Chemist.
1895. Brookman, Fred W., 8, West Street, Rochdale, Manure Works Manager.
1903. Brooks, H. Kibbe, Swanton, Vermont, U.S.A., Chemist.
1893. Broome, F. S. J., Leaholme, Holloway, near Matlock Bath, Derbyshire, Assayer.
1901. Broome, Jos., 40, East 39th Street, Bayonne, N.J., U.S.A., Chemical Engineer.
- O.M. Brotherton, E. A., M.P., Commercial Buildings, Leeds, Ammonia Distiller.
1884. Brown, Prof. A. Crum, F.R.S., 8, Belgrave Crescent, Edinburgh, Professor of Chemistry.
1902. Brown, A. H., c/o Daly Reduction Co., Hedley, B.C., Canada, Metallurgist.
1891. Brown, Casar R., 23, Gower Road, Forest Gate, E., Works Foreman.
- O.M. Brown, D., 93, Abbey Hill, Edinburgh, Chemical Manufacturer.
- O.M. Brown, D., Donaghmore, Tyrone, Ireland, Soap Manufacturer.
1890. Brown, Edw. Hilton, c/o W. Ropes and Co., St. Petersburg, Russia, Analytical Chemist.
1903. Brown, Frank C., P.O. Box 211, Framingham, Mass., U.S.A., Foreman.
1904. Brown, Fred. W., 470, Lenox Avenue, New York City, U.S.A., Chemist.
1894. Brown, Geo. E., c/o "The British Journal of Photography," 24, Wellington Street, Strand, London, W.C., Chemist.
1905. Brown, Harold G. S., c/o Messrs. G. H. Ogston and Moore, Strada degle Argentieri, 19, Messina, Sicily, Analyst.
- O.M. Brown, Henry, Benskin's Brewery, Watford, Herts., Brewing Chemist.
1899. Brown, Dr. Henry C., The Chemical Works, King's Lynn, Chemical Manufacturer.

- O.M. Brown, Dr. Horace T., F.R.S., 52, Nevern Square, Kensington, S.W., Brewing Chemist.
- O.M. Brown, Dr. J. Campbell, 8, Abercromby Square, Liverpool, Professor of Chemistry.
1891. Brown, J. Henry, Minas d'Aljustrel Alemtejo, Portugal, Technical Chemist.
1901. Brown, Jos., Ashleigh House, Savile Town, Dewsbury, Manufacturing Chemist.
1892. Brown, Reginald B., c/o Badische Co., Ltd., 2, Samuel Ogden Street, Manchester, Technical Chemist.
1889. Brown, Robt., The Firs, Hartford, Northwich, Engineer.
1901. Brown, Samuel B., Loveclough, Rawtenstall, Lancashire, Calico Printer's Manager.
- O.M. Brown, Walter, c/o Jas. H. Dennis and Co., Ltd., Widnes, Technical Chemist.
1900. Brown, Walter B., Victor Chemical Works, Chicago Heights, Ill., U.S.A., Chemist.
1904. Brown, W. Anderson, 104, Kingston Road, Ilford, Essex, Soap Analyst.
1897. Brown, Wm., Terrace House, The Cliff, Higher Broughton, Manchester.
1901. Browne, Dr. Arthur L., 13-15, North Street, Baltimore, Md., U.S.A., Analytical Chemist.
1903. Browne, Dr. Chas. A., jun., Audubon Park, New Orleans, La., U.S.A., Sugar Chemist.
- O.M. Browning, W., Broad Oak, Accrington, Calico Printer.
1901. Brownlie, David, 11, Langford Road, Heaton Chapel, near Manchester, Chemist.
1902. Brownrigg, Marcus P., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1902. Brownson, Dr. H. W., King's Norton Metal Co., Ltd., Abbey Wood, Kent, Works Chemist.
1902. Bruce, Alex., Laboratory, Hyde Park Corner, Colombo, Ceylon, Chemist.
1890. Bruce, Jas., 2, Kirkliston Drive, Bloomfield, Belfast, Ireland, Distiller.
1900. Bruce, Wm. T., c/o Hugh Wallace and Co., Ltd., 5, Fenchurch Street, London, E.C., Director.
1892. Bruckmann, G. T., 192, 18th Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1905. Bruhier, A. G., 534, Canal Street, New York City, U.S.A., U.S. Agent for Kalle and Co.
- O.M. Brunner, H., Holly Mount, Tarbock Road, Huyton, near Liverpool, Chemical Manufacturer.
1894. Brunner, H. Bertram, Winnington Park, Northwich, Chemist and Electrician.
1887. Brunner, J. F. L., c/o Brunner, Mond and Co., Ltd., 39, Victoria Street, London, S.W., Chemical Manufacturer.
- O.M. Brunner, Sir J. T., Bart., M.P., Druid's Cross, Wavertree, Liverpool, Chemical Manufacturer.
1902. Brunner, Roscoe, c/o Messrs. Brunner, Mond and Co., Ltd., Northwich, Alkali Manufacturer.
1894. Brunton, J. Dixon, Wire Mill, Musselburgh, N.B., Wire Manufacturer.
1904. Bryant, Arthur P. (communications) c/o Glucose Sugar Refining Co., West Taylor Street and River, and (Journals) 661, Winthrop Avenue, Chicago, Ill., U.S.A., Chemist.
1903. Bryant, V. Seymour, The Bank, Camborne, Cornwall, Analytical Chemist.
1905. Bryce, Clarence H., c/o Benj. Moore and Co., 244, Water Street, Brooklyn, N.Y., U.S.A., Factory Superintendent.
1894. Bryce, Thos., Tharsis Mines, Huelva, Spain, Chemist.
1897. Bryson, Jas., Pumpherston Oil Works, Midcalder, N.B., Oil Works Manager.
1892. Buchanan, D. G., (Subs.) Mount Vernon House, Glasgow, and (Journals) c/o Gibbs and Co., Iquique, Chili, Analyst.
1902. Buchanan, Duncan, G., 500, Church Street, Toronto, Ont., Canada, Chemist.
1904. Buchanan, E. F., 712, Payne Avenue, Akron, Ohio, U.S.A., Chemist.
1888. Buchanan, Jas., jun., Caledonia Foundry, Brasenose Road, Liverpool, Engineer.
1904. Buchanan, Joshua D., c/o Nobel's Explosives Co., Ltd., Polmont Station, N.B., Chemist.
1904. Buchanan, J. L., 27, Birch Road, Lower Bebington, Cheshire, Analytical Chemist.
1897. Bucher, Prof. John E., Brown University, Providence, R.I., U.S.A., Assistant Professor.
1897. Buck, Chas. A., 521, Locust Street, South Bethlehem, Pa., U.S.A., Chief Chemist (Bethlehem Iron Co.).
1897. Bucknill, Jno. A., P.O. Box 52, Government Patent Office, Pretoria, Transvaal, Comptroller General.
- O.M. Budden, E. R., Park View, Eversleigh Road, Finchley, N., Consulting Chemist.
1900. Bull, Dr. Benjamin S., 104, Humber Road, Blackheath, S.E., Technical Chemist.
1902. Bull, Irving C., P.O. Box, 294, Middletown, N.Y., U.S.A., Chemist.
- O.M. Bullock, J. L., 3, Hanover Street, Hanover Square, London, W., Manufacturing Chemist.
1899. Bult, Herbert J., 18, Billiter Street, London, E.C., Chemist.
- O.M. Bumby, H., Coltness Ironworks, Newmains, N.B., Ironworks Manager.
- O.M. Bunker, H. E., 19, Napier Street, Toronto, Ont., Canada, Technical Chemist.
1901. Bunting, Henry H., c/o Peruvian Corporation, Ltd., Lima, Peru, Analyst.
1894. Bunting, W., Lightfoot, Forest Bank, Crawshaw-booth, near Manchester, Calico Printer.
1905. Bunzl, Hugo, 175, High Street, Chorlton on Medlock, Manchester, Chemist.
1893. Burbridge, Jas., India-rubber Mills, Tottenham, N., India-rubber Manufacturer.
1886. Burdekin, G., jun., Heathfield, Prescott Road, St. Helens, Chemical Works Manager.
1896. Burford, Samuel F., The Firs, Kirby Muxloe, near Leicester, Analytical Chemist.
1898. Burge, Chas. H., Government Laboratory, Clement's Inn Passage, Strand, W.C., Analyst.
1889. Bürger, Dr. J., 1, Birch Avenue, Talbot Road, Old Trafford, Manchester, Technical Chemist.
1901. Burgess, Prof. C. F., University of Wisconsin, Madison, Wis., U.S.A., Electro-chemical Engineer.
1889. Burgess, Geo., Hale Road, Ditton, Widnes, Chemist.
1889. Burgess, Wm. T., 20, Priory Road, Bedford Park, London, W., Analytical Chemist.
1902. Burkard, Dr. Ernst, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.
1899. Burkhardt, Dr. G., Pragerstrasse 12, Wilmersdorf-Berlin, Germany, Chemist.
1897. Burland, Lt.-Col. Jeffrey H., 824, Sherbrooke Street, Montreal, Canada, Paper and Card Manufacturer.
1896. Burland, Richard O., Bishopsgate, Wigan, Manufacturing Chemist.
1900. Burleigh, Wm. F., c/o Murphy Varnish Co., Newark, N.J., U.S.A., Technical Chemist.
1897. Burls, Frank B., 4, Dyers Hall Road, Leytonstone, Essex, Chemist.
1898. Burls, Herbert T., (Journals) c/o Royal Societies Club, St. James Street, S.W., and (communications) Foulis Terrace, Onslow Gardens, S.W., Mechanical Engineer.
1901. Burnand, Sydney, Manbré Saccharine Co., Ltd., Hammersmith, W., Manager.
- O.M. Burnard, R., Plymouth Chemical Works, Plymouth, Chemical Manufacturer.
1891. Burnet, Henry K., North Brook Vitriol Works, Bradford, Yorks., Sulphuric Acid Maker.
1897. Burnet, Jno. Jas., 18, University Avenue, Glasgow, Architect.
1893. Burnham, J. C., Cordite Factory, Wellington, Nilgiri Hills, India, Analytical Chemist.
1900. Burnside, Chas. F., c/o International Smokeless Powder Co., Parlin, N.J., U.S.A., Chemist.
1900. Burr, Edmund C., 1722, Vallejo Street, San Francisco, Cal., U.S.A., Manufacturer.
- O.M. Burrell, B. A., 8, Springfield Mount, Leeds, Analytical Chemist.
1892. Burrough, Horace, jun., 503, West Lombard Street, Baltimore, Md., U.S.A., Technical Chemist.
1888. Burrows, Edw., Home Villa, Low Fell, Gateshead-on-Tyne, Alkali Works Manager.



1905. Burtenshaw, Wm. H., P.O. Box 814, Detroit, Mich., U.S.A., Secretary, Michigan Carbon Works.
1901. Burton, Alf., 114, Bedford Road, Toronto, Canada, Dyer and Finisher.
1903. Burton, Jno., 2, Green Street, Bethnal Green, E., Dye and Chemical Manufacturer.
1904. Burton, T. R., c/o Scott, Greenwood and Co., 19, Ludgate Hill, London, E.C., Technical Journalist.
1889. Burton, Wm., The Hollies, Clifton Junction, near Manchester, Potter's Chemist.
1897. Burwell, A. W., Kyle Street, Lakewood, *via* Cleveland, Ohio, U.S.A., Consulting Chemist.
1885. Bury, J. H., Church Chemical Works, near Accrington, Chemical Manufacturer.
1897. Bush, J. M., c/o W. J. Bush and Co., Ltd., Ash Grove, Hackney, E., Manufacturing Chemist.
1897. Butler, David B., 41, Old Queen Street, Westminster, S.W., Cement Expert.
1903. Butler, Fredk., Ash Lane, Hough Green, near Widnes, Manager (Ditton Copper Works).
1890. Butler, Paul, Lowell, Mass., U.S.A., Ammunition Manufacturer.
1885. Butler, Samuel, The Cedars, Compton, Wolverhampton, Brewer.
1886. Butler, W. W., Southfield, Norfolk Road, Edgbaston, Birmingham, Brewer.
1903. Buttenshaw, E. L., 31, Edge Lane, Chorlton-cum-Hardy, Manchester, Analytical Chemist.
- O.M. Butterfield, J. C., 79, Endlesham Road, Balham, S.W., Analytical Chemist.
1892. Butterfield, W. J. A., 66, Victoria Street, Westminster, S.W., Analytical Chemist.
1897. Butters, Charles, 28-31, Bishopsgate Street Within, London, E.C., and (Journals) Ros-lawn, Oakland, Cal., U.S.A., Metallurgist.
1900. Butterworth, Elwell R., c/o Reversible Collar Co., 111, Putnam Avenue, Cambridge, Mass., U.S.A., Chemist.
1902. Butterworth, F. J., P.O. Box 54, Newark, N.J., U.S.A., Chemist.
1892. Buttfeld, Horace V., 13, Wellington Road, Bush Hill Park, Enfield, N., Chemical Demonstrator.
- O.M. Byard, A. G., c/o Burt, Boulton, and Haywood, Apartado, 8, Bilbao, Spain, Technical Chemist.
1899. Byrnes, Eugene A., c/o Byrnes and Townsend, 918, F. Street, N.W., Washington, D.C., U.S.A., Patent Lawyer.
1893. Byrom, T. H., Laboratory, Wigan Coal and Iron Co., Wigan, Analytical Chemist.
1887. Bythway, M., 44, Lloyd Street, Albert Square, Manchester, Drysalter.
1884. Cabot, Godfrey L., 82, Water Street, Boston, Mass., U.S.A., Chemist.
1889. Cadett, Jas., Ashted, Surrey, Chemical Engineer.
1902. Cady, Walter B., c/o Wabash Portland Cement Co., Stroh, Ind., U.S.A., Chemist.
1901. Cady, Wm. H., 127, Power Street, Providence, R.I., U.S.A., Colour Chemist.
1905. Cain, Dr. J. C. (Journals) 28, Pembury Road, Lower Clapton, N.E., and c/o Brooke, Simpson and Spiller, Ltd., Hackney Wick, N.E., Manager and Head Chemist.
1891. Caines, G. S. A., 7, Rochester Terrace, Camden Road, London, N.W., Analytical Chemist.
1900. Cairns, Adam, Thistle Rubber Mills, 98, Commerce Street, Glasgow, Manager.
1897. Cairns, Wm., 5, Carlton Place, Glasgow, Plumber.
1891. Caldecott, W., Arthur, Box 67, Johannesburg, Transvaal, South Africa, Metallurgist.
1905. Calder, Prof. Edwin E., Long Meadow, R.I., U.S.A., Professor of Chemistry.
1897. Calder, W. A. S., Ormedale, Little Moor Hill, Smethwick, Chemical Manufacturer.
1888. Caldwell, Wm., Murray Street, Paisley, N.B., Dry-salter.
1891. Calkin, Wm. S., Spring Forge, Pa., U.S.A., Paper Pulp Works Chemist.
1902. Calm, Chas. E., 190, Michigan Street, Chicago, Ill., U.S.A., Manufacturing Chemist.
1904. Calvert, Harry T., West Riding of Yorkshire Rivers Board, Wakefield, Chemist.
1901. Calvert, Jos. E., 293, Butler Street, Etta, Allegheny Co., Pa., U.S.A., Analytical Chemist.
1899. Calvert, Sidney, State University, Columbia, Mo., U.S.A., Professor of Chemistry.
1895. Cambier, Jacob, 910, Spruce Street, Pueblo, Colo., U.S.A., Chemist.
1894. Cameron, Alex., Whitechapel, Rochester Road, Camden Road, N.W., Chemical Engineer.
1891. Cameron, Jas., Ingleby, Woodhey, near Birkenhead, Chemist.
1904. Cameron, Walter S., 239, West 136th Street, New York City, U.S.A., Manufacturing Perfumer.
- O.M. Cammack, J., 51, Denton's Green Lane, St. Helens, Lancashire, Technical Chemist.
1886. Campbell, Andrew, c/o Burmah Oil Co., Ltd., Dunneclaw, Rangoon, Burmah, Analytical Chemist.
- O.M. Campbell, Archibald, Berry Lodge, Rugeley, Staffordshire, Technical Chemist.
1902. Campbell, Ashley, Colonial Sugar Refining Co., Ltd., Yarraville Refinery, Melbourne, Vic., Australia, Analytical Chemist.
1899. Campbell, Jas. Emyve, 22, Shirley Street, Worcester, Mass., U.S.A., Chemical Engineer.
1886. Campbell, John, 75, Hudson Street, New York City, U.S.A., Dye Manufacturer.
1904. Campbell, J. H., 41, Summit Street, Brooklyn, N.Y., U.S.A., Chemist.
1901. Campbell, Kenneth F., M.Inst.C.E., 1, Peel Street, Huddersfield, Civil Engineer.
1904. Campion, A., Laboratory, 144 Wellington Street, Glasgow, Chemist and Metallurgist.
1897. Canfield, F. D., jun., c/o Cuban Sugar Refining Co., Cardenas, Cuba, Sugar Refiner.
1893. Cannon, J. C., Danehurst, Gordon Road, Shoreham, Sussex, Analyst.
- O.M. Cannon, M., 25, Stormont Road, Clapham Common, S.W., Vinegar Works Manager.
1891. Canziani, Enrico, 3, Palace Green, Kensington, W., Civil Engineer.
1905. Capen, Geo. H., Canton Junction, Mass., U.S.A., Manufacturer of Leather Dressings.
1891. Carden, Albert J., Dunster House, 12, Mark Lane, E.C., Distiller.
1904. Carol, Prof. Hubert C., Laboratory, University of Minnesota, Minneapolis, Minn., U.S.A., Chemist, (State Board of Health).
1893. Carey, Arthur, 1, Grassendale Road, Cressington, near Liverpool, Chemist.
- O.M. Carey, Eustace, The United Alkali Co., Ltd., 30, James Street, Liverpool, Chemical Manufacturer.
1904. Cargill, J. T., c/o Finlay, Fleming and Co., Rangoon, Burmah, East India Merchant.
1904. Carhart, Dr. C., c/o Mr. Berk Talley, Rama, Nicaragua, Pharmacist.
- O.M. Carlie, T., St. Bryde's, Dunblane, N.B., Chemical Manufacturer.
1895. Carlsson, Hugo, 42, Smolandskatan, Stockholm, Sweden, Analytical Chemist.
1893. Carmichael, Dr. H., 176, Federal Street, Boston, Mass., U.S.A., Analytical Chemist.
1896. Carmichael, Herbert, Bureau of Mines, Victoria, British Columbia, Public Analyst and Assayer.
1884. Carmody, Prof. Patrick, Government Laboratory, Port of Spain, Trinidad, Analytical Chemist.
1903. Carneiro da Cunha, J. M., Comp. Agricola and Mercantil, Rua do Apollo, 28, Pernambuco, Brazil, Manager.
1897. Carnell, Wm. C., c/o Tacony Chemical Works, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.
- O.M. Caro, Dr. H., Mannheim, Germany, Technical Chemist.
1893. Carpenter, C. C., South Metropolitan Gas Co., 709A, Old Kent Road, London, S.E., Civil Engineer.
1900. Carpenter, Frank B., Crenshaw Building, Richmond, Va., U.S.A., Chemist.

1900. Carpenter, Harry B., c/o Lister's Agricultural Chemical Works, Newark, N.J., U.S.A.
1903. Carpenter, H. C. Harold, The National Physical Laboratory, Bushy House, Teddington, Middlesex, Chemist and Metallurgist.
- O.M. Carpenter, R. Forbes, Prestwich, Greencroft Gardens, West Hampstead, N.W., Chief Inspector under the Alkali, &c., Works Acts.
1904. Carr, Francis H., Kelvin, Church Avenue, Sidcup, Kent, Manufacturing Chemist.
1904. Carroll, Jno. L., 23, Division Place, Newark, N.J., U.S.A., Secretary (American Oil and Supply Co.).
1885. Carruthers, J. G., Burnbrae House, Milngavie, N.B., Dyeworks Manager.
1901. Carson, Geo. C., Hotel Broadway, Denver, Colo., U.S.A., Mining Engineer.
- O.M. Carteighe, M., 180, New Bond Street, London, W., Pharmaceutical Chemist.
1904. Carter, A., Cuba Street, Petone, Wellington, New Zealand, Works Manager.
1902. Carter, Jno. P., 626, South 24th Street, Philadelphia, Pa., U.S.A., Analytical Chemist.
1905. Carter, Robert A., c/o Roessler and Hasslacher Chemical Co., 100, William Street, New York City, U.S.A., Chemist.
1895. Carter, Stewart F., Windsor Printworks, North Adams, Mass., U.S.A., Technical Chemist.
1903. Carter, Thomas, 322, Scarr Hill, Bradford, Yorks, Works Chemist.
1886. Carter, W. Chas., c/o Dominion Iron and Steel Co., Sydney, C.B., Canada, Analytical Chemist.
1889. Carulla, F. J. R., 84, Rose Hill Street, Derby, Chemical Manufacturer.
1903. Caspari, Dr. W. A., 28, Coleshill Road, Teddington, Chemist and Physicist.
1895. Catlin, Chas. A., 133, Hope Street, Providence, R.I., U.S.A., Chemist (Rumford Chemical Works).
1896. Caven, Robt. M., University College, Nottingham, Lecturer in Chemistry.
- O.M. Cawley, G., 25, Victoria Street, Westminster, S.W., Chemical Engineer.
- O.M. Cawley, J., 278, Passaic Street, Newark, N.J., U.S.A., Analytical Chemist.
1897. Cawley, Thos. A., British Gelatin Works, New Bedford Road, Luton, Gelatin Manufacturer.
1900. Cayvan, Llewellyn L., 4647, Indiana Avenue, Chicago, Ill., U.S.A., Chemist.
1902. Cerasoli, Alburto, c/o Dr. L. Mond, 18, Avenue Rd., Regent's Park, N.W., Engineer.
1891. Chadwick, Walter M., 24, West 3rd Street, Bayonne, N.J., U.S.A., Chemical Works Manager.
1897. Challen, Matthew B., School of Mines, Daylesford, Victoria, Australia, Assayer.
- O.M. Chaloner, G., 30, Weston Park, Crouch End, N., Chemical Lecturer.
1894. Chaloner, G. W., 26, Eagle Wharf Road, Hoxton, N., Chemical Manager.
1901. Chamberlain, G. E., 5169, Delmar Building, St. Louis, Mo., U.S.A., Chemist.
1902. Champion, Edmund C., 510, South Washington Avenue, Iola, Kansas, U.S.A., Chemist.
- O.M. Chance, A. M., Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.
- O.M. Chandler, Dr. C. F., Columbia University, West 116th Street, New York City, U.S.A., Professor of Chemistry.
1900. Chandler, Prof. W. H., Lehigh University, South Bethlehem, Pa., U.S.A., Professor of Chemistry.
1893. Chaplin, Dr. Edw. M., Public Analyst's Laboratory, Wakefield, Yorks., Analytical Chemist.
1890. Chapman, Alf. C., 8, Duke Street, Aldgate, E.C., Analytical Chemist.
1903. Chapman, Geo. W., Swift Fertilizer Works, 913, Prudential Building, Atlanta, Ga., U.S.A., Superintendent.
- O.M. Chapman, S., 36, Mark Lane, E.C., Chemical Manufacturer.
1894. Charlier, A. C. J., 6, Talbot Road, South Tottenham, N., General Manager and Chemist.
1902. Charlton, Thos., 2926, Webster Street, San Francisco, Cal., U.S.A., Manufacturing Chemist.
1900. Chase, March F., c/o New Jersey Zinc Co., Palmetton, Pa., U.S.A., Chemist.
1889. Chase, R. L., Arnold Printworks, North Adams, Mass., U.S.A., Printworks Chemist.
1894. Chatard, Dr. T. M., 1716, Rhode Island Avenue, Washington, D.C., U.S.A., Chemical Engineer.
1898. Chattock, Herbert E., 23, Apsley Road, Clifton, Bristol, Oilcake Manufacturer.
1901. Cheetham, Howard, 18, St. Ann Street, Manchester, Chartered Patent Agent.
1905. Cheke, Thos. W., 7, Elm Grove, Stroud Green, London, N., Analytical Chemist.
1894. Cheney, J. P., c/o Cheney Bros., South Manchester, Conn., U.S.A., Silk Manufacturer's Chemist.
1885. Cheyne, A. M., c/o Messrs. Burgoyne, 16, Coleman Street, London, E.C., Analytical Chemist.
1905. Chick, Oliver, 52, High Street, Hornsey, N., Analytical Chemist.
1902. Chilwell, John, Oakeswell, Wednesbury, Analyst.
1893. Cholerton, A. F., 40½, Belgrave Gate, Leicester, Manufacturing Chemist.
1890. Chorley, Jno. C., Bewsey, Oxford Road, Birkdale, Lancs., Analytical Chemist.
- O.M. Christie, J., Levenfield, Alexandria, N.B., Dyer and Printer.
1903. Christie, John, c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Analytical Chemist.
1898. Christison, Geo., Cremona, Cambridge Drive, Glasgow, Engineer.
1883. Christy, Thos., The Manor House, Wallington, Surrey: and 4, 10, and 12, Old Swan Lane, London, E.C., Chemical Botanist.
- O.M. Chrystal, W. J., 7, West George Street, Glasgow, Chemical Manufacturer.
1904. Chubb, H. M., Wharfedale Villas, Tadcaster, Yorks., Brewery Chemist.
- O.M. Church, Professor A. H., F.R.S., Shelsley, Kew, Surrey, Professor of Chemistry in the Royal Academy.
1890. Church, Elihu D., jun., 63, Wall Street, New York City, U.S.A., Soda Manufacturer.
1896. Claffin, Alan, Littleton, Mass., U.S.A., Manufacturing Chemist.
1900. Clamer, Guillian H., 46, Richmond Street, Philadelphia, Pa., U.S.A., Chemist.
1885. Clanahan, H. C., 79, Mosley Street, Manchester, Chemical Merchant.
1901. Clapham, Henry E., Laurel Bank, Wilsden, near Bradford, Yorks., Technical Chemist.
1891. Clapp, Ralph R., c/o Standard Ammonia Co., Ltd., Iceland Wharf, Old Ford, E., Ammonia Works Manager.
1889. Clapperton, J., jun., Analytical Chemist.
1903. Clare, Henry, 107, Newgate Street, Morpeth, Northumberland, Schoolmaster.
1904. Clark, Arthur W., c/o J. Elwood Lee Co., Conshohocken, Pa., U.S.A., Chemist and Bacteriologist.
1903. Clark, Augustus, Fundicio do Bowman, Caixa 57, Recife, Pernambuco, Brazil, Mechanical Engineer.
1896. Clark, Donald, Bairnsdale, Victoria, Australia, Director of School of Mines.
1903. Clark, Edmund, Room 1007, Appraisers' Stores, 641 Washington Street, New York City, U.S.A., Chemist.
1904. Clark, Ernest, Royal Technical Institute, Salford, Assistant Lecturer in Chemistry.
1904. Clark, Dr. Friend E., Pennsylvania State College, State College, Pa., U.S.A., Chemist.
1904. Clark, Dr. Homer, c/o The Vacuum Varnish and Chemical Co., 6, Seaview Avenue, East Norwalk, Conn., U.S.A., Chemical Manufacturer.
- O.M. Clark, Dr. J., 138, Bath Street, Glasgow, Analytical Chemist.
1900. Clark, Jno., Broadway Works, Millwall Dock, London, E., Manufacturing Chemist.
1902. Clark, Robt. M., Rockbank, Partickhill, Glasgow, Chemist.
1903. Clark, Dr. W. Inglis, 104, South Canongate, Edinburgh, Manufacturing Chemist.



1902. Clark, Wm. Linus, Champion Cotted Paper Co., Hamilton, Ohio, U.S.A., Chemist.
1904. Clarke, A. R., 613-617, Eastern Avenue, Toronto, Canada, Leather Manufacturer.
1891. Clarke, Goddard, South Lodge, Champion Hill, S.E., Drysalter.
1898. Clarke, J. F. Wyllie, Messrs. J. and R. Tennent, Wellpark Brewery, Glasgow, Managing Director.
1903. Clarke, Robt. W., (Journals) c/o Clinical Research Association, Ltd., 1, Southwark Street, London, S.E., (subs.) 3, Aberdeen Villas, Chase Road, Southgate, N., Analyst.
1897. Clarke, Wm. B., c/o Edison-Swan U.E.L. Co., Ltd., Ponders End, N., Electro-Chemist.
- O.M. Claudet, A. C., 6, Coleman Street, E.C.; and (Journals) 9, Daleham Gardens, Hampstead, N.W., Metallurgist.
- O.M. Claudet, F. G., 181, Willesden Lane, N.W., Assayer and Metallurgist.
1889. Claus, Wm. H., c/o Claus and Ree, Clayton, Manchester, Manufacturing Chemist.
- O.M. Clayton, E. G., Chemical Laboratory, 32, Holborn Viaduct, London, E.C., Consulting Chemist.
1895. Clayton, Dr. G. C., Etonfield, Wavertree, Liverpool.
1891. Clayton, J. W., c/o Clayton and Jowett, Ltd., Concert Street, Liverpool, Essence Distiller.
1894. Clayton, Robt. H., Woodleigh, Blackfield Lane, Kersal, Manchester, Chemist.
1893. Clemes, J. H., The Bracken, Newquay, Cornwall.
1886. Clemminshaw, E., Alkali Works, Oldbury, near Birmingham, Technical Chemist.
1883. Clemmons, G. H., Cudbear Street, Hunslet Road, Leeds, Dyeware Manufacturer.
1884. Clerk, Dugald, 18, Southampton Buildings, Chancery Lane, W.C., Engineer.
1899. Cleveland, D. B., 116, Olive Street, Cleveland, Ohio, U.S.A., Chemist.
1900. Clifford, Wm., Sewage Outfall Works, Wolverhampton, Sewage Works Manager.
- O.M. Cloud, T. C., 4, Lloyd's Avenue, Fenchurch Street, London, E.C., Metallurgist.
- O.M. Clowes, Dr. F., 40, Craven Street, Charing Cross, W.C.; and the Grange, College Road, Dulwich, S.E., Chief Chemist (L.C.C.).
1891. Clutton, J. H., Elliott's Metal Co., Ltd., Burry Port, R.S.O., Carmarthenshire, Assayer.
1900. Clymer, Wm. R., c/o National Carbon Co., Cleveland, Ohio, U.S.A., Chemist.
1899. Coates, Chas. E., jun., Louisiana State University, Baton Rouge, La., U.S.A., Professor of Chemistry.
1888. Coats, Jno. T., 105, Broughton Street, Edinburgh, Manufacturing Chemist.
1893. Cobb, Jno. W., Farnley Ironworks, near Leeds, Technical Assistant to Managing Director.
1904. Coblentz, Lambert, 1708, Sutter Street, San Francisco, Cal., U.S.A., Chemist.
1894. Coblentz, Dr. Virgil, College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Chemical Lecturer.
1899. Cochran, Alfred, 559, Madison Street, Brooklyn, N.Y., U.S.A., Chemist.
1904. Cochran, C. B., 514, South High Street, West Chester, Pa., U.S.A., Teacher of Chemistry.
1898. Cochrane, A. Lynde, 55, Kilby Street, Boston, Mass., U.S.A., Clerk (Cochrane Chemical Co.).
1901. Cockburn, John A., Ardeer, Stevenston, Ayrshire, Analytical Chemist.
1902. Cocking, Allan T., Carhampton House, Four Oaks, Sutton Coldfield, Ammunition Manufacturer.
1903. Coiman-Nicoresiti, J., 41, Hart Street, Bloomsbury, W.C., Chemist.
1903. Coggeshall, Dr. G. W., Chestnut Street, Dedham, Mass., U.S.A., Chemical Manufacturer.
1887. Coghill, P. de G., Borax Works, Old Swan, Liverpool, Technical Chemist.
1884. Cogswell, W. B., Syracuse, N.Y., U.S.A., Chemical Engineer.
- O.M. Cohen, Dr. J., 13, Cardigan Road, Leeds, Analytical Chemist.
1897. Cohn, Alfred J., c/o Metropolitan Co., 13-19, University Place, New York City, U.S.A., Chemist.
1901. Conn, Sigmund, 13, Dutch Street, New York City, U.S.A., Metallurgical Chemist.
1904. Conoc, Prot. W. P., M. Master University, Toronto, Canada, Professor of Chemistry.
1903. Colbert, W., British S.A. Dynamite Factory, Modderfontein, Transvaal, Analytical Chemist.
1891. Colby, Albert L., c/o International Nickel Co., 43, Exchange Place, New York City, U.S.A., Metallurgical Engineer.
1899. Colby, E. A., Baker Platinum Works, Newark, N.J., U.S.A., Metallurgical Chemist.
- O.M. Colby, W. H., Carreg-wen, Aberystwith, Wales.
1893. Colefax, Dr. Arthur, 85, Onslow Square, London, S.W., Barrister-at-Law.
1893. Coleman, W. H., 299, North Road, Clayton, Manchester, Tar Works Chemist.
- O.M. Collens, E., Vinegar Works, Stourport, Worcestershire, Manager.
1887. Collett, J. M., Hillfield, Gloucester, Chemical Manufacturer.
1901. Colley, Bernard T., c/o American Smelting and Refining Co., Aguas Calientes, Mexico, Assayer.
1902. Colley, Hylton H., c/o Dr. Bedford, Ponsonby, Auckland, New Zealand, Chemist.
1903. Collier, Pierre, Companhia Industrial Pernambucana, Pernambuco, Brazil, Civil Engineer.
1893. Collin, Dr. C. A., Ferguslie Threadworks, Paisley, N.B., Textile Chemist.
1898. Collingridge, Frank, 15, Beaufort Road, Edgbaston, Birmingham, Chemist.
1883. Collins, J. H., Crinnis, Par Station, Cornwall, Technical Chemist.
1899. Collins, S. Hoare, Armstrong College, Newcastle-on-Tyne, Agricultural Chemist.
1888. Collins, W. Hepworth, Analytical Chemist.
1899. Collis, Walter T., Swinford House, Stourbridge, Worcestershire, Chemist.
1891. Colman, Dr. H. G., Elmside, Worcester Park, Surrey, Analytical Chemist.
1892. Colquhoun, Lewis, c/o South African Explosives Co., Modderfontein, Transvaal, Analytical Chemist.
1894. Colquhoun, W., Plas Penyddol, Bersham, near Wrexham, North Wales, Engineer.
1901. Colwell, J. Kear, Finsbury Town Hall, Rosebery Avenue, E.C., Analytical and Consulting Chemist.
1900. Comey, Arthur M., 12, Pearl Street, Boston, Mass., U.S.A., Technical Chemist.
1899. Conant, Francis M., c/o Sanderson and Porter, Mishawaka, Ind., U.S.A., Chemical Engineer.
1901. Connah, Jas., 31, Rudall Crescent, Hampstead, N.W., Government Analyst.
1905. Conner, Arthur B., 1070 Fort St. West, Detroit, Mich., U.S.A., Chemist.
1902. Conner, Robt. S., c/o Newaygo Portland Cement Co., Newaygo, Mich., U.S.A., Chemist.
1883. Connor, C. C., 4, Queen's Elms, Belfast, Ireland, Chemist.
1891. Conradson, Pontus H., Galena Oil Works, Franklin, Pa., U.S.A., Analytical Chemist.
1889. Conroy, Dr. Jas. T., 13, Howard Drive, Grassendale, Liverpool, Chemist.
1887. Constable, W. H., (Journals) Australian Alum Works, Runcorn; and (communications) Grassendale, Dee Banks, Chester, Analytical Chemist.
1902. Converse, W. A., Rooms 27-34, Rialto Building, Chicago, Ill., U.S.A., Chemist.
1891. Coode, J. Charles, 19, Freeland Road, Ealing, W., Civil Engineer.
- O.M. Cook, H. J., The Firs, Woodford Green, Essex, Soap Manufacturer.
1903. Cook, Jas. W., London and Provincial Dye Works, Hackney Wick, N.E., Dyer.
1888. Cook, Jno. J., Atlas Foundry, St. Helens, Lancashire, Ironfounder.
1899. Cook, R. Anderson, New Brunswick, N.J., U.S.A., Chemist.
1898. Cook, Thos. Alex., East London Soap Works, Bow, E., Soapmaker.

1899. Cook, Walter G., 9, Hendon Lane, Finchley, N., Analytical Chemist.
1891. Cooke, Arthur W., c/o Brotherton and Co., Ltd., Holmes Street, Dewshury Road, Leeds, Analytical Chemist.
1904. Cooke, W. Ternent, 84, Elliscombe Road, Charlton, S.E., Research Student.
1901. Cooper, T. S., Beckfoot, Manchester, S.E., Calico Printing Chemist.
1891. Cooper, Walter J., (communications) c/o South Wales Cement Co., Penarth, Cardiff; and (Journals) The Elms, Lower Penarth, South Wales, Cement Works Manager.
1897. Cooper, Wm. R., 113, Tulse Hill, S.W., Electrical Engineer.
1890. Corcoran, Bryan, Chestnuts, Sutton, Surrey, Chemical Engineer.
1887. Corder-James, J. H., Finsbury House, Blomfield Street, London, E.C., Mining Engineer.
1905. Cormack, Wm., c/o G. Nelson, Dale and Co., Ltd., Emscote Mills, Warwick, Chemist.
1899. Cornelison, Dr. Robt. W., Bloomfield, N.J., U.S.A., Consulting Chemist.
1887. Cornett, Jas. P., Ford Paper Works, Hylton, near Sunderland, Paper Maker.
1903. Corrêa de Brito, Dr. L., Rua do Commercio, 6, Recife, Pernambuco, Brazil, Civil Engineer.
1889. Corrie, David, c/o Nobel's Explosives Co., Ltd., Polmont Station, N.B., Technical Chemist.
1902. Corse, Wm. Malcom, 1283, Third Avenue, Detroit, Mich., U.S.A., Chemist.
1903. Cortright, R. M., 20, South Centre Street, Bethlehem, Pa., U.S.A., Assistant Chemist.
1894. Coste, J. H., 40, Craven Street, W.C., and (Journals) 206, Amhurst Road, Hackney, E., Analytical Chemist.
1904. Costohadie, H. A., Overdale, Mottram-in-Longden-dale, near Manchester, Calico Printer.
1891. Cotton, W. F., Hollywood Roebuck, Co. Dublin, Gas Works Manager.
1905. Cotton, Wm. H., The Schlüsselburg Calico Printing Co., Schlüsselburg, near St. Petersburg, Russia, Chemist.
1904. Coubrough, Col. John, Blane-field, Stirlingshire.
1898. Coupe-Annable, H. W., c/o Tungsten and Rare Metals Co., Queen's Road, Battersea, S.W., Chemist.
1891. Court, Heywood, 67, Surrey Street, Sheffield, Analytical Chemist.
1898. Courtney, Samuel, 37, The Mount, Belfast, Ireland, Manager.
1894. Cousins, W. J., 17, Temple Chambers, Temple Avenue, E.C., Consulting Chemist and Director.
1903. Cowan, Wallace, c/o The Stirling Boiler Co., Ltd., Motherwell, N.B., Analytical Chemist.
1893. Cowan, W. J., 12, Park Avenue, Wood Green, N., Fine Colour Manufacturer.
1897. Cowburn, Arthur W., 29, Princess Street, Manchester, Chemical Merchant and Analytical Chemist.
1894. Cowburn, W. H., 29, Princess Street, Manchester, Chemical Merchant.
1904. Cowee, Harvey D., 161, River Street, Troy, N.Y., U.S.A., Chemist.
1905. Cowles, Horace W., jun., Box 225, Hinsdale, Du Page Co., Ill., U.S.A., Assistant Chemist.
1891. Cownley, A. J., 225, Barry Road, Dulwich, S.E., Analytical Chemist.
1891. Cowper-Coles, Sherard Osborn, Grosvenor Mansions, Victoria Street, Westminster, S.W., Metallurgical Engineer.
1902. Coyle, Benj. C., City Laboratory, 17, Castle Street, Dublin, Analytical Chemist.
1904. Coysh, Basil R., 23, Woodville Gardens, Ealing, W., Manufacturing Chemist.
1884. Craig, Geo., Chemical Laboratory, 95, Bath Street, Glasgow, Technical Chemist.
1895. Craig, Thos. J., 21, Dunard Road, Rutherglen, N.B., Chemist.
1903. Craine, Chas. R., 42, Pooley Place, Buffalo, N.Y., U.S.A., Chemist.
1904. Cramer, A., jun., Cramer and King Co., Paterson, N.J., U.S.A., Chemist.
1901. Crane, Fred. D., 28, Hillside Avenue, Montclair, N.J., U.S.A., Consulting Chemist.
1902. Crane, Jasper E., c/o The Arlington Co., Arlington, N.J., U.S.A., Chemist.
1898. Cranfield, Wm., Higher Grade Board School, Halifax, Yorks, Teacher of Chemistry.
1903. Cranmer, Ridgeway, 170, 88th Street, Bay Ridge, Brooklyn, N.Y., U.S.A., Chemist.
1902. Craven, Alfd. B., 91, Fielding Terrace, Armley, Leeds, Analytical Chemist.
1889. Craven, Chas. E., Oak Villa, Bramley, near Leeds, Dyer.
1899. Craven, Jas, c/o Columbia Creosoting Co., Shirley, Ind., U.S.A., Chemist.
1891. Craven, Jno., jun., c/o Dominion Tar and Chemical Co., Ltd., Sydney, C.B., Canada, Chemist.
1885. Craw, John, 15, Cadogan Street, Glasgow, Drysalter.
- O.M. Crawford, D., Langdale's Chemical Manure Co., Ltd., St. Lawrence, Newcastle-on-Tyne, Manager.
1884. Crawford, D., 12, Abbey Grove, Eccles, Manchester, Dyer and Printer.
1890. Crawshaw, E., 25, Tollington Park, London, N., Dye Merchant.
1900. Crayen, Dr. Gustav, 354, West 23rd Street, New York City, U.S.A.
- O.M. Cresswell, C. G., Ermyngarth, Ashted, Surrey; and 9, Bridge Street, Westminster, S.W., Chemist.
1901. Cribb, Cecil, 136, Shafteshury Avenue, London, W., Analytical and Consulting Chemist.
1905. Crighton, W. H., 33, Ardleigh Road, Southgate Road, London, N., Chemist.
1890. Criper, Wm. R., c/o Messrs. D. Weldie and Co., Konnagar, near Calcutta, India, Manufacturing Chemist.
1902. Cripps, R. A., Laboratory, D'Avigdor Road, Hove, Sussex, Analyst.
1902. Croasdale, Dr. Stuart, 1574, York Street, Denver, Colo., U.S.A., Mining Engineer and Metallurgist.
1885. Crompton, Percy R., Elton Paper Mills, near Bury, Lancashire, Paper Maker.
1901. Cronquist, G. W., Hyllinge, Bjuf, Sweden, Fire Brick Works Manager.
1889. Cronquist, Prof. A. Werner, 4, Kaimmakaregatan, Stockholm, Sweden, Consulting Chemist.
- O.M. Crookes, Sir Wm., F.R.S., 7, Kensington Park Gardens, Notting Hill, W., Analytical Chemist.
1896. Crosby, Thos., Llanelly Steelworks, Llanelly, South Wales, Metallurgist.
- O.M. Crosfield, A. L., 46, Bidston Road, Oxtou, Birkenhead, Analytical Chemist and Assayer.
1896. Crosfield, Capt. G. R., Volunteer Quarters, Sankey Street, Warrington, Soap Manufacturer.
1905. Crosley, W., Hall Mines Smelting Co., Ltd., Nelson, B.C., Canada, Chemist.
1884. Cross, C. F., 4, New Court, Lincoln's Inn, London, W.C., Analytical Chemist.
1894. Crossley, Prof. Arthur W., Pharmaceutical Society, 17, Bloomsbury Square, London, W.C., Professor of Chemistry.
1900. Crossley, Frank, Duchy Bank, Seedley Road, Pendleton, Manchester, Analytical Chemist.
1904. Crossley, T. Linsey, Hawkesbury, Ont., Canada, Analytical Chemist.
1902. Crossley-Holland, F. W., 68, Parade, Leamington, Chemist and Druggist.
1892. Crossman, Tom, Albion Brewery, Coldhurst Street, Oldham, Brewing Chemist.
1894. Crow, Henry W., 94, Romford Road, Stratford, E., Tar Distiller.
1884. Crow, Dr. J. K., 2, Ulundi Road, Blackheath, S.E., Technical Chemist.
1902. Crowell, Henry H., c/o Jos. Pancroft and Sons Co., Wilmington, Del., U.S.A., Dyer.
1893. Crowther, Edw., Woodland Dyeworks, Headingley, Leeds, Dyer.
1883. Crowther, Horace W., The Beeches, West Bromwich, Technical Chemist.



1899. Crowther, J., South Australian School of Mines ; and (Journals) Weedna Villa, Maud Street, Unley, Adelaide, South Australia, Metallurgist.
1884. Crowther, W. M., Field House, Gomersal, near Leeds, Manufacturing Chemist.
1884. Crumbe, W. D., 146, Washington Street, East Orange, N.J., U.S.A., Analytical Chemist.
1902. Crush, E. H., 225, Westcombe Hill, Blackheath, S.E., Technical Chemist.
1903. Cullen, W. H., The Castner-Kellner Alkali Co., Ltd., Weston Point, near Runcorn, Cheshire, Engineer.
1892. Cullen, Wm., Dynamite Factory, Modderfontein, Transvaal, Chemist.
1897. Culmann, Dr. Julius, 525, Norwood Avenue, Buffalo, N.Y., U.S.A., Chemist and Colourist.
1904. Culmer, Harry H., 6200, Madison Avenue, Chicago, Ill., U.S.A., Chemist and Tar Distiller.
1883. Cuming, James, jun., Chemical Works, Yarraville, Melbourne, Australia, Chemical and Fertiliser Manufacturer.
1897. Cunliffe, Albert J., Claytonfield, Clayton-le-Woods, Chorley, Lancashire, Calico Printer.
1893. Cunningham, Edw., c/o S. Cabot, 141, Milk Street, Boston, Mass., U.S.A., Chemical Engineer.
- O.M. Curphey, W. S., Borva, Lenzie, N.B., Alkali Works Inspector.
1902. Currier, Edw. Eng., 15, Ferry Street, Everett, Mass., U.S.A., Chemist.
1898. Curtis, Marvin, 123, California Street, San Francisco, Cal., U.S.A., Wine Chemist.
1903. Cushing, Robt. P., Lock Haven, Pa., U.S.A., Chemist.
1902. Cutbush, Chas. G., 149, Westcombe Hill, Blackheath, S.E., Electrical Engineer.
1899. Cutler, Fred. F., 183, Essex Street, Boston, Mass., U.S.A., Publisher.
1904. Cutts, Henry E., 55, Fulton Street, New York City, U.S.A., Technical Chemist.
1891. Davidson, Richard, 44, High Street, Dundee, Old Merchant's Clerk.
- O.M. Davidson, R. Holden, c/o United Alkali Co., Ltd., Ammonia Soda Works, Fleetwood, Manager.
1904. Davidson, Robert, c/o Dalgety and Co., Ltd., 15, Bent Street, Sydney, N.S.W., Australia.
1905. Davidson, Thos. A., c/o Jos. Watson and Sons, Ltd., Leeds ; and (Journals) 20, Cromer Terrace, Leeds, Chemist (Glycerin Distillery).
1897. Davies, Charles T., 207, Windsor Street, Reading, Pa., U.S.A., Chemist.
1889. Davies, G. W., 8, Spring Hill, Stockport, Chemical Lecturer.
1898. Davies, Herbert E., The Laboratory, 28, Chapel Street, Liverpool, Analytical Chemist.
1898. Davies, Leysion, 1, North Claremont Gardens, Glasgow, Gunpowder Mills Manager.
1896. Davies, Llewellyn J., Bute Chambers, Bute Road, Cardiff, Analytical and Consulting Chemist.
1886. Davies, M. Lloyd, North American Chemical Co., Bay City, Mich., U.S.A., Alkali Works Manager.
1897. Davies, Saml. H., c/o Rowntree and Co., Ltd., Cocoa Works, York, Research Chemist.
1903. Davies, Thomas, 56, Wellesley Street, Toronto, Ont., Canada, Manufacturer.
1902. Davies, Wm. Rhys, 60, Northampton Terrace, Bradford, Yorks, Analytical Chemist.
1900. Davis, Arthur C., 2, Downing Grove, Cambridge, Cement Maker.
- O.M. Davis, A. R., Havelock Villa, Wellington Road North, Stockport, Analytical Chemist.
1901. Davis, Bernard F., c/o Borneo Co., Boedok, Sambas, Borneo, Metallurgical Engineer.
1902. Davis, Charles B., S.W., Corner of 23rd Street and 9th Avenue, New York City, U.S.A., Technical Chemist.
1902. Davis, Emerson, 515, Cass Avenue, Detroit, Mich., U.S.A., Chemist.
1893. Davis, Fred., 51, Imperial Buildings, Ludgate Circus, London, E.C., Consulting Chemist.
- O.M. Davis, George E., 265, Strand, London, W.C., Chemical Engineer.
- O.M. Davis, H. W., Government Laboratory, Clement's Inn Passage, Strand, W.C., Analytical Chemist.
1903. Davis, Leon K., Room 510, 31, Milk Street, Boston, Mass., U.S.A., Chemical Engineer.
- O.M. Davis, T. Sebastian, 199, South Lambeth Road, London, S.E., Vinegar Works Chemist.
1897. Davis, Wm. A., 8, Quenington Mansions, Rostrevor Road, Fulham, S.W., Chemist.
1900. Daw, Fred W., Alexander Place, Ebbw Vale, Mon., Metallurgical Chemist.
1903. Dawes, Arthur W., 3, Madison Place, Albany, N.Y., U.S.A., Chemist.
- O.M. Dawson, C. A., 40, Russell Road, Sefton Park, Liverpool, Technical Chemist.
1886. Dawson, W. Haywood, British Alizarin Co., Ltd., Silvertown, E., and (Journals) 187, Eglinton Road, Woolwich, S.E., Technical Chemist.
1901. Day, Dr. David T., U.S. Geological Survey, Washington, D.C., U.S.A., Geologist.
- O.M. Deacon, H. W., 8, Ullet Road, Liverpool, Alkali Manufacturer.
- O.M. Deakin, H. T., Dewhurst House, Egerton, near Bolton, Dyer.
1903. Deane, Harry, 23, Spinkfield Road, Birkby, Huddersfield, Chemist.
1899. Deane, Leopold M., Davington House, Faversham, Kent, Chemist (Cotton Powder Co., Ltd.).
1892. Deaville, B., Beech Avenue, Nottingham, Manufacturing Chemist.
1903. De Blois, W. H., c/o Pulaski Mining Co., Pulaski, Va., U.S.A., Chemist.
1899. De Castro, J. Paul, Laboratory, Eflingham House, Arundel Street, Strand, W.C., Consulting Chemist and Assayer.
1902. De Cew, J. A., c/o Canada Paper Mills, Windsor Mills, Quebec, Canada, Chemist.
1893. De Clerck, Maurice, Heule-lez-Courtrai, Belgium.
1884. Deering, W. H., Chemical Department, Royal Arsenal, Woolwich, S.E., Analytical Chemist.
- O.M. Dacie, J. C., Soap Works, Putney, S.W., Soap Manufacturer.
1897. Dains, Herbert H., 27, Inderwick Road, Stroud Green, N., Analytical Chemist.
1904. Dale, G., Waverley Terrace, Hood Lane, Warrington, Technical Chemist.
1884. Daniell, Louis C., (Journals) Royal Standard Brewery, Tamworth, New South Wales ; and (subs.) c/o W. T. Allen and Co., 132, Queen Victoria Street, London, E.C., Brewer.
1904. Danker, Dan. J., 247, Atlantic Avenue, Boston, Mass., U.S.A., Dyestuff and Chemical Manufacturer.
1903. Dannenbaum, Dr. H., 3346, Frankland Avenue, Philadelphia, Pa., Secretary and Treasurer (National Ammonia Co.).
1902. Danziger, Jos. L., 302, West 114th Street, New York City, U.S.A., Analytical Chemist.
1885. Darby, Jno. H., Brymbo Hall, near Wrexham, Ironmaster.
1894. Darling, G. A., c/o Lisbon Berlyn, Ltd., Frankfort, Pilgrim's Rest, Transvaal, S.A., Metallurgical Chemist.
- O.M. Darling, W. H., 26, Dover Street, Manchester, Analytical Chemist.
1887. Davenport, Dr. B. F., 161, Tremont Street, Boston, Mass., U.S.A., Consulting Chemist.
1900. Davidson, Alex., jun., 2, Hamilton Park Terrace, Hillhead, Glasgow, Analytical Chemist.
1899. Davidson, Charles, 37, Heriot Street, Pollokshields, Glasgow, Analytical Chemist.
1901. Davidson, G. M., Chicago and N.W. Railroad Shops, P.O. Station E., Chicago, Ill., U.S.A., Chemist.
1883. Davidson, J. E., 40, Percy Gardens, Tynemouth, Chemical Manufacturer.

1900. Deerr, Noel, Blaimont, Berbice, British Guiana, Analytical Chemist.
1902. Deghué, Dr. Jos. A., 247, Harrison Street, Brooklyn, N.Y., U.S.A., Chemist.
1901. De Jonge, Cornelius, 36, Doughty Street, Brooklyn, N.Y., U.S.A., Pharmaceutical Chemist.
1893. Delahaye, Philibert, 105, Rue St. Lazare, Paris (IX.), Gas Engineer.
1901. Delany, Chas., c/o Elliott Bros., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Chemist.
1888. Dempsey, Geo. C., 165, Market Street, Lowell, Mass., U.S.A., Chemist.
1904. Dempwolf, Chas., jun., 713, South George Street, York, Pa., U.S.A., Chemical Manufacturer.
1899. Denham, Wm. S., 2, Kelvinside Terrace North, Glasgow, Chemist.
1891. Denison, Joseph R., 18, Duckworth Lane, Bradford, Yorks., Analytical Chemist.
1898. Dent, Dr. Frankland, 3, Claremont Drive, Headingley, Leeds, Consulting Chemist.
1901. Devas, Dr. Ernest W., 74, Woodland Terrace, Old Charlton, Kent, Technical Chemist.
1890. De Velling, F. W., Higher Grade Board School, The Boulevard, Hull, Head Master and Science Lecturer.
1898. Dewar, Alex. H., c/o The Linoleum Manufacturing Co., Staines, Middlesex, Chemist.
- O.M. Dewar, Sir J., F.R.S., Royal Institution, Albemarle Street, W. (Journals); and I, Scroope Terrace, Cambridge, Professor of Chemistry and Physics.
1889. Dewey, Fred. P., Lanier Heights, Washington, D.C., U.S.A., Metallurgist.
1899. Dewez, Eugène, jun., Herve, Belgium, Tanner.
1904. Dewhurst, J. A., 36, Southfield Square, Bradford, Yorks., Analyst.
1891. De Wilde, Prof. P., 1, Quai du Léman, Geneva, Switzerland, Professor of Chemistry.
1903. Diamond, Wm., c/o Simon-Carves, Ltd., Barrow Collieries, near Barnsley, Yorks., Works Manager.
- O.M. Dibdin, W. J., Edinburgh Mansions, Howick Place, S.W.; and (Journals) Mayfield, Grange Road, Sutton, Surrey, Analytical Chemist.
1897. Dick, Jno., c/o Jno. Dick, Ltd., 77, York Street, Toronto, Ont., Canada, Manufacturer.
1902. Dick, Jno., Wharf Road, Cubitt Town, London, E., Manager and Chemist.
1904. Dick, W. D., 46, Primrose Hill Road, South Hampstead, N.W., Analytical Chemist.
1898. Dickenson, Frank, 26, O'Connell Avenue, Berkeley Road, Dublin.
1896. Dickenson, F. M., c/o Broken Hill Proprietary Co., 3, Great Winchester Street, E.C., Secretary.
1904. Dickenson-Gair, C. J., 11, St. Luke's Road, Clapham, S.W., Analytical Chemist.
1902. Dieckman, Judson C., 10, Minot Street, Woburn, Mass., U.S.A., Chemical Engineer.
1893. Dickerson, E. N., 141, Broadway, New York City, U.S.A., Lawyer.
- O.M. Dickinson, A. J., Neptune Tar and Chemical Works, Deptford, S.E.; and (Journals) 57, Lewisham High Road, S.E., Tar Distiller.
1905. Dickinson, Cyril, Abbotsford, Hollycroft Avenue, Hampstead, N.W., Analytical Chemist.
1887. Dickson, Jno., Easter Fluchter, Baldernock, near Glasgow.
1898. Dickson, Samuel, 2, Broadway, Westminster, S.W., Analytical Chemist.
1899. Dieckmann, Dr. Otto, 1182, Harrison Avenue, Cincinnati, Ohio, U.S.A., Chemist.
1901. Diehl, Oscar C., c/o Saginaw Salt Co., St. Charles, Mich., U.S.A., Chemist.
1894. Diestel, Wm., 77, William Street, New York City, U.S.A., Dyestuff Importer.
1898. Dillon, Wm., 28, Oakwood Avenue, Roundhay, Leeds, Oil, Colour, and Varnish Manufacturer.
- O.M. Divers, Dr. E., F.R.S., 3, Canning Place, Palace Gate, London, W., Professor of Chemistry.
1903. Divine, Robt. E., Hamburg, Erie Co., N.Y., U.S.A., Chemist.
1899. Dixon, Fred. W., 11, Clarendon Avenue, Newtonville, Mass., U.S.A., Dyer.
1888. Dixon, Prof. Harold B., F.R.S., Owens College, Manchester, Professor of Chemistry.
1885. Dixon, Jos., Spring Grove, near Sheffield, Paper Maker.
1884. Dixon, Wm., 102, Spring Street, Bury, Lancashire, Science Master.
1902. Dixon, Wm. A., 97, Pitt Street, Sydney, N.S.W., Australia, Public Analyst and Assayer.
1892. Dobb, Thos., 54, Riverdale Road, Sheffield, Pharmaceutical Chemist.
- O.M. Dobbie, Dr. J. J., Royal Scottish Museum, Chambers Street, Edinburgh, Director.
1901. Dobbie, Jas., Laurel Bank, Broomfield Road, Ayr, N.B., Tanner.
- O.M. Dobbie, Dr. L., Chemical Laboratory, University, Edinburgh, Professor of Chemistry.
1890. Dodd, A. J., Heathfield House, Belvedere, Kent, Works Manager.
1889. Dodd, W. Ralph, Trederwen, Village Road, Enfield, Middlesex, Chemical Works Manager.
1901. Dodds, Roger, Bigod's Hall, Dummow, Essex, Technical Chemist.
1900. Dodge, Dr. Francis D., 69, Avenue A., Bayonne, N.J., U.S.A., Chemist.
1897. Doerflinger, Wm. F., c/o Acker Process Co., Niagara Falls, N.Y., U.S.A., Research Chemist.
1897. Dohme, Dr. Alf. R. L., Messrs. Sharp and Dohme, Baltimore, Md., U.S.A., Manufacturing Chemist.
1885. Doidge, H., Mountain Rise, Maritzburg, Natal.
1903. Dole, Richard B., State Bacteriological Laboratory, Minneapolis, Minn., U.S.A., Chemist.
1897. Dolge, Carl B., Westport, Conn., U.S.A., Manufacturer of Instruments and Antiseptics.
1884. Donald, Jas., 96, Anerley Park, Anerley, S.E., Manufacturing Chemist.
1903. Donald, Dr. Jas. T., 112, St. Francois Xavier Street, Montreal, Canada, Consulting Chemist.
- O.M. Donald, W., Saltecoats, N.B., Analytical Chemist.
1900. Donald, Wm., Ridgefield Park, Bergen Co., N.J., U.S.A., Assayer and Chemist.
1902. Donaldson, Thos., c/o South African Explosives Co., Ltd., Modderfontein, Transvaal, Chemist.
1901. Donnelly, Francis, 335, Hyde Road, Ardwick, Manchester, Manager (Varnish Co.).
1886. Doolittle, Orrin S., 445, Oley Street, Reading, Pa., U.S.A., Chemist.
1890. Dore, Jas., Copper Works, High Street, Bromley-by-Bow, E., Distiller's Engineer.
1896. Doremus, Dr. Chas. A., 59, West 51st Street, New York City, U.S.A., Professor of Chemistry.
- O.M. Dott, D. B., Abbey Hill Chemical Works, Edinburgh, Analytical Chemist.
1883. Dougall, Archibald, Gasworks, Kidderminster, Gas Engineer.
1897. Douglas, Geo., Heather Bank, Bingley, Yorks., Dyer.
1894. Douglas, Loudon M., Baltic Wharf, Putney, S.W., Chemical Manufacturer.
1884. Douglas, William, Diamond Plantation, Demerara, British Guiana, Chemical Engineer.
1900. Doulton, H. Lewis, Lambeth Pottery, London, S.E., Potter.
1902. Doveton, Godfrey D., 319, Majestic Building, Denver, Colo., U.S.A., Metallurgist.
1900. Dow, Allan W., 2016, Hillyer Place, Washington, D.C., U.S.A., Chemist (District Engineer's Dept.).
1898. Dow, Herbert H., Midland, Mich., U.S.A., Manufacturing Chemist.
1905. Dowbiggin, James, Pentland Cottage, Lancaster, Chemist.
1885. Dowson, J. Emerson, 39, Victoria Street, Westminster, S.W., Civil Engineer.
1901. Doxrud, Christian, Christiania, Norway, Professor of Chemical Technology.
1902. Drake, Bryant S., 1121, 5th Avenue, East Oakland, Cal., U.S.A., Chemist.
1885. Drake, Chas. A., Three Mills Distillery, Bromley-by-Bow, E., Brewer.
1886. Dreaper, W. P., 38, Sydney Road, Beckenham, Kent, Technical Chemist.
- O.M. Drew, D., Lower House Print Works, near Burnley, Calico Printer.



1896. Drewsen, Dr. Viggo B., 5, Beekman Street, New York City, U.S.A., Wood Pulp and Paper Expert.
- O.M. Dreyfus, Dr. C., Clayton Aniline Co., Ltd., Clayton, Manchester, Dye Manufacturer.
1904. Dreyfus, Dr. L. A., c/o The Murado Co., New Brighton, S.I., N.Y., U.S.A., Chemist.
1893. Dreyfus, S., 1, Sunnyside Terrace, North Road, Clayton, Manchester, Chemist.
1899. Dreyfus, Dr. Wm., 162, East 95th Street, New York City, U.S.A., Chemist.
1899. Drobegg, G., 81, Maiden Lane, New York City, U.S.A., Superintending Chemist.
1889. Drummond, Hon. Sir George, K.C.M.G., Montreal, Canada.
1898. Drummond, Dr. Isaac W., 436, West 22nd Street, New York City, U.S.A., Chemist.
1904. Dubois, Norman A., 405, Euclid Avenue, Syracuse, and (Journals) Havemeyer Chemical Laboratory, New York University, N.Y., U.S.A., Instructor in Chemistry.
1903. Dubuque, Edwin D., 310, Realty Building, Elmira, N.Y., U.S.A., Chemist.
1899. Ducas, B. P., 151, Front Street, New York City, U.S.A., Chemical and Dyestuff Importer.
1897. Duckham, Alex., Phoenix Wharf, West Ferry Road, Millwall, E., Works Chemist.
1902. Duckworth, Wm. H., Moorfield, Sylvan Avenue, Sale, Cheshire, Manufacturing Chemist.
1899. Duddridge, Frank R., 55, Northumberland Street, Newcastle-on-Tyne, Teacher of Chemistry.
1890. Dudley, Dr. C. B., 1219, 12th Avenue, Altoona, Pa., U.S.A., Analytical Chemist.
1887. Dudley, Prof. W. L., Vanderbilt University, Nashville, Tenn., U.S.A., Professor of Chemistry.
1899. Duff, Wm. S., Sebert Villa, Bashwood, Leytonstone, Essex, Manufacturing Chemist.
1901. Duffy, Lawrence, 23, Broomhall Place, Sheffield, Analytical Chemist.
- O.M. Duggan, T. R., 60, Foyle Road, Blackheath, S.E., Analytical Chemist.
1898. Duisberg, Dr. Carl, The Bayer Co., Ltd., (Journals) Elberfeld, Germany; (subscriptions) 19, St. Dunstan's Hill, E.C., Chemist.
1888. Dukes, T. William, Box 10, Vryheid, South Africa, Merchant.
1889. Duncan, Arthur W., 1, Trafalgar Road, Higher Bentcliffe, Pendleton, Manchester, Analytical Chemist.
- O.M. Duncan, Jas., 52, Shakespeare Street, Hove, Sussex; and (Journals) Hotel Bristol, San Remo, Italy, Sugar Refiner.
1904. Duncan, R. A., P.O. Box, 509, Honolulu, Hawaii, Chemist.
1904. Duncan, Wm. Wheeler, 406, Massachusetts Avenue, Boston, Mass., U.S.A., Chemist.
1898. Dunham, Edw. K., 338, East 26th Street, New York City, U.S.A., Professor of Bacteriology and Hygiene.
1901. Dunham, Henry V., c/o Casein Co. of America, Bellows Falls, Vermont, U.S.A., Chemist.
1905. Dunlop, Harry, Craigdarroch, Cove, Dumbartonshire, Chemist.
1889. Dunlop, Robt., 5, Morrison Terrace, North Road, Bellshill, N.B., Oil Works Manager.
1892. Dunn, Fred., 193, Collins Street, Melbourne, Victoria, Analytical Chemist.
- O.M. Dunn, Dr. J. T., 10, Dean Street, Newcastle-on-Tyne, Consulting Chemist.
- O.M. Dunn, P., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.
1902. Dunning, D. M., jun., Auburn, N.Y., Gas Engineer.
1901. Dunsford, Geo., Laboratory, Wigan Coal and Iron Co., Ltd., Wigan, Analytical Chemist.
- O.M. Dupré, Dr. A., F.R.S., Edinburgh Mansions, Howick Place, S.W., Consulting Chemist.
1905. Durand, Halsey, Dept. of Health, 55th Street and 6th Avenue, New York City, U.S.A., Chemist.
1897. Durant, H. T., P. O. Box 603, Bulawayo, Matabeleland, South Africa, Metallurgist.
1897. Durkee, Frank W., Tufts College, Mass., U.S.A., Assistant Professor of Chemistry.
1899. Duryer, Chester B., 80, Madison Avenue, New York City, U.S.A., Starch Manufacturer.
1891. Dyerkovitch, Dr. P., 26, Bevis Marks, London, E.C., Technical Chemist.
1903. Dyck, George E., c/o Morris and Co., South Saint Joseph, Mo., U.S.A., Analytical Chemist.
- O.M. Dyer, Dr. B., 17, Great Tower Street, London, E.C., Analytical and Consulting Chemist.
- O.M. Dyson, C. E., Flint, North Wales.
1902. Dyson, George W., 89, Cowlishaw Road, Sheffield, Analyst.
1892. Dyson, Septimus, 8, Belmont Avenue, Harrogate, Manufacturing Chemist.

## E

1905. Eager, Nassau B., Toronto, Ont., Canada, Barrister.
1904. Eames, Charles J., 99, Water Street, New York City, U.S.A., Consulting Chemist.
1899. Earnshaw, Edward H., 22nd and Filbert Streets, Philadelphia, Pa., U.S.A., Chemist (Gas Improvement Co.).
1902. Earp, Dr. Francis S., 72, Addis Street, Kilmorlie, West Australia, Metallurgical Chemist.
- O.M. Earp, W. R., c/o Rowland A. Earp, Buckfastleigh, Devon, Chemical Manufacturer.
1902. Easterbrooks, Frank D., Raritan Copper Works, Perth Amboy, N.J., U.S.A., Chemist.
1884. Eastick, C. E., 7, King Edward Street, Whitechapel, E., Sugar Works Manager.
- O.M. Eastick, J. J., Millaquin Refinery, Bundaberg, Queensland, Sugar Works Manager.
1890. Eastlake, A. W., Greenwood House, Grove Road, Clapham Park, S.W., Petroleum Works Manager.
1891. Eastwick, Jos. H., 2216, North 51st Street, Philadelphia, Pa., U.S.A., Chemist.
1885. Eastwood, Edw., 7, Bolton Road, Port Sunlight, Birkenhead, Soapmaker.
1902. Eastwood, Robert F., 128, Derby Road, Widnes, Chemist.
1903. Eaton, Edward N., 1628-315, Dearborn Street, Chicago, Ill., U.S.A., Chemist.
1898. Eavenson, Alban, 2013, Vine Street, Philadelphia, Pa., U.S.A., Soap Works Chemist.
1902. Eckel, Edwin Clarence, U.S. Geological Survey, Washington, D.C., U.S.A., Geologist.
1892. Eddy, Harrison P., Sewage Purification Works, Worcester, Mass., U.S.A., Superintendent.
1901. Eddy, W. Clifton, Owosso, Mich., U.S.A., Superintendent.
1894. Ede, Henry E., c/o Copaque Copper Sulphate Co., Ltd., (Journals) Iquique, Chile; (subscriptions) 101, Leadenhall Street, London, E.C., Chemist.
1885. Edge, Anthony, 79, Milton Street, Readville, Mass., U.S.A., Chemist.
1900. Edgerley, Daniel W., Chilton Paint Co., 63, Cortlandt Street, New York City, U.S.A., Chemist.
1902. Edison, Thos. Alva, Edison Laboratory, Orange, N.J., U.S.A., Inventor and Manufacturer.
1902. Edwards, H. Seaton, 19, Park Road, Port Sunlight, Cheshire, Analyst.
1903. Edwards, R. S., Rockland-Rockport Lime Co., Rockland, Maine, U.S.A., Chemist.
1885. Ehrenfeld, Prof. Chas. H., York Collegiate Institute, York, Pa., U.S.A., Professor of Chemistry.
1896. Ehrhardt, Ernest F., Badische Anilin und Soda Fabrik, Ludwigshafen a Rhein, Germany, Research Chemist.
1895. Ekenberg, Dr. M., Stockholm, Sweden, Technical Chemist.
1885. Elborough, T., 59, Mark Lane, London, E.C., Manure Manufacturer.
1901. Elkan, Leo A., 594, Dearborne Avenue, Chicago, Ill., U.S.A., Tanner.
1901. Elkins, Arthur W., 520, Park Avenue, East Orange, N.J., U.S.A., Civil Engineer.

1884. Elliott, Dr. A. H., Consolidated Gas Co., 4, Irving Place, New York City, U.S.A., Chemist.
1896. Elliott, Dr. J. F., c/o Grimwade and Co., 6, Trinity Square, E.C.; and (Journals), O'Connell Street, Sydney, N.S.W., Manufacturing Chemist.
1904. Elliott, Philip, c/o Lanosap, Ltd., Marion Street Works, Bradford, Yorks, Works Chemist.
1902. Elliott, Victor G., Chemical Works, Rozelle, Sydney, N.S.W., Australia, Manufacturing Chemist.
1903. Ellis, A. W., Public Analyst's Laboratory, Town Hall, Southwark, S.E., Analytical Chemist.
1903. Ellis, Chas. E., Iowa State College, Ames, Iowa, U.S.A., Agricultural Chemist.
1885. Ellis, C. J., Almorah Villa, Milngavie, near Glasgow, Technical Chemist.
1893. Ellis, E. Victor, 7, Hillside Crescent, Edinburgh, Analytical Chemist.
1902. Ellis, Frederick R., 15, Shadwell Road, Bishopston, Bristol, Chemist and Druggist.
1894. Ellis, G. Beloe, 70, Chancery Lane, London, W.C., Patent Agent.
- O.M. Ellis, H., 112, Regent Road, Leicester, Chemical Merchant.
1891. Ellis, Prof. W. Hodgson, School of Practical Science, Toronto, Ont., Canada, Professor of Applied Chemistry.
1891. Ellison, Henry, Northfield, Cleckheaton, Yorks., Manufacturing Chemist.
1901. Ellms, Jos. W., Laboratory, East Court and Martin Street, Cincinnati, Ohio, U.S.A., Chemist.
- O.M. Elmore, A. S., 4, Broad Street Place, London, E.C., Electro-Metallurgist.
1904. Elson, J. Hugh, Monroe Drug Co., Unionville, Mo., U.S.A., General Manager.
1885. Elworthy, H. S., Battlefield Road, St. Albans, Herts, Sugar Works Chemist.
1901. Emerson, Dr. W. H., Georgia School of Technology, Atlanta, Ga., U.S.A., Professor of Chemistry.
1902. Emery, Arthur L., 83-85, New Montgomery Street, San Francisco, Cal., U.S.A., Chemical Engineer.
1905. Emery, Delevan, Bradford, Pa., U.S.A., Oil Refiner.
1899. Emery, E. G., c/o Pacific Coast Oil Co., Point Richmond, Cal., U.S.A., Chemist.
- O.M. Endemann, Dr. H., 23, William Street, New York City, U.S.A., Analytical Chemist.
1897. Enequist, Erik W., North 8th and Roebling Streets, Brooklyn, N.Y., U.S.A., Chemist.
1894. Enequist, John, 267, Rutland Road, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1904. Englehard, Charles, 41, Cortlandt Street, New York City, U.S.A., Platinum Importer.
1895. English, Frank H., 217, Strone Road, Manor Park, E., Analytical Chemist.
1899. Enright, Bernard, Fordwick, Augusta Co., Va., U.S.A., Chemist (Virginia Portland Cement Co.).
1905. Epstein, Dr. Wilhelm, 98, Southhill Park, Hampstead Heath, N.W., Chemist.
1904. Erdmann, Prof. Dr. H., Bismarck Strasse 12 II., Charlottenburg, Berlin, Professor of Inorganic Chemistry.
1902. Erhart, Wm. H., 11, Bartlett Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1904. Ermen, Walter F. A., 10, Marsden Street, Manchester, Analytical Chemist.
1888. Erskine, J. K., New Kleinfontein Co., P.O. Benoni, Transvaal, Analytical Chemist.
1897. Escher, Paul, 735, West 64th Street, Chicago, Ill., U.S.A., Chemist.
1884. Esilman, A., 25, Roe Lane, Southport, Lancashire, Analytical Chemist.
- O.M. Estcourt, C., 5, Seymour Grove, Old Trafford, Manchester, Consulting Chemist.
1905. Etheridge, Arthur T., c/o Kynoch, Ltd., Kynochtown, Essex, Chief Chemist.
1903. Euler, C. G., 18-20, Platt Street, New York City, U.S.A., Agent for Essential Oils.
1883. Evans, Enoch, 660, Coventry Road, Birmingham, Accountant.
1898. Evans, Ernest D., The Western Tanning Co., Bedminster, Bristol, Tanner.
1903. Evans, F. Sparke, Avonside Tannery, Bristol, Tanner.
1904. Evans, James Rittenhouse, 87, 4th St., Troy, N.Y., U.S.A., Assistant in Chemistry.
1905. Evans, John, 67, Surrey Street, Sheffield, Analytical Chemist.
1883. Evans, Sir John, K.C.B., F.R.S., Nash Mills, Hemel Hempstead, Herts, Paper Maker.
1889. Evans, R. E., 3, Glencoe, Stratford-on-Avon, Brewing Chemist.
1896. Evans, Dr. Thos., University of Cincinnati, Ohio, U.S.A., Instructor in Technical Chemistry.
1903. Evans, Wm. J., 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.
1898. Evans, Wm. Percival, Canterbury College, Christchurch, New Zealand, Professor of Chemistry.
1904. Everitt, Walter, 83, The Grove, Ealing, W., Analyst.
- O.M. Evershed, F., c/o Clarke, Nickolls and Coombs, Hackney Wick, N.E., Chemist.
1903. Evershed, John, Union Oil Mills, Copenhagen Place, Limehouse, E., Chemist.
1894. Ewan, Dr. Thos., 57, Montgomerie Street, Kirkcree, Glasgow, Chemist (Aluminium Co.).
1904. Ewing, Dr. A. Ramsay, Rose Cottage, Lennoxtown, Stirlingshire, Technical Chemist.
1892. Exley, Arthur, Braemore, Vesper Road, Kirkstall, Leeds, Tanner.

## F

1898. Fadé Louis, c/o Dr. F. Stockhausen, Deutsche Gold und Silber Scheide-Anstalt, Frankfurt a/M., Germany, Chemist and Director.
- O.M. Fahlberg, Dr. C., Saccharin Fabrik, Salbke-Westerhüsen a/Elbe, Germany, Manufacturing Chemist.
1902. Fahrig, Dr. Ernst, 3642, York Road, Philadelphia, Pa., U.S.A., Chief of Laboratories (Commercial Museum).
1902. Faill, Jas., 51, Partickhill Road, Glasgow, Technical Chemist.
1902. Fairchild, Benj. T., P.O. Box 1120, New York City, U.S.A., Manufacturing Chemist.
1903. Fairhall, E. J., (Journals) c/o The Powell Wood Process Syndicate, Ltd., Carpenters Road, Stratford, E., and (Subscriptions) 29, Winsham Grove, Clapham Common, S.W., Chemist.
- O.M. Fairley, T., 17, East Parade, and (Communications) 8, Newton Grove, Leeds, Analytical Chemist.
- O.M. Fairlie, H. C., Camelon Chemical Works, Falkirk, N.B., Chemical Manufacturer.
1901. Fairlie, Jas., Camelon Chemical Works, Falkirk, N.B., Manufacturing Chemist.
1894. Fairweather, Wallace, 62, St. Vincent Street, Glasgow, Patent Agent.
1902. Fairweather, Wallace C., 65-66, Chancery Lane, W.C., Engineer.
1898. Falding, F. J., 52, Broadway, New York City, U.S.A., Chemical Engineer.
1904. Falk, Milton J., 16 East 81st Street, New York City, U.S.A., Teacher of Chemistry.
1891. Fallon, J. H. M., Boulhaf-le-Dyr, Ligne de Tebessa, Algeria, Fertiliser Expert.
1897. Farmer, John E., Beddington Farm, near Croydon, Assistant Manager (Sewage Works).
- O.M. Farrant, N., c/o J. Nicholson and Sons, Chemical Works, Hunslet, Leeds, Chemist.
1897. Farrell, Frank J., 24, Primrose Mansions, Prince of Wales Road, S.W., Analytical Chemist.
- O.M. Farries, T., 12, Coleman Street, London, E.C., Manufacturing Chemist.
- O.M. Farrington, T., 5, Summerhill Terrace, Cork, Ireland, Chemical Engineer.
1902. Fasnacht, E. A., The Hollies, Clayton Bridge, Manchester, Technical Chemist.
- O.M. Faulkner, F., The Laboratory, 65, Bath Row, Birmingham, Consulting Brewer's Chemist.
1891. Fawcett, Jas. H., c/o Bank of Australasia, 4, Threadneedle Street, London, E.C., Metallurgist.



1884. Fawsitt, C. A., Atlas Chemical Works, East Nelson Street, Glasgow, Chemical Manufacturer.
1903. Fawsitt, Dr. Chas. E., Chemical Department, The University, Glasgow, Assistant in Chemistry.
1903. Feilmann, Dr. M. E., c/o John Feilmann & Co., 11, Short Hill, Nottingham, Chemist.
1892. Feld, Walther, Hönningen a Rhein, Germany, Chemical Works Director.
1897. Felix, Dr. Lorenz, 53, Rue Petit, St. Denis s Seine, France, Technical Chemist.
1899. Ferguson, Geo., Gleniffer Soap Works, Paisley N.B., Soap Manufacturer.
1900. Ferguson, Geo. A., College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Professor of Analytical Chemistry.
1896. Ferguson, J. Hart, Loch Katrine Distillery, Camlachie, Glasgow, Distillery Manager.
- O.M. Ferguson, Prof. J., The University, Glasgow, Professor of Chemistry.
1902. Fergusson, Donald M., c/o Acadia Sugar Refining Co., Halifax, N.S., Canada, Analytical Chemist.
1883. Fergusson, H., Prince Regent's Wharf, Victoria Docks, E., Technical Chemist.
1905. Fernberger, Harry M., c/o Acker Process Co., Niagara Falls, N.Y., U.S.A., Chemist.
1901. Ferris, Wm. S., c/o Miami Mining Co., Concord, N.C., U.S.A., Chemist.
1905. Fiebigler, Peter, 530, Canal Street, New York City, U.S.A., Colour Chemist.
1893. Fiebing, John H., 644, 28th Street, Milwaukee, Wis., U.S.A., Leather Trade Chemist.
1885. Field, E. W., Cloud House, Sandiaca, near Nottingham, Brewer.
1887. Field, S. S., 3, Glenlue Road, Blackheath, S.E., Manufacturing Chemist.
1891. Field, Wm. Eddington, 65, Sutherland Road, Armadale, Melbourne Victoria, Chemist.
1884. Filecock, P., Sunny Bank, Prestbury Road, Macclesfield, Analytical Chemist.
1900. Fillis, Frank, 43, Romilly Road, Barry, Glam., Cement Works Chemist.
1902. Finch, Chas. Allt., 130, King Street, Sydney, N.S.W., Australia, Analytical and Pharmaceutical Chemist.
1904. Finch, Martin, L., Vitriol and Chemical Works, Cattedown, Plymouth, Chairman of Directors.
1899. Fingland, Jno. J., Minas de Aznalcollar, Prov. de Sevilla, Spain, Analytical Chemist.
1899. Finley, Norval H., 6638, Denry Street, Sta. A. Pittsburg, Pa., U.S.A., Chemist.
1904. Finn, Cornelius P., Farnley Iron Works, Farnley, Leeds, Technical Chemist.
1903. Fischer, Dr. Carl, 213-215, Water Street, New York City, U.S.A., Chemist.
1903. Fish, Chas. C. R., 10, Park Square, Boston, Mass., U.S.A., Chemist.
1900. Fisher, Henry, 57, East 83rd Street, New York City, U.S.A., Teacher of Chemistry.
- O.M. Fisher, W. W., 5, St. Margaret's Road, Oxford, Chemical Lecturer.
1895. Fison, Jno., Messrs. Jas. Fison and Sons, Thetford, Norfolk, Chemical Manufacturer.
1904. Fitch, A. J., 19, Grange Road, Canonbury, N., Brewer's Chemist.
- O.M. Fitzbrown, G., Ditton Copper Works, Widnes, Metallurgist.
1897. Fitzgerald, Francis A. J., Fitzgerald and Bennie Laboratories, P.O. Box 118, Niagara Falls, N.Y., U.S.A., Chemical Engineer.
1902. FitzGibbon, Thos., 14A, Kenyon Street, Fulham, S.W., Analytical Chemist.
1900. Fitz-Randolph, R. B., State Laboratory of Hygiene, Trenton, N.J., U.S.A., Bacteriologist and Chemist.
1896. Flammer, E., Heilbronn a N., Germany, Manufacturing Chemist.
1892. Flanagan, Chas. A., 54, Gorse Street, Stretford, Manchester, Manufacturing Chemist.
1901. Flavell, Jos. W., Toronto Technical School, College Street, Toronto, Canada, Chemist.
1892. Fleming, J. Arnold, Britannia Pottery, 136, Glebe Street, Glasgow, Potter.
1903. Fleming, Jno. A., Vulcan Copper Works, 465, East Front Street, Cincinnati, Ohio, U.S.A., Engineer.
- O.M. Fletcher, A. E., Combe Lea, Dorking, Surrey, Ex-Chief Inspector Alkali, &c., Works.
1893. Fletcher, E. Morley, 3, Woodhouse Cliff, Leeds, Alkali Works Inspector.
- O.M. Fletcher, F. W., Beauchamp Lodge, Enfield, Manufacturing Chemist.
1891. Fletcher, R. Jacques, North Geelong, Victoria, Manufacturing Chemist.
1904. Fletcher, Wm. E., c/o Forcite Powder Co., Landing, N.J., U.S.A., Chemist.
1901. Fleurent, Dr. E., 5, Villa du Chateau, Bois Colombes (Seine) France, Professor of Chemistry.
1899. Foelt, Louis, 105, E. Hanover Street, Trenton, N.J., U.S.A., Civil Engineer.
1890. Foden, Alfred, 19, Lancaster Avenue, Sefton Park, Liverpool, Metallurgical Chemist.
1900. Foersterling, Dr. H., c/o Roessler Hasslachier Chem. Co., Perth Amboy, N.J., U.S.A., Chemist.
1900. Fogetti, Lucien, 3722, Lake Avenue, Chicago, Ill., U.S.A., Chemist.
1895. Fogg, Chas. A., Graythorne, Albert Road, Bolton-le-Moors, Lecturer on Chemistry.
1901. Folsom, Herbert A., 254, Knight Street, Providence, R.I., U.S.A., Textile Chemist.
1900. Forbes, Eli, Lancaster Mills, Clinton, Mass., U.S.A., Chemist.
1895. Forbes, Paul R., 37, Avenue de l'Alma, Paris, Chemist and Assayer.
1893. Ford, J. B., jun., Michigan Alkali Co., Wyandotte, Mich., U.S.A., Secretary and Treasurer.
1889. Ford, Jno. S., Abbey Brewery, Edinburgh, Analyst.
1899. Forel, Geo., 18, Rue Hohenlohe, Strassburg, Alsace, Germany, Chemist.
1885. Formoy, J. Arthur, Chestham, Grange Road, Sutton, Surrey, Oil Expert.
1904. Forrest, Chas. N., New York Testing Laboratory, Long Island City, N.Y., U.S.A., Chemist.
1898. Forrest, J. Kerr, 97, Jelfcott Street, Melbourne, Victoria, Australia, Manufacturing Chemist.
1890. Forrester, A. M., c/o Laidlaw, Mackill and Co., 3400-3500, Williamsburg Avenue, Richmond, Va., U.S.A., Analytical Chemist.
1902. Forstal, Alf. E., 58, William Street, New York City, U.S.A., Consulting Gas Engineer.
1902. Forster, Ferdinand E. P., c/o Messrs. Bass and Co., 19, Guild Street, Burton-on-Trent, Chemist.
1901. Forster, Wiss E. L. B., King's College, Strand, London, W.C., Analyst.
1899. Forster, Dr. M. O., F.R.S., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.
1884. Forster, Ralph C., c/o Messrs. Bessler, Waechter, and Co., 18 and 19, Fenchurch Street, London, E.C., Chemical Merchant.
1884. Forth, Henry, Meadowcroft, Marple, Cheshire, Drysalter.
1895. Foster, Jas., 42, Herriet Street, Pollokshields, Glasgow, Engineer.
- O.M. Foster, R. Le Neve, Harrytown Hall, Bredbury, near Stockport, Manufacturing Chemist.
1888. Foster, Wm., St. Martin's Terrace, Newton Park, Leeds, Manufacturing Chemist.
1903. Fotheringham, John, Naisori Mill, Rewa River, Fiji, Chemist.
1904. Foust, Thomas B., c/o Bon Air C. & I. Co., Allen's Creek, Tenn., U.S.A., Chemist.
1891. Fowler, Dr. Gilbert J., Broad Oak, Urmston, near Manchester, Superintendent and Chemist (Manchester Corporation Sewage Works).
1898. Fowler, Theo. V., P.O. Box 168, Buffalo, N.Y., U.S.A., Chemical Works Manager.
1896. Fox, A. Stanley, 23, South Road, Faversham, Kent, Chemist (Cotton Powder Co., Ltd.).
1898. Fox, Jno., 42, Highfield Road, Rock Ferry, Cheshire, Analyst.
1888. Fox, J. Wesley, 7, Bushell Street, Wapping, E., Salt Merchant.
- O.M. Fox, T., jun., Tonedale, Wellington, Somerset, Wool Manufacturer.

1901. France, G. Herbert, Woodroyd Dyeworks, Low Moor, Bradford, Yorks., Dyer.
1899. Franchot, Stanislaus P., c/o National Electrolytic Co., Niagara Falls, N.Y., U.S.A., Chemist.
1885. Francis, Edwld., Park Ravine, Nottingham, Chemical Lecturer.
- O.M. Francis, E. G., 29, Matheson Road, West Kensington, W., Glucose Works Manager.
- O.M. Francis, G. B., 38, Southwark Street, London, S.E., Wholesale Druggist.
- O.M. Francis, W. H., Cleveland, Thornton Road, Clapham Park, S.W., Wholesale Druggist.
1894. Franck, Jerome W., 29, Broadway, New York City, U.S.A., Chemist.
1903. Francksen, Dr. Aug., 4803, Garden Street, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.
1886. Frankenburg, Isidor, Greengate Rubber Works, Salford, Manchester, India-rubber Manufacturer.
1895. Frankforter, Dr. G. B., University of Minnesota, Minneapolis, Minn., U.S.A., Prof. of Chemistry.
1904. Frankl, A., Clotilde Chemical Works, Nagy Boeskö, Hungary, Chief Manager.
- O.M. Frankland, H., Streonshalh, The Crescent, Linthorpe, Middlesbro', Analytical Chemist.
- O.M. Frankland, Prof. P. F., F.R.S., The University, Birmingham, Professor of Chemistry.
1902. Franklin, Chas. R., Gibbstown, Gloucester Co., N.J., U.S.A., Analytical Chemist.
1904. Frasch, George B., 543, Morris Avenue, Elizabeth, N.J., U.S.A., Chemist.
1901. Frasch, Hans A., c/o F. T. Falding, 52, Broadway, New York City, U.S.A., Manager.
1900. Frasch, Herman, 681, Euclid Avenue, Cleveland, Ohio, U.S.A., Oil Refiner.
1904. Fraser, Jas. D., 8, Percy Street, Ibrox, Glasgow, Chemist.
1902. Fraser, R. A., 519, Produce Exchange, Manchester, Fellmonger.
1886. Fraser, W. J., 121, Adelaide Road, London, N.W., Mechanical Engineer.
1902. Frederick, Geo. E., jun., P.O. Box 762, New York City, U.S.A., Chemical Merchant.
1903. Free, R. E., The Elms, Mistley, Essex, Maltster.
1885. Freear, H. M., Hardwick Road, Woburn Sands, Beds., Analytical Chemist.
1903. Freeman, L. E., Room 503, 26, Broadway, New York City, U.S.A., Technical Chemist.
1899. French, Alf., St. Bartholomew's Hospital, Rochester, Kent, Dispenser.
1900. French, Thos., 1, Kelvinside Terrace West, Glasgow, Chemist.
1902. Frenzel, Arthur B., 1540, Sherman Avenue, Denver, Colo., U.S.A., Consulting Engineer.
1903. Frerichs, F. W., c/o Merck and Co., St. Louis, Mo., U.S.A., Manufacturing Chemist.
1888. Frew, Dr. Wm., King James' Place, Perth, N.B., Brewing Chemist.
1903. Frew, John, Dunrod Cottage, Hamilton, N.B., Chemist.
1886. Fries, Dr. Harold H., 92, Reade Street, New York City, U.S.A., Chemical Manufacturer.
1902. Fries, Jno. W., Winston, Salem, N.C., U.S.A., Cotton Manufacturer.
- O.M. Friswell, R. J., 43-45, Gt. Tower Street, London, E.C., Consulting Chemist.
1898. Frith, J. Mason, Linden Lodge, Runcorn, Cheshire, Lime Burner.
1899. Fritzsche, Karl, c/o Schimmel and Co., Miltitz, near Leipzig, Germany, Manufacturer of Essential Oils.
1890. Frost, Dr. Howard V., 3958, Drexel Boulevard, Chicago, Ill., U.S.A., Professor of Chemistry.
1884. Frost, Joe, Storths Mill, Moldgreen, Huddersfield, Manufacturing Chemist.
- O.M. Fryer, Dr. A. C., 13, Eaton Crescent, Clifton, Bristol, Alkali Works Inspector.
1904. Fryer, Percival J., 27, Minster Road, West Hampstead, N.W., Analyst.
1903. Fudge, T., 397, Avenue E., Bayonne, N.J., U.S.A., Chemist.
1889. Fuerst, Jos. F., 17, Philpot Lane, London, E.C., Chemical and Oil Merchant.

1895. Fuerst, W. F., 2, Stone Street, New York City, U.S.A., Chemical Merchant.
1894. Fuller, Chas. J. P., 79, Brownlow Road, Horwich, near Bolton, Analytical Chemist.
1902. Fuller, Henry C., 30, Irving Street, West Medford, Mass., U.S.A., Analytical Chemist.
1899. Fuller, Robt. F., Neston Park, Corsham, Wilts., Rubber Manufacturer.
1899. Fuller, W. M., c/o Morris and Griffin, Ltd., Maindee, Newport, Mon., Chemical Manufacturer.
- O.M. Fuller, Wm., 8, Orchard Road, Blackheath, S.E., Chemist.
1898. Fulmer, Elton, Pullman, Wash., U.S.A., Professor of Chemistry.
1896. Fulton-Smith, J., 20, Bold Street, Warrington, Brewer.
1885. Fyfe, Jno., 7, West George Street, Glasgow, Oil Works Director.

## G

1898. Gabain, Chas. E., Messrs. Gabain Frères, Havre, France, Manufacturer of Edible Fats.
- O.M. Gabbett, E. R., 64, Vanbrugh Road, Blackheath, S.E.; (Journals) Prince Regent's Wharf, Silvertown, E., Chemical Engineer.
1904. Gadd, Henry Wippell, 100, Fore Street, Exeter, Analytical Chemist.
1890. Gajjar, T. K., Techno-chemical Laboratory, Girgaum, Bombay, India, Consulting Chemist.
1884. Gall, Henry, c/o Soc. d'Electro-Chimie, 2, Rue Blanche, Place de la Trinité, Paris, Technical Chemist.
1897. Galletly, J. C., 101, Armadale Street, Dennistoun, Glasgow, Assistant to Professor of Metallurgy.
1905. Gallinagh, James P., Electricity Works, Limerick, Ireland, Borough Electrical Engineer.
1901. Gullivan, Frank B., 113, 3rd Street, South Boston, Mass., U.S.A., Chemist.
1903. Gallum, Albert F., Milwaukee, Wis., U.S.A., Tanner.
1901. Gallup, W. Arthur, Arnold Printworks, North Adams, Mass., U.S.A., Printer.
1901. Galpin, Harry T., 55, West 57th Street, New York City, U.S.A., Chemist.
1891. Galt, Hugh Allen, Columbia Chemical Co., Barberton, Ohio, U.S.A., Works Manager.
- O.M. Gamble, Sir David, Bart., Windlehurst, St. Helens, Chemical Manufacturer.
1887. Gamble, Jas. N., The Laboratory, Procter and Gamble Co., Ivorydale, Ohio, U.S.A., Soap Manufacturer and Oil Refiner.
- O.M. Gamble, J. C., Haresfinch, St. Helens, Lanes., Chemical Manufacturer.
1894. Gane, Eustace H., 95, Fulton Street, New York City, U.S.A., Pharmaceutical Chemist.
1888. Gans, Adolf, Farbenfabrik von L. Cassella & Co., Frankfurt a/Main, Germany, Dye Works Manager.
1901. Gansser, Dr. A., c/o Messrs. Lepetit, Dollfus and Gansser, Garesio-Ponte (Provincia di Cuneo), Italy, Chemical Engineer.
1896. Gardair, Aimé, 51, Rue St. Ferréol, Marseilles, France, Director of Chemical Co.
1893. Gardiner, H. J., 90, Cannon Street, London, E.C., Chemical Manufacturer.
1891. Gardner, Walter M., Municipal Technical College, Bradford, Director of Chemistry and Dyeing Department.
1897. Garfield, Jos., Thackley, Bradford, Yorks., Civil Engineer.
1888. Garibaldi, Joachim A., 21, Church Place, Gibraltar, Chemist.
1905. Garle, John L., Sanctuary House, Tothill Street, Westminster, Consulting Chemist.
1904. Garnar, G. Lester, Monticello, Sullivan Co., N.Y., U.S.A., Superintendent of Leather Works.
1904. Garnaas, John C., 69, Barclay Street, New York City, U.S.A., Dyestuff Merchant.



1890. Garrett, F. C., Armstrong College, Newcastle-on-Tyne, Teacher of Science.
1900. Garrigues, W. E., 66, Beaver Street, New York City, U.S.A., Chemical Engineer.
1901. Garroway, Jno., 58, Buchanan Street, Glasgow, Manufacturing Chemist.
1899. Garroway, Wm., 694, Duke Street, Glasgow, Chemical Manufacturer.
1898. Garry, H. Stanley, 66, Mapperley Road, Nottingham, Manure Works Manager.
- O.M. Garton, R., Messrs. Hill, Garton, & Co., Southampton Wharf, Batterssea, S.W., Glicose Manufacturer.
1893. Garton, Rd. S., Woodycrest Avenue, Highbridge, New York City, U.S.A., Chemist.
1886. Gascoyne, Dr. W. J., 2741, North Charles Street, Baltimore, Md., U.S.A., Analytical Chemist.
- O.M. Gaskell, Holbrook, Woolton Wood, Woolton, near Liverpool, Alkali Manufacturer.
- O.M. Gaskell, Holbrook, jun., Erindale, Frodsham, Cheshire, Alkali Manufacturer.
1902. Gaskell, Holbrook III., Erindale, Frodsham, Cheshire, Engineer.
1897. Gaster, Leon, 32, Victoria Street, Westminster, S.W., Electrical Engineer.
1895. Gate, Tom Erskine, (Journals) The Santubong Cutch and Tanning Extract Co., Ltd., Santubong, Sarawak, Borneo, and (subscriptions) Calder House, Dewsbury, Yorks., Manufacturing Chemist.
- O.M. Gatheral, Geo., 174, Soho Hill, Handsworth, Birmingham.
1903. Gaylord, Wallace K., Throop Polytechnic Institute, Pasadena, Cal., U.S.A., Professor of Chemistry.
1904. Gazdar, J. J., 5, Wroxham Mansions, 38, Canfield Gardens, South Hampstead, N.W., and (Journals) Watson's Hotel Annexe, Bombay, India, Barrister-at-Law.
1905. Geisenheimer, Albert, P.O. Box 994, New York City, U.S.A., Dyestuff Merchant.
1891. Geisler, Dr. Jos. F., New York Mercantile Exchange Building, 6, Harrison St., New York City, U.S.A., Consulting Chemist.
1901. Gemmell, G. H., 4, Lindsay Place, George IV. Bridge, Edinburgh, Analytical Chemist.
1901. Gent, Percy W., 789, Highland Avenue, Forest Hill, Newark, N.J., U.S.A., Chemist.
1897. Gent, Wm. T., Springfield, Misterton, near Gainsboro', Metallurgical Chemist.
1896. Genth, Fred. A., jun., 222, Walnut Street, Philadelphia, Pa., U.S.A., Chemist.
1902. George, Wm. K., c/o Standard Silver Co., Ltd., 35, Hayter Street, Toronto, Ont., Canada, Manufacturer.
1894. Georgi, Carl, 77, John Street, New York City, U.S.A., Aniline Colour Importer.
1903. Georgii, Max, 606, F Street, N.W., Washington, D.C., U.S.A., Patent Attorney.
1904. Gerard, Thos. A., 122, Foxhill Road, Nottingham, Soap Manufacturer.
- O.M. Gerland, Dr. B. W., 105, Plantation Street, Acerrington, Consulting Chemist.
1903. Ghose, Anukul, 42, Shambazar Street, Calcutta, India, Analyst.
1891. Gibb, Thos., Wilford, Dornoch Terrace, Brisbane, Queensland, Metallurgist.
1903. Gibbings, Wm., 11, Howard Drive, Grassendale, Liverpool, Works Manager.
- O.M. Gibbins, H. B., 177, Redland Road, Bristol.
1902. Gibbon, Edw., Ynys House, Clydach, R.S.O., Glam., Works Chemist.
1904. Gibbs, A. E., Wyandotte, Mich., U.S.A., Manufacturing Chemist.
1883. Gibbs, D. Cecil, Soap Manufacturer.
- O.M. Gibbs, Wm. P., Fabriken, Hjerpen, Jemtland, Sweden, Analytical Chemist.
1893. Gibbs, W. T., Buckingham, Prov. Quebec, Canada, Manufacturing Chemist.
- O.M. Gibson, Dr. J., 20, George Square, Edinburgh, Chemical Lecturer.
- O.M. Gibson, J. M., c/o Buckley Brick and Tile Co., Buckley, via Chester Brick and Tile Manufacturer.
1905. Gibson, John, Victorian Portland Cement Works, Burnley Street North, Richmond, Vic., Australia, Manager.
1905. Gibson, Wm. F., 60, Parrock Street, Gravesend, Kent, Works Chemist.
1904. Giese, Otto E., 4, Cedar Street, Manhattan, New York City, U.S.A., Importer.
1899. Gifford, Wm. E., 408, New Jersey Railroad Avenue, Newark, N.J., U.S.A., Chemist.
1892. Gilbard, T. Francis H., 245, Dalston Lane, Hackney, N.E., Analytical Chemist.
1905. Gilbertson, Isaac H., 5, Broad Street, Rhodes, near Middleton, Lancs., Calico Printer.
1903. Gilby, Joseph W., c/o Brotherton and Co., Ltd., Haigh Park Chemical Works, Stourton, Leeds, Works Chemist.
- O.M. Gilchrist, P. C., F.R.S., Metallurgist.
1884. Gilchrist, Peter S., Charlotte, N.C., U.S.A., Chemical Engineer.
1900. Gildersleeve, W. H., Middleboro', Ky., U.S.A., Chemist.
- O.M. Giles, W. B., The Grange, Leyton, Essex, Chemical Manufacturer.
1886. Gill, Dr. Aug. H., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Assistant Professor of Gas Analysis.
1900. Gill, J. Arthur, Pennsylvania, Lower Green Road, Rusthall, Tunbridge Wells, Analyst.
1901. Gill, Wm. S., c/o Farquhar and Gill, North of Scotland Colour Works, Aberdeen, Colour and Varnish Manufacturer.
1903. Gillean, R. Hampson, c/o General Chemical Co., Bayonne, N.J., U.S.A., Chemist.
1901. Gilles, Wm. S., Bradford Street, Bocking, near Braintree, Essex, Technical Chemist.
1903. Gillett, Wm. Lowry, Hotel San Remo, Central Park West and 75th Street, New York City, U.S.A., Chemical Engineer.
1905. Gilliland, Elijah P., 79, Highland Avenue, Salem, Mass., U.S.A., Foreman Tanner.
1888. Gillman, Gustave, Ferrocarril de Murcia á Granada, Aguilas, Prov. de Mureia, Spain, Civil Engineer.
1892. Gilmour, J. D., 190, Butterfiggins Road, Glasgow, Chemist.
1891. Gimmingham, Edw. A., 28, Stamford Hill Mansions, Stamford Hill, N., Electrician.
1900. Ginder, Wm. H., c/o American Sheet Steel Co., Vandergrift, Pa., U.S.A., Analytical Chemist.
1904. Ginsburg, Louis, 438, Main Street, New Britain, Conn., U.S.A., Match Manufacturer.
1886. Girdwood, Dr. G. P., 111, University Street, Montreal, Canada, Professor of Chemistry.
1903. Gladding, Thos. S., 55, Fulton Street, New York City, U.S.A., Analytical Chemist.
1886. Glaeser, F. A., Carpenters' Road, Stratford, E., Varnish Manufacturer.
1889. Glaser, Chas., City Hall Annex, North Gay Street, Baltimore, Md., U.S.A., Consulting Chemist.
1889. Glatz, Jos., 485-493, Kent Avenue, Brooklyn, N.Y., U.S.A., Chemical Manufacturer.
1901. Glegg, Robt., 55, Falkner Street, Liverpool, Analytical Chemist.
1894. Glen, Chas., Glengowan Printworks, Caldercruix, N.B., Calico Printer.
1890. Glen, J., jun., Glengowan Printworks, Caldercruix, N.B., Calico Printer.
1900. Glendenning, Arthur, 31, Bright Street, Middlesbrough, Analytical Chemist.
1884. Glendinning, H., Winnington Park, Northwich, Cheshire, Technical Chemist.
1904. Glendinning, T. A., Wellpark Brewery, Glasgow, Brewery Chemist.
1895. Glenn, Wm., Baltimore Chrome Works, 1348, Block Street, Baltimore, Md., U.S.A., Chrome Manufacturer.
1888. Gloag, Robt. F., Grove Hill, Middlesbrough, Secretary.
- O.M. Glover, G. T., 24, Craven Hill Gardens, Lancaster Gate, W., Chemical Works Manager.
1896. Glover, H., East Falls, Schuylkill, Philadelphia, Pa., U.S.A., Chemical Works Superintendent.

- O.M. Glover, W., Rio Tinto Mines, Huelva, Spain, Technical Chemist.
1903. Goetschins, Howard B., Little Ferry, N.J., U.S.A., Chemist.
1896. Goetz, Isidore, 2, Kelfield Gardens, North Kensington, W., Mine Manager.
1898. Golding, Jno., Midland Agricultural and Dairy Institute, Kingston, and (Journals) Ashby Road, Kegworth, Derby, Agricultural Chemist.
- O.M. Goldschmidt, Dr. S. A., 43-51, Sedgwick Street, Brooklyn, N.Y., U.S.A., Chemical Manufacturer.
1897. Goldschmidt, Dr. Guido, Laboratory, II Salmgasse 1, Prag, Austria, Professor in Imperial German University.
1895. Goldsmith, Byron B., 19, East 74th Street, New York City, U.S.A., Vice-President (American Lead Pencil Co.).
1899. Goldsmith, Jno. N., British Nylonite Co., Ltd., Manningtree, Essex, Chemist.
1900. Goodchild, Wm. H., (Journals) Bannie Mine, Sambas, Dutch West Borneo, and (subscriptions) Elmwood Lodge, Long Lane, Finchley, N., Chemist.
1898. Goode, J. Archibald, 16, Crampton Street, London, S.E., Analytical Chemist.
1904. Goodier, Herbert, 16, Hall Royd, Shipley, Bradford, Yorks., Textile Engineer.
1904. Gooding, E. Claude, 1, Beech Villas, Yelverton, R.S.O., Devon, Chemical Student.
1898. Goodrich, Chas. G., Akron, Ohio, U.S.A., Rubber Manufacturer.
1884. Goodwin, C. C., The White House, St. John's Road, Bowdon, Cheshire, Soapmaker.
1894. Goodwin, Dr. W. L., The School of Mining, Kingston, Canada, Professor of Chemistry.
- O.M. Goppelsroeder, Dr. F., Leimenstrasse, 51, Basel, Switzerland, Professor of Chemistry.
1901. Gordon, A. T., c/o Oliver Iron Mining Co., Mount Iron, Minn., U.S.A., Chemist.
1898. Gordon, Colin, Storers' Wharf, Cubitt Town, E., and (Journals) Lynwood, Vanbrugh Hill, Blackheath, S.E., Chemical Engineer.
1884. Gordon, J. G., Queen Anne's Mansions, Westminster, S.W., Steel Manufacturer.
1883. Gore, Dr. G., F.R.S., 20, Easy Row, Birmingham, Metallurgist.
1891. Gorvin, Jno. C., English Crown Spelter Co., Ltd., Swansea, Works Manager.
- O.M. Gossage, F. H., Camp Hill, Woolton, Liverpool, Alkali Manufacturer.
1897. Gossage, W. Winwood, Widnes, Lancashire, Soap Manufacturer.
1904. Gotthelf, August H., Hastings-on-Hudson, N.Y., U.S.A., Chemist.
1890. Goulding, Sir Wm. J., Bart., 25, Eden Quay, Dublin, Manure Manufacturer.
1903. Govers, F. X., 250, Main Street, Owego, Tioga Co., N.Y., U.S.A., Manager and Chemist.
- O.M. Gow, R. J., Ivy Lea, Hough Green, near Widnes, Metallurgical Chemist.
- O.M. Gowland, W., F.R.S., 13, Russell Road, Kensington, W., Assayer and Metallurgist.
1886. Goyder, G. A., 12, Pirie Street, Adelaide, South Australia, Chemist.
1890. Grabfield, Dr. J. P., 4712, Greenwood Avenue, Chicago, Ill., U.S.A., Chemist.
1883. Graesser, R., Cefn, near Ruabon, North Wales, Manufacturing Chemist.
- O.M. Graham, Prof. C., The Reculvers, Hastings, Consulting Chemist.
- O.M. Graham, C. C., Highmoor, Ben Rhydding Road, Ilkley, Yorks., Technical Chemist.
1883. Grandage, H., Bassishaw House, Basinghall Street, London, E.C., Dyer.
1897. Granger, Dr. J. Darnell, 25, All Saints Street, Nottingham, Analytical Chemist.
1900. Granja, Rafael, Ceres Chemical Co., Kingston, N.Y., U.S.A., Chemist.
1903. Grant, Henry C., c/o Grasselli Chemical Co., 63, Wall Street, New York City, U.S.A., Manager.
1896. Graves, Geo. H., c/o General Chemical Co., Bridgeport, Conn., U.S.A., Manufacturing Chemist.
1896. Graves, Walter G., 364, Harkness Avenue, Cleveland, Ohio, U.S.A., Chemist.
1895. Gray, Elisha B., c/o United Oil and Refining Co., Beaumont, Texas, U.S.A., Oil Inspector and Chemist.
1903. Gray, G. Oscar, Iron Gate, Va., U.S.A., Chemist.
1884. Gray, G. Watson, S. Inner Temple, Dale Street, Liverpool, Consulting Chemist and Assayer.
1902. Gray, J. Campbell, Glengoyt, Strines, near Stockport, Printworks Chemist.
1904. Gray, Jas., c/o Langlaagte Estate and G. M. Co., P.O. Box 98, Johannesburg, Transvaal, Chemist.
1886. Gray, Jno., 13, Queen's Road, Rock Ferry, near Birkenhead, Oil Works Chemist.
1902. Gray, John, Port Credit, Ont., Canada, Starch Manufacturer.
1903. Gray, Jno. Lathrop, c/o Tide Water Oil Co., East 22nd Street, Bayonne, N.J., U.S.A., Assistant Superintendent (Paraffin Works).
1896. Gray, Dr. Thos., 204, George Street, Glasgow, Lecturer in Chemistry.
1903. Gray, Wm. S., 76, William Street, New York City, U.S.A., Chemical Merchant.
1901. Greaves, Albert E., c/o P. Spence and Sons, Ltd., Goole Alum Works, Goole, Yorks., Works Chemist.
1891. Greaves, I. A. R., Morton, Gainsborough, Brewer.
1894. Greaves, Wm., Powell Duffryn Steam Coal Co., Aberaman, Aberdare, South Wales, Chemical Engineer and Chemist.
1894. Greeff, R. W., 20, Eastcheap, London, E.C., Chemical Agent.
1890. Green, Alfred H., Oaklands, Lowton, Newton-le-Willows, Lancs., Manufacturing Chemist.
- O.M. Green, Prof. Arthur G., 2, Dartmouth Road, Brondesbury, N.W., and Clothworkers' Department, The University, Leeds, Professor of Dyeing.
1903. Green, G. F. Dudbridge, c/o Davey and Co., Gainsborough Road, Hackney Wick, N.E., Manufacturing Chemist.
- O.M. Green, H., Hayle Mill, Maidstone, Paper Manufacturer.
1896. Green, Jno. Wilberforce, 22, Alwyne Mansions, Wimbledon, Technical Chemist.
- O.M. Green, L., Lower Tovil, Maidstone, Paper Manufacturer.
- O.M. Greenaway, A. J., The Orchard, Chertsey, Surrey, Sub-Editor of Chemical Society's Journal.
1884. Greenhalgh, Jas. Herbert, Whitebirk, Green Monnt, Bury, Lancs., Assistant Manager of Printworks.
- O.M. Greenway, T. J., Chillagoe, North Queensland, Australia, Metallurgist.
1902. Greenwood, Conrad Varley, Green Hill, Colne, Lancs., Cotton Mill Manager.
- O.M. Greenwood, Holmes, Regent House, Hartmann Street, Accrington, Lancashire, Technical Chemist.
1897. Gref, Anthony, 40, Stone Street, New York City, U.S.A., Patent Lawyer.
1905. Greiner, F. M., Ensley, Alabama, U.S.A., Steel Melter.
- O.M. Greville, H. L., 51, Hafton Road, Catford, S.E., Consulting Chemist.
1900. Griffin, Dr. Jno. J., Catholic University of America, Washington, D.C., U.S.A., Professor of Chemistry.
1890. Griffin, Jno. R., 20-26, Sardinia Street, Lincoln's Inn Fields, W.C., Chemical Apparatus Maker.
1886. Griffin, Martin L., Mechanicville, Saratogo Co., N.Y., U.S.A., Consulting Chemist.
- O.M. Griffith, R. W. S., Eyeworth Lodge, Lyndhurst, Hants, Gunpowder Manufacturer.
1902. Griffiths, Manfred E., Fernside, Childer Road, Stowmarket, Suffolk, Explosives Chemist.
1894. Griffiths, Thos., The Cedars, Clapham Common, S.W., Manufacturing Chemist.
1902. Grimwade, Wilfrid R., (Journals) 342, Flinders Lane, Melbourne, Vic., Australia; (subscriptions) c/o Grimwade, Ridley and Co., 6, Trinity Square, London, E.C., Manufacturing Chemist.



O.M. Grimwood, R., 41, Lady Margaret Road, London, N.W., Analytical Chemist.

1900. Grimwood, Robt. G., 17, Dagmar Road, Stroud Green, N., Analytical Chemist.

O.M. Grindley, J., Upper North Street, Poplar, London, E., Tar Distiller.

1905. Grip, August E., 194, Lee Avenue, Brooklyn, N.Y., U.S.A., Chemical Engineer.

1888. Gripper, Harold, Great Central Railway, Gorton, Manchester, Analytical Chemist.

1903. Griswold, Geo. G., Globe Plant, A. S. and R. Co., Denver, Colo., U.S.A., Assistant Superintendent.

1897. Gronemeyer, Herman H., 315, Amesbury Avenue, Cleveland, Ohio, U.S.A., Chemical Superintendent.

1900. Gross, Abraham, 341, Oakland Avenue, Pittsburg, Pa., U.S.A., Technical Chemist.

1904. Gross, Hy. B., Royal Societies Club, St. James Street, London, S.W., Chemical Manufacturer.

O.M. Grossmann, Dr. J., Northern Assurance Buildings, Albert Square, Manchester, Consulting Chemist and Chemical Engineer.

1896. Grosvenor, Wm. M., jun., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Electro-Chemist.

O.M. Groves, C. E., F.R.S., 352, Kennington Road, London, S.E., Chemist (Thames Conservancy).

1903. Grundy, F. Barnes, Victoria Mills, Bredbury, near Stockport, Technical Chemist.

1899. Gudemann, Dr. Edw., 4319, Vincennes Avenue, Chicago, Ill., U.S.A., Chemist.

1902. Guenther, Felix, jun., c/o Crescent Portland Cement Co., Wampun, Pa., U.S.A., Chemist.

1898. Guess, Harry A., c/o Cananea Consolidated Copper Co., Cananea, Sonora, Mexico, Chemist.

1899. Guest, Edw. Graham, 5, Church Hill, Edinburgh, Cereals Chemist.

1903. Guest, Hon. Lionel G., 58, Metcalfe Street, Montreal, Quebec, Canada, Engineer.

1899. Guild, Frank N., University of Arizona, Tucson, Arizona, U.S.A., Professor of Chemistry.

1900. Guitermann, Edw. W., Passaic Printworks, Passaic, N.J., U.S.A., Chemist.

1894. Gulliver, Geo. W., c/o Burt, Boulton, and Haywood, Selzaete, Belgium, Chemist.

1904. Gundlach, Walter, 153, East 79th Street, New York City, U.S.A., Superintendent of Colour Works.

1905. Gundlich, Dr. Charles, c/o Thorium Chemical Co., Maywood, N.J., U.S.A., Technical Chemist.

1903. Gunn, Gilbert, 181, Bury New Road, Summit, Heywood, Lancs., Paper Mill Chemist.

1883. Gunn, W. L., Broad Plain Soap Works, Bristol, Analytical Chemist.

1900. Günther, Chas. E., Liebig's Extract of Meat Co., Ltd., 4, Lloyd's Avenue, London, E.C., Merchant.

1902. Günther, Wm. J. W., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Inspector.

1894. Garney, J. Clare, Fabrica Roma, La Union, Prov. de Murcia, Spain, Analytical Chemist.

1899. Gatcher, Wm., Singapore Oil Mills, Singapore, S.S., Superintendent Engineer.

1903. Guthrie, Alan, c/o Cooper, Allen and Co., Cawnpore, India, Leather Chemist.

1903. Guthrie, Alex., The Cottage, Bocking, Braintree, Essex, Manager.

1892. Guthrie, John, Trentham Street, Dewsbury Road, Leeds, Chemical Works Manager.

1901. Guthrie, John M., 199, Ferry Road, Leith, N.B., Analytical Chemist.

1903. Guttman, Dr. Leo F., 18, Aberdare Gardens, West Hampstead, N.W.; and (Journals) University College, Gower Street, W.C., Research Chemist.

1892. Guttman, Oscar, 12, Mark Lane, London, E.C., Consulting Chemical Engineer, M.Inst.C.E.

1904. Gyr, Dr. K. H., c/o Messrs. Joseph Fison and Co., Ltd., Ipswich, Analytical Chemist.

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1902. Haas, Herbert, c/o Great Western Gold Co., Redding, Cal., U.S.A., Chemist and Metallurgist.

O.M. Habirshaw, W. M., Glenwood Works, Yonkers, N.Y., U.S.A., Chemical Engineer.

1904. Hacking, D. H., Henfield House, Clayton-le Moors, near Accrington, Lancs., Soap Manufacturer.

1883. Hacking, W. H., The Grange, Clayton-le Moors, near Accrington.

1900. Haddock, Arthur G., c/o Castner-Kellner Alkali Co., Ltd., Weston Point, Runcorn, Cheshire, Technical Chemist.

1898. Haddow, Geo., Parkview, Redding, Pohnont Station, N.B., Chemist.

1887. Hadfield, R. A., Newhall Road, Attercliffe, Sheffield, Steel Founder.

1884. Hadkinson, F., Pamphala Oil and Soap Works, Mitylene, Mediterranean, Oil Refiner and Soap Manufacturer.

O.M. Hadkinson, R., Smyrna, Asia Minor, Oil Refiner.

1904. Hadley, Geo., 58, Halesowen Street, Blackheath, Staffs., Spelter Works Manager.

1902. Haff, Max M., 77, Gloucester Street, Ottawa, Canada, Chemist.

1887. Haig, Robert, Mechanical Retorts Co., Ltd., Murray Street, Paisley, N.B., Chemical Engineer.

1904. Haigh, B. Wilson, 1, York Street, Barnsley, Yorks., Chemical Engineer.

1896. Haigh, De Laguel, 33, Norwood Avenue, Summit, N.J., U.S.A., Chemist.

1898. Haigh, Frederic, Matteawan, N.Y., U.S.A., Chemist.

1898. Haigh, Percy, c/o Messrs. Bird Bros., Duxford, Cambridge, Analytical Chemist.

1888. Hailes, A. J. de, 15, Red Lion Square, London, W.C., Analytical Chemist.

1889. Haines, Reuben, Haines Street, near Chew Street, Germantown, Philadelphia, Pa., U.S.A., Analytical Chemist.

O.M. Hake, C. N., 423, Flinders Lane, Melbourne, Victoria, Australia, Inspector of Explosives.

1903. Halbert, Thos., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.

1903. Hale, Dr. Frank E., Mount Prospect Laboratory, Flatbush Avenue and Eastern Parkway, Brooklyn, N.Y., U.S.A., Chemist.

1888. Hale, Edw. P., c/o Wakefield and Co., Gatebeck, Kendal, and (communications) Endmoor, near Kendal, Analytical Chemist.

1887. Hall, Allan T., c/o Sissons Bros. and Co., Ltd., Hull, Oil Refiner and Varnish Manufacturer.

1905. Hall, Archibald A., Armstrong College, Newcastle-on-Tyne, Demonstrator in Chemistry.

1886. Hall, Archibald D., 7, Fenchurch Avenue, London, E.C., Analytical Chemist.

1898. Hall, Clarence A., 517, North American Building, Philadelphia, Pa., U.S.A., Chemist.

O.M. Hall, Edgar, Silver Spur, Stanthorpe, Queensland, Australia, Technical Chemist.

1902. Hall, Geo., c/o A. A. Vantine and Co., Froa Iway and 18th Street, New York City, U.S.A., Chemist.

1902. Hall, Henry, c/o Booth and Co., Irk Vale Works, Middleton, Lancashire, Dyer and Finisher.

1893. Hall, Jas. W., Bombay, Baroda and Central India Railway, Sabarmata, near Ahmedabad, India, Linseed Oil Mills Manager.

1885. Hall, Jno. A., Victoria Chemical Works, Victoria, British Columbia, Analytical Chemist.

1900. Hall, Jos. J., 414, Fifth Avenue, Cedar Rapids, Iowa, U.S.A., Chemist.

O.M. Hall, S., East London Soap Works, Bow, London, E., Soap Manufacturer.

1896. Hall, S. Godfrey, East London Soap Works, Bow, E.; (Journals) 19, Aberdeen Park, Highbury, N., Soap Maker.

1886. Haller, Geo., Sussex House, 52, Leadenhall Street, London, E.C., Chemical Merchant.

1893. Haller, H. Lott, 26, Scale Lane, Hull, Analytical Chemist.

1895. Halliwell, Edw., c/o Ribble Joint Committee, 2, Stanley Place, Preston, Chief Inspector.

1901. Hallock, Dr. Albert P., 440, First Avenue, New York City, U.S.A., Chemist.
1892. Hamaguchi, K., Hiro Mura, Arito Gori, Wakayama Ken., Japan, Soy Manufacturer.
1904. Hamblet, Abel Martin, c/o Oxford Paper Co., Rumford Falls, Maine, U.S.A., Chemist.
1897. Hambly, Fred. J., Buckingham, Quebec, Canada, Chemist.
1901. Hambuechen, Carl, c/o Pittsburg Reduction Co., East St. Louis, Ill., U.S.A., Electro-Chemist.
1904. Hamilton, E. H., Anaconda Copper Mining Co., Anaconda, Montana, U.S.A., Asst. Superintendent.
1885. Hamilton, Oswald, Lancaster Cottage, Old Stratford, near Stony Stratford, Chemical Engineer.
1884. Hamilton, Robert, Glengarnock Chemical Co., Ltd., Glengarnock, N.B., Works Manager.
1892. Hamilton, Robt., 62, Tempest Road, Beeston Hill, Leeds, Analytical Chemist.
- O.M. Hammill, M. J., The Gables, St. Helens, Alkali Manufacturer.
1898. Hammersley, W. Stanley, Longjumeau, S. et O., France, Tanner.
1892. Hammond, Geo. W., Yarmouthville, Maine, U.S.A., Paper Co.'s Agent.
1904. Hammond, H. S., Government Laboratory, Kingston, Jamaica, Analyst.
- O.M. Hammond, J., Gas Works, Eastbourne, Sussex, Gas Manager.
1902. Hampson, B. A., "Hampson's Buildings," Smith Street, Durban, Natal, S. Africa, Assayer.
1900. Hampton, F. T., Hill City, Tenn., U.S.A., Civil Engineer.
1900. Hancock, Walter C., 10, Upper Chadwell Street, Myddelton Square, London, E.C., Chemist.
1896. Hand, Daniel, 30, Mount Pleasant Avenue, Newark, N.J., U.S.A., Chemist.
1889. Handy, Jas. O., 325, Water Street, Pittsburg, Pa., U.S.A., Chemist.
1888. Hanks, Abbot A., 531, California Street, San Francisco, Cal., U.S.A., Assayer.
1901. Hanna, Charles E., P.O. Box 2303, Montreal, Canada, Secretary.
1899. Hanna, Dillinger C., 4262, Parkside Avenue, Philadelphia, Pa., U.S.A., Chemist and Superintendent.
- O.M. Hanson, A. M., Abbey Printworks, Whalley, Blackburn, Print Works Chemist.
1905. Hanson, H. Norman, Field Head, Brighouse, Yorks., Research Assistant.
1905. Harcourt, Prof. R., Ontario Agricultural College, Guelph, Ont., Canada, Professor of Chemistry.
1904. Hard, Dr. James, M.B., Cordobanes 16, Mexico City, Mexico, Chemist and Pathologist.
1901. Hardcastle, G. Fred., 17, Chancer Street, Leicester, Teacher of Science and Technology.
1894. Harden, Dr. Arthur, c/o British Institute of Preventive Medicine, Grosvenor Road, London, S.W., and (communications) 2, Marlborough Road, Richmond, S.W., Lecturer in Chemistry.
1900. Hardwick, W. Roscoe, 13, Batavia Buildings, Hackins Hey, Liverpool, Chemist.
1902. Hardy, G. B., Belmont Gold Mine, Cordova, Ont., Canada, Metallurgist.
1896. Hargreaves, Jas., Farnworth, Widnes, Lancashire, Chemical Engineer.
- O.M. Hargreaves, Jno., Widnes, Alkali Manufacturer.
1904. Harker, Dr. George, 35, Boulevard, Petersham, Sydney, N.S.W., Australia, Chemist.
- O.M. Harland, R. H., Plough Court, 37, Lombard Street, London, E.C., Consulting Chemist.
1904. Harley, B., 12, Russell Street, Falkirk, N.B., Analytical Chemist.
1893. Harlock, E. B., Newton House, Middlewich, Chemical Manufacturer.
1898. Harman, Edw. A., Gas Works, Huddersfield, Gas Engineer, M.Inst.C.E.
1905. Harper, Dr. Henry W., University of Texas, 2208, San Antonio Street, Austin, Texas, U.S.A., Professor of Chemistry.
1904. Harriman, Norman F., c/o Union Pacific Railroad, Laboratory, Omaha, Neb., U.S.A., Chemist.
1904. Harrington, Dr. B. J., MacDonald Chemical and Mining Building, McGill University, Montreal, Canada, Director.
1903. Harrington, E. M., 79, Fair Street, Paterson, N.J., U.S.A., Explosives Manufacturer.
- O.M. Harrington, W. B., Leeview, Montserrat, Cork, Ireland, Chemical Manufacturer.
1893. Harris, Arthur, 22, Marsh Gate Lane, Stratford, E., Soap Maker.
1885. Harris, Booth, jun., Beeleigh, Victoria Road, Buckhurst Hill, Essex, Soap Maker.
- O.M. Harris, David, F.R.S.E., Lyncombe Rise, Prior Park Road, Bath, Chemical Manufacturer.
1897. Harris, Fred. W., Corporation Chemical Department, 26, John Street, Glasgow, Public Analyst.
1900. Harris, L. A., Wyoming, Wood Vale, Lordship Lane, London, S.E., Chemist.
1904. Harris, Norman B., (Journals) to Upper Montclair, N.J., and (communications) 50, West Broadway, New York City, U.S.A., Manufacturing Pharmacist.
1896. Harris, Wm. T. A., Ideal Soapery, East Street, Brompton, Adelaide, South Australia, Soap Maker.
- O.M. Harrison, A., Thames Sugar Refinery, Silvertown, London, E., Sugar Works Chemist.
- O.M. Harrison, G. D., c/o United Alkali Co., Ltd., Netham Works, Bristol, Chemical Manufacturer.
1883. Harrison, G. Herbert, c/o Electrolytic Alkali Co., Ltd., Middlewich, Cheshire, Chemist.
1884. Harrison, G. King, Fireclay Mine Owner.
1904. Harrison, H. E., 1688, Buckingham Place, Chicago, Ill., U.S.A., Chemist.
1892. Harrison, Prof. John B., C.M.G., Government Laboratory, Georgetown, Demerara, B.G., Government Analyst.
1898. Harrison, Wm. H., 29, Avenue Crescent, Harehills Lane, Leeds, Analytical Chemist.
1896. Hart, Bertram, c/o Tennants and Co., Clayton, Manchester, Analyst.
1886. Hart, Bertram H., The Elms, Old Charlton, S.E., Analytical Chemist.
- O.M. Hart, Dr. E., Gayley Hall, Lafayette College, Easton, Pa., U.S.A., Professor of Chemistry.
1890. Hart, H. W., 13, Lynwood Villas, Darwen, Lancashire, Analytical Chemist.
1897. Hart, Wm. Beamont, Manchester Laboratory, 8, Exchange Street, Manchester, Consulting Chemist.
1883. Hartley, Joseph, 102, Kirkmanshulme Lane, Longsight, Manchester, Technical Chemist.
1889. Hartley, R. Kent, Springwood House, Middleton Junction, near Manchester, Chemical Works Manager.
- O.M. Hartley, Prof. W. N., D.Sc., F.R.S., Royal College of Science, Dublin, Professor of Chemistry.
1897. Hartmann, Ernest E., (Journals) 303 Boston Building, and (communications) Box 154 Honolulu, Hawaii, Chemist.
1892. Hartridge, Jas. Hills, Holmwood, Hendon, N., Manufacturing Chemist.
1901. Hartwell, S. Warren, 215, North 2nd Street, Easton, Pa., U.S.A., Chemist.
1901. Hartzell, Harry S., 126, North 4th Street, Allentown, Pa., U.S.A., Chemist.
1899. Harvey, Chas., 17, Alloa Road, Goodmayes, Ilford, Essex, Manufacturing Chemist.
1892. Harvey, E. Feild, Omrac, St. John's, Newfoundland, Chemist.
1885. Harvey, Ernest W., Stoneleigh, Grove Road, Clapham Park, S.W., A.R.S.M., Engineer.
1888. Harvey, H. C., Raglan House, Brooklands, near Manchester, Chemist.
1904. Harvey, John G., Todmorden, Ontario, Canada, Manufacturing Chemist.
1891. Harvey, Sidney, South-Eastern Laboratory, Canterbury, Analytical Chemist.
1899. Harvey, Thos. F., 84, Henry Road, West Bridgford, Nottingham, Analyst (Drug Co.).
1883. Harvey, T. H., Cattedown, Plymouth, Chemical Manufacturer.



1903. Hasenclever, Max, Chemische Fabrik Rhenania, Aachen, Prussia, Chemical Manufacturer.
1900. Haslwanter, Chas., 908, Willoughby Avenue, Brooklyn, N.Y., U.S.A., Analytical Chemist.
1897. Hasslacher, Jacob, P.O. Box 1999, New York, U.S.A., President, Roessler-Hasslacher Chemical Co.
1903. Hasting, J. J., c/o Benjamin Moore and Co., 211-259, Water Street, Brooklyn, N.Y., U.S.A., Chemist.
1894. Hatfield, Jno. A., c/o J. Lysaght, Ltd., Orb Ironworks, Newport, Mon., Analytical Chemist.
1903. Hatschek, Emil, c/o The Niles-Bement Pond Co., 138, Liberty Street, New York City, U.S.A., Engineer.
1887. Hatton, Wm. P., c/o W. R. Hatton and Sons, Wormwood Scrubs, W., Starch Works Manager.
1900. Havens, Dr. F. S., c/o Franklin H. Kalbfleisch Co., 35, Burling Slip, New York City, U.S.A., Silk Conditioner.
1899. Hawdon, H. S., Harton Road, Westoe, South Shields, Manager.
1895. Hawker, E. W., Adelaide Club, Adelaide, South Australia, Metallurgist.
1902. Hawkins, Clement C., c/o The Chatfield Manufacturing Co., Carthage, Ohio, U.S.A., Chemist.
1897. Hawkins, Ernest M., Lime Tree Farm House, Stone Street, Petham, Canterbury, Chemist.
- O.M. Hawkins, H., Concord Junction, Mass., U.S.A., Explosive Works Manager.
1893. Hawkins, J. Dawson, c/o Colo. Phila. Reduction Co., Colorado City, Colo., U.S.A., Smelting Works Manager.
1903. Hawley, Fred G., Box 10, La Cananea, Sonora, Mexico, Assayer and Chemist.
1887. Hawliczek, Josef, 77A, Lord Street, Liverpool, Consulting Chemical Expert.
1899. Haworth, Dr. Edw., Sunnyside, Norman Road, Runcorn, Cheshire, Chemist.
1903. Haworth, Herbert, Crown Works, Appley Bridge, near Wigan, Director (Grove Chemical Co.).
1904. Hawthorn, J. H., Municipal Technical School, Leicester, Head Master.
1895. Hay, Alex. B., Kelvindock Chemical Works, Maryhill, Glasgow, Manufacturing Chemist.
1898. Hayercraft, Jos. H., St. Peter's, Adelaide, South Australia, Metallurgical Chemist.
1904. Hayman, Jack V. J., Semper Aurea, Burwell, Cambridge, Chemist.
1894. Haynes, David O., 90, William Street, New York City, U.S.A., Proprietor, "Pharmaceutical Era."
1902. Hays, B. F., c/o Fraser Tablet Co., 454-474, 18th Street, Brooklyn, N.Y., U.S.A., Chemist.
1902. Hazard, Dr. Elmer C., Shrewsbury, N.J., U.S.A., Chemist.
1903. Hazen, Chas. R., Collingwood, Ohio, U.S.A., Chemist.
1894. Heal, Carlton, Duston, near Northampton, Chemist.
1903. Heald, Henry I., Wherside, Windsor Road, Doncaster, Manager of Earthenware Factory.
1899. Healey, Alfred E., Willesden Paper and Canvas Works, Willesden Junction, N.W., Managing Director.
1890. Heape, Chas., 19, George Street, Manchester, Calico Printer.
1898. Heasman, Walter, Castle Brewery, Bridgnorth, Salop, Brewer.
- O.M. Heath, R. C., Myton Grange, near Warwick, Chemical Manufacturer.
1904. Heaton, Noel, 20, Baker Road, Harlesden, N.W., Colour Manufacturer.
1895. Hebden, Jno. C., 64, Exchange Place, Providence, R.I., U.S.A., Works Manager and Chemist.
1889. Hecht, Jos. L., Bettendorf Metal Wheel Co., Davenport, Iowa, U.S.A., Analytical Chemist.
1895. Hecker, Paul, 102, Fenchurch Street, London, E.C., Chemical Merchant.
1900. Heckman, J. Conrad, Larkin Soap Manufacturing Co., Seneca Street, Buffalo, N.Y., U.S.A., Chemist.
1889. Heckmann, C., 9, Görlitzerufer, Berlin, S.O., Germany, Chemical Apparatus Maker.
1885. Hedley, Armorer, Durrant House, Bournemouth, Hants., Soap Manufacturer.
1895. Hedley, Geo. H., Hedge Mill, Loudwater, Bucks., Chemical Manufacturer.
1902. Heebner, Prof. Chas. F., Ontario College of Pharmacy, Toronto, Canada, Professor of Pharmaceutical Chemistry.
1903. Hegeman, John W., 102, Barbey Street, Brooklyn, N.Y., U.S.A., Chemist.
- O.M. Hehner, Otto, 11, Billiter Square, London, E.C., Analytical and Consulting Chemist.
1902. Heike, Rudolph E., American Sugar Refining Co., P.O. Box 1, Jersey City, N.J., U.S.A., Chemist.
1898. Heileman, W. H., (communications) U.S. Department of Agriculture, Bureau of Soils, Washington, D.C.; and (Journals) Cambridge, Iowa, U.S.A., Expert Field Assistant.
1887. Hellier, E. A., Avonside Varnish Works, Bristol Varnish Manufacturer.
1885. Hellon, Dr. R., 10, New Lowther Street, Whitehaven, Analytical and Consulting Chemist.
- O.M. Helm, H. J., Simonstone, Hammeton Road, Bromley, Kent, Government Analyst.
1903. Helps, D. H., c/o Reading Gas Co., King's Road, Works, Reading, Engineer and Manager.
1898. Hemingway, Frank C. R., 133, Front Street, New York City, U.S.A.
1883. Hemingway, H., Marsh Gate Lane, Stratford, E., Chemical Manufacturer.
1884. Hempleman, F. S., Wennington House, Wennington, Romford, Essex, Manure Manufacturer.
1903. Hemstreet, George P., Hastings-on-Hudson, N.Y., U.S.A., Mechanical Engineer.
1883. Henderson, Prof. G. G., The Technical College, George Street, Glasgow, Professor of Chemistry.
1902. Henderson, Prof. Jas. A. Russell, c/o Dr. Chas. D. Tenney, Tientsin, North China, Professor of Chemistry and Physics.
1900. Henderson, J. Brownlie, Government Analyst's Office, Brisbane, Queensland, Government Analyst.
1902. Henderson, J. C. A., 4, Sun Court, Cornhill, London, E.C.
1894. Henderson, Jos., Thornaby Ironworks, Thornaby-on-Tees, Metallurgical Chemist.
1894. Henderson, Norman M., Broxburn Lodge, Broxburn, N.B., Oil Works Manager.
- O.M. Henderson, W. F., Moorfield, Claremont Gardens, Newcastle-on-Tyne.
1893. Hendrick, Jas., Marischal College, Aberdeen, Lecturer on Agricultural Chemistry.
1904. Henley, F. R., 9, Beaufort Gardens, London, S.W., Brewer's Chemist.
1889. Hennin, Alphonse, Portoferraio, Elba, Italy, Metallurgical Chemist.
1905. Henning, Albert, 92, Harrow Road, Leytonstone, N.E., Chemical Manufacturer.
1904. Henshaw, Percy B., 3, Dobbin Hill, Endcliffe, Sheffield, Steel Chemist.
1894. Henshaw, Sam., Glenthorne, Wolstanton, Stoke-on-Trent, Chemical Works Manager.
1894. Hepburn, J. G., Priory Works, Dartford, Kent, Leather Manufacturer.
1894. Heriot, T. H. P., 23, Wolseley Road, Crouch End, N., Analytical Chemist.
- O.M. Herman, W. D., Holm Lea, Rainhill, Lancashire, Glass Works Chemist.
1904. Hermsdorf, Dr. Walter, Salzstrasse 69, Chemnitz, Saxony, Chemist.
- O.M. Heron, J., 110, Fenchurch Street, London, E.C., Brewing Chemist.
1903. Herreshoff, J. B. F., 40, West 69th Street, New York City, U.S.A., Chemical Engineer.
1899. Herrick, Rufus F., 16, Herrick Street, Winchester, Mass., U.S.A., Chemist.
1887. Herriot, Wm. Scott, 19, Kier Street, Pollokshields, Glasgow, Chief Engineer.
- O.M. Herrmann, R. W., 59, Mark Lane, London, E.C., Chemical Merchant.

1891. Hersam, Ernest A., University of California, Berkeley, Cal., U.S.A., Assistant Professor of Metallurgy.
- O.M. Herschel, Prof. A. S., F.R.S., Observatory House, Slough, Bucks., Hon. Professor of Experimental Physics.
1898. Hersey, Milton L., P.O. Box 554, Montreal, Canada, Consulting Chemist.
1901. Hershey, Aldus N., c/o Sharpe and Dohme, Baltimore, Md., U.S.A., Chemist.
1903. Herstein, Dr. Bernard, 9A, Trask Avenue, Bayonne, N.J., U.S.A., Technical Chemist.
1898. Heslop, Oliver, 55, Sandown Lane, Wavertree, Liverpool, Analytical Chemist.
1885. Hess, Dr. Adolph, Kirkstall Road, Leeds, Chemical Manufacturer.
1904. Hess, H. W., c/o Toledo Gas Light and Coke Co., 327, South Erie Street, Toledo, Ohio, U.S.A., Chemist.
1891. Hetherington, Dr. Albert E., Ammonia Soda Works, Fleetwood, Lancashire, Analytical Chemist.
1904. Heinrich, Christian, 1307, New Hampshire Avenue, N.W., Washington, D.C., U.S.A., Brewer.
1894. Hewitt, A. H., The Green Island Cement Co., Ltd., Hong Kong, China, and (Journals) Spring Vale, near Gurnard, Isle of Wight, Engineer.
- O.M. Hewitt, Dr. D. B., Oakleigh, Northwich, Cheshire, Alkali Manufacturer.
1903. Hewitt, H. R., 329, Bradford Road, Manchester, Chemical Works Manager.
1896. Hewitt, Dr. J. Theo., 8, Montpelier Road, East Twickenham, Lecturer.
1890. Hewlett, John C., 40-42, Charlotte Street, Great Eastern Street, London, E.C., Manufacturing Chemist.
1893. Hey, Harry, 2, Ash Terrace, Savile Town, Dewsbury, Dyer.
1894. Heyl-Dia, G. Edw., Chemical Engineer.
1901. Heys, Thos., 114, Bay Street, Toronto, Canada, Consulting Chemist.
1884. Heys, W. E., Llanberis, Bushey Hall Road, Watford, Consulting Engineer.
1883. Heywood, J. H., 231, Drake Street, Rochdale, Technical Chemist.
- O.M. Heywood, J. S., 7, Caledonian Road, King's Cross, London, N., Chemical Manufacturer.
1897. Hibbard, Paul L., 2657, North 42nd Court, Chicago, Ill., U.S.A., Starch Chemist.
1901. Hiby, Dr. Walter, 4, Southampton Row, London, W.C., Chemical Engineer.
1897. Hicks, Edwin F., 4837, Fairmount Avenue, Philadelphia, Pa., U.S.A., Analytical Chemist.
1893. Hicks, Jas. A., c/o Dr. B. Redwood, 4, Bishopsgate Street Within, London, E.C., Analytical Chemist.
- O.M. Higgin, W. H., Hollywood, Lostock, near Bolton-le-Moors, Chemical Manufacturer.
1886. Higgins, C. L., 79, Bedford Street South, Liverpool, Manufacturing Chemist.
1905. Higgins, J. M., 39, Queen Street, Melbourne, Vic., Australia, Consulting Metallurgist.
1901. Highley, Arnold, 20, Spotland Road, Rochdale, Chemist.
1904. Hildebrand, Charles C., 113, Metoxan Avenue, Ridgeway, Pa., U.S.A., Chemist.
1903. Hill, Chas. Alex., 64, Park Street, Southwark, S.E., Wholesale Druggist.
1897. Hill, George, Barton-on-Humber, Chemical Works Manager.
1897. Hill, Dr. Herbert M., University of Buffalo, N.Y., U.S.A., Professor of Chemistry and Toxicology.
- O.M. Hill, J. K., 13, Osborne Place, Copland Road, Govan, near Glasgow, Manufacturing Chemist.
1892. Hill, Sydney, c/o Blundell Spence and Co., Ltd., Hull, Analytical Chemist.
1903. Hill, W. Basil, James Street Leather Works, York, Tanner.
1902. Hill, Wm. G. H., jun., American Rubber Co., East Cambridge, Mass., U.S.A., Chemist.
1898. Hill-Jones, Thos., 30, Bisham Gardens, Highgate, N., Manufacturing Chemist.
- O.M. Hills, C. H., Anglesea Copper Works, Low Walker, Newcastle-on-Tyne, Copper Smelter.
1894. Hills, Harold F., Commercial Gas Works, Stepney, London, E., Analytical Chemist.
1898. Hills, Thos. Herbert, Chemical Works, Deptford, S.E., Chemical Manufacturer.
- O.M. Hills, W., 225, Oxford Street, London, W., Pharmaceutical Chemist.
1893. Hilton, Edgar G., 17, Howard Drive, Grassendale, Liverpool, Varnish and Paint Manufacturer.
1899. Hinchley, J. W., Royal Mint, Bangkok, Siam, Chemical Engineer.
1904. Hinckley, J. F., c/o Jones Bros., Pearl and Water Streets, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1905. Hind, H. Lloyd, 55, Stanton Road, Burton-on-Trent, Analytical Chemist.
- O.M. Hindle, J. H., 8, Cobham Street, Accrington, Dye-works Manager.
1899. Hinks, Percy J., Danger Building Dept., Royal Laboratory, Woolwich Arsenal, S.E., Chemist.
1891. Hinman, Bertram C., 23, Trewsbury Road, Sydenham, S.E., Metallurgical Chemist.
1892. Hinshelwood, Thos., Glasgow Oil and Paint Works, Glenpark Street, Glasgow, Oil Refiner.
1900. Hirsh, Jos. E., 1245, 85th Street, Brooklyn, N.Y., U.S.A., Chemist.
1903. Hirshfield, E., c/o Maas and Waldstein Co., Riverside Avenue, Newark, N.J., U.S.A., Chemist.
1895. Hirst, H. Reginald, Croft House, Batley, Yorks., Works Chemist.
1886. Hislop, Geo. R., (Journals) Gas Works, (communications) Greenhill House, Underwood Road, Paisley, N.B., Gas Engineer and Manager.
1900. Hobbs, Alex. F., Rolfe Street, Lowell, Mass., U.S.A., Printworks Superintendent.
1900. Hobbs, Dr. Perry L., Western Reserve Medical College, Cleveland, Ohio, U.S.A., Professor of Chemistry.
1905. Hobson, Alfred, Dantzic Brewery, Imperial Street, Regent Street, Leeds, Brewer and Wine Manufacturer.
1904. Hochstetter, Henry, Ault and Wiborg Co., Cincinnati, Ohio, U.S.A., Chemist.
1894. Hodge, Andrew, 28, Grosvenor Road, Heaton Moor, near Stockport, Printworks Chemist.
1890. Hodges, Harry B., Long Island Railroad Co., Long Island City, N.Y., U.S.A., Chemical Engineer.
1902. Hodgkins, David H., 82, Lafayette Avenue, Passaic, N.J., U.S.A., Manufacturing Chemist.
- O.M. Hodgkinson, Dr. W. R., (Journals) 18, Glenluce Road, Blackheath, S.E., and Royal Artillery College, Woolwich, S.E., Professor of Chemistry.
- O.M. Hodgson, Chris., 33, Oakdale Road, Nether Edge, Sheffield, Metallurgical Chemist.
1897. Hodgson, Matthew, Ardmore, Wicklow, Ireland, Technical Chemist.
1890. Hodgson, Wm., 66, Deansgate, Manchester, Oil and Colour Broker.
1903. Hoffmann, W. F., 23, Division Place, Newark, N.J., U.S.A., Chemical Merchant.
1886. Hogben, W., c/o Viscoloid Co., Leominster, Mass., U.S.A., Chemist and Superintendent.
- O.M. Hogg, T. W., c/o John Spencer and Sons, Newburn Steelworks, Newcastle-on-Tyne, Metallurgical Chemist.
1899. Holden, Archie Neill, c/o Hardman and Holden, Ltd., Miles Platting, Manchester, Chemist.
1903. Holden, G. E., 23, Durnford Street, Middleton, near Manchester, Works Chemist.
1887. Holden, G. H., Manchester Oxide Co., Ltd., Canal Street, Miles Platting, Manchester, Chemist.
1904. Holden, Norman N., c/o Hardman and Holden, Ltd., Miles Platting, Manchester, Manufacturing Chemist.
1902. Holdsworth, Ernest T., Westholme, Great Horton, Bradford, Dyer.
1904. Holgate, Arthur, Rigby Street Mills, Liverpool, Corn Miller.



1885. Holgate, T. E., 173, Hollins Grove, Darwen, Lancashire, Metallurgist.
1884. Holgate, Thos., 5, Victoria Street, Westminster, S.W., Gas Engineer.
- O.M. Holland, Philip, 22, Taviton Street, Gordon Square, London, W.C., Analytical Chemist.
1892. Holland, Philip H., 958, Sherbrooke Street, Montreal, Canada, Merchant.
1901. Hollick, Herbert, c/o General Chemical Co., Camden, N.J., U.S.A., Works Manager.
1902. Holliday, Lionel B., Lunnclough Hall, Huddersfield, Chemical Manufacturer.
1896. Hollings, J. Spencer, Brynbo, North Wales, Works Manager.
1903. Hollinshead, Peter, New Field House, Wimboldsley, near Middlewich, Cheshire, Chemist.
1900. Hollinshead, W. H., Vanderbilt University, Nashville, Tenn., U.S.A., Teacher of Chemistry.
1904. Holloway, E. G., 447, Belle Plain Avenue, Chicago, Ill., U.S.A., Chemist.
1890. Holloway, G. T., 57-58, Chancery Lane, London, W.C., Analytical and Consulting Chemist.
1900. Holloway, Jno., 6, Highbury Grange, London, N., Mine Owner.
1883. Holmes, Ellwood, Wyncote, Jesmond Park East, Newcastle-on-Tyne, Colour Manufacturer.
- O.M. Holmes, F. G., Northeroft, Tewitwell Road, Harrogate, Yorks., Chemical Chemist.
1900. Holthouse, Harold B., 12, Melton Grove, West Bridgford, Nottingham, Chemist.
1902. Holton, Alf. L., Chemical Dept., Gas Works, Bradford Road, Manchester, Chemist.
1892. Holton, E. C., Sherwin-Williams Co., 100, Canal Street, Cleveland, Ohio, U.S.A., Chemist.
1893. Holzapfel, Max., Maritime Buildings, Quayside, Newcastle-on-Tyne, Manufacturer.
1893. Homfray, D., 6, Dartmouth Row, Greenwich, S.E., Analytical Chemist.
1904. Hooker, A. H., c/o Heath and Milligan Manufacturing Co., 170, Randolph Street, Chicago, Ill., U.S.A., Manufacturing Chemist.
- O.M. Hooper, E. Grant, Government Laboratory, Clement's Inn Passage, Strand, W.C.; and (Journals) 16, Royal Avenue, Sloane Square, S.W., Chemist.
1889. Hooper, Ernest F., Wear Fuel Works, Hendon Dock, Sunderland, Technical Chemist.
1888. Hope, Jas., Dean House, Lenzie, N.B., Nickel Works Manager.
1904. Hopewell, Fredk., 86, Youville Square, Montreal, Canada, Manager.
1892. Hopkins, Erastus, Lake Helen, Fla., U.S.A., Consulting Chemist.
1893. Hopkins, Gerald V., Nicholaston House, Penmaen, near Swansea, Metallurgist.
1894. Hopkins, Herbert W., (Journals) c/o Waihi G. M. Co., Waihi, Paeroa, N.Z.; and 13, Harrington Gardens, South Kensington, S.W., Metallurgist.
1905. Hoppstedt, A. W., 138, Joralemon Street, Brooklyn, N.Y., U.S.A., Chemist.
1898. Hopwood, Wm. H., Levenbank Cottage, Jamestown, Dumbartonshire, Printworks Chemist.
1895. Horne, Dr. W. D., Yonkers, N.Y., U.S.A., Consulting Chemist.
1904. Hornsey, J. W., 914, New England Building, Cleveland, Ohio, U.S.A., Chemical Engineer.
1900. Horsfall, Jno., 4, Grange Avenue, Rawtenstall, Manchester, Analytical and Consulting Chemist.
1902. Horsfall, L. H., c/o Binny and Co., Madras, India, Chemist.
1901. Horton, Edw., jun., 8, Orford Street, Chelsea, S.W., Student.
1889. Horton, William, 12, Princes Road, Liverpool, Analytical Chemist.
1902. Hosford, Roger F., 125, Milk Street, Boston, Mass., U.S.A., Chemical Engineer.
1890. Hoskins, A. Percy, Clonlee, Rosetta Park, Belfast, Ireland, Analytical Chemist.
1899. Hoskins, Wm., Room 55, 81, South Clark Street, Chicago, Ill., U.S.A., Chemist.
1899. Houlder, Bertram E., 50, Lady Margaret Road, Southall, Middlesex, Chemist.
1892. Houston, John, 26, Princess Street, Manchester, Drysalter.
1888. Houston, Robt. S., Brisbane House, Bellahouston, Glasgow, Analytical Chemist.
1891. Hovenden, Fred., Glenlea, Thurlow Park Road, West Dulwich, S.E.
- O.M. Howard, A. G., Burnt House, Chigwell, Essex, Chemical Manufacturer.
1901. Howard, Bernard F., Devon House, Buckhurst Hill, and (Journals) Lavender Mount Works, Ilford, Essex, Chemist.
- O.M. Howard, D., Devon House, Buckhurst Hill, Essex, Chemical Manufacturer.
1887. Howard, D. Lloyd, City Mills, Stratford, E., Chemical Manufacturer.
1903. Howard, Fred. A., 254, Montello Street, Brockton, Mass., U.S.A., Chemist.
1898. Howard, Henry, 175, Mountford Street, Brookline, Mass., U.S.A., Chemical Engineer.
1902. Howard, Nelson A., c/o General Chemical Co., Hegewisch, Ill., U.S.A., Chemist.
1904. Howard, T., Hibernia House, Hibernia Road, Hounslow, Chemist.
- O.M. Howard, W. D., City Mills, Stratford, London, E., Chemical Manufacturer.
1903. Howe, Jas. Lewis, Washington and Lee University, Lexington, Va., U.S.A., Professor of Chemistry.
1901. Howell, Walter L., Appraiser's Office, Custom House, New Orleans, La., U.S.A., Chemist.
1899. Howles, Fred., c/o McDougall Bros., Millwall Docks, London, E., Chemist.
1889. Howorth, F. Wise, 46, Lincoln's Inn Fields, W.C., Technical Chemist and Chartered Patent Agent.
1896. Hoyte, Percy S., Gas Works, Coxside, Plymouth, Gas Engineer.
1900. Hübner, Julius, Ash Villa, Cheadle Hulme, Cheshire, Director of Dyeing and Papermaking Departments (Municipal School of Technology).
1898. Hudson, Albert W., c/o Yampa Smelting Co., Bingham Canyon, Utah, Assayer.
1902. Hudson, C. Edward, c/o E. G. Jepson and Co., Albion Walk Chambers, Leeds, Drysalter.
1899. Hudson, Dr. Edw. J., c/o Pioneer Iron Co., Marquette, Mich., U.S.A., Chemist.
- O.M. Hughes, J., 79, Mark Lane, London, E.C., Agricultural Chemist.
1898. Hughes, Raymond M., Oxford, Butler Co., Ohio, U.S.A., Professor of Chemistry and Physics.
1904. Huillard, A., 7, Rue Salamon de Rothschild, Suresnes, Seine, France, Tannin Extract Manufacturer.
1903. Hullegard, H., c/o Orford Copper Co., New Brighton, N.Y., U.S.A., Chemical Engineer.
1900. Hulley, Geo. D., c/o J. Evenson and Sons, 20th and Wood Streets, Philadelphia, Pa., U.S.A., Soapworks Chemist.
1893. Humfrey, Chas., Hilderstone, Hartford, Cheshire, Alkali Works Manager.
1903. Humphrey, John, 72, Great Russell Street, London, W.C., Editor ("Pharmaceutical Journal").
1902. Humphrey, Rich. L., 1001, Harrison Building, Philadelphia, Pa., U.S.A., Civil Engineer.
1903. Humphreys, A. C., 31, Nassau Street, New York City, U.S.A., Engineer.
- O.M. Humphrys, N. H., Gasworks, Salisbury, Wilts., Gas Engineer.
1895. Hunicke, Dr. H. Aug., 3532, Victor Street, St. Louis, Mo., U.S.A., Prof. of Applied Chemistry.
1900. Hunt, Arthur V., 76, Cromwell Street, Stretford, Lancashire, Analytical Chemist.
- O.M. Hunt, Bertram, Tres Amigos Mine, Puntarenas, Costa Rica, Technical Chemist.
- O.M. Hunt, Chas., 15, Victoria Street, Westminster, London, S.W., Gas Engineer.
1883. Hunt, J. S., Appleton, Widnes.
1903. Hunt, P. C. Holmes, Metropolitan Gas Co., Flinders Street, Melbourne, Vic., Australia, Gas Engineer.
- O.M. Hunt, W., Hampton House, Wood Green, Wadnesbury, Staffordshire, Chemical Manufacturer.

1897. Hunter, Prof. A. G. Kidston, (subs.) c/o A. G. Kidston and Co., 81, Great Clyde Street, Glasgow; and (Journals) P.O. Box 164, Dunedin, N.Z., Professor of Chemistry.
1903. Hunter, H. B., Denney Factory, St. Lucia, West Indies, Sugar Works Manager.
1902. Hunter, Hy. Blount, Hunter Chemical Co., Norfolk, Va., U.S.A., Industrial Chemist.
1893. Hunter, Prof. Matthew, Rangoon College, Rangoon, Burmah, Professor of Chemistry.
1892. Hunter, Sidney H., 202, Bow Road, London, E., Mechanical Engineer.
- O.M. Huntington, Prof. A. K., King's College, Strand, London, W.C., Professor of Metallurgy.
1902. Huntly, Geo. N., 96, Gower Street, London, W.C., Analytical and Consulting Chemist.
1902. Huntton, Louis D., c/o Sheffield Scientific School, New Haven, Conn., U.S.A., Engineer.
1904. Huntzinger, Alfred, 3, Egerton Road, Chorlton-cum-Hardy, near Manchester, Chemist and Colourist.
1900. Hurd, Geo. E., 241, Hampden Court, Chicago, Ill., U.S.A., Food Products Manufacturer.
1903. Hurlburt, Allen S., c/o Thomsen Chemical Co., Baltimore, Md., U.S.A., Chemist.
1904. Hurren, F. H., 43, Northumberland Road, Coventry, Analytical Chemist.
1894. Hurry, E. H., Goodwyns, Haslemere, Surrey, Mechanical Engineer.
1884. Hurst, G. H., 22, Blackfriars Street, Salford, Manchester, Analytical Chemist.
1901. Hurty, Jno. N., Cor. Penn and Ohio Streets, Indianapolis, Ind., U.S.A., Analytical Chemist.
- O.M. Huskisson, P. L., 77, Swinton Street, London, W.C., Chemical Manufacturer.
- O.M. Huson, C. W., 18, Batavia Buildings, Hackins Hey, Liverpool, Analytical Chemist.
1894. Hutcheson, Jno. F., 22, St. Enoch Square, Glasgow, Chemical Manufacturer.
- O.M. Hutchinson, C. C., 3, Harcourt Buildings, Temple, E.C., Barrister-at-Law and Chemical Engineer.
1900. Hutchinson, Edw. G., Gas Offices, Pontefract Road, Barnsley, Yorks., Assistant at Gasworks.
- O.M. Hutchinson, T. J., Aden House, Manchester Road, Bury, Analytical and Consulting Chemist.
1901. Hutton, Robt. S., The University, Manchester, Lecturer on Electro-Chemistry.
- O.M. Huxley, Jas. H., c/o Vickers, Son and Maxim, Ltd., River Don Works, Sheffield, Metallurgical Chemist.
1897. Hyams, Geoffrey M., P. O. Box 5104, and 312, Sears Building, Boston, Mass., U.S.A., Mines Manager.
1902. Hyde, Austin T., Box 365, Rumford Falls, Maine, U.S.A., Chemical Engineer.
1897. Hyde, B. T., Babbitt, c/o B. T. Babbitt, 82, Washington Street, New York City, U.S.A., Soap Manufacturer.
1899. Hyde, Fred. S., 215, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Research Chemist.
1897. Hyde, Henry St. John, 210, East 18th Street, New York City, U.S.A.
1899. Hyde, Wm. Grantley, 26, Winsham Grove, Clapham Common, S.W., Assayer.
1901. Hyman, Leonard W., 342, South Pearl Street, Albany, N.Y., U.S.A., Analytical Chemist.
1896. Hyndman, H. H., Francis, 27, Pembroke Square, Kensington, W., Consulting Chemist.
1898. Ibbotson, E. C., 3, Ashgate Road, Sheffield, Metallurgist.
1900. Ichioka, Dr. Tajiro, 19, Maruyama Shinmachi, Hongo, Tokio, Japan, Chemist (Imperial Japanese Navy).
1885. Idris, T. H. W., 110, Pratt Street, Camden Town, N.W., Mineral Water Manufacturer.
1902. Ihart, John P., 427, West 38th Street, New York City, U.S.A., Technical Chemist.
1900. Imrie, John, 415, Shields Road, Pollokshields, Glasgow, Analytical Chemist.
1900. Ingalls, Walter R., 52, Broadway, New York City, U.S.A., Mining Engineer and Metallurgist.
1889. Ingle, Dr. Harry, 15, John Street, Kirkcaldy, Fife-shire, Organic Chemist.
1891. Ingle, Herbert, Dept. of Agriculture, Government Buildings, Pretoria, Transvaal, Chemist.
1884. Inglis, R. A., Culrain, Bothwell, N.B., Analytical Chemist.
1904. Irlam, H. A., 34, East Street, Faversham, Kent, Chemist.
1884. Irving, J. M., 17A, Dickinson Street, Cooper Street, Manchester, Chemical Merchant.
- O.M. Irwin, W., Inglehurst, Stand, near Manchester, Analytical Chemist.
1893. Isaac, J. F. V., Research Chemist.
1888. Isaac, T. W. Player, Barton Court, Abingdon, Chairman of Waterworks Co.
1896. Isaacs, Louis A., 110, Greencroft Gardens, West Hampstead, N.W., (Journals) c/o Yeatman and Co., Ltd., Denmark Street, E., Manufacturer.
1901. Isakovics, Alois von, Monticello, N.Y., U.S.A., Manufacturing Chemist.
- O.M. Isler, Otto, 35-37, Dickinson Street, Manchester, Chemical Merchant.
1900. Ittner, Dr. Martin H., c/o Colgate and Co., Jersey City, N.J., U.S.A., Soap and Essential Oil Chemist.
- J
1890. Jackman, E. J., 60, Belgrave Road, Ilford, Essex, Technical Chemist.
1898. Jackson, Alf. Greville, George Street, Brisbane, Queensland, Electro-Chemical Engineer.
1901. Jackson, Daniel D., Mount Prospect Laboratory, Flatbush Avenue and Eastern Parkway, Brooklyn, N.Y., U.S.A., Chemist.
1903. Jackson, D. H., 47, Mecklenburgh Square, London, W.C., Chemist.
- O.M. Jackson, Edward, Ravens Clift, Oxford Road, Moseley, Birmingham, Alkali Works Inspector.
1904. Jackson, Ernest W., 11, Queen's Terrace, Middlesbro, Analytical Chemist.
1891. Jackson, F., Smedley Bridge Works, Cheetham, near Manchester, Bleacher and Dyer.
1883. Jackson, Frederick, 14, Cross Street, Manchester, Laboratory Funnisher.
1901. Jackson, Henry A., 1101, Washington Street, Wilmington, Del., and Columbia University, New York City, U.S.A., Chemist.
1886. Jackson, John, 98, Dobbie's Loan, Glasgow, Lubricant Manufacturer.
1901. Jackson, Percy G., Chemical Laboratory, Locomotive Dept., Midland Railway, Derby, Chemist.
- O.M. Jackson, R. V., c/o Scotch and Irish Oxygen Co., Polmadie, Glasgow, Technical Chemist.
1890. Jackson, Saml., c/o Binny and Co., Madras, India, Analytical Chemist.
1902. Jackson, Samuel, c/o Wm. Metcalf, Ltd., Church, near Accrington, Director (Tar Distillery).
1898. Jackson, Thos., Clayton Chemical Works, Clayton, Manchester, Chemical Manufacturer.
1900. Jackson, Victor G., 167, Grove Lane, Denmark Hill, S.E., Chemist.
1901. Jackson, W. B., Glengowan Printworks, Caldercruix, N.B., Chemist.
1903. Jackson, Wm. D. N., 78, North Road, Wallsend-on-Tyne, Analytical Chemist.
1900. Jackson, Dr. W. Hatchett, Radcliffe Library, Oxford, Librarian and Science Tutor (Keble College).
1903. Jackson, W. H., 50 and 52, North Front Street, Philadelphia, Pa., U.S.A., Chemist and Importer.
1893. Jackson, Rt. Hon. W. L., F.R.S. See Allerton, Rt. Hon. Lord.



1899. Jackson, W. Morton, c/o Manchester Oxygen Co., Ltd., Great Marlborough Street, Manchester, Manager.
- O.M. Jackson, W. P., Saxilby, near Lincoln, Chemical Works Manager.
1901. Jacobs, Charles B., c/o American Lithographic Co., 19th Street and 4th Avenue, New York City, U.S.A., Chemist.
1901. Jacobsen, Rudolph C., 154, Lake Street, Chicago, Ill., U.S.A., Editor of "Hide and Leather."
1900. Jacoby, Arch H., c/o American Dyewood Co., 156, William Street, New York City, U.S.A., Chemist.
1897. Jacqué, Maurice, "La Cantabrica," Galdacano, cerca Bilbao, Spain, Chemical Engineer.
1901. Jadhava, Khasherao B., Nansori, Bombay, India, Collector and District Magistrate.
1900. Jäger, B. M., c/o Geo. Jäger and Sons, 77, Burlington Street, Liverpool, Sugar Chemist.
1886. Jago, Wm., Godrevy House, Wilbury Avenue, Hove, Sussex, Chemical Engineer.
1889. James, Alf., 2, Broad Street Place, London, E.C., Mining Engineer.
1883. James, E. T., British Alizarin Co., Ltd., Silvertown, Victoria Docks, E., Secretary.
1885. James, Dr. J. Wm., Aylmer House, Weston-super-Mare; and (Journals) 29, Redcliff Street, Bristol, Chemical Lecturer.
1893. James, Lawrence S., 32, Hawley Street, Boston, Mass., U.S.A., Gas Inspector.
1905. James, Oscar S., 227, George Street, Toronto, Canada, Analytical Chemist.
1902. Jameson, Lewis, 83, Queen Victoria Street, London, E.C., Consulting Chemist.
1903. Janes, Frank W., Wolsey Street, Surrey Hills, Victoria, Australia, Assayer.
1890. Jantzen, Paul, 133, Fenchurch Street, London, E.C., Chemical Merchant.
- O.M. Japp, Dr. F. R., F.R.S., The University, Aberdeen, Professor of Chemistry.
1890. Jarman, Geo. S., Hazel Grove, Edgerton, Huddersfield, Wool Extractor.
- O.M. Jarmay, G., Hartford Lodge, Hartford, Cheshire, Alkali Manufacturer.
1884. Jarves, Deming, Michigan Carbon Works, Detroit, Mich., U.S.A., Manufacturing Chemist.
1900. Jarvie, Jas., Monkland House, Kirkintilloch, N.B., Chemist.
- O.M. Jayne, Dr. H. W., 931, North Broad Street, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
- O.M. Jekyll, J., Castle Moat House, Lincoln, Chemical Manufacturer.
1892. Jenkin, W. A., 5, Bella Vista, Minas de Rio Tinto, Provincia de Huelva, Spain, Metallurgical Chemist.
1894. Jenkins, John H. B., Laboratory, G.E.R. Works, Stratford, E., Analytical Chemist.
1894. Jenks, Robt. L., 89, Bartholomew Close, London, E.C., Chemist.
- O.M. Jenner, E., 203, Markhouse Road, Walthamstow, Essex, Chemical Manufacturer.
1903. Jennings, Henry, 42, Marlowes, Hemel Hempstead, Herts, Analyst.
1899. Jennings, Thos., Brookfield, Cork, Ireland, Chemical Manufacturer.
1904. Jepson, John Elliott, The Star Paper Mill Co., Ltd., Feniscowles, near Blackburn, Chemist.
1899. Jerdan, Dr. David S., c/o J. and G. Cox, Ltd., Gorgie Mills, Edinburgh, Chemist (Gelatin Works).
1899. Jessop, Louis V., Holmlea, Woodville Road, Leytonstone, Essex, Chemist.
1904. Jessup, Alfred E., c/o U.S. Consul, Tientsin, China, Assayer.
1904. Jewell, Wm. M., Cable Building, Chicago, Ill., U.S.A., Chemist and Engineer.
1904. Jewson, F. T., Thornly Park Terrace, Paisley, N.B., Chemist.
1896. Job, Robt., 109, Windsor Street, Reading, Pa., U.S.A., Analytical Chemist.
1886. Johnson, A. E., Claremont, Lyndhurst Road, Wolverhampton, Analytical Chemist.
1904. Johnson, Cedric, Field House, Wilmington, Northwiche, Chemical Engineer.
1902. Johnson, Chas. M., 701, Orchard Street, Avalon, Allegheny Co., Pa., U.S.A., Chemist.
1891. Johnson, Edmund E., Corsden, Harold Wood, Essex, Chemical Engineer.
1900. Johnson, Edw., c/o Pereira, Carneiro and Co., Rua do Commercio No. 6, Pernambuco, Brazil, Sugar Works Manager.
1902. Johnson, Emil F., 96 98, Maiden Lane, New York City, U.S.A., Consulting Chemist.
1900. Johnson, F. Carter, National Acid Co., 714, Union Street, New Orleans, La., U.S.A., Chemical Engineer.
1904. Johnson, F. M. G., 286, Peel Street, Montreal, Canada, Chemist.
1904. Johnson, G. B., 7, Church Street, Liverpool, Wholesale Chemist.
1903. Johnson, Horace, Waiialua, Oahu, Hawaii, Chemist.
- O.M. Johnson, J. E., 40, Idmiston Road, Stratford, E., Manufacturing Chemist.
1884. Johnson, J. Grove, 23, Cross Street, Finsbury, E.C., Assayer.
1895. Johnson, Jesse F., 58, Metcalfe Street, Montreal, Canada, Chemical Engineer.
1900. Johnson, John, c/o John Johnson and Co., Franklin Square, New York City, U.S.A., Chemical Engineer.
1900. Johnson, Jno. W. H., York House, Thornhill, Dewsbury, and (Journals) West Riding Rivers Board, Wakefield, Yorks., Chemist.
- O.M. Johnson, S. H., Warren Hill House, Loughton, Essex, Chemical Engineer.
1904. Johnson, S. Heaton, 7, Church Street, Liverpool, Wholesale Chemist.
1899. Johnson, Saml. H., jun., Hempstead House, Woodford Wells, Essex, Chemical Engineer.
- O.M. Johnson, T. A., Field House, Winington Park, Northwiche, Cheshire.
1903. Johnson, Thos., Caixa 94, Pernambuco, Brazil, Manager.
1895. Johnston, Alex. R., 18, Percy Street, Ibrox, Glasgow, Analytical Chemist.
1894. Johnston, G. Lawson. See Lawson-Johnston, G.
1904. Johnston, J. H., 8, Leopold Road, Wimbledon, S.W., Chemist and Bacteriologist.
1889. Johnston, Thos., Nobel's Explosives Co., Ltd., 195, West George Street, Glasgow, Manager.
1904. Johnston, Thos. J., 4, Garrioch Drive, Kelvinside North, Glasgow, Chemist.
1890. Johnston, Wm. A., The S. S. White Dental Manufacturing Co., Prince's Bay, Staten Island, N.Y., U.S.A., Dental Enamel Manufacturer.
1894. Johnston, W. E. Lawson. See Lawson-Johnston, W. E.
- O.M. Johnston, Wm. G., Anchor Chemical Works, 1005, Garnad Road, Glasgow, Technical Chemist.
- O.M. Johnstone, Jas., Shawfield Works, Rutherglen, Glasgow, Technical Chemist.
1903. Johnstone, S. J., 15, Springfield Road, New Southgate, N., Research Chemist.
- O.M. Johnstone, W. G., The Brewery, Newark-on-Trent, Chemist.
1902. Jollyman, Walter H., Government Laboratory, P.O. Box 1089, Johannesburg, Transvaal.
1903. Jones, Alfred O., c/o Carr and Co., Caldwgate, Carlisle, Works Chemist.
1904. Jones, Arthur B., c/o General Chemical Co., Station F, Box 12; and (Journals) 452, Russell Avenue, Cleveland, Ohio, U.S.A., Superintendent.
1897. Jones, Chas. H., El Cobre Mines, Santiago de Cuba, Cuba, Technical Chemist.
1902. Jones, David R., Standard Chemical Co., Deseronto, Ont., Canada, Chemical Engineer.
1902. Jones, E. Strangways, Sulphide Corporation, Ltd., Cockle Creek, N.S.W., Australia, Metallurgical Chemist.
- O.M. Jones, E. W. T., 10, Victoria Street, Wolverhampton, Analytical Chemist.
1897. Jones, Fred. W., 96, Downs Park Road, Clapton, N.E., Explosives Works Manager and Chemist.

1896. Jones, G. Cecil, Stour Villa, Mistley, Essex, Brewer's Chemist.
1904. Jones, Geo. F., c/o De Beers P.O. Explosive Works, Somerset W., Cape Colony, Technical Chemist.
1903. Jones, G. Robert, Gas Works, Caixa 147, Pernambuco, Brazil, Gas Engineer.
1898. Jones, Henry, Broughton Bridge Mills, Salford, Dyer and Finisher.
- O.M. Jones, H. Chapman, Royal College of Science, South Kensington, S.W., Senior Demonstrator in Chemistry.
1893. Jones, Herbert. *See* Sefton-Jones, H.
1901. Jones, Herbert J., c/o The Scottish Acid and Alkali Co., Ltd., Kilwinning, N.B., Chemist.
1904. Jones, J. Shirley, c/o Giant Powder Co., Giant, Contra Costa Co., Cal., U.S.A., Chemist.
1899. Jones, Llewellyn J. W., Tacoma Smelting Co., Tacoma, Washington, U.S.A., Metallurgist.
1898. Jones, Martin L., c/o Ooregum G. M. Co., Oorgaum, Mysore State, India, Metallurgical Chemist.
1894. Jones, M. W., Greystonedale, Kensington Hill, Bristol, Manager (Oil and Colour Works).
1887. Jones, T. Tolley, Australian Explosives and Chemical Co., Ltd., 138, Queen Street, Melbourne, Victoria, Australia, Explosives Manufacturer.
1903. Jones, Wm. App., c/o Boston Artificial Leather Co., Stamford, Conn., U.S.A., Chemist.
- O.M. Jones, W. Norris, Lancashire Metal Works, Widnes, Technical Chemist.
1902. Jonker Czn., Hendrik, Hotel Europaischer Hof, Hagenau, Elsass, Germany, Chemical Engineer.
1899. Joplin, Geo. C., Brierbank, Albert Road, Strathfield, Sydney, N.S.W., Australia, Analyst.
1904. Jordan, Stanley, 100, William Street, New York City, U.S.A., Importer of Chemicals.
1897. Jorissen, Dr. Wm. P., Koninklijk Inst. v. d. Marine, Willemsoord, Holland, Editor.
1900. Josephson, Edgar, 131, Amity Street, Brooklyn, N.Y., U.S.A.
1891. Joslin, Omar T., 3223, Spring Grove Avenue, Cincinnati, Ohio, U.S.A., Chemical Engineer.
1887. Joüet, Dr. C. H., Roselle, Union Co., N.J., U.S.A., Technical Chemist.
1889. Journand, Louis, 21, Grand Rue, Bourg-de-Péage, Drôme, France, Technical Chemist.
1904. Jowett, Dr. H. A. D., Wansfell, Church Avenue, Sidecup, Kent, Chemist.
1888. Joy, Douglas G., The Rookery, Stevenage, Herts., Oil Refiner.
1904. Joy, Dr. J. Holmes, Manor House, Tamworth, Staffordshire, Physician.
1903. Joyce, Clarence M., c/o Arlington Co., Arlington, N.J., U.S.A., Chemist.
1887. Jürgensen, Dr. Rolof, Karlsgasse 5, Prag-Zizkov, Austria, Chemist.
1900. Just, Jno. A., Jefferson Avenue and Delano Street, Pulaski, Oswego Co., N.Y., U.S.A., Chemist.
- O.M. Justice, P. M., 55-56, Chancery Lane, London, W.C., Patent Agent.
- K**
1898. Kahn, Julius, 100, West 80th Street, New York City, U.S.A., Manufacturer of Rubber Goods.
1896. Kalbfleisch, Franklin H., 33-35, Burling Slip, New York City, U.S.A., Chemical Manufacturer.
1884. Kalle, Dr. Wm., Biebrich-am-Rhein, Germany, Colour Manufacturer.
1904. Kane, Richard W. H., 88, Kimmersitch Street, Burton-on-Trent, Mechanical Engineer.
1899. Karas, Jno., c/o Buffalo Shirt Co., 565-577, Washington Street, Buffalo, N.Y., U.S.A., Laundryman.
1901. Kasson, Henry R., 1209, Stock Exchange Building, Chicago, Ill., U.S.A., Asphalt Chemist.
1905. Katzenbach, Welling S., 120, East 31st Street, New York City, U.S.A., Chemist.
1901. Kauder, Dr. E., c/o Merck and Co., Rahway, N.J., U.S.A., Chemist.
1903. Kauffman, Milton H., American Smelting and Refining Co., Durango, Colo., U.S.A., Chemist.
1892. Kaufmann, Dr. Herbert M., c/o Mutual Chemical Co., Jersey City, N.J., U.S.A., Chemist.
1904. Kaus, Dr. Emil, c/o Roessler and Hasslacher Chemical Co., Perth, Amboy, N.J., U.S.A., Chemist.
1904. Kawai, I., Camphor Monopoly Bureau, Fukuoka, Japan, Chemist.
1885. Kawakita, Prof. Michitada, Imperial Engineering College, Tokio, Japan, Professor of Applied Chemistry.
- O.M. Kay, Wm., E., Marple Lodge, Marple, Cheshire, Printworks Chemist.
1904. Kaye, Thos., Westerfield, Perth, Scotland, Analytical Chemist.
- O.M. Kearns, H. W., Baxenden House, near Accrington, Dyer.
1897. Kearns, Jno. S., Baxenden House, near Accrington, Chemist and Dyer.
1894. Kebler, Lyman F., Department of Agriculture, Bureau of Chemistry, Washington, D.C., U.S.A., Chief of Drug Laboratory.
1904. Keddell, H. Hewes, 2, Lime Street Square, London, E.C., Merchant.
1886. Keiser, Prof. E. H., Washington University, St. Louis, Mo., U.S.A., Professor of Chemistry.
1900. Kelf, Henry C., The Millaquin and Yengarie Sugar Co., Millaquin, Bundaberg, Queensland, Australia, Sugar Chemist.
1900. Kellner, Dr. Carl, (Journals) Laby., Borschkegasse No. 8, Vienna, IX/2; and (subscriptions) Hohe Warte No. 29, Vienna XIX., Austria, Paper Chemist.
1885. Kellner, Dr. Wm., 135, Victoria Road, Old Charlton, S.E., Chemist to War Department.
1889. Kempson, John F., Pye Bridge Chemical Works, near Alfreton, Derbyshire, Chemical Manufacturer.
1901. Kennedy, Alex., Kenmill House, Bothwell, N.B., Rosin Distiller.
1903. Kennedy, Hugh Watson, 626, South 19th Street, Philadelphia, Pa., U.S.A., Chemist.
1904. Kenney, Fredk. J., 493, Lexington Avenue, New York City, U.S.A., Chemist.
1901. Kenrick, Dr. Frank B., 209, John Street, Toronto, Canada, Lecturer on Chemistry.
1903. Kenyon, Percy S., 15, Rook Street, Manchester; and (Journals) Park House, Cheadle Hulme, Cheshire, Drystalter.
1889. Kenyon, Thos., The Shrubbery, Hilton Park, Prestwich, near Manchester, Manufacturing Chemist.
1900. Keppelmann, Alf. J., P.O. Box 1549, Philadelphia, Pa., U.S.A., Chemical Merchant.
1888. Ker, Alan D., Milburn Chemical Works, Garngad Hill, Glasgow, Chemical Manufacturer.
1899. Kern, Walter P., 262, Paulison Avenue, and (Journals) c/o General Chemical Co., Dundee Works, Passaic, N.J., U.S.A., Chemist.
1894. Kerr, Jas., Surgeons Hall, Edinburgh, Lecturer on Chemistry.
1890. Kerr, Saml. T., 516, North Delaware Avenue, Philadelphia, Pa., U.S.A., Salt Manufacturer.
1897. Kerr, Wm. M., c/o General Chemical Co., 608, Philadelphia Bourse, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1896. Kershaw, Jno. B. C., West Lancashire Laboratory, Waterloo, Liverpool, Analytical Chemist.
1902. Kessler, Henry W., Brandt, Susquehanna Co., Pa., U.S.A., Manufacturing Chemist.
1903. Kessler, R., jun., The Nordmont Chemical Co., Nordmont, Pa., U.S.A., Chemical Manager.
1893. Kestner, Paul, 5, Rue de Toul, Lille, France, Chemist.
1898. Keswick, Wm., M.P., 3, Lombard Street, London, E.C., Merchant.
1900. Kewley, Jas., Arbory Road, Castletown, Isle of Man, Technical Chemist.
1890. Keys, W. H., Lyndon House, West Bromwich, Oil and Chemical Manufacturer.



1892. Kibble, W. Oakes, Charlotte, N.C., U.S.A., Chemical Engineer.
1896. Kier, Thos., Thornliebank, Glasgow, Chemist.
1900. Kilgore, Benj. W., Raleigh, N.C., U.S.A., Chemist.
1901. Kilmer, Fred. B., New Brunswick, N.J., U.S.A., Chemical Manufacturer.
- O.M. Kinch, E., Royal Agricultural College, Cirencester, Professor of Chemistry.
- O.M. King, A. J., (Journals) Ingersley Vale, and (communications) Rock Bank, Bollington, near Macclesfield, Bleacher and Finisher.
1884. King, C. M., Campsie Alum Works, Lennoxton, N.B., Alum Manufacturer.
- O.M. King, J. Falconer, 29, Chambers Street, Edinburgh Consulting Chemist.
1897. King, Joshua, Clarewood, Camberley, Surrey, Indian Civil Service (retired).
1887. King, Robt., 115, Wellington Street, Glasgow, Chemical Manufacturer.
1895. King, Sidney J., 1, Russell Villas, Pope's Grove, Strawberry Hill, Middlesex, Colour and Dyestuff Traveller.
- O.M. King, Walter R., 16, Mincing Lane, London, E.C., and (Journals) Avalon, Trinity Avenue, Southend-on-Sea, Chemical Manufacturer.
1903. King, William, c/o Natal Estates, Ltd., South Coast Junction, Natal, S. Africa, Analytical Chemist.
1899. King, Wm. R., 17, Fernwood Road, Summit, N.J., U.S.A., Mechanical Engineer.
1896. Kingdon, Holman, 25, Grappenhall Road, Stockton Heath, Warrington, Technical Chemist.
1883. Kingsford, T. P., Oswego, N.Y., U.S.A., Starch Manufacturer.
- O.M. Kingzett, C. T., Elmstead Knoll, Chislehurst, Kent, Technical Chemist.
1892. Kinnicutt, Professor L. P., 77, Elm Street, Worcester, Mass., U.S.A., Professor of Chemistry (Worcester Polytechnic Institute).
1897. Kipping, Dr. F. Stanley, F.R.S., University College, Nottingham, Prof. of Chemistry.
1898. Kirkland, Archd., 78, High Street, Irvine, N.B., Baker.
1905. Kirkland, John, 8, Corrance Road, Brixton, S.W., Technical Instructor.
1897. Kirkland, Robt., 7, Ross Street, Mill Road, Cambridge, Chemist.
1900. Kirkpatrick, Stafford F., 96, Barrie Street, Kingston, Ont., Canada, Assayer.
1887. Kitamura, Y., c/o R. Fujihanaya, Yokoyamacho Sanchome, Tokyo, Japan, Agricultural Chemist.
1902. Kitchen, Wm. J., Port Melbourne North, Vic., Australia, Soap and Candle Manufacturer.
1891. Kitson, Sir James, Bart., M.P., Gledhow Hall; and (Journals) Monkbridge Iron and Steel Co., Ltd., Leeds, Iron and Steel Manufacturer.
1883. Kitto, B., 26, Lancaster Road, Finsbury Park, London, N., Analytical Chemist.
1900. Kittredge, H. G., 42, Linden Avenue, Dayton, Ohio, U.S.A., Chemist.
1900. Kleber, Dr. Clemens, Union Avenue, Clifton, N.J., U.S.A., Director (Fritzsche Bros.' Laboratory).
1888. Kleemann, Dr. S., Farben Fabrik, Forchheim, Bavaria, Analytical Chemist.
1898. Klein, Otto H., Room 110, 280, Broadway, New York City, U.S.A., Consulting Engineer.
1903. Kline, Clarence M., c/o Smith, Kline, and French Co., Canal and Poplar Streets, Philadelphia, Pa., U.S.A., Wholesale Druggist.
1889. Klipstein, A., 122, Pearl Street, New York City, U.S.A., Chemical Manufacturer.
1902. Klipstein, Ernest C., 116, Prospect Street, East Orange, N.J., U.S.A., Chemical Manufacturer.
1891. Knaggs, Alfred B., Bradley Lane, Huddersfield, Technical Chemist in Dyeworks.
1900. Knapp, Rudolf E., 1219, 8th Street, Evansville, Ind., U.S.A., Chemist.
1905. Knapp, Sewell A., Tonopah, Nevada, U.S.A., Mine Manager.
1892. Knecht, Dr. E., Municipal School of Technology, Manchester; and (Journals) 5, Station Road, Crumpsall, Manchester, Professor of Tinctorial Chemistry.
1904. Knitten, Frederick, Indian Head, Md., U.S.A., Chemist.
1887. Knight, A. H., 2, Gerald Road, Oxtou, Cheshire, Assayer.
1903. Knight, Harley F., 61, Amhurst Park, Stamford Hill, N., Analyst.
1884. Knight, Henry, Stanley House, 73, Anfield Road, Liverpool, Colour and Varnish Manufacturer.
- O.M. Knight, J. B., Silvertown Soapworks, Silvertown, London, E., Soap Manufacturer.
1887. Knights, J. West, Public Laboratory, Tenison Road, Cambridge, Analytical Chemist.
1885. Knipler, F., c/o R. Harper and Co., Port Melbourne, Victoria, Australia, Starch Manufacturer.
1883. Knowles, Joshua, Stormer Hill, Tottington, near Bury, Calico Printer.
1904. Knowles, W. R., The Hollies, Wood Green, Wednesbury, Chemical Works Manager.
1886. Knox, E. W., Colonial Sugar Refining Co., Sydney, N.S.W.; and c/o Parbury, Henty and Co., 20, Eastcheap, London, E.C., Sugar Manufacturer and Refiner.
1902. Knudsen, Hans, 29A, Gillingham Street, London, S.W., Inventor.
1904. Koch, J. A., Bluff and Pride Streets, Pittsburg, Pa., U.S.A., Chemist.
1903. Koch, Walter E., c/o Lustre Mining Co., Sta. Maria del Oro, *via* Parral, Eze Durango, Mexico, Metallurgical and Mining Engineer.
1904. Koebig, Dr. J., 127, West First Street, Los Angeles, Cal., U.S.A., Chemical Engineer.
1895. Koechl, Victor, P.O. Box 159, New York City, U.S.A., Dye Merchant.
1901. Koehler, Dr. H., c/o Roessler and Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Manager.
1904. Koerner, H. Theo., Beyerstrasse 28, Chemnitz, Germany, Student of Chemistry.
1884. Kohn, Dr. Charles A., M.Sc., Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C., Principal.
1902. Kohnstamm, Lothair S., 87, Park Place, New York City, U.S.A., Chemist.
1904. Korte, Dr. R. F., 146, Alexandra Road, N.W.; and (Journals) University College, Gower Street, London, W.C., Chemist.
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- O.M. Kraftmeier, E., 54, Parliament Street, Westminster, S.W., Explosives Manufacturer.
1894. Krause, Dr. Albert H., 32, Wellington Avenue, Cleveland, Ohio, U.S.A., Chemist (Grasselli Chemical Co.).
- O.M. Krause, Prof. Dr. G., "Chemiker-Zeitung," Cöthen, Germany, Editor.
- O.M. Krause, O. H., c/o American Sugar Refining Co., Jersey City, N.J., U.S.A., Chemical Engineer.
1898. Krebs, H. J., Wilmington, Del., U.S.A., Manufacturing Chemist.
1903. Kremer, Frank N., 646, Broadway, Milwaukee, Wis., U.S.A., Chemist.
1900. Kremers, Dr. Edw., Madison, Wis., U.S.A., Professor (University of Wisconsin).
1904. Kübler, Alfred, 69, Barclay Street, New York City, U.S.A., Vice-President, Geigy Aniline and Extract Co.
- O.M. Kühl, W. H., 73, Jägerstrasse, Berlin, Germany, Bookseller.
1900. Kunheim, Dr. Erich, 32, Dorotheenstrasse, Berlin, N.W., Germany, Chemist.
1904. Kunz, Dr. George F., c/o Tiffany and Co., 11-15, Union Square, New York City, U.S.A., Gem Expert.
1885. Kupferberg, Dr. H., 19, Schulstrasse, Mainz, Germany, Technical Chemist.
1896. Kuttroff, Adolf, 128, Duane Street, New York City, U.S.A., Chemical Merchant.

1900. Kuttroff, Fred., 128, Duane Street, New York City, U.S.A., Merchant.
1904. Kyle, J., Canada Paint Co., Ltd., 572, William Street, Montreal, Canada, Analytical Chemist.
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- L**
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1890. Lacey, E. C., 10, Clarence Road, Croydon, Manufacturing Chemist.
1899. Lachman, Albert, California Wine Association, San Francisco, Cal., U.S.A., Wine Merchant.
1903. Lachman, Dr. Arthur, 131, Second Street, San Francisco, Cal., U.S.A., Chemical Engineer.
1888. Lagerwall, Dr. Ivar, Sunthorpe, Wallington, Surrey, Petroleum Manufacturer.
- O.M. Laidler, C. P., 20, Noble Terrace, Gateshead-on-Tyne, Analytical Chemist.
- O.M. Lake, G. jun., Lee Mount, Glossop, Derbyshire, Analytical Chemist.
1900. Lamar, Wm. R., Mallinckrodt Chemical Works, St. Louis, Mo., U.S.A., Chemist.
1898. Lamb, Morris Chas., 151, Westcombe Hill, Blackheath, S.E., Chemist.
1900. Lambert, Walter S., Vandre Road, Clydach, R.S.O., Glamorgan, Analyst.
1899. Lamborn, Leebert Lloyd, 134, Willoughby Avenue, Brooklyn, N.Y., U.S.A., Factory Superintendent.
1895. Lancaster, Jno. C., 260, Alfreton Road, Nottingham, Engineering Works Manager.
1904. Lancey, Darragh de, Great Barrington, Mass., U.S.A., Secretary (Stanley Instrument Co.).
1895. Landin, John, 40, Drottninggatan, Stockholm, Sweden, Public Analyst.
1904. Lane, C. Cyril P., c/o The Avon India-Rubber Co., Melksham, Wilts., Chemist.
1903. Lane, Nathaniel J., U.S. Laboratory, 641, Washington Street, New York City, U.S.A., Chemist.
1890. Lang, Jas. G., P.O. Box 283, Greenwood, B.C., Canada, Analytical Chemist.
1893. Lang, Dr. Wm. R., University of Toronto, Canada, Professor of Chemistry.
- O.M. Langdon, Dr. M. J., 64, Northern Grove, West Didsbury, Manchester, Analytical Chemist.
1890. Lange, Dr. Martin, 66, Grafton Street, C. on M., Manchester, Analytical Chemist.
1892. Langer, Dr. Carl, Ynyspenllwch, Clydach, R.S.O., Glamorganshire, Analytical Chemist.
1897. Langmuir, Arthur C., c/o Marx and Rawolle, 9, Van Brunt Street, Brooklyn, N.Y., U.S.A., Analytical Chemist.
1902. Langmuir, F. Leighton, 22, Goethestrasse, Freiburg, i/B, Germany, Chemist.
1898. Langstaff, Wm., c/o Grasselli Chemical Co., Tremley, N.J., U.S.A., Chemist.
1900. Lant, Herbert, "Ivy Bank," Wath-on-Dearne, near Rotherham, Yorks., Chemist and Manager.
1903. Larter, Alfred T., The Basingstoke Ironworks, Basingstoke, Hants, Chemist.
1904. Lasher, F. G., The Lake Pigment Co., Dunellen, N.J., U.S.A., Chemist.
1884. Latham, Baldwin, Parliament Mansions, Victoria Street, Westminster, S.W., Civil Engineer.
1889. Latham, J. J., Mill House, Bold, Widnes, Chemical Works Manager.
1904. Laury, N. Arthur, Capelton, Prov. Quebec, Canada, Chemist.
1904. Law, Herbert, 72, Belvedere Road, Liscard, Cheshire, Analytical Chemist.
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1885. Lawson, Arthur J., Marsh Soapworks, Bristol, Soap Manufacturer.
1904. Lawson, Jos. H. S., Worsley Street, Mills, Hulme, Manchester, Salesman.
1900. Lawson, Wm., c/o Utah Sugar Co., Salt Lake City, Utah, U.S.A., Chemist.
1894. Lawson-Johnston, G., (Journals) 29, Portman Square, W., and c/o Bovril, Ltd., 152, Old Street, London, E.C., Vice-Chairman.
1894. Lawson-Johnston, W. E., c/o Bovril, Ltd., 152, Old Street, London, E.C., Director.
1893. Lawton, Thos., Calthorpe House, Aldridge Road, Perry Bar, Birmingham, Chemical Works Manager.
1890. Laycock, Dr. W. F., 46, Boar Lane, Leeds, Analytical Chemist.
1902. Lazell, Ellis Warren, 42, North 16th Street, Philadelphia, Pa., U.S.A., Chemist.
1898. Lean, Geo., 15, Park Terrace, Glasgow, Chemist.
1897. Leathart, Thos. H., c/o Locke, Blackett and Co., Ltd., Lead Works, Newcastle-on-Tyne, Lead Manufacturer.
- O.M. Leather, Dr. J. Walter, Dehra Dun, United Provinces, India, Government Agricultural Chemist.
1893. Le Boutillier, Clement, c/o Taylor Iron and Steel Co., High Bridge, N.J., U.S.A., Chemist.
1904. Le Chatelier, Prof. H., 75, Rue Notre Dame des Champs, Paris, France, Professor (l'Ecole des Mines).
1896. Lecomber, W. G., Cambridge Works, Knott Mill, Manchester, Engineer.
1896. Lederle, Dr. E. J., Health Department, New York City, U.S.A., Chief Chemist.
1892. Ledoff, Prof. A., Technological Institute, Kharkoff, Russia, Professor of Chemistry.
1895. Ledoux, Dr. Albert R., 99, John Street, New York City, U.S.A., Chemist.
1903. Ledoux, Aug. D., 68, Beaver Street, New York City, U.S.A., Importer of Pyrites.
1901. Lee, FitzHugh, c/o Grasselli Chemical Co., Cleveland, Ohio, U.S.A., Superintendent.
1905. Lee, John C., Mountford Street, Brookline, Mass., U.S.A., Assistant Engineer (American Telegraph and Telephone Co.).
1898. Lee, Jno. L., Woodfield, Lytham, Lancashire, Dyer and Bleacher.
1885. Lee, S. Wright, 6-10, Whitechapel, Liverpool, Wholesale Druggist.
1899. Lee, Waldemar, 4620, Wayne Street, Philadelphia, Pa., U.S.A., Chemist.
1886. Leeds, F. H., 26, East Bank, Stamford Hill, N., Analytical Chemist.
1903. Leerburger, Henry, 54, Beekman Street, New York City, U.S.A., Essential Oil Merchant.
1889. Leese, Joseph, 3, Lord Street West, Southport.
1903. Leese, Jos., jun., 13, Albert Place, Longsight, Manchester, Analytical and Technical Chemist.
1901. Lefebvre, Georges, Compagnie du Phospho-Guano, 27 Rue La Rochefoucauld, Paris, Director.
1901. Lefler, Rudolf L., c/o Thos. Firth and Sons, Ltd., Norfolk Works, Sheffield, Metallurgical Chemist.
1901. Leibfried, Jno., E., Bethlehem, Pa., U.S.A., Analytical Chemist.
1888. Leigh, Cecil, Birmingham Metal and Munition Co., Adderley Park Rolling Mills, Birmingham, Technical Chemist.
1902. Leighton, A. E., Cordite Factory, Aruvankad, Nilgiris, India, Analytical Chemist.
1894. Leitch, Jno. W., Milnsbridge Chemical Works, near Huddersfield, Aniline Dye Manufacturer.
1904. Le Maistre, Fred J., Henry S. Spackman Engineering Co., 1619, Fillbert Street, Philadelphia, Pa., U.S.A., Organic Chemist.
1898. Leman, Wm. T., c/o The Texas Co., Beaumont, Tex., U.S.A., Oilworks Manager.
1901. Lengfeld, Dr. Felix, 202, Stockton Street, San Francisco, Cal., U.S.A., Manufacturing Chemist.
1883. Lennard, F., 70, Gracechurch Street, E.C.: and (Journals) 29, Adelaide Crescent, Hove, Sussex, Chemical Manufacturer.
1884. Leonard, Wm. J., 1, Lindfield Gardens, Hampstead, N.W., Naphtha Distiller.



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1888. Lequin, E., Directeur Général des Usines de Produits Chimiques de la Société de St. Gobain, 1, Place des Saussaies, Paris (VIII.), France.
1904. Lesley, R. W., Pennsylvania Building, Philadelphia, Pa., U.S.A., Cement Manufacturer.
1894. Leslie, Hugh M., Marikuppam, Mysore State, South India, Chemical Engineer.
1899. Lesser, Wm., P.O. Box 162, Albany, N.Y., U.S.A., Manufacturing Chemist.
1904. Lessing, Dr. Rudolf, c/o The Gas Light and Coke Co., Tar and Liquor Works, Beckton, E., Chemist.
1900. Lessner, Chas. B., San Finx Tin Mines, Ltd., Carrill, Spain, Metallurgical Chemist.
1896. Lester, Isaac E., 57, Westminster Road, Handsworth, Birmingham, Steelworks Manager.
1892. Lester, J. H., Royal Exchange, Manchester, Analytical Chemist.
1904. Le Sueur, E. A., 59, MacLaren Street, Ottawa, Ont., Canada, Electrical and Chemical Engineer.
1899. Le Sueur, Dr. Henry R., Chemical Laboratory, St. Thomas' Hospital, London, S.E., Demonstrator.
1894. Lett, Stephen J., Morland, near Penrith, Chemical Engineer.
1898. Lenthardt-Thornton, Peter, 33, Rydal Gardens, Streatham, S.W., Chemical Manufacturer.
1891. Lever, Wm. H., Thornton House, Thornton Hough, Cheshire, Soap Manufacturer.
1901. Levett, Walter, Fairview, St. Margaret's Avenue; and (Journals) Mines Safety Explosives Co., Stanford-le-Hope, Essex, Factory Manager.
1903. Levi, Louis E., c/o Pfister and Vogel Leather Co., Milwaukee, Wis., U.S.A., Chemist.
1900. Levine, Edmund J., c/o The Fiberloid Co., 7, Waverley Place, New York City, U.S.A., Chemist.
1901. Levinstein, Dr. Herbert, (Journals) Hawkesmoor, Fallowfield, and (communications) 21, Minshull Street, Manchester, Chemist.
- O.M. Levinstein, Ivan, Hawkesmoor, Fallowfield, Manchester, Colour Manufacturer.
1901. Levy, Dr. Albert, Alfonsstrasse 15, Aachen, Germany, Works Chemist.
1903. Levy, Arthur G., 45, Warrington Crescent, Maida Vale, London, W., Chemist.
1887. Lewes, Prof. Vivian B., Royal Naval College, Greenwich, S.E., Professor of Chemistry.
1898. Lewin, H. James, Royal Victoria Yard, Deptford, S.E., Analytical Chemist.
1889. Lewis, A. E., 20, Seymour Street, Broadgreen, near Liverpool, Analytical Chemist.
1896. Lewis, Daniel C., c/o Millville Manufacturing Co., Millville, N.J., U.S.A., Dye Works Chemist.
1900. Lewis, Ernest A., 310, Dudley Road, Birmingham, Chemist and Metallurgist.
1904. Lewis, E. W., 97, Belgrave Road, Ilford, E., Chemist.
1900. Lewis, John, 10, Windsor Road, Denmark Hill, S.E., Cashier (Paint Works).
1900. Lewis, Saml. J., 122, Newington Causeway, London, S.E., Pharmaceutical Chemist.
1889. Lewkowitzsch, Dr. Julius, 71, Priory Road, West Hampstead, N.W., Consulting Chemist.
1901. Lichtenstein, Alf. F., c/o Geisenheimer and Co., P.O. Box 994, New York City, U.S.A., Chemist.
- O.M. Lichtenstein, Theodore, Chemical Works, Silvertown, E., Manufacturing Chemist.
1904. Liehtenthæler, Robt. A., University of Florida, Lake City, Fla., U.S.A., Chemist.
1892. Liddle, G. A., Ring o' Bells, Church St., Wilmslow, Cheshire, Chemist, Dyewood Extract Works.
1885. Liddle, W. T., 14, Willows Avenue, Ansdell, Lytham, Lanes., Manager, Dyewood Extract Works.
1904. Lieber, Hugo, 25, West Broadway, New York City, U.S.A., Chemist.
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1899. Liedbeck, P. F. Alarik, 43, Strandwagen, Stockholm, Sweden, Chemical Engineer.
- O.M. Lightfoot, T. E., 88, Arden Terrace, Accrington, Calico Printer's Chemist.
1905. Liley, Thos. A., 37, Aston Road, Bramley, Leeds, Chemist.
1898. Lilly, Josiah K., c/o Eli Lilly and Co., Indianapolis, Ind., U.S.A., Manufacturing Pharmacist.
1885. Lilly, Oliver M., The Croft, Spaldon, Derby, Colour Manufacturer.
1904. Lindemann, Ottocar, 53, Victoria Street, Westminster, S.W., Managing Director (Korting Bros., Ltd.).
1903. Lindmueller, C., c/o United Zinc and Chem. Co., Argentine, Kansas, U.S.A., Chemist.
1897. Lindsay, Robt., Geldenhuis Deep G. M. Co., Cleveland, Johannesburg, Transvaal, Chemist.
1890. Ling, Arthur R., Laboratory, 74, Great Tower Street, E.C.; and (Journals) Hazeldene, Kingston Road, New Malden, Consulting Chemist.
1901. Lippincott, Warren B., c/o United Zinc and Chemical Co., Argentine, Kansas, U.S.A., Chemist.
1896. Lishman, Geo. P., Bunker Hill, Fence Houses, Co. Durham, Colliery Chemist.
1904. Litter, Hans, Farbenchemisches Laboratorium der Kgl. Technischen Hochschule, Dresden, Germany, Chemist.
1901. Little, C. A., Elyria, Ohio, U.S.A., Analytical Chemist.
1889. Little, Wm. G., Blendon Grove, Bexley, Kent, Chemical Manufacturer.
- O.M. Littlejohn, Jas., c/o African Banking Corporation, Johannesburg, Transvaal, Analytical Chemist.
1902. Littlewood, Dr. Jas. B., U.S. Patent Office, Washington, D.C., U.S.A., Chemical Examiner.
1904. Livermore, W. D., Washington Mill, Lawrence, Mass., U.S.A., Chemist.
1886. Liversedge, A. J., Clock House, Arundel Street, Strand, London, W.C., Mechanical Engineer.
1904. Liverseege, J. F., Council House, Birmingham, Public Analyst.
- O.M. Liversidge, Prof. A., F.R.S., The University, Sydney, N.S.W., Professor of Chemistry.
1883. Livingston, W. J., London County Council, Spring Gardens, London, S.W., Analytical Chemist.
1903. Llewellyn, Ivor P., c/o Peter Spence and Sons, Ltd., Manchester Alum Works, Manchester, Chemist.
1899. Lloyd, Charles, (subscriptions) c/o Lake View Consols, Ltd., Salisbury House, London, E.C.; and (Journals) c/o Manager, Lake View Consols, Ltd., Boulder, West Australia, Secretary.
1900. Lloyd, Fred. J., Muscovy House, Trinity Square, London, E.C., Analyst.
1904. Lloyd, Leonard B., Broadford Tannery, Broadford, Victoria, Australia, Tanner.
1900. Lloyd, Thos. H., c/o Quibell Bros., Newark, Analyst.
1901. Lober, Jno. B., Vulcanite Portland Cement Co., 1230, Land Title Building, Philadelphia, Pa., U.S.A., Cement Manufacturer.
1888. Lodge, Edw., 25, Scale Hill, Cowcliffe, Huddersfield, Teacher of Wool Dyeing.
1900. Loeb, Dr. Morris, New York University, University Heights, New York City, U.S.A., Professor of Chemistry.
1891. Loewenthal, Dr. R., Uhlandstrasse 39, Frankfurt a. M., Germany, Lecturer on Dyeing.
1899. Logan, John, Offendene, Oakfield Drive, Ashton-on-Mersey, Indigo-blue Dyer.
1905. Lomax, Abraham, 30, Taskers Lane, Kearsley, Farnworth, R.S.O., Potter's Chemist.
1901. Long, Eugene J., c/o E. O'Callaghan and Son, City Tannery, Limerick, Ireland, Tanner.
1902. Longden, Alf. Ily., Stanton-by-Dale, Nottingham, Analytical Chemist.
1898. Longstaff, Jas. P., Chemical Department, The University, Edinburgh, Assistant.
1904. Loomis, Dr. H., 58, West 40th Street, New York City, U.S.A.
1902. Loomis, Henry M., 1326, De Kalb Street, Norristown, Pa., U.S.A., Chemist.
1890. Lord, F. J., 4, Winmarleigh Street, Warrington, Analytical Chemist.
1896. Lord, Jno. Lloyd, 23, Park View, Elton, Bury, Lanes., Chemist and Manager.

1897. Lord, N. W., 338, West 8th Avenue, Columbus, Ohio, U.S.A., Professor of Metallurgy.
- O.M. Lorenz, H., 7 and 8, Idol Lane, London, E.C., Chemical Merchant.
- O.M. Lorimer, J., Britannia Row, Islington, N., Manufacturing Chemist.
1904. Lorimer, John H., 280, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Textile Machinist and Merceriser.
- O.M. Lorrain, J. G., Norfolk House, Norfolk Street, Strand, London, W.C., Civil Engineer.
1904. Lossen, Dr. Clemens F., c/o Gulf Refining Co., Port Arthur, Texas, U.S.A., Chemist.
- O.M. Lott, F. E., The Laboratory, Bridge Chambers, Burton-on-Trent, Consulting Brewing Chemist.
- O.M. Louis, D. A., 77, Shirland Gardens, London, W., Metallurgist and Mining Engineer.
1894. Louis, Prof. Henry, Armstrong College, Newcastle-on-Tyne, Professor of Mining.
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1899. Love, Wm., 28, Royal Exchange Square, Glasgow, Managing Director (Broxburn Oil Co., Ltd.).
1895. Lovejoy, Frank W., Kodak Park, Rochester, N.Y., U.S.A., Chemical Engineer.
1904. Loveland, Jas. W., 8, Kenwood Street, West Somerville, Mass., U.S.A., Superintendent of Soap Works.
- O.M. Lovibond, J. W., Lake House, Salisbury, Tintometer Manufacturer.
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1897. Low, Albert H., P.O. Drawer 1537, Denver, Colo., U.S.A., Metallurgical Chemist.
1900. Low, Prof. Wilson H., Cudahy Packing Co., South Omaha, Neb., U.S.A., Chemist.
1887. Lowe, Clement W., Cornbrook, Legh Road, Knutsford, Cheshire, Manufacturing Chemist.
1905. Lowe, Houston, The Lowe Bros. Co., Dayton, Ohio, U.S.A., Paint and Varnish Maker.
- O.M. Lowe, W. F., 9, Hough Green, Chester, Analytical Chemist.
1904. Lowenstein, Arthur, c/o Nelson, Morris and Co., U.S. Yards, Chicago, Ill., U.S.A., Chemist.
1885. Lowson, J. G. F., 18, Coates' Gardens, Edinburgh, Paper Maker.
1895. Lucas, Alf., Survey Department, Public Works Ministry, Cairo, Egypt, Analyst.
1892. Lucas, Bernard R., Winnington Park, Northwich, Alkali Works Manager.
- O.M. Lucas, R., Alwinenstrasse 11, Wiesbaden, Germany, Technical Chemist.
- O.M. Luck, Alf., Naval Arsenal, Zarate, Argentina, Explosives Chemist.
1900. Lumsden, Walter E., 62, Newhall Street, Lynn, Mass., U.S.A., Manager (Commonwealth Manufacturing Co.).
1903. Lumsden, Alex. A., Forth Chemical Works, Bo'ness, N.B., Technical Chemist.
1888. Lund, Jas., 142, Hawthorne Street, Malden, Mass., U.S.A., Ammonia Works Manager.
1888. Landholm, Carl O., Nobel's Explosives Co., Ltd., Ardeer Factory, Stevenston, Ayrshire, Manager.
1898. Lundteigen, Andreas, Union City, Mich., U.S.A., Chemist.
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1894. Lungwitz, Theo., c/o Chas. Pfizer and Co., 81, Maiden Lane, New York City, U.S.A., Chemist.
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1890. Luthy, Edmund O., 2419, Ohio Avenue, Cincinnati, Ohio, U.S.A., Distiller.
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1899. Luxton, Thos., 28, Albany Street, Hnll, Teacher of Chemistry.
1903. Lye, Ernest B., Legrave Hall, near Luton, Beds., Straw Plait Dyer and Bleacher.
1885. Lye, W. T., Legrave Hall, near Luton, Beds., Straw Dyer.
1884. Lyle, James, Ardesco, Plaistow Wharf, Victoria Docks, E., Sugar Refiner.
1885. Lyle, Jno., 21, Mincing Lane, London, E.C., Sugar Refiner.
1902. Lyle, Robert F., Berry Yards Sugar Refinery, Greenock, N.B., Analytical Chemist.
1889. Lymn, Arthur H., 125, Alexandra Road, Wimbledon, Chemical Works Manager.
1899. Lynn, R. Rankine, 7, Highburgh Terrace, Dowanhill, Glasgow, Chemical Engineer.
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1902. Lyon, Edwd. H., 520, West 27th Street, New York City, U.S.A., Manufacturing Chemist.
- O.M. Lyon, J. G., The Aire Tar Works, Knottingley, Yorks., Tar Distiller.
- O.M. Lyte, F. Maxwell, 60, Finborough Road, Redcliffe Square, London, S.W., Chemical Manufacturer.
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## M

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1904. Mabec, Fred Carleton, McMaster University, Toronto, Ont., Canada, Assistant in Chemistry.
1887. Mabery, Prof. Chas. F., Case School of Applied Science, Cleveland, Ohio, U.S.A., Professor of Chemistry.
1894. Mabey, Fred O., 196, Amhurst Road, Hackney, N.E., Wine Merchant.
1891. Macadam, Herbert E., Milton House, Selsdon Road, Wanstead, Essex, Manure Works Manager.
1894. Macadam, Stevenson, 55, York Place, Edinburgh, Analytical Chemist.
1894. McAlley, Robt., Bankside, Falkirk, N.B., Paint Works Manager.
1891. Macallan, J., 3, Rutland Terrace, Clontarf, Dublin, Analytical Chemist.
1892. Macara, Thos., jun., c/o Jas. Robertson and Sons, Thrusgrove Works, Paisley, N.B., Chemist.
1889. McArthur, Jno., 196, Trinity Road, Wandsworth Common, S.W., Chemist.
1887. McArthur, J. B., Price's Patent Candle Co., Limited, Bromborough Pool, near Birkenhead, Chemist.
- O.M. McArthur, J. S., 45, Renfield Street, Glasgow, Consulting Chemist and Metallurgist.
1901. MacArthur, Jno. S., 15, St. John's Road, Pollokshields, Glasgow, Paint and Varnish Manufacturer.
1892. McArthur, Thos., 7, Temple, Dale Street, Liverpool, Drysalter and Dyewood Extractor.
1898. MacCallum, D. A., 389, Central Chambers, 93, Hope Street, Glasgow, Chemist.
- O.M. McCallum, J. M., Southdene, Paisley, N.B., Soap Manufacturer.
1903. McCandless, Jno. M., State Laboratory, Atlanta, Ga., U.S.A., Analytical Chemist.
1894. McCann, Owen, c/o J. Gilton and Co., Oriol Street, Vauxhall Road, Liverpool, Printing Ink Manufacturer.
1893. McCombie, C., 19, St. Dunstan's Hill, London, E.C., Drug and Chemical Merchant.
1903. McCourt, Cyril D., 52, Victoria Road, Clapham, S.W., Research Chemist (Morgan Crucible Co.).
- O.M. McCowan, W., Essex Wharf, Narrow Street, Limehouse, E.
1897. McCrae, Dr. John, jun., 7, Kirklee Gardens, Kelvin-side, Glasgow, Chemical Demonstrator.
1898. McCreath, Wm. D., c/o Quantock Vale Cider Works, North Petherton, Bridgewater, Cider Manufacturer.
1884. McCulloch, J., 13, Clarence Drive, Hyndland Road, Glasgow, Chemical Works Manager.
1900. McCulloch, John, Glencoe, Lostock Gralam, Cheshire, Chemical Engineer.



1903. McCully, R. E. J., 251, Maidstone Road, Rochester, Kent, Analytical Chemist.
- O.M. McDaniel, J. J., Woodlands, Bandon, Ireland, Distiller.
- O.M. Macdonald, A., 72, Great Clyde Street, Glasgow.
1897. MacDonald, G. W., c/o Curtis's and Harvey, Ltd., Dartford, Kent, Explosives Chemist.
- O.M. Macdonald, J. W., Cleveland, The Globe, Blackheath, S.E., Analytical Chemist.
1902. Macdonald, Peter, jun., Mazapil Copper Co., Ltd., Concepcion del Oro, Zacatecas, Mexico, Analytical Chemist.
1899. MacDonald, S. Fremont, c/o Ashtabula Hide and Leather Co., Ashtabula, Ohio, U.S.A., Tanner.
- O.M. McDonald, T. M., Wahlabo Estate, St. Vincent, West Indies, Sugar Chemist.
1899. McDougall, Hugh, 45, Warton Terrace, Newcastle-on-Tyne, and (Journals) Johnson's Cement Works, Gateshead-on-Tyne, Chemical Engineer.
1895. McDougall, Isaac, jun., The Orchard, Hale, near Manchester, Student.
1895. McDougall, Isaac S., The Orchard, Hale, near Manchester, Manufacturing Chemist.
1890. McDougall, J. T., Dunolly, Morden Road, Blackheath, S.E., Manufacturing Chemist.
1905. McDowell, Stewart H., 1246, South 51st Street, Philadelphia, Pa., U.S.A.
1889. MacEwan, Peter, 64, Southwood Lane, Highgate, N., Editor of "Chemist and Druggist."
1891. McEwen, Atholl P., 1, Northbrook Road, Lee, S.E., Analytical Chemist and Assayer.
1901. McEwen, Duncan C., c/o British and Korean Corporation, Ltd., Gwendoline, Korea, Metallurgical Chemist.
1902. McFarland, Alan R., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.
- O.M. Macfarlane, R. F., Tharsis Copper Works, East Moors, Cardiff, Technical Chemist.
1884. Macfarlane, Thos., 317, Queen Street, Ottawa, Canada, Analyst to Dominion of Canada.
1901. McFarlane, Walter, Sunnyside, Mansewood, Pollockshaws, Glasgow, Printworks Manager.
1890. McFarlane, W. W., 522, West 9th Street, Chester, Pa., U.S.A., Dyeworks Manager.
1893. McGhie, T. Burns, c/o Quirk, Barton and Co., Normandy Wharf, Rotherhithe, S.E., Analytical Chemist and Assayer.
1904. McGill, A., 317, Queen Street, Ottawa, Canada, Analytical Chemist.
1891. McGill, Dr. J. T., Vanderbilt University, Nashville, Tenn., U.S.A., Adjunct Professor of Chemistry.
1899. MacGillivray, Wm. A., c/o Swansea Safety Fuse Co., Pipe House Wharf, Swansea, Analytical Chemist.
1887. McGlashan, John, Cawnpore Sugar Works, Cawnpore, India, Technical Chemist.
1902. McGovney, Chas. S., Experiment Station, West La Fayette, Ind., U.S.A., Chemist.
1884. McGowan, John, Ash House, Talke, near Stoke-upon-Trent, Colliery Manager.
1896. McIlhenny, Dr. Parker C., 145, East 23rd Street, New York City, U.S.A., Chemist.
1894. McIlwaine, Alf. W., Stoneferry, Hull, Oil Manufacturer.
- O.M. MacIndoe, G. D., Ettrick Street, Invercargill, New Zealand, Chemical Works Manager.
1903. Macintire, Benj. Gould, P.O. Box 365, Rumford Falls, Maine, U.S.A., Chemist.
1904. Macintosh, J. C., Helen Mine, Michipicoten, Ont., Canada, Chemist.
1888. MacKean, Wm., Welsbach Incandescence Gas Light Co., Ltd., Broomhill Road, Wandsworth, S.W., Technical Chemist.
- O.M. McKechnie, D., Heath House, Runcorn, Copper Extractor.
- O.M. McKechnie, D. M., Metal Works, Widnes, Lancashire, Copper Extractor.
1904. McKechnie, R. D., c/o The British Explosives Syndicate, Ltd., Pitsea, Essex, Chemist.
1887. McKellar, W. G., c/o United Alkali Co., Ltd., Eglinton Works, Irvine, N.B., Technical Chemist.
1904. McKenna, A. G., 506, Hawkins Avenue, Bradlock, Pa., U.S.A., Metallurgical Chemist.
1895. McKenna, Dr. Chas. F., 221, Pearl Street, New York City, U.S.A., Chemist.
1903. McKenny, Chas., Bayview House, Drogheda, Ireland, Chemical Engineer and Manure Manufacturer.
1899. Mackenzie, Alex. H., 40, Hall Street, North Adams, Mass., U.S.A., Colour Mixer.
1893. McKerrow, C. A., Thornbank, Knutsford Road, Alderley Edge, Cheshire, Consulting Chemist.
1893. McKesson, John, 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.
1891. Mackey, W. McD., Victoria Chambers, Leeds, Analytical Chemist.
1900. McKillop, George F., Broxburn Oil Works, Broxburn, N.B., Works Chemist.
1890. McKillop, Jno., 93, Brook Green, London, W., Metallurgist.
1902. McKim, Wm., 25, Fairview Street, Vonkers, N.Y., U.S.A., Colour Maker.
1898. McLaurin, Robt., 414, Sauchiehall Street, Glasgow, Chemist.
1888. MacLean, Alex. S., 31, Bank Street, Greenock, N.B., Soap Refiner.
- O.M. McLellan, J. Y., Beech Cottage, Boothferry Road, Goole, Chemical Manufacturer.
1892. McLeod, Jas., Westhill, Cardross Road, Dumbarton, N.B., Analytical Chemist and Gas Examiner.
1903. MacMahon, F. W., 8, Niederwald Road, Sydenham, S.E., Chemist (Oxychlorides, Ltd.).
1896. McMaster, Daniel, c/o Oxford Paper Co., Rumford Falls, Maine, Paper Mill Manager.
1894. Macmillan, Arch., 12, Hastings Street, Sunderland.
1903. McMullan, Charles, 20, Corn Market, Belfast, Ireland, Chemist.
1904. McMullen, Alan, 108, James Street, Dublin, Ireland, Brewer.
1889. McMurtrie, J. M., 21, Princes Street, Pollokshields, Glasgow, Brass Founder.
1900. McMurtrie, Dr. Wm. T., 144, West 49th Street, New York City, U.S.A., Chemist.
1895. McMurtry, G. C., Wallaroo Smelting Works, Wallaroo, South Australia, Manager.
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1894. McVitie, Robt., 25, Nicoll Road, Harlesden, N.W., Biscuit Manufacturer.
1901. Maertens, Emile, P.O. Box 1002, Providence, R.I., U.S.A., Engineer.
1895. Magnus, Isidor, 52, Leadenhall Street, London, E.C., Chemical Merchant.
1901. Magruder, Egbert W., Department of Agriculture, Richmond, Va., U.S.A., Chemist.
1885. Mahon, R. W., N. Y. Central and Hudson River Railroad, West Albany, N.Y., U.S.A., Chemist.
1898. Main, Wm., 299, Jefferson Avenue, Brooklyn, N.Y., U.S.A., Chemical Expert.
1904. Mair, William, 7, Comiston Road, Edinburgh, Chemist.
- O.M. Major, J. Lewis, Welton Garth, Brough, East Yorks., Tar Distiller and Chemical Manufacturer.
1886. Mallinckrodt, Edw., Mallinckrodt Chemical Works, St. Louis, Mo., U.S.A., Manufacturing Chemist.
1897. Mallory, J. Halsey, Drawer 69, Columbia, S.C., U.S.A., Assistant Chemist (The American Cotton Oil Co.).
1896. Mann, E. A., Government Laboratory, Perth, Western Australia, Government Analyst.
1893. Mann, Harold H., Indian Tea Association, Royal Exchange Buildings, Calcutta, India, Research Chemist.
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1891. Mann, John C., 9, Lambert Street, Hull, Chemist.
1903. Mannhardt, Hans, 1641, Melrose Street, Chicago, Ill., U.S.A., Analytical Chemist.
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1893. Marchlewski, Dr. L., Strzelecka 9, Krakow, Austria.
1904. Marchworth, O. S., Ohio Testing Laboratory, 19 and 25, Board of Trade, Columbus, Ohio, U.S.A., Analytical Chemist.
1903. Mardick, Jno. R., c/o Wm. F. Moser and Co., Du Bois, Pa., U.S.A., Chemical Engineer.
1904. Maréchal, H., Eugene Maréchal et fils, Vénissier (Rhône), France, Oilcloth Manufacturer.
1883. Markel, Dr. K., Lodge Lane, Bewsey, Warrington, Technical Chemist.
1886. Markham, A. D., 71, Queen Street, Hull, Pharmaceutical Chemist.
1905. Marland, Percy, c/o Brotherton and Co., Ltd., Ammonia Works, Wakefield, Yorks., Chemist.
1905. Marlatt, Wilbur T., Oakville, Ont., Canada, Leather Manufacturer.
1902. Marriott, F. Grant, 14, Selby Street, Toronto, Canada, Chemical Student.
1904. Marris, H. C., The Russian Steam Oil Mills Co., 32, Kourlandski Street, St. Petersburg, Russia, Analytical Chemist.
1904. Marshall, Adolf J., Little Falls, N.Y., U.S.A., Chemist.
1901. Marsden, Dr. Fred., 3, Mannville Terrace, Bradford, Yorks., Chemist.
1905. Marsh, John, 6, Netherby Terrace, South Stifford, Grays, Essex, Cement Works Chemist.
- O.M. Marsh, J. T., Ammonia Soda Works, Fleetwood, Lancashire, Chemist.
1883. Marsh, W., Union Alkali Co., Soho Works, Manchester, Chemical Manufacturer.
1895. Marshall, Arthur, Hope Cottage, Church Hill, Loughton, Essex, Explosives Chemist.
1891. Marshall, Dr. Hugh, 12, Lonsdale Terrace, Edinburgh, Professor of Chemistry.
1895. Marshall, Francis G., 4, Woodhouse Terrace, Bewick Road, Gateshead, Technical Chemist.
1901. Marshall, Jos. W., Boulevard Higher Grade School, Hull, Science Lecturer.
1896. Marshall, Percy S., Union Laboratory, Half Moon Street, Huddersfield, Assistant Chemist.
1883. Marshall, Wm., Carisbrook, Queen's Road, Cheadle Hulme, Cheshire, Dyer.
1884. Marshall, Wm., Barkley, Teddington, Middlesex, Analytical Chemist.
1904. Marston, John P., 247, Atlantic Avenue, Boston, Mass, U.S.A., Merchant.
1894. Martin, Alex. M., Hillview, Twechar by Glasgow, Analytical Chemist.
1895. Martin, Chas. H., 14, Aldred Street, Crescent, Salford, Oil and Soap Works Manager.
- O.M. Martin, N. H., Ravenswood, Low Fell, Gateshead-on-Tyne, Manufacturing Chemist.
1904. Martin, W. C., College Station, Texas, U.S.A., Instructor in Industrial Chemistry.
1899. Martin, Wm. E., c/o Kynoch Ltd., Arklow, Co. Wicklow, Ireland, Chemist.
- O.M. Martin, W. H., 183B, King's Road, Chelsea, London, S.W., Analytical Chemist.
1887. Martineau, Sydney, Northwood, Rydal Road, Streatham, S.W., Sugar Chemist.
1894. Martyu, T. Graham, 11, Stratton Terrace, Truro, Cornwall, Metallurgist.
1902. Marx, Joseph S., California Powder Works, Pinole, Cal., U.S.A., Chemist.
1905. Marx, Dr. Max, 81, Shanley Avenue, Newark, N.J., U.S.A., Manufacturing Chemist.
1904. Mason, Dr. Edward D., c/o Messrs. Grimshaw Brothers and Co., Ltd., Clayton, Manchester, Chemist.
1904. Mason, Glen F., c/o H. J. Heinz Co., Pittsburg, Pa., U.S.A., Chemist.
1887. Mason, J. Francis, Eynsham Hall, Witney, Oxon.
1892. Mason, Thos., Beech Avenue, Nottingham, Manufacturing Chemist.
1903. Massey, Joseph B., 60, Colne Road, Burnley, Chief Sanitary Inspector.
- O.M. Masson, Prof. D. Orme, University of Melbourne, Victoria, Australia, Professor of Chemistry.
1904. Masson, Victor E., Pleasant Valley Wine Co., Rheims, Steuben Co., N.Y., U.S.A., Chemist.
1889. Master, Ardesheer B., 679, Tardeo, Bombay, India, Chemical Manufacturer.
1902. Masujima, Bunjiro, 19, Honjoku Midoricho San-chome, Tokyo, Japan, Prof. of Applied Chemistry.
1903. Masure, Gaston, 7, Rue de Constantine, Rouen, France, Chemist.
1902. Masury, Fred. L. M., Sharon, Pa., U.S.A., Explosives Manufacturer.
- O.M. Mather, J., Blaydon Chemical Works, Blaydon-on-Tyne, Manager.
1904. Mather, J. Cecil, 15, The Holloway, Runcorn, Cheshire, Works Chemist.
1900. Mather, Wm., c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Chemist.
1890. Mathesson, W. J., c/o Cassella Colour Co., 182, Front Street, New York City, U.S.A., Chemical Merchant.
1901. Mathew, W. E. B. de Vere, Shanklin, Lucion Road, Upper Tooting, S.W., Analytical Chemist.
1900. Mathews, Dr. Jno. A., c/o Crucible Steel Co. of America, Syracuse, N.Y., U.S.A., Chemist.
1898. Mathewson, E. P., Anaconda, Mont., U.S.A., Metallurgist.
1888. Mátyos, Louis J., 105, North 19th Street, East Orange, N.J., U.S.A., Chemist.
1896. Matsui, G., c/o Japan Sugar Refinery Co., Onagigawa, Tokio, Japan, Chemical Engineer.
1899. Matthews, Dr. J. Merritt, 425, South Broad Street, Philadelphia, Pa., U.S.A., Professor of Chemistry and Dyeing (Philadelphia Textile School).
1889. Mawdsley, W. H., c/o Gold Mining Co., Ltd., Mount Morgan, Queensland, Chemist.
1903. Maxim, Hudson, 891, Sterling Place, Brooklyn, N.Y., U.S.A., Chemist and Mechanical Engineer.
1894. Maxwell, Jno., Solway Chemical Works, Silloth, and (communications) English Street, Carlisle, Cumberland, Chemical Manure Manufacturer.
1903. Maxwell, Orin P., Piedmont, Mineral Co., West Va., U.S.A., Chemist.
1897. May, George H., c/o Fabrikoid Co., Newburgh, N.Y., U.S.A., Assistant Chemist.
1901. May, Dr. Sidney, 313, East 112th Street, New York City, U.S.A., Lecture Assistant.
1884. Mayenfeld, Dr. E. von Salis. *See* Salis-Mayenfeld, Dr. E. von.
1903. Mayer, Andrew, jun., 104, St. Mark's Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1896. Mayfield, A. S., 14, Beresford Avenue, Hull, Analyst.
1892. Mayfield, H. B., Normanhurst, Mundy Street, Heanor, near Nottingham, Dyer.
1901. Mayfield, Thos., Fair View House, Heanor, near Nottingham, Hosiery Manufacturer.
1885. Mayhew, E. W. A., High Street, Freemantle, Western Australia, Manufacturing Chemist.
1904. Mays, Edmund A., 100, North Moore Street, New York City, U.S.A., Chemist.
1900. Maywald, F. J., 1028, 72nd Street, Brooklyn, N.Y., U.S.A., Technical Chemist.
1902. Meade, Richard K., Nazareth, Pa., U.S.A., Chemist.
1904. Meads, Charles J., Bel Air, Dartmouth, Inland Revenue Officer.
1903. Mears, James, 77, Arden Road, Handsworth, Birmingham, Analytical Chemist.
1898. Meeds, Alonzo D., 2424, Harriet Avenue, Minneapolis, Minn., U.S.A., Analytical Chemist.
1896. Meggitt, Loxley, Wheatshaf Works, Alexandrina, Sydney, N.S.W., Australia, Analytical Chemist.
1901. Meier, Dr. Franz, Basle Chemical Works, Basle, Switzerland, Chemist.
1888. Meikle, Jno., 8, Melrose Street, Great Western Road, Glasgow, Journalist.
1902. Melcher, Arthur C., 58, Bowen Street, Newton Centre, Mass., U.S.A., Chemist.
- O.M. Meldola, Prof. R., F.R.S., 6, Brunswick Square, London, W.C., Professor of Chemistry.
1901. Meldrum, Dr. And. N., 16, Moorocks Road, Sheffield, Lecturer on Chemistry.
1891. Meldrum, Jas. Jones, Timperley, Cheshire, Manufacturing Engineer.



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- O.M. Mellon, W. W., 9, Glenart Avenue, Blackrock, Co. Dublin, Ireland, Manufacturing Chemist.
1902. Mellor, Percy H., Burton Road, Woodville, near Burton-on-Trent, Pottery Manager.
- O.M. Mellor, S., Magnesium Metal Co., Patricroft, Manchester, Metal Refiner.
1884. Melville, D., P.O. Box No. 1, Woodmere, Wayne Co., Mich., U.S.A., Chemical Works Manager.
1893. Mensching, Dr. C., c/o Act-Ges. für Anilinfabrikation, Berlin, S.O., Germany, Chemist.
- O.M. Menzies, R. C., Inveresk Mills, Musselburgh, N.B., Paper Maker.
1892. Mercer, C. A., 34, Camomile Street, London, E.C., Chemical Apparatus Maker.
1886. Mercer, J. B., 330, Lower Broughton Road, Manchester.
1890. Merck, E., Darmstadt, Germany, Manufacturing Chemist.
1905. Merck, George, Merck and Co., University Place, New York City, U.S.A., Manufacturing Chemist.
1887. Merrell, Geo., Lock Box 786, Cincinnati, Ohio, U.S.A., Manufacturing Chemist.
1905. Merrin, A. C., 44, Bishopsgate Street Without, London, E.C., Assistant Editor and Analyst.
1899. Merrill, Frank H., Los Angeles Soap Co., Los Angeles, Cal., U.S.A., Factory Superintendent.
1903. Merrill, Herbert C., 38, Main Street, Peabody, Mass., U.S.A., Chemical Engineer (Leather Factory).
1902. Merritt, Wm. G., 643, Second Avenue, Detroit, Mich., U.S.A., Chemical Engineer.
1904. Merry, Jno. B., 61, Woodfield Road, Kings Heath, near Birmingham, Works Chemist.
1903. Mersan, Ferdinand de, 17, Cecil Street, Gainsborough, Lincolnshire, Chemist.
1903. Mersereau, G., Susquehanna Dyeworks, Williamsport, Pa., U.S.A., Chemist.
1905. Merz, Eugene, P.O. Box 216, Newark, N.J., U.S.A., General Superintendent, Heller and Merz Co.
1905. Merzbacher, Aaron, Laboratory, Reading Iron Co., Reading, Pa., U.S.A., Chemist.
1897. Meslans, Prof. M., 59 Quai de la Baronnie, Ablon (Seine et Oise), France, Professor of Chemistry.
- O.M. Messel, Dr. R., 147, Victoria Street, London, S.W., Chemical Manufacturer.
1899. Metcalf, Howard F., Farr Alpaca Co., Holyoke, Mass., U.S.A.
1886. Metcalf, Jno., Moorfield, Altham, near Accrington, Tar Distiller.
1898. Metz, Herman A., P.O. Box 2178, New York City, U.S.A., Chemical Merchant.
1900. Mewborne, Robt. G., c/o Kentucky Tobacco Product Co., Louisville, Ky., U.S.A., Chemist.
1904. Meyenberg, Dr. Alex., 9, Nelson Street, Plymouth Grove, Manchester, Works Manager.
1902. Meyer, August R., c/o United Zinc and Chemical Co., Kansas City, Mo., U.S.A., Metallurgist.
1898. Meyer, Dr. Franz, 52, Broadway, New York City, U.S.A., Metallurgical and Chemical Engineer.
1902. Meyer, Dr. Fredk. L., 2028, Park Avenue, Philadelphia, Pa., U.S.A., Chemist.
1900. Meyer, Karl, Sortedams Dossering 95A, Copenhagen, O., Denmark.
1904. Meyer, Prof. Dr. Richard, Technische Hochschule, Braunschweig, Germany, Professor of Chemistry.
1902. Meyrick, L. J., 137, City Road, Birmingham, Assistant Analyst.
1903. Miall, Dr. Stephen, 6, Stone Buildings, Lincoln's Inn, London, W.C., Solicitor.
1904. Mighill, Thos. A., 127, Purchase Street, Boston, Mass., U.S.A., Chemist.
1896. Miles, G. Wellington, 29, Central Street, Boston, Mass., U.S.A., Analytical Chemist.
1889. Milestone, W. C., 7, Heathfield Road, Wandsworth Common, S.W., Chemical Works Manager.
1899. Millar, Jas. H., P.O. Box 120, Durban, Natal, Manufacturing and Analytical Chemist.
1897. Millard, Edgar J., 40-42, Charlotte Street, London, E.C., Chemist and Manager.
1903. Miller, J. Dunlop, Mount Bischoff Smelting Works, Launceston, Tasmania, Analyst and Assayer.
1883. Miller, Dr. A. K., Kilvert's Buildings, Withy Grove, Manchester, Analytical Chemist.
- O.M. Miller, E. V., Sugar Works, Chelsea, Auckland, New Zealand, Sugar Works Chemist.
1889. Miller, Geo., 54, Ramilies Road, Sefton Park, Liverpool, Technical Chemist.
1897. Miller, Dr. Edmund H., School of Mines, Columbia University, New York City, U.S.A., Chemist.
1900. Miller, Hampton K., Lake City, Fla., U.S.A., Chemist (Florida A. & M. College).
1893. Miller, Dr. Harry E., 1015, Chestnut Street, Oakland, Cal., U.S.A., Chemist.
1902. Miller, H. Harold, Consumers' Gas Co., 269, Front Street East, Toronto, Canada, Chemist.
1883. Miller, Dr. H. von., III. Beatrixgasse 32, Wien, Austria, Chemical Manufacturer.
1904. Miller, Chas. E., 58, Chardon Street, Boston, Mass., U.S.A., Manufacturing Chemist.
1904. Miller, Jas., 178, Duane Street, New York City, U.S.A., Pharmacist.
1897. Miller, Jas., Minas de Sao Bento, Santa Barbara de Matto Dentro, Minas Geraes, Brazil, Metallurgical Chemist.
1894. Miller, Dr. John A., 40-45, Lewis Block, Buffalo, N.Y., U.S.A., Consulting Chemist, State Analyst.
1894. Miller, J. Carlile, 89, Rumford Street, Bridgeton, Glasgow, Manufacturing Chemist.
1888. Miller, J. Hopkins, 5, Catherine Street, Parliamentary Road, Glasgow, Dyeworks Chemist.
1889. Miller, Jno. Poynter, Sandilands Chemical Works, Aberdeen, Technical Chemist.
1884. Miller, Dr. N. H. J., Harpenden, near St. Albans, Agricultural Chemist.
1899. Miller, P. Schuyler, Mount Prospect Laboratory, Flatbush Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1901. Miller, Stuart B., 701, South 20th Street, Birmingham, Ala., U.S.A., Chemical Engineer.
1904. Miller, William Exley, c/o The Arizona Copper Co., Ltd., 29, St. Andrew Square, Edinburgh, Secretary.
1901. Miller, W. Lash, 50, St. Alban Street, Toronto, Canada, Associate Professor of Physical Chemistry.
1884. Miller, W. M., Caledonia Estate, Prov. Wellesley, Penang, S.S., Sugar Chemist.
1902. Milligan, R. E., New York Continental Jewell Filtration Co., 15, Broad Street, New York City, U.S.A., Chemical Engineer.
1903. Millington, Abraham, c/o J. Parry, E.V. Wharf, The Docks, Newport, Mon., Metallurgical Chemist.
1904. Millroy, Alfred T., 53, Guilford Street, London, W.C., Laboratory Furnisher.
- O.M. Mills, Prof. E. J., F.R.S., 64, Twyford Avenue, West Acton, W., Professor of Chemistry.
1904. Mills, Dr. J. E., University of North Carolina, Chapel Hill, N.C., U.S.A., Associate Professor of Chemistry.
1905. Milne, Thomas, c/o The Gas Light and Coke Co., Ltd., 4, Fenchurch Avenue, London, E.C., Chemical Products Salesman.
1903. Milnes, Cresswell, Arlescy, near Hitchin, Herts., Chemist.
1887. Milnes, Edmund, Seedfield, Bury, Lancashire, Dyeing Extract Maker.
1902. Milnes, Ernest E., c/o Joseph Smithson, Ltd., India Buildings, Halifax, Yorks., Chemist.
1901. Milroy, Andrew, 48, Dinmont Road, Crossmyloof, Glasgow, Manager.
1895. Miner, Harlan S., c/o Welsbach Light Co., Gloucester City, N.J., U.S.A., Technical Chemist.
1889. Miniati, T., Penketh, near Warrington, Chemist.
1904. Minor, John C., Jun., Saratoga Springs, N.Y., U.S.A., Manufacturer.
1895. Mitchell, Chas. A., c/o Beaufoy and Co., South Lambeth Road, S.W., Analyst.
1901. Mitchell, Frank H., c/o Dill and Collins, Richmond and Toga Streets, Philadelphia, Pa., U.S.A., Tutor in Chemistry.

1898. Mitchell, G. D. H., c/o S. S. White Dental Manufacturing Co., Prince's Bay, Staten Island, N.Y., U.S.A., Chemist.
1883. Mitchell, J. W., Plantation House, Clough Fold, near Manchester, Waste Bleacher.
1904. Mitsugi, R., Engineering College, Imperial University, Tokyo, Japan, Chemist.
- O.M. Mitting, E. K., 43, Highfield South, Rock Ferry, Cheshire, Technical Chemist.
1900. Mixner, Albert F., c/o Homeward Bound G. M. Co., Yalwal, Nowra, N.S.W., Australia, Metallurgist.
1895. Moale, Dr. Philip R., c/o Asheville Printing Co., 3, West Court Square, Asheville, N.C., U.S.A., Analytical Chemist.
1902. Möckel, Heinrich A., Bockwa, Post Cainsdorf, Saxony, Chemist and Engineer.
1903. Möhlau, Prof. Dr. Rd., Semperstrasse 4, Dresden, A., Germany, Professor of Colour Chemistry.
1905. Modi, E. M., Opposite Grant Road Station, Sleater Road, Bombay, India, Manufacturing and Analytical Chemist.
- O.M. Mohr, Dr. B., 69A, Parliament Hill, Hampstead, N.W., Consulting Chemist and Metallurgist.
1894. Mole, Herbert B., The Croft, Shepton Mallet, Somerset, Brewer.
1902. Molesworth, F. H., 46, West Street, North Sydney, N.S.W., Australia, Analytical Chemist.
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1891. Mond, Robt. L., Winnington Hall, Northwich, Chemist.
1890. Moodie, Wm. E., Alexandria Works, Alexandria, N.B., Analytical Chemist.
1901. Moody, Chas. J., Lake View Consols Mine, Boulder, West Australia, Analyst and Assayer.
1905. Moody, Dr. Gerald T., Lorne House, North Dulwich, S.E., Lecturer on Chemistry.
1898. Moody, Dr. Herbert R., Hobart College, Geneva, N.Y., U.S.A., Science Instructor.
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1903. Mooney, F. M., 118, Pembroke Road, Dublin, Chemical Manure Manufacturer.
1903. Mooney, Geo. A., 2716, St. Catherine Street, Montreal, Canada, Chemical Merchant.
1902. Mooney, Luke, 36, West 52nd Street, Bayonne, N.J., U.S.A.
1887. Moore, Chas. C., 33, Clarendon Road, Garston, Liverpool, Chemist.
1901. Moore, Chas. W., 38, Demesne Road, Whalley Range, Manchester, Chemical Student.
1902. Moore, Fred., Victoria Chemical Co., Ltd., Victoria, B.C., Canada, Manufacturing Chemist.
1892. Moore, Dr. Geo. D., 201, Salisbury Street, Worcester, Mass., U.S.A., Professor of Chemistry.
1902. Moore, Jas. H., Saltville, Va., U.S.A., Chemist.
1899. Moore, Quintin, Jun., Dalmarnock Chemical Works, 89, Rumford Street, Glasgow, Works Manager.
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1903. Moran, Geo. A., 333, Haverhill Street, Lawrence, Mass., U.S.A., Chemist.
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1890. Morris, Herbert N., Gorton Brook Chemical Works, Manchester, Technical Chemist.
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1902. Morrison, Jos., Wellfield, Farnworth, Widnes, Manager.
1901. Morse, Willard S., Apartado A., Aguascalientes, Mexico, Assistant Manager.
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1897. Morton, Jno., North Road, St. Helens, Lancashire, Analytical Chemist.
1902. Mosbaugh, F. R., c/o Huntsville and Bracebridge Tanning Co., Huntsville, Ont., Canada, Chemist.
1888. Mosenthal, Henry de, 220, Winchester House, Old Broad Street, E.C., Explosives Company Manager.
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1901. Moule, Jno. W., Sulphide Corporation, Ltd., Cockle Creek, N.S.W., Metallurgical Chemist.
1884. Moul, J., Underhill, Low Fell, Gateshead-on-Tyne, Secretary.
1898. Moulton, Prof. Chas. W., Vassar College, Poughkeepsie, N.Y., U.S.A., Professor of Chemistry.
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1894. Muir-Smith, W., c/o A. B. Fleming and Co., Ltd., Caroline Park, Edinburgh, Oil Works Manager.



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1896. Mundy, Lionel, 27, Merton Road, Kensington, W., Importer of Unfermented Wines.
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1900. Munsell, Dr. Chas. E., c/o Devor and Reynolds Co., 110, Horatio Street, New York City, U.S.A., Colour Chemist.
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1899. Murphy, Albert J., The Laboratory, 11, Lyddon Terrace, Leeds, Brewer's Chemist.
1901. Murray, Benjamin L., c/o Merck and Co., University Place, New York City, U.S.A., Chemist.
1903. Murray, Chas. B., c/o St. Louis Plate Glass Co., Valley Park, Mo., U.S.A., Chemist.
1899. Murray, Jas. J., Iron King Mines, Val Verde, Arizona, U.S.A., Mining Engineer.
1901. Murray, Jas. P., Toronto Carpet Manufacturing Co., Ltd., King Street and Fraser Avenue, Toronto, Canada, Carpet Manufacturer.
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1898. Murray, Rd., c/o Brotherton and Co., Ltd., Ammonia Works, Holmes Street, Leeds, Analyst.
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1894. Muspratt, Max, 2, Mannering Road, Sefton Park, Liverpool, Technical Chemist.
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1895. Muurling, I. J. R., P.O. Box 2160, New York City, U.S.A., Dyestuff Importer.
1903. Myers, Edgar C., New Franklyn, Mo., U.S.A., Agricultural Chemist.
1891. Myers, Wm. S., Nitrate of Soda Propaganda, 12, John Street, New York City, U.S.A., Director.
1903. Nash, A. Douglas, 221, Broadway, Flushing, N.Y., U.S.A., Glass Manufacturer.
1897. Nash, Leonard M., 281, Seven Sisters Road, Finsbury Park, N., Works Chemist.
1900. Nathan, Major Fred. L., R.A., Royal Gunpowder Factory, Waltham Abbey, Essex, Superintendent.
1892. Naylor, Wm., 3, Garstang Road, Fulwood, Preston, Lancs., Chemist.
- O.M. Naylor, W. A. H., 38, Southwark Street, London, S.E., Manufacturing Chemist.
1899. Neate, Percy J., "Belsize," Watts Avenue, Rochester, Kent, Director of Cement Co.
1902. Neave, Geo. B., Technical College, 204, George Street, Glasgow, Assistant to Professor of Chemistry.
1905. Needham, Edward R., 48, Paton Street, Glasgow, Manufacturing Chemist.
1905. Needham, Geo., 51, Queen Elizabeth Street, London, S.E., Druggist's Manager.
1898. Neil, Jas. Millar, Farnham Avenue, Deer Park P.O., Toronto, Canada, Technical Chemist.
1890. Neill, Geo. D., Drumslea, Greenock, N.B., Sugar Refiner.
1898. Neilson, Alex. McG., (Journals), P.O. Box 615, Durban, Natal; and (subscriptions) c/o W. Neilson, 42, Brisbane Street, Greenock, N.B., Analytical Chemist.
1889. Neilson, Thos., Highland Boy Smelter, Murray, Utah, U.S.A., Metallurgical Chemist.
1903. Neiman, Howard S., 122, Hudson Street, New York City, U.S.A., Manufacturing Chemist.
1902. Neish, Arthur C., Columbia University, New York City, U.S.A., Chemist.
1898. Nelson, Elhanan K., c/o Link and Nelson, Paris, Ill., U.S.A., Chemist.
1897. Nelson, Walter, Emseote Mills, Warwick, Gelatin Manufacturer.
1902. Nesbitt, Dr. Beattie, 71, Grosvenor Street, Toronto, Canada, Physician.
1901. Neufville, Dr. Rudolf de, c/o Metallurgische Gesellschaft, Frankfurt a/M., Germany.
1902. Neumann, Dr. Edgar, 60, Chancery Lane, London, W.C.
1903. Neumann, Dr. Max, Hohenstaufenstrasse 32, Berlin, W. 30, Germany.
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1905. Newall, Joseph, 28, Greenway Road, Runcorn, Cheshire, Chemist.
1889. Newberry, Spencer B., Sandusky Portland Cement Co., Sandusky, Ohio, U.S.A., Manager.
1896. Newcomen, Thos., Chemical Works, Lydbrook, near Ross, Wood Distiller.
1904. Newgass, Solomon, 257, West 132nd Street, New York City, U.S.A., Student.
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- O.M. Newlands, W. P. R., 232, Amesbury Avenue, Streatham Hill, S.W., Sugar Chemist.
- O.M. Newton, Jno., Manor Works, Rotherhithe New Road, London, S.E., Manure Manufacturer.
1900. Newton, Dr. Wm., 39, Mining Lane, London, E.C., Chemist.
1901. Nibelius, Axel W. T., American Forcite Powder Manufacturing Co., Landing, N.J., U.S.A., Chemist.
1904. Nichols, C. W., 406, Clinton Avenue, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1884. Nichols, J. A., Stanley Mount, New Mills, near Stockport, Teacher of Science.
1888. Nichols, Wm. H., 25, Broad Street, New York City, U.S.A., Chemical Manufacturer.
1897. Nicholson, Harry, St. David's Gold Mine, Bontddu, Dolgelly, North Wales, Assayer.
1904. Nicholson, Wilfred E., Hunslet Chemical Works, Leeds, Chemical Manufacturer.
1897. Nicholson, Wm. J., Ardeer, Stevenston, Ayrshire, N.B., Chemist.
1897. Nickel, Herman, c/o The N. K. Fairbank Co., 3rd and Convent Streets, St. Louis, Mo., U.S.A., Chemist.

1888. Nickolls, John B., The Laboratory, Grange, Guernsey, Analytical Chemist.
- O.M. Nicol, Dr. W. W. J., 15, Blacket Place, Edinburgh, Chemical Lecturer.
1903. Nicoll, Frank, 221, Walmersley Road, Bury, Lancs., Chemist.
1900. Nield, J. H., c/o General Chemical Co., P.O. Box 8, Hudson Heights, N.J., U.S.A., Superintendent.
1898. Nightscales, Geo., 13, Spring Street, Hull, Oil Merchant.
1899. Nihoul, Dr. Edw., Waremmes, Belgium, Director of the Liège Tannery School.
- O.M. Nimmo, Jas., Penshurst, 8, Lawrence Road, South Norwood, S.E., Analytical Chemist.
1885. Nishigawa, T., Ryuso Kaisha, Osaka, Japan, Director of Sulphuric Acid and Soda Works.
1898. Nishikawa, T., c/o Nippon Seimikaisha, Onoda, Nagato, Japan, Chemist.
1904. Noake, Frank, S. S. Mond Gas Co., Trindle House, Dudley, Chief Engineering Assistant.
- O.M. Nolting, Dr. E., Ecole de Chimie, Mulhouse, Alsace, Germany, Professor of Chemistry.
- O.M. Norman, F. J., Lyndhurst, Higher Runcorn, Cheshire, Chemical Manufacturer.
1900. Norman, Geo. M., 929, University Avenue, Madison, Wis., U.S.A., Chemist.
1892. Norman, J. T., 23, Leadenhall Street, London, E.C., Consulting Chemist.
1898. Norris, Albert P., 760, Massachusetts Avenue, Cambridgeport, Mass., U.S.A., Assistant Chemist.
1904. Norris, Cassius W., 612, Commerce Street, Milwaukee, Wis., U.S.A., Tannery Chemist.
1899. Norris, Geo. L., Standard Steel Works, Burnham, Mifflin Co., Pa., U.S.A., Chemist.
1893. Norris, Wm. M., Princeton, N.J., U.S.A., Leather Chemist.
1902. North, Barker, Glenholme, Glenholme Road, Manningham, Bradford, Lecturer in Chemistry.
1890. North, E. Gordon N., Technical Chemist.
1903. North, Henry A., 649, Green Avenue, Brooklyn, N.Y., U.S.A., Chemist.
- O.M. Northing, J., The Murrrough, Wicklow, Ireland, Technical Chemist.
1905. Norton, F. A., Brookings, S. Dak., U.S.A., Instructor in Chemistry, South Dakota Agricultural College.
- O.M. Norton, Dr. S. A., 363, East Town Street, Columbus, Ohio, U.S.A., Professor of Chemistry (Ohio State University).
1887. Norton, Dr. T. H., U.S. Consulate, Mezereh, Mamouret-ul-Aziz, Turkey-in-Asia, open Mail, via Constantinople, Ph.D., Sec.D., U.S. Consul.
1901. Novarine, John L., 79, Main Street, Brooklyn, N.Y., U.S.A., Chemist.
1899. Noyes, Henry, c/o J. C. Lanyon and Sons, Gresham House, London, E.C.; and (Journals), 17, Queen Street, Melbourne, Vic., Australia, Engineer.
1901. Noyes, Dr. Wm. A., Melrose Street, Chevy Chase, Md., U.S.A., Editor (J. Amer. Chem. Society).
1884. Oehler, K., Offenbach-am-Main, Germany, Colour Manufacturer.
1888. Ogata, Saburo, Zohei Shikyoku, Okurasho, Tokyo, Japan, Assayer.
1901. Ogden, Richard L., Room 21, P.O. Building, Harrisburg, Pa., U.S.A., Chemist (U.S. Navy).
1896. Ogilvy, D. J., Gest Street and C. H. and O. R. R., Cincinnati, Ohio, U.S.A., Manufacturing Chemist.
1902. Oglesby, Wm. R., c/o Alma Cement Co., Wellston, Ohio, U.S.A., Chemist.
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1903. Ohlenschlager, J. G., jun., 2, Fowkes Buildings, Great Tower Street, London, E.C., Chemical Merchant.
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1902. Oliver, Frank M., 755, North 38th Street, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
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1901. Olivier, Dr. Louis, 22, Rue du Général-Foy, Paris, 8<sup>e</sup>, Directeur (Revue Générale des Sciences).
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1898. Ormerod, Ernest, Pestalozzi Strasse 24<sup>n</sup>, Zurich V, Switzerland, Chemical Student.
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1899. Orr, Thos. W., Esperanza Nitrate Co., Taltal, Chile, Chemist.
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1883. O'Sullivan, J., High Bank, Burton-on-Trent, Brewing Chemist.
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## P

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- O.M. Packard, E., Jun., Bramford, near Ipswich, Manure Manufacturer.
1899. Paessler, Dr. Joh., Vorstandder Deutschen Versuchsanstalt für Lederindustrie, Freiberg in Sachsen, Germany, Chemist.
1904. Page, Edwin P., Heath Street, Stourbridge, Worcestershire, Chemist.
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1886. Pagès, Albert, 34, Boulevard Henri IV., Paris, Technical Chemist.
1892. Paine, Augustus G., 60, Times Building, and (Journals) 41, Park Row, New York City, U.S.A., President of Paper-Making Co.
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1902. Pakes, Dr. Walter C. C., Box 1080, Johannesburg, Transvaal, S. Africa, Analyst and Bacteriologist.
1905. Palethorpe, Percy R., The Tobacco Warehousing and Trading Co., 11th and Magnolia Avenue, Louisville, Ky., U.S.A., Chemist and Manager.
1903. Palmenburg, O. W., 107, West 70th Street, New York City, U.S.A., Chemist.
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1887. Palmer, T. Chalkley, Box 19, Chester, Pa., U.S.A., Manufacturing Chemist.
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1898. Parker, Charles H., Craigside, Clark Street, Wolverhampton, Chemist.
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1898. Parker, W. W., Whitehouse Street Tannery, Bristol, Tanner.
1901. Parkes, Albert E., 43, Whitehorse Street, Stepney, E., Analytical Chemist.
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1902. Patch, Prof. Jas. A., Syrian Protestant College, Beirut, Syria, Professor of Chemistry.
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1897. Patchett, Jas., Oakworth, Hadley, Wellington, Salop, Ironmaster.
1901. Paterson, David, Leabank, Rosslyn, Midlothian, Colour Chemist.
1884. Paterson, John, Belle Isle Place, Workington, Cumberland, Mechanical Engineer.
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1889. Pattison, Percy, J., 5, Kingsley Road, Forest Gate, E., Technical Chemist.
1904. Patz, E. O., 215, Water Street, New York City, U.S.A., Manager, Berlin Aniline Works.
1891. Paul, Jas., H., 19, Glenluce Road, Blackheath, S.E., Analytical Chemist.
1900. Paul, Dr. L. Gordon, Market Hall Chambers, King Street, Huddersfield, Consulting Chemist.
1902. Pay, Walter Herbert, Government Laboratory, Durban, Natal, S. Africa, Chemist and Assayer.
1904. Payne, A. G. C., 15, Lanvanor Road, Queen's Road, Peckham, S.E., Assistant Works Chemist.
- O.M. Payne, J. B., 15, Mosley Street, Newcastle-on-Tyne, Manufacturing Chemist.
1898. Pearce, Edw. D., Messrs. T. P. Shepard and Co., P.O. Box 1336, Providence, R.I., U.S.A., Manufacturing Chemist.
1894. Pearce, Jas. Stanley, Clements, Snaresbrook, Essex, Chemical Manufacturer.
1897. Pearce, Richard, Argo, Colo., U.S.A., Smelting Works Manager.
1903. Pearce, Sidney H., P.O. Box 149, Johannesburg, Transvaal, South Africa, Metallurgist.
1883. Pearce, W., Chemical Works, Bow Common, London, E., Chemical Manufacturer.
1903. Pearcey, A. C., 27, St. Kilda's Road, Stoke Newington, N., Director, Explosives Co.
1903. Pears, Thos., The Laboratory, Soap Works, Isleworth, Soap Manufacturer.
1893. Pearson, Frank P., 178, Pawtucket Street, Lowell, Mass., U.S.A., Printworks Manager.
1894. Pearson, Wm. H., 6, Fenchurch Buildings, London, E.C., Analytical Chemist.
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- O.M. Pechincy, A. R., Les Rochers, Hyères (Var), France, Chemical Engineer.
1898. Peck, Dr. Ernest L., Claremont, Merrilocks Road, Blundellsands, near Liverpool, Chemist.
1898. Peckham, Stephen F., Room 104, 280, Broadway, New York City, U.S.A., Chemist.
1894. Peden, Jno., 30, Ardgowan Street West, Greenock, N.B., Analytical Chemist.
- O.M. Pedler, Prof. A., C.I.E., F.R.S., Writer's Buildings, Calcutta, India, Director of Public Instruction.

1886. Pedler, J. R., 47, Tregunter Road, South Kensington, S.W., Clerk.
1905. Peet, Wm. J., Stockyards Station, Kansas City, Kas., U.S.A., Superintendent.
1903. Peffer, Harry C., c/o Pittsburgh Reduction Co., East St. Louis, Ill., U.S.A., Manufacturing Chemist.
1899. Pell, A., 7, Elphinstone Circle, Bombay, India, Chemist.
1897. Pellew, Chas. E., Columbia University, New York City, U.S.A., Adjunct Professor of Chemistry.
1904. Pelly, Russell George, 63, Rowan Road, Brook Green, Hammersmith, W., Analytical Chemist.
1896. Penney, Mulgrave D., 11, High Street, Hull, Analytical Chemist.
1903. Pennington, R. W. R., "Carbonic," Mazagon, Bombay, India, General Manager and Engineer (Sirdar's Carbonic Acid Co., Ltd.).
1904. Pennington, Thos., Platteville, Wis., U.S.A., Chemist.
1890. Pennock, J. D., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Technical Chemist.
1885. Pentecost, S. J., Nottingham Road, New Basford, and (Journals), Sherwood Hill Works, Sherwood Rise, Nottingham, Lace Dresser.
1887. Pentermann, H. T., 37, Clifton Crescent, Peckham, S.E., Brewing Chemist.
1892. Peploe, D. H. T., Underriver House, Sevenoaks, Kent.
1899. Peppel, S. Vernon, 431, Main Street, Louisville, Ky., U.S.A., Chemist.
1885. Perkin, A. G., F.R.S., 8, Montpelier Terrace, Hyde Park, Leeds, Technical Chemist.
1898. Perkin, Dr. F. Mollwo, Borough Polytechnic Institute, Borough Road, S.E., Head of Chemical Department.
- O.M. Perkin, Dr. W. H., F.R.S., The Chestnuts, Sudbury, Harrow, Research Chemist.
1887. Perkin, Dr. W. H., Jnn., F.R.S., Fairview, Wilbraham Road, Fallowfield, Manchester, Professor of Chemistry.
1903. Perkins, Frank G., Planters' Manufacturing Co., 192, Fulton Street, New York City, U.S.A., Starch Manufacturer.
1893. Perkins, T. S., 155, Bushkill Street, Easton, Pa., U.S.A., Chemist.
1899. Perks, Walter G., (Journals) Glanafon, and (communications) c/o National Explosives Co., Ltd., Hayle, Cornwall, Manufacturer.
1904. Perrott, Bert, County School, Neath, Glamorgan, Demonstrator in Chemistry.
1901. Perry, Chas. M., 4, Catalpa Road, Providence, R.I., U.S.A., Bleach and Dyeworks Chemist.
1887. Perry, D., Norwood, Lenzie, N.B., Manufacturing Chemist.
1895. Perry, Jos. H., 276, Highland Street, Worcester, Mass., U.S.A., Teacher of Chemistry.
1903. Perry, M. J. T., Australian Drug Co., O'Connell Street, Sydney, N.S.W., Australia, Manufacturing Chemist.
1903. Perry, Robt. Swain, c/o Harrison Bros. and Co., Inc., 35th Street and Grays Ferry Road, and (Journals) Station D., Philadelphia, Pa., U.S.A., President.
1901. Persons, Ashton C., 315, Prospect Street, Williamantic, Conn., U.S.A., Chemist.
1897. Peter, Dr. A. H., c/o Zinsser and Co., Hastings-on-Hudson, N.Y., U.S.A., Chemist.
1893. Pethybridge, Walter, 3, Rhodesia Road, Clapham Rise, S.W., Chemist and Assayer.
1903. Petrie, Jas. M., The University, Sydney, N.S.W., Australia, Chemist.
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1883. Pettigrew, J., 6, St. Helen's Place, Bishopsgate, London, E.C., Technical Chemist.
1892. Pettigrew, Robt., c/o Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Electro-Chemist.
1902. Pettitt, Alf., 3421, Avenue G, Flatbush, N.Y., U.S.A., Chemist.
1904. Petty, Gordon N., 566, Stretford Road, Old Trafford, Manchester, Technical Chemist.
1905. Peuchot, A., 129, Crosby Street, New York City, U.S.A., Chemical Manufacturer.
1904. Peyser, Horace F., 68, West 47th Street, New York City, U.S.A., Chemist.
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1900. Peyton, Wm. C., c/o Peyton Chemical Co., Room 30, 4th Floor, Mills Building, San Francisco, Cal., U.S.A., Chemist.
1904. Pfahler, H. W., 208, Linden Street, Holyoke, Mass., U.S.A., Chemist.
1888. Philip, Arnold, Chemical Laboratory, H.M. Dockyard, Portsmouth, Electro-Metallurgist and Electrical Engineer.
1903. Philipp, Herbert, 84, High Street, Perth Amboy, N.J., U.S.A., Chemist and Electrochemical Engineer.
1886. Phillips, A. G., 11, Essex Villas, Phillimore Gardens, Kensington, W., Barrister-at-Law.
1904. Phillips, Edw. W., c/o Fairmont Coal Co., Fairmont, W. Va., U.S.A., Chemist.
1891. Phillips, G. Brinton, (Journals) 622, Race Street; and (communications) 2007, De Lancey Place, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
- O.M. Phillips, Harcourt, Lynwood, Turton, Lancs., Analytical Chemist.
1895. Phillips, S. Chas., 47, Cannon Street, London, E.C., Chemical Engineer.
1904. Phillips, V. C., Haselmere, Morris Avenue, Manor Park, E., Chemist.
1898. Phillips, Wm. H., 100, Milton Avenue, East Ham, E., Soapmakers' Assistant.
1883. Phipson, Dr. T. L., Casa Mia, Putney, S.W., Analytical and Consulting Chemist.
1894. Picard, Hugh F. K., 44, London Wall, London, E.C., Metallurgist.
- O.M. Pick, Dr. S., Direction der Soda Fabrik, Szczakowa, Galizien, Austria, Chemical Engineer and Manager.
1904. Pickard, Glenn H., Susquehanna Dyeworks, Williamsport, Pa., U.S.A., Chemist.
1905. Pickard, Greenleaf W., American Telegraph and Telephone Co., 125, Milk Street, Boston, Mass., U.S.A., Electrical Engineer.
1902. Pickard, R. H., Merlin Road, Blackburn, Teacher and Analyst.
1897. Pickert, Leo. W., American Sngar Refining Co., Granite Street, South Boston, Mass., U.S.A., Chemist.
1904. Pickett, Chas. E., 26, East 23rd Street, Bayonne, N.J., U.S.A., Superintendent, Borax Refinery.
1904. Pickup, Edgar H., 348, Great Clowes Street, Higher Broughton, Manchester, Calico Printer.
1899. Pidduck, E. W., University College of Wales, Aberystwith, Wales, Assistant Chemist.
1901. Pierce, Ira L., c/o Atlantic Manufacturing Co., Washburn, Wis., U.S.A., Chemist.
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1888. Pilkington, G., 263, Walmersley Road, Bury, Lancashire, Analytical Chemist.
1893. Pilley, Thos. W., 33, Grove Hill Road, Denmark Hill, S.E., Analytical Chemist.
1894. Pilling, John E., Agnew Villas, 78, Whitegate Drive, Blackpool, Chemist.
1883. Pipe, Jas., Messrs. Wm. Henderson and Co., Irvine, N.B., Chemical Manufacturer.
1896. Piper, Walter E., Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.
1905. Pirie, Frank D., Stonewood Works, Bucksburn, Aberdeenshire, Paper Manufacturer.
1900. Pitman, Jno. R., c/o Lafin and Rand Powder Co., Haskell, N.J., U.S.A., Chemist.
- O.M. Pitt, T., 16, Coleman Street, London, E.C., Manufacturing Chemist.
1902. Pittard, Jno., 30, Mansfield Road, Ilford, Essex, Chemical Manufacturer.
1905. Pittock, C. K., Baithney Estate, Saklaspur, Hassan, India, Coffee Grower and Chemist.



1884. Pittuck, F. W., 15, Stratford Grove, Heaton, Newcastle-on-Tyne, Technical Chemist.
1899. Pizey, Jas. H., Anchor Chemical Works, Provam-mill, Glasgow, Chemist.
1894. Platten, Frank, 15, Barnsley Road, Edgbaston, Birmingham, Metallurgical Chemist.
1890. Platts, Jno. C., Heaton Moor Lodge, Heaton Chapel, near Stockport, Metallurgical Chemist.
1896. Plaut, Albert, 128, William Street, New York City, U.S.A., Wholesale Druggist.
1888. Playfair, David J., 7, Victoria Crescent, Dowanhill, Glasgow, Manufacturing Chemist.
1891. Poeklington, Hy., 41, Virginia Road, Leeds, Assurance Co.'s Local Manager.
1901. Pollard, Wm., Museum, Jermyn Street, London, S.W., Chemist (H.M. Geological Survey).
1904. Pollitt, Dr. Geo. P., c/o Brunner, Mond, and Co., Northwich, Cheshire, Chemist.
1902. Pollitt, Jas. C. T., c/o Kynoch, Ltd., Witton, near Birmingham, Manufacturing Chemist.
1893. Pollitt, R. B., De Beers Explosives Works, Somerset West, C.C., South Africa, Civil Engineer.
1883. Pollock, A., Kirkland, Bonhill, Dumbartonshire, Dyeworks Manager.
1890. Pomeroy, Dr. Chas. T., 55, Broad Street, Newark, N.J., U.S.A., Ink Manufacturer.
1896. Pond, Prof. G. G., State College, Centre Co., Pa., U.S.A., Professor of Chemistry.
- O.M. Pond, J. A., 99, Queen Street, Auckland, New Zealand, Analytical Chemist.
1900. Pont, Francis G. du, Montchanin, Del., U.S.A., Manufacturer.
1895. Pont, Pierre S. du, Wilmington, Del., U.S.A., Explosives Manufacturer.
1896. Poole, Herman, 331, West 57th Street, New York City, U.S.A., Manufacturing Chemist.
1892. Pope, Frank, c/o The Dunwoody Bros. Soap Co., Denver, Colo., U.S.A., Chemist.
- O.M. Pope, S., 35, Victoria Road, Runcorn, Chemical Works Manager.
1899. Pope, Thos. H., The University, Birmingham, Chemist.
1900. Pope, Prof. W. J., F.R.S., Municipal School of Technology; and (Journals) 16, Hope Street, Higher Broughton, Manchester, Professor of Chemistry.
1900. Popplewell, Jos. M., c/o Brotherton and Co., Provan Chemical Works, Millerston, Glasgow, Chemist.
1899. Porter, A. Felix, c/o American E. C. and Schulze Powder Co., Oakland, N.J., U.S.A., Chemist.
1896. Porter, Herbert, 80, Lancaster Avenue, Fennel Street, Manchester, Alkali Inspector.
1902. Porter, J. Edw., P.O. Box 785, and 205, W. Genesee Street, Syracuse, N.Y., U.S.A., Chemist.
1901. Porter, Jno. L., New Orleans Sewerage Board, 602, Carondelet Street, New Orleans, La., U.S.A., Chemist.
1904. Portner, Edward G., Robert Portner Brewing Co., Alexandria, Va., U.S.A., Chemist.
1884. Potter, Chas. E., Love Lane Sugar Refinery, Liverpool, Sugar Works Chemist.
1888. Potter, Chas. J., Heaton Hall, Newcastle-on-Tyne, Cement Manufacturer.
- O.M. Potter, E. P., Salvick Hall, near Preston, Alkali Manufacturer.
1899. Potter, Rowland S., 97, Belgrave Road, Ilford, Essex, Chemist.
1902. Potts, Cuthbert, Hawkesbury Agricultural College, Richmond, N.S.W., Lecturer in Chemistry.
1900. Potts, Geo. E., Landing, N.J., U.S.A., Explosives Manufacturer.
1902. Potts, Henry Wm., Hawkesbury Agricultural College, Richmond, N.S.W., Australia, Chemist and Principal.
1892. Potts, Joseph T., Price's Patent Candle Co., Brom-boro' Pool, near Birkenhead, Chemist.
1900. Pough, Frank H., c/o T. and S. C. White Co., 28, Burling Slip, New York City, U.S.A., Manager.
1889. Powell, A. Ernest, Craigowan, Clarendon Road, Whalley Range, Manchester, Oil Merchant.
1900. Powell, Harry J., 506, Lordship Lane, S.E., Glass Manufacturer.
1884. Powell, L. S., St. John's Cottage, Hildenborough, Tonbridge, Electrician.
1897. Power, Dr. Fred. B., Wellcome Research Labora-tories, 6, King Street, Snow Hill, London, E.C., Director.
1902. Powney, Wm. E. F., 9, Lancaster Road, Stroud Green, N., Analytical Chemist.
1900. Pratt, N. P., Laboratory, Atlanta, Ga., U.S.A., Manufacturing Chemist.
1889. Pratt, Walter E., 17, East Road, Lancaster, Ana-lytical Chemist.
1897. Prentice, Dr. Bertram, Royal Technical Institute, Salford, Lecturer on Chemistry.
1902. Prentice, Dr. David, 30, Whitefield Road, Stockton Heath, Warrington, Chemist.
1903. Prentice, Jas., Cossipore Sugar Works, Calcutta, India, Chemist.
1888. Prescott, Dr. Albert B., Ann Arbor, Mich., U.S.A.
1900. Prescott, Saml. C., Mass. Inst. of Technology, Boston, Mass., U.S.A., Instructor in Bacteriology.
- O.M. Price, A. F., 524, Sacramento Street, San Francisco, Cal., U.S.A., Analytical Chemist.
1904. Prichard, Norman B., Capelton, Quebec, Canada, Chemical Engineer.
1904. Prideaux, E. B. R., 17, Barnmead Road, Beckenham, Kent, Student.
1905. Priest, Geo. Wesley, Mansfield, Mass., U.S.A., Manufacturer.
1902. Pringsheim, Dr. H. H., 131, Hilliard Street, Cam-bridge, Mass., U.S.A., Chemist.
1899. Prinsen-Geerligs, H. C., Pekalongan, Java, Nether-lands Indies, Director of Sugar Cane Experi-mental Station.
1893. Pritchard, Edgar J., North Hill, Swansea, Works Manager.
1903. Pritchard, Philip M., Chief Engineer's Office, United Alkali Co., Ltd., Widnes, Engineer.
1896. Prochazka, Dr. Geo. A., 138, West 13th Street, New York City, U.S.A., Colour Manufacturer.
1897. Prochazka, John, c/o Central Dyestuff and Chemical Co., Newark, N.J., U.S.A., Coal-Tar Colour Chemist.
- O.M. Procter, Prof. H. R., The University, Leeds; and (Journals) Rowangarth, Ben Rhydding, near Leeds, Yorks., Lecturer on Tanning.
1884. Procter, J. W., Skeldergate Bridge, York, Manure Manufacturer.
1890. Proctor, Miss Anne J., Free Library, Widnes, Librarian.
- O.M. Proctor, C., 27, London Road, Forest Hill, S.E., Analytical Chemist.
- O.M. Proctor, W. W., 10, The Side, Newcastle-on-Tyne, Assayer and Analytical Chemist.
1901. Propach, C., Apartment G., 1097, North Clark Street, Chicago, Ill., U.S.A., Colour Merchant.
1894. Proude, Jas., 30, Cromwell Terrace, Halifax, Yorks., Soap Works Chemist and Manager.
1899. Pullar, Edmund, Keirfield, Bridge of Allan, N.B., Manufacturer.
1894. Pullar, Herbert S., Pullar's Dyeworks, Perth, N.B., Dyer.
- O.M. Pullar, Sir Robert; Journals to Jas. Craigie, Sande-man Public Library, Perth, N.B., Dyer.
- O.M. Pullar, R. D., Pullar's Dyeworks, Perth, N.B., Dyer.
1903. Pullin, Sydney R., 10, Newton Grove, Chapeltown Road, Leeds, Chemist.
1902. Puntan, H. H. C., 10, London Chambers, Durban, Natal, Public Analyst.
1891. Purdie, Dr. Thos., F.R.S., 14, South Street, St. Andrews, N.B., Professor of Chemistry.
1905. Pyman, Dr. Frank Lee, The Oaks, Hitchin, Herts., Chemist.

## Q

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1905. Queiroz, Dr. Luiz M. Pinto de, Rua Direita 10B, Sao Paulo, Brazil, Manufacturing Chemist.
1903. Queneau, Augustin L., c/o New Jersey Zinc Co., South Bethlehem, Pa., U.S.A., Mining Engineer.
1887. Quibell, Oliver, Shalem Lodge, Newark-on-Trent, Manure Manufacturer.
1902. Quinan, Kenneth B., c/o De Beers Explosives Works, Somerset West, C.C., South Africa, Chemist.
1897. Quinan, Wm. R., (Journals) General Manager, De Beers Explosives Works, Dynamite Factory, Cape Colony, South Africa: and (subscriptions) c/o De Beers Consolidated Mines, 15, St. Swithin's Lane, E.C., Superintendent (Powder Works).
1897. Quirk, Jno. S., Lead Smelting Works, St. Helens, Lancs., Manager.

## R

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1904. Rademacher, Dr. Ferdinand, Prag-Carolinenthal, Austria, Chemical Manufacturer.
1900. Radley, Ernest G., 49, Ernest Street, West Norwood, S.E.
1895. Raegener, Louis C., 141, Broadway, New York City, U.S.A., Patent Lawyer.
1901. Ralston, Wm., Government Chem. Laboratory, Lagos, West Africa, Government Chemist.
1902. Ramsay, A. Alexander, Laboratory, Department of Agriculture, 136, George Street, Sydney, N.S.W., Australia, Assistant Chemist.
- O.M. Ramsay, Sir William, K.C.B., F.R.S., University College, London, W.C.: Journals to 19, Chester Terrace, N.W., Professor of Chemistry.
1888. Ramsay, W., c/o Cammell, Laird and Co., Ltd., Birkenhead Ironworks, Birkenhead, Chemist and Assayer.
1898. Ramsden, Andrew, York Villa, Walmersley Road, Bury, Lancs., Sugar Works Manager.
1901. Ransom, Francis, The Chilterns, Hitchin, Herts., Manufacturing Pharmaceutical Chemist.
1904. Rapelje, Walter S., 957, Liberty Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1898. Raschen, Dr. Julius, The Highlands, Runcorn, Cheshire, Consulting Chemist (United Alkali Co.).
1893. Ratcliff, Frank D., The Cottage, Green Hill, Broms-grove, Worcestershire, Vinegar Brewer.
1904. Ratcliffe, C. F., c/o Brotherton and Co., Ltd., Provan Chemical Works, Millerston, Glasgow, Tar Distiller.
1904. Ratcliffe, Mrs. F. A., 111, Croxted Road, West Dulwich, S.E.
1898. Ratcliffe, Walter, 21, Mawdsley Street, Bolton, Analytical Chemist.
1895. Rau, Dr. H. M., 130-132, Pearl Street, New York City, U.S.A., Chemist.
1901. Rauter, Dr. G., Canerstrasse, 2, Charlottenburg, 1, bei Berlin, Germany, Engineering Chemist.
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1903. Rawolle, Frederick C., c/o Marx and Rawolle, 100 William Street, New York City, U.S.A., Chemist.
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1883. Rawson, Dr. S. G., Technical Schools, Huddersfield, Analytical Chemist.
1895. Read, E. J., St. Ives, The Avenue, Gravesend, Kent, Analyst.
1890. Reade, Thos., Sebright House, Tettenhall Wood, Wolverhampton, Manufacturing Chemist.
1903. Reading, Richard W., Knight's Deep, Ltd., P.O. Box 143, Germiston, Transvaal, S. Africa, Assayer and Mechanical Engineer.

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1902. Redfern, C. G., 4, South Street, Finsbury, London, E.C., Patent Agent.
1890. Redgate, J. G., Traffic Street, Nottingham, Aërated Water Manufacturer.
1901. Redpath, Leon W., International Smokeless Powder and Dynamite Co., Parlin, N.Y., U.S.A., Chemist.
- O.M. Redwood, Dr. Boverton, 4, Bishopsgate Street Within, London, E.C., Petroleum Expert.
1884. Redwood, I. L., Bantry House, Picardy Hill, Belvedere, Kent, Technical Chemist.
1887. Redwood, Robt., 4, Bishopsgate Street Within, London, E.C., Secretary.
1891. Redwood, T. Horne, Olveston, Sedlescombe Road, St. Leonard's-on-Sea, Analytical Chemist.
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1884. Reed, Albert E., The Grange, Leigham Court Road, Streatham, S.W., Paper Works Chemist.
1902. Reed, Herbert C., c/o Stamford Manufacturing Co., Stamford, Conn., U.S.A., Chemist.
1895. Reed, Dr. J. Hastings, Hambledon Mill, *via* Cairns, North Queensland, Sugar Manufacturer.
1893. Reekie, J. A., Blackford House, Whitefield, near Manchester, Calico Printer's Colour Mixer.
1883. Reeks, T. H., 106, Queen Victoria Street, London, E.C., Analytical and Consulting Chemist.
1901. Rees, Harold B., c/o Harris-Rees Tanning Co., Sylva, N.C., U.S.A., Tanner and Currier.
1897. Rees, W. H., Big Pine, Inyo Co., Cal., U.S.A., Chemist.
1900. Reese, Dr. Chas. L., c/o Repauno Chemical Co., Chester, Pa., U.S.A., Chemist.
1897. Reid, Andrew, 133, Minard Road, Crossmyloof, Glasgow, Chemist.
1896. Reid, Robt., Oil Mills, Horbury Bridge, near Wakefield, Chemical Student.
1895. Reid, T. Anderson, c/o Johnsen, Jørgensen, and Wettre, 38, Victoria Buildings, Manchester, Works Manager.
- O.M. Reid, Walter F., Fieldside, Addlestone, Surrey, Technical Chemist.
1893. Reid, Wm., Jun., Bombay Dyeworks, Dadur, Bombay, India, Dyer.
1904. Reinherz, Otto, (Journals) 9, Heaton Grove, Bradford, Yorks., and (communications) 181, Cromwell Road, London, S.W., Chemist.
1898. Reitmeyer, Robt. E. D., 63, Crutched Friars, London, E.C., Chemical Merchant.
1901. Remington, J. Percy, jun., 36, Doughty Street, Brooklyn, N.Y., U.S.A., Chemist.
1904. Remington, Prof. Joseph P., 1823, Pine Street, Philadelphia, Pa., U.S.A., Author, U.S. Pharmacopoeia.
1900. Remington, J. Stewart, Aynsome, Grange-over-Sands, R.S.O., Lancs., Consulting Chemist.
1903. Remsen, President Ira, Johns Hopkins University, Baltimore, Md., U.S.A., President.
1884. Renaut, F. W., 17, Emanuel Avenue, Friar's Park, Acton, W., Secretary.
- O.M. Rennie, Dr. E. H., University of Adelaide, South Australia, Professor of Chemistry.
- O.M. Rennoldson, W. L., c/o United Alkali Co., Ltd., Hebburn-on-Tyne, Manager.
1901. Renwick, Frank F., Hylands, Brentwood, Essex, Chemist (Photographic Works).
1894. Rettie, Theodore, 16, Great King Street, Edinburgh, Metallurgical Chemist.
1895. Reubens, Chas. M., c/o Brady Brass Co., 202, Tenth Street, Jersey City, N.J., U.S.A., Chemist.
1902. Reuterdaahl, Arvid, 194, Calla Street, Providence, R.I., U.S.A., Consulting Electrical Chemist.
- O.M. Reynolds, Dr. J. Emerson, F.R.S., 29, Campden Hill Court, Kensington, W., Professor of Chemistry.
1904. Rhett, Edmund, American Ether Co., Richmond, Va., U.S.A., Superintendent.
- O.M. Rhodes, E., c/o Thos. Vickers and Sons, Widnes, Technical Chemist.
1892. Rhodes, Jos., Church Bridge House, Accrington, Print Works Chemist.



1902. Rhodin, B. E. F., Sault Ste. Marie, Ont., Canada, Chemical Engineer.
1889. Richards, Edgar, 16, Latayette Square, Washington, D.C., U.S.A., Analytical Chemist.
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1888. Richardson, D. B., Chemical Merchant.
1903. Richardson, F. J., Chemical Works, Ringsend Docks, Dublin, Ireland, Chemical Manure Manufacturer.
1884. Richardson, F. W., City Analyst's Office, Bradford; and (Journals) Oak Lea, Menston-in-Wharfedale, Yorkshire, Analytical Chemist.
1892. Richardson, G. E., Branch House, Batley, Yorks., Manufacturing Chemist.
1900. Richardson, Jno. H., c/o H. D. Pochin and Co., Ltd., Salford, Manchester, Manager.
1905. Richardson, L. G., c/o E. Ripley and Sons, Ltd., Bowling Dye-works, Bradford, Yorks., Chemist.
1889. Richardson, S. M., 415, Main Street, Bonhill, N.B., Analytical Chemist.
1891. Richardson, Walter W., Aldingham, Park View Crescent, Roundhay, Leeds, Manufacturing Chemist.
1903. Richardson, Wm., 2, Oakfield Terrace, Headingley, Leeds, Drysalter.
1900. Richardson, Wm. Derrick, 4306, Forestville Avenue, Chicago, Ill., U.S.A., Chemist (Swift and Co.).
1894. Richardson, Wm. H., Newsy Thread Mills, Malaja Bolotnaja, St. Petersburg, Russia, Textile Chemist.
1904. Richardson, Wm. S., 201, High Street, Lincoln, Chemical Manure Manufacturer.
1886. Richmond, H. D., 8, Woodfield Road, Ealing, W., Chief Chemist (Aylesbury Dairy Co.).
1898. Richmond, Jno. R., Stalheim, Eccleston Park, Preseot, Lancs., Alkali Works Manager.
1901. Richmond, Sylvester O., Royal Victoria Yard, Deptford, London, S.E., Analytical Chemist.
1886. Riddell, R., 87, Horninglow Street, Burton-on-Trent, Brewer.
1894. Ridding, Howard C., School of Mines, Clinton Road, Redruth, Cornwall, Principal.
1884. Rideal, Dr. Samuel, Laboratory, 28, Victoria Street, Westminster, S.W., Consulting Chemist.
- O.M. Ridsdale, C. H., Ferndale, Linthorpe, Middlesbrough, Yorks., Analytical Chemist.
1899. Riederer, Emil J., Forcite Powder Co., Landing, N.J., U.S.A., Chemist.
1902. Riederer, Dr. Herman S., 251, West 95th Street, New York City, U.S.A., Chemist.
1892. Riker, Jno. J., 46, Cedar Street, New York City, U.S.A., Merchant.
- O.M. Riley, E., 2, City Road, Finsbury Square, London, E.C., Metallurgical Chemist.
1902. Riley, Fred., c/o Rhode Island Dyeing and Finishing Co., Woonsocket, R.I., U.S.A., Traveller.
- O.M. Riley, J. E., Arden Hall, near Accrington, Chemical Manufacturer.
1884. Riley, Jno., Mayfield, Thornliebank, near Glasgow, Print Works Manager.
1904. Riley, Oliver, Arden Hall, Accrington; and (Journals) Hapton Chemical Works, near Accrington, Chemical Manufacturer.
1904. Riley, W. A., Brunswick Lodge, Newmarket Road, Norwich, Brewer.
1899. Rink, Arnold, 9, Butler Street, Milton Street, London, E.C., Tannin Extract Manufacturer.
1889. Rintoul, Wm., 4, Sewardstone Road., Waltham Abbey, Essex, Explosives Chemist.
1901. Ripley, Philip F., 48, Central Street, Andover, Mass., U.S.A., Chemist.
1900. Rising, Willard B., Berkeley, Cal., U.S.A., Professor of Chemistry.
1885. Ritson, T. N., 1, West Cliff Villas, West Cliff Road, Ramsgate, Gas Engineer.
1899. Rivington, W. John, 24, Mark Lane, London, E.C., Newspaper Proprietor.
- O.M. Rix, W. P., Frocester House, Kinglake Road, Egremont, Cheshire, Potter.
1890. Roberts, C. F., Linlitts, Delph, *see* Oldham, Chemical Merchant.
- O.M. Roberts, F. G., Admir, Oak Hill Lodge, Frognal, N.W., Chemical Manufacturer.
1901. Roberts, H. E. U., 11, Albion Terrace, Faversham, Kent, Chemist (Cotton Powder Co., Ltd.).
1885. Roberts, R. Wightwick, 22, Calle Arturo Prat, Valparaiso, Chili, Analytical and Consulting Chemist.
1900. Roberts, Wm. Brittain, Wilderspool House, Warrington, Brewer and Analyst.
1902. Roberts, Wm. H., 1, Newborough Avenue, Sefton Park, Liverpool, S., Analytical Chemist.
1902. Robertshaw, Chas. D., c/o Chas. Price and Co., Oilworks, Belyedere, Kent, Analytical Chemist.
1891. Robertson, Alex. A., Riversdale, Cressington Park, Liverpool, Technical Chemist.
1897. Robertson, Andrew, J., 17, South 12th Street, Richmond, Va., U.S.A., Analytical Chemist.
1903. Robertson, Fred., 128, Wellington Street, Glasgow, Analytical Chemist.
1900. Robertson, Jas., 103, Whifflet Street, Coatbridge, N.B., Analytical Chemist.
1891. Robertson, Dr. Robt., 9, Sewardstone Road; (Journals) Royal Gunpowder Factory, Waltham Abbey, Essex, Analytical Chemist.
1901. Robertson, Robert, California Powder Works, Santa Cruz, Cal., U.S.A., Superintendent.
1903. Robertson, W. Crum, 15, Commerce Street, Glasgow, Oil Merchant and Importer.
1895. Robins, Walter, Wanstead Cottage, New Wanstead, Essex, Chemist.
1897. Robinson, Clarence J., Westerleigh, West New Brighton, N.Y., U.S.A., Chemist.
1900. Robinson, Edw. B., Victoria Oil Works, Nitshill, near Glasgow, Oil Distiller.
1904. Robinson, Prof. Franklin C., Bowdoin College, Brunswick, Maine, U.S.A., Professor of Chemistry.
1902. Robinson, Hy. Fishwick, Culcheth Chemical Works, Newton Heath, Manchester, Manufacturing Chemist.
- O.M. Robinson, H. H., 75, Finborough Road, West Brompton, S.W., Analytical Chemist.
- O.M. Robinson, Jno., 8, Kaludah Terrace, Albert Road, Widnes, Chemical Engineer.
- O.M. Robinson, Jos., Farnworth, Widnes, Chemical Manufacturer.
1887. Robinson, Thomas, (Journals) 401, West Street, Glasgow; and (communications), The Villa, Nitshill, N.B., Chemical Works Manager.
1902. Robitschek, Carl, 200, Worth Street, New York City, U.S.A., Scientific Brewer.
1903. Robson, Tom, Caixa 149, Pernambuco, Brazil, Engineer.
1894. Rodda, Edw. D., 6, Gold Street, Roath, Cardiff, Engineer.
1884. Rodger, Edw., 1, Clairmont Gardens, Glasgow, W.
1904. Rodger, Robert, Government Laboratory, Clement's Inn Passage, Strand, London, W.C., Chemist.
1904. Roeber, Dr. E. F., 114, Liberty Street, New York City, U.S.A., Editor, "Electrochemical Industry."
1903. Roelofsen, Dr. J. A., c/o Coal Distillation Co., Middlesbrough, Yorks., Works Manager.
1905. Rogers, Dr. Allen, 346, Madison Avenue, Flushing, N.Y., U.S.A., Research Chemist.
1900. Rogers, Geo. J., Wallaroo Smelting Works, South Australia, Chemist.
1890. Rogers, Harry, 5, Stoke Newington Common, London, N.
1899. Rogers, John, Ardeer Factory, Stevenston, Ayrshire, N.B., Chemist.
1901. Rogerson, John W., 101, Leadenhall Street, London, E.C., Maltster.
1898. Roller, H. C., 102, Montague Street, Brooklyn, N.Y., U.S.A., Superintendent.
1899. Rollin, Chas., Bylton, East Jarrow-on-Tyne, Chemical Manufacturer.
- O.M. Rollin, J. C., 1, St. Nicholas Buildings, Newcastle-on-Tyne, Chemical Manufacturer.

1898. Roode, Rudolf de, International Paper Co., Glens Falls, N.Y., U.S.A., Chemist and Superintendent.
- O.M. Roscoe, Sir Henry, F.R.S., 10, Bramham Gardens, South Kensington, S.W., Consulting Chemist.
1901. Roscow, Jas., 471, Park Avenue, Paterson, N.J., U.S.A., Colourist and Chemist.
1893. Roscow, Jno. F., P.O. Box 417, Boonton, N.J., U.S.A., Print Works Chemist.
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1901. Rose, Jno. Leonard, Gorton Brook Chemical Works, Manchester, S.E., Chemist.
1902. Rosebrugh, Prof. T. R., 666, Spadina Avenue, Toronto, Canada, Professor of Electrical Engineering.
1904. Rosenblatt, A. H., 55 East 92nd Street, New York City, U.S.A., Superintendent and Chemist, Toch Bros.
1897. Rosengarten, Dr. Geo. D., 1700, Fitzwater Street, Station D, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1896. Rosenheim, Dr. Otto, 68, Belsize Park Gardens, Hampstead, N.W., Research Chemist.
1887. Ross, Alex. J. J., Tayavalla, Falkirk, N.B., Chemical Manufacturer.
1893. Ross, Arthur, I, Glengall Road, Old Kent Road, London, S.E., Analytical Chemist.
1901. Ross, Herbert W., Corner of Bancroft Way and Piedmont Avenue, Berkeley, Cal., U.S.A., Chemist.
1887. Ross, Jas. G., (Journals) 5-9, Sunbury Place, Belford Road; and (subscriptions) 47, Comely Bank Place, Edinburgh, Analytical Chemist.
1900. Ross, Raymond, Public Analyst's Office, Burnley, Lancashire, Analytical Chemist.
1904. Rostosky, Dr. Leopold, Tiergartenstrasse 28, Dresden Alt, Saxony, Chemist.
1888. Rothwell, C. F. Seymour, Photographic Works, Moberley, Cheshire, Chemist.
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1899. Rouse, H. W., 62, Russell Road, Custom House, E., Foreman (Sulphuric Acid Works).
1903. Rouse, Wm., King Edward Street, Alexandria, Dumbartonshire, Chemist.
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1904. Rowley, Ernest W., Chemical Laboratory, Locomotive Department, North Eastern Railway, Gateshead-on-Tyne, Analytical Chemist.
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1904. Rowling, S. R., 1, Beechwood, Kendal, Westmoreland, Analyst.
1899. Roy, Benjamin, Ailsa Lodge, 17, Whitelaw Road, Chorlton-cum-Hardy, Manchester, Chemist.
1896. Royal-Dawson, H., 6, Wimbourne Road, City Road, Edgbaston, Birmingham, Chemist.
1898. Royle, Chas. L., c/o Parry and Co., Madras, India, Sugar Chemist.
1898. Royle, Thos. H., Bareilly, United Provinces, India, Chemist.
- O.M. Royle, T., 329, Upton Laue, Forest Gate, Essex, Chemical Engineer.
- O.M. Royse, S. W., St. Andrew's Chambers, 20, Albert Square, Manchester, Chemical Engineer.
1902. Rücker, Dr. Hermann von, Chemist.
1896. Ruddock, Fred. G., Egypt Street Chambers, Warrington, Analytical Chemist.
1895. Rudge, Alfred, Sutton Alkali Works, St. Helens, Lancs., Analytical Chemist.
1904. Ruef, Harry H., 335, Marshall Street, Elizabeth, N.J., U.S.A., Chemist.
1884. Ruffle, Jno., Musley, Ware, Herts., Consulting Chemist and Electrician.
1898. Ruhl, Louis, c/o Roessler and Hasslacher Chemical Co., P.O. Box 1999, 100, William Street, New York City, U.S.A., Chemical Merchant.
1902. Ruhoff, O. E., c/o Mineral Point Zinc Co., Mineral Point, Wis., U.S.A., Chemist.
- O.M. Rumble, C., Belmont Works, Battersea, London, S.W., Candle Works Chemist.
1899. Rumbold, Wm. R., 47, Watling Street, London, E.C., Electro-Metallurgist.
1895. Rump, Ernst, The Leeds Phosphate Works, Hunslet, Leeds, Manager.
1903. Runting, D. A., Moreland Grove, Coburg, Melbourne, Vic., Australia, Assayer.
1903. Runyan, Elmer G., Hutchins Building, Washington, D.C., U.S.A., Chemist and Gas Inspector.
1899. Rushby, Wm., 22, Surrey Street, Batley, Yorks., Analyst.
1901. Rushton, Benjamin, Waterloo, Whalley Road, Accrington, Analytical Chemist.
1887. Russell, D., Cadham, Markinch, Fife, N.B., Paper Maker.
1884. Russell, Jno., Anchor Brewery, Britten Street, Chelsea, London, S.W., Brewer.
1903. Russell, T. A., Walmer Road; and (Journals) 3, Queen's Park, Toronto, Ont., Canada, Manufacturer (Bicycles and Automobiles).
- O.M. Russell, Dr. W. J., F.R.S., 34, Upper Hamilton Terrace, London, N.W., Professor of Chemistry.
1901. Rust, Robt. R., c/o Mineral Point Zinc Co., North Chicago, Ill., U.S.A., Chemist.
1905. Ryan, Prof. F. G., (Journals) c/o Parke, Davis and Co., Detroit, Mich., U.S.A., and (subscriptions) c/o Parke, Davis and Co., III, Queen Victoria Street, London, E.C., Manufacturing Chemist.
1884. Ryland, Howard P., Agricultural Chemist.

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1905. Sabin, Alvah H., P.O. Box 85, Long Island City, N.Y., U.S.A., Chemist, Varnish Works.
1883. Sadler, A. E., Sand Hall, Ulverston, Lancashire, Manufacturing Chemist.
- O.M. Sadler, Dr. S. A., M.P., Middlesbrough-on-Tees, Colour Manufacturer.
1884. Sadtler, Dr. S. P., 145, North 10th Street, Philadelphia, Pa., U.S.A., Consulting Chemist.
1896. Sadtler, Dr. S. S., N.E. corner of 10th and Chestnut Streets, Germantown, Philadelphia, Pa., U.S.A., Chemist (U.S. Customs).
1905. Safford, E. Brigham, Albuquerque, New Mexico, U.S.A., Chemist.
1897. Sage, C. Edward, 2, Charterhouse Street, London, E.C., Consulting Chemist.
1902. Sahn, Louis N., 22, Cliff Street, New York City, U.S.A., Chemist.
1904. St. Clair-Fewings, L., 3, Bolingbroke Grove, Wandsworth Common, S.W., Incandescent Mantle Chemist.
1884. Salamon, A. Gordon, I, Fenchurch Avenue, London, E.C., Consulting Chemist.
1885. Salamon, Jno., Rainham, S.O., Essex, Manufacturing Chemist.
1884. Salis-Mayenfeld, Dr. E. von., 9, Macpherson Terrace, Albany, N.Y., U.S.A., Technical Chemist.
1902. Salter, M. J., 65, Park Road, Crouch End, London, N., Analytical Chemist.
- O.M. Samuel, W. Colden, 66, Croxted Road, West Dulwich, S.E., Analytical Chemist.
- O.M. Samuelson, Rt. Hon. Sir Bernhard, Bart., F.R.S., 56, Prince's Gate, London, S.W., Ironmaster.
1896. Samuelson, Francis A. E., Sir B. Samuelson and Co., Ltd., Middlesbrough, Ironmaster.
1895. Samuelson, Godfrey B., Parliament Mansions, Victoria Street, London, S.W., Electrical Manufacturer.



1904. Sand, Dr. Henry J. S., University College, Nottingham, Lecturer and Demonstrator.
1902. Sanders, Warren W., c/o Larkin Soap Co., Buffalo, N.Y., U.S.A., Chemist.
1895. Sanderson, John, c/o B. S. Cohen, Ltd., 15, Clerkenwell Close, London, E.C., Chemist.
1898. Sanderson, T. C., Duboise Avenue, West New Brighton, N.Y., U.S.A., Chemical Engineer.
1884. Sandoz, R., 42, Lewisham Road, Dartmouth Park, N.W., Examiner at Patent Office.
- O.M. Sanford, P. Gerald, 20, Cullum Street, London, E.C., Public Analyst and Consulting Chemist.
1904. Sanger, Charles Robt., Harvard College, Cambridge, Mass., U.S.A., Professor of Chemistry.
1890. Saniter, E. H., Strafford Villa, Moorgate, Rotherham, Analytical Chemist.
1901. Sargent, Dr. Geo. W., Carpenter Steel Co., Reading, Pa., U.S.A., Chemist and Metallurgist.
1903. Saunders, Lewis E., Niagara Research Laboratories, Niagara Falls, N.Y., U.S.A., Electro-Chemical Engineer.
1896. Saunders, Walter M., 20, Dewey Street, Olneyville, R.I., U.S.A., Analytical Chemist.
1895. Savage, Arthur E., Charles Street, Elsternwick, Victoria, Australia, Metallurgist.
1895. Sawers, Wm. D., 1, Athole Gardens Place, Glasgow, Chemist.
1903. Sawin, Luther R., Office of Sanitary Patrol, Katonah, N.Y., U.S.A., Bacteriologist.
1903. Saxby, Fred. W., c/o P. Haulgrave and Co., 25, Hill Street, Liverpool, Tar Distiller.
1898. Saxe, Sigmond, 107, Manhattan Avenue, New York City, U.S.A., Manufacturing Chemist.
1895. Sayer, Harry, Cotwells, Ponders End, Middlesex, Metallurgical Chemist.
1894. Sayers, Jos. J., Nobel Villa, Stevenston, Ayrshire, Explosives Chemist.
1895. Scales, F. Shillington, "Jersey," St. Barnabas Road, Cambridge.
1899. Schnack, Dr. Milton F., 108, Penn Street, Brooklyn, N.Y., U.S.A., Chemist.
- O.M. Schack-Sommer, Dr. G., 48, Marlborough Mansions, Victoria Street, London, S.W., Sugar Refiner.
1899. Schaefer, Dr. L., Maywood, N.J., U.S.A., Manufacturing Chemist.
1898. Schaffer, Herbert A., 321, Spring Garden Street, Easton, Pa., U.S.A., Chemist (Portland Cement).
1903. Schanche, Herman G., 3401, Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.
1903. Scheidel, Dr. Aug., Union Club, Sydney, N.S.W., Australia, Managing Director.
1886. Schellhaas, Henry Alf., Thornhill, Beach Road, Hartford, Northwich, Mechanical Engineer.
1904. Schenck, Henry, 80, Washington Square, New York City, U.S.A.
1894. Schidowitz, Dr. P., 57, Chancery Lane, London, W.C., Research Chemist.
1895. Schieffelin, Dr. W. Jay, 841, Southern Boulevard, New York City, U.S.A., Manufacturing Chemist.
1901. Schieren, G. Arthur, Dixie Tannery, Bristol, Tenn., U.S.A., Mechanical Engineer and Tanner.
1902. Schjölberg, T. E., Taltal, Chile, S. America, Chemist.
1902. Schlegel, Jno. Wm., 602, East 5th Street, New York City, U.S.A., Chemist.
1893. Schleicher, Francis J., 38, West Tenth Street, Long Island City, N.Y., U.S.A., Technical Chemist.
1902. Schlesinger, Basil E., 92, Mount Vernon Street, Boston, Mass., U.S.A., Chemist.
1901. Schlichting, Emil, 38, Cranberry Street, Brooklyn, N.Y., U.S.A., Chemist.
1905. Schmidt, Herman B., 2523, Essex Place, W.W.H., Cincinnati, Ohio, U.S.A., Manufacturing Chemist.
1901. Schneider, Edw. J., c/o Union Carbide Co., Sault Ste. Marie, Mich., U.S.A., Chemist.
1899. Schniewind, Dr. F., c/o United Coke and Gas Co., 17, Battery Place, New York City, U.S.A., Chemist.
1904. Schniewind, Heinrich, Jun., Susquehanna Silk Mills, 62, Greene Street, New York City, U.S.A., Vice-President and Treasurer.
1897. Schoder, Dr. Robt., c/o Deutsche Gasglühlicht Act.-Ges., 13, Alte Jakobstrasse, Berlin, Chemist.
1904. Schoeller, Walter R., 169-170, Shorechitch High Street, London, E.C., Analytical Chemist.
1902. Schofield, Jas. A., The University, Sydney, N.S.W., Australia, Lecturer in Chemistry.
- O.M. Schofield, H. E., Edge Hill Chemical Works, Liverpool, Chemical Manufacturer.
1898. Scholes, Geo. R., Liebig's Extract of Meat Co., Ltd., 21, Longue Rue des Chaires, Antwerp, Belgium, Analytical Chemist.
1902. Schoonmaker, H., c/o R. A. Perez, 120, North Main Street, Los Angeles, Cal., U.S.A., Metallurgical Chemist.
1895. Schroeder, E. August, c/o Church and Co., 36, Ash Street, Brooklyn, N.Y., U.S.A., Chemist.
1904. Schultz, Carl R., 440, First Avenue, New York City, U.S.A., Mineral Water Manufacturer.
1901. Schultze, Wm., 194, Academy Street, Jersey City Heights, N.J., U.S.A., Chemist.
1902. Schulze, Emil A., 15, Stanthorpe Road, Streatham, S.W., Incandescent Mantle Manufacturer.
1893. Schüpphaus, Dr. R. C., 174, Broadway, New York City, U.S.A., Consulting Chemist.
1893. Schwab, Dr. L. C., Sedanstrasse 53, Bernburg, Anhalt, Germany, Technical Chemist.
1901. Schwartz, David, c/o Southern Cotton Oil Co., Gretna, La., U.S.A., Chemist.
1902. Schwarz, Gustav A., Grasselli Chemical Co., 63, Wall Street, New York City, U.S.A., Manager.
1900. Schwarz, Dr. Henry P., c/o Western Sugar Refining Co., Potrero, San Francisco, Cal., U.S.A., Chemist.
1889. Schweich, Emile. *See* Mond, Emile S.
1903. Schweickert, Karl, 45, Hazelwood Avenue, Rahway, N.J., U.S.A., Chemist.
1894. Schweitzer, Dr. H., 40, Stone Street, New York City, U.S.A., Analytical Chemist.
1904. Schwüiter, Martin, Tin City, Cape Prince of Wales, Alaska, U.S.A., Chemist and Assayer.
1891. Scott, Andrew, Royal Gunpowder Factory, Waltham Abbey, Essex, Analytical Chemist.
1889. Scott, Ernest G., 2, Talbot Court, Gracechurch Street, London, E.C., Soap Works Chemist.
1898. Scott, Jas., Cawnpore Woollen Mills, Cawnpore, India, Chemist.
1894. Scott, Jno. Gillespie, 33, Siennes Road, Edinburgh, Analytical Chemist.
1902. Scott, Walter, 696, Stockport Road, Longsight, Manchester, Chemist.
1894. Scott-Smith, G. E., 67, Surrey Street, Sheffield, Analytical Chemist.
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1904. Scoville, Wilbur L., 50, Washington Street, Boston, Mass., U.S.A., Analytical Chemist.
1896. Scrymgeour, Wm., Fraser's Gold Mine, Southern Cross, West Australia, Chemist.
- O.M. Scudder, F., Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Chemist.
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1889. Searl, Albert, Montreux, Victoria Road, Sidecup, Kent, Technical Chemist.
1898. Searle, Alf. B., 280, Western Bank, Sheffield, Analytical Chemist.
1896. Sedding, G. H. P., c/o Florida Syndicate, Jacksonville, Florida, U.S.A., Chemist.
1901. Sederholm, Erik, 28, Jakopsgatan, Stockholm, Sweden, Chemist (Royal Navy Board).
1901. Seeler, Dr. F., c/o Merck and Co., Rahway, N.J., U.S.A., Manufacturing Chemist.
1893. Sefton-Jones, Herbert, c/o W. P. Thompson and Co., 322, High Holborn, London, W.C., Chemist.
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1896. Seldner, Rudolph L., 1395, Dean Street, Brooklyn N.Y., U.S.A., Instructor in Chemistry.
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1884. Semet, Louis, 217, Chaussée de Vleurgat, Brussels, Alkali Manufacturer.
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1895. Senger, Robt., 37, Warren Street, New York City, U.S.A., Manufacturing Chemist.
1899. Senior, Francis L., Lock 28, Sanford, Maine, U.S.A., Mill Chemist.
1904. Setzler, Dr. Horace B., c/o Lake Carriers Oil Co., Coraopolis, Pa., U.S.A., Superintendent.
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1896. Seyler, Clarence A., Technical Institute, Nelson Terrace, Swansea, Chemist and Assayer.
1889. Seymour-Jones, A., Pendower, Wrexham, Leather Manufacturer.
1903. Shacklady, T. G., Addiscombe Villas, Cliffe-at-Hoo, Rochester, Technical Chemist.
1892. Shanks, Arch., Bridgend Mills, Dalry, Ayrshire, N.B., Chemist.
1883. Sharp, James, Shirley Manor, Wyke, near Bradford, Yorks., Dyer.
1891. Sharpe, Granville H., 11 and 12, Great Tower Street, London, E.C., Analytical Chemist.
1904. Sharples, G. H., Holly Villas, Sutton Lane, Middlewich, Cheshire, Works Chemist.
1884. Sharples, Stephen P., 26, Broad Street, Boston, Mass., U.S.A., Analytical Chemist.
1896. Sharpley, Wm. P., P.O. Box 102, Germiston, Transvaal, S. Africa, Analytical Chemist.
1900. Sharwood, Wm. J., 2600, Hillegas Avenue, Berkeley, Cal., U.S.A., Metallurgical Chemist.
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1904. Shedden, Frank, 5, Belvidere Road, Walsall, Science Master.
1903. Sheldon, Dr. N. L., Cordite Factory, Aruvankad, Nilgiri Hills, India, Works Manager.
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1902. Shepard, Chas. H., Laboratory, Union Iron Works, San Francisco, Cal., U.S.A., Chemist.
1889. Shepard, Dr. Chas. U. (communications) P.O. Box 42, Summerville, S.C.; and (Journals) 56, Broad Street, Charleston, S.C., U.S.A.
1904. Shepherd, A. B., c/o British Oil and Cake Mills, Ltd., 151, Cleveland Street, Hull.
1900. Shepherd, E. Sanger, 5-7, Gray's Inn Passage, Holborn, London, W.C., Scientific Instrument Maker.
1893. Shepherd, H. H. B., Northcote, Mount Pleasant Lane, Upper Clapton, N.E., Chemist.
1898. Shepherd, Reginald des F., c/o Calico Printers' Association, 56, Mosley Street, Manchester, Printworks Chemist.
1895. Sherman, G. W., Akron, Ohio, U.S.A., General Manager.
1899. Shero, John E., c/o Pittsburg Reduction Co., Niagara Falls, N.Y., U.S.A., Chemist.
1893. Shields, Dr. John, Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.
1896. Shimomura, K., c/o Osaka Seimi Works Co., Kawagishicho, Nishiku, Osaka, Japan, Chemist.
1886. Shimosé, Masachika, Shimosé Powder Works, Takinogawa, near Oji, Tokyo, Japan, Chemical Engineer.
1902. Shimotome, Henry, Higher Technical School, Asakusa, Tokyo, Japan, Professor of Chemistry.
1888. Shishkoff, Sergius A., Perm, Russia, Glass Manufacturer.
1899. Sholes, Chas. E., 25, Broad Street, New York City, U.S.A., Chemical Agent.
1900. Shonk, Albert, 6, York Road, West Hendon, Analytical Chemist.
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1904. Short, Andrew, Choppington, Morpeth, Works Chemist.
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1902. Shoubridge, Sydney Y., M.I.C.E., Gasworks, Lower Sydenham, S.E., Gas Engineer.
1901. Shukoff, Dr. Alexis A., Borowaja No. 86, St. Petersburg, Russia, Technical Chemist.
1899. Shuler, Darius P., Mine La Motte, Mo., U.S.A., Chemist.
1890. Shutt, Frank T., Central Experimental Farm, Ottawa, Canada, Agricultural Chemist.
1901. Sian, Raymond, L., Springfield Brewery, Wolverhampton, Carbohydrate Research Chemist.
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1903. Simmons, Wm. H., Oakleigh, Stoke Newington Common, N., Analytical Chemist.
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1902. Simonson, Wm., 126, West 9th Street, Cincinnati, Ohio, U.S.A., Chemist.
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1899. Singmaster, J. Arthur, c/o New Jersey Zinc Co. of Penna., Palmerton, Pa., U.S.A., Chemist.
1901. Sinnatt, Frank S., Glenside, Church Lane, Moston, Manchester, Demonstrator of Chemistry.
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1900. Sodean, Wm. H., 114, Park Road, Newcastle-on-Tyne, Chemist.

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1894. Sonstadt, Edw., Church Fields, Cheshunt, Herts., Chemical Technologist.
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1887. Spackman, Chas., Rosehaugh, Clitheroe, Lancashire, Portland Cement Manufacturer.
1904. Sparke, Archibald, Public Library and Art Gallery, Bury, Lancs., Chief Librarian, &c.
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1901. Sparrow, J. Marcellus, c/o Imperial Varnish and Colour Co., Ltd., 6-22, Morse Street, Toronto, Canada, Varnish and Colour Manufacturer.
1904. Spayd, Chas. Hay, 5143, Arch Street, Philadelphia, Pa., U.S.A., Analytical Chemist.
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1883. Spence, D., Sendig Hotel, Europaeischer Hof, Dresden A. Germany, Alum Manufacturer.
- O.M. Spence, F., Alum Works, Manchester, Alum Manufacturer.
1900. Spence, Howard, (Journals) Andley, Broad Road, Sale, Cheshire; and Alum Works, Manchester, Chemical Manufacturer.
1901. Spence, Jno. Davidson (Journals) 2, Hawkhill Place, Dundee; and (communications) 39, Mincing Lane, London, E.C., Consulting Chemist.
1883. Spence, Jno. W., Tiviot Colour Works, Manchester Road, Stockport, Drysalter.
1903. Spencer, Arthur G., 146, St. James' Street, Montreal, Canada, Chemist.
1884. Spencer, Jno., Globe Tube Works, Wednesbury, Tube Manufacturer.
- O.M. Spencer, J. W., Newbiggin House, Kenton, Newcastle-on-Tyne, Steel Manufacturer.
1901. Spencer, Robt., Jun., c/o E. Ripley and Son, Ltd., Bowling Dye-works, Bradford.
1902. Sperry, Elmer A., 855, Case Avenue, Cleveland, Ohio, U.S.A., Electrical Engineer.
1897. Sperry, Erwin S., P.O. Box 656, Bridgeport, Conn., U.S.A., Metallurgist.
1884. Spiegel, Dr. Adolf, Messel, bei Darmstadt, Germany, Analytical Chemist.
1899. Spieler, Aug. J., 543, Gifford Street, Syracuse, N.Y., U.S.A., Stearic Acid Works Superintendent.
1903. Spielmann, P. E., 21, Cadogan Gardens, London, S.W., Chemical Student.
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1885. Spiller, A., Edison-Swan Electric Co., South Benwell Works, Newcastle-on-Tyne, Electrician.
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1896. Spoor, J. L., Madras Cement Works, Madras, India; and (Journals), Rede Court, Rochester, Kent, Portland Cement Manufacturer.
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1896. Stafford, Chas. H., Hollyfield, Weldbank; and (Journals) c/o The Birkacre Printing Co., Chorley, Lancs., Colourist.
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1895. Summers, Bertrand S., 2368, Military Street, Port Huron, Mich., U.S.A., Electro-Chemist.
1890. Sumner, Harold, Worthington, near Wigan, Dyer and Bleacher.
1896. Sunderland, A., 84, Hainworth Wood Road, Ingrow, Keighley, Teacher of Chemistry.
1899. Sundström, Carl, c/o Solvay Press Co., Detroit, Mich., U.S.A., Chemist.
1895. Sundström, Karl J., Sibley, Mich., U.S.A., Manufacturing Chemist.
1884. Sutherland, D. A., 13, Victoria Street, Westminster, S.W., Consulting Technical Chemist and Assayer.
1894. Sutherland, Geo., Croft Cottage, Bonhill, N.B., Chemist.
1887. Sutherland, Jas., c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Chemist.
- O.M. Sutherland, R. M., Lime Wharf Chemical Works, Falkirk; and Solsgirth, Dollar, N.B., Chemical Manufacturer.
1901. Sutro, H. H., 126, Liberty Street, New York City, U.S.A., Chemist.
- O.M. Sutton, Francis, Norfolk County Laboratory, Redwell Street, Norwich, Analytical Chemist.
1886. Sutton, F. Napier, 6, Grosvenor Gardens, Willesden Green, N.W., Alkali Works Inspector.

1900. Sutton, W. Lincolne. Hillcroft, Eaton, Norwich, Public Analyst.
- O.M. Swan, J. Cameron, 4, Nicholas Buildings, Newcastle-on-Tyne, Manufacturing Chemist.
- O.M. Swan, Sir Jos. W., F.R.S., 58, Holland Park, London, W., Chemist and Electrician.
1898. Swanson, Jas. F., 5, Edmiston Terrace, Copeland Road, Govan, N.B., Technical Chemist.
1884. Swinburne, Geo. (Journals), 99, Queen Street, Melbourne, Australia; (subs.) c/o Jno. Coates and Co., Suffolk House, Laurence Pountney Hill, E.C., Gas Engineer.
1904. Swindells, Seth, The Laurels, Scholar Green, Stoke-on-Trent, Chemist.
1901. Swinton, Ralph S., c/o W. J. Bush, Incorporated, Linden, N.J., U.S.A., Analytical Chemist.
1903. Sykes, Walter F., 85, Water Street, New York City, U.S.A., Chemical Merchant.
1902. Sylow, Paul L. P. G., Korsör, Alexandra Street, Drummoyn, Sydney, N.S.W., Australia, Analytical Chemist.
- O.M. Syme, W. B., Elm Cottage, Addiewell, West Calder, N.B., Oil Works Chemist.
1903. Symmes, Whitman, 630, Harrison Street, San Francisco, Cal., U.S.A., Chemical Engineer.
- T
1895. Taber, G. H., 814, Frick Building, Pittsburg, Pa., U.S.A., General Manager (Gulf Refining Co.).
1896. Takagi, T., Kyoikuhin, Seizo Kaisha, Asakusa, Shickihin Cho, Tokyo, Japan, Chemical Engineer.
- O.M. Takamatsu, T., Tokyo University, Japan, Analytical Chemist.
- O.M. Takamine, Dr. J., 613, West 142nd Street, New York City, U.S.A., Engineer.
1890. Takayama, Jintaro, Nando Machi 26, Ushigome, Tokyo, Japan, Director (Imperial Industrial Experiment Station).
1901. Talati, K. E., Tirvettyoor, near Madras (Chingulput), India, Leather Dresser.
1903. Talbott, Dr. B. E., Chaneyville, Md., U.S.A., Manufacturing Chemist.
1902. Talley, Thos. Washington, Fisk University, Nashville, Tenn., U.S.A., Chemist.
1898. Tanaka, Keishin, Matsuba Hotel, Kudansaka, Ōye, Tokyo, Japan, Chemist.
1900. Tankard, Arnold R., 67, Surrey Street, Sheffield, Analytical Chemist.
- O.M. Tate, F. H., 9, Hackins Hey, Liverpool, Analytical and Technical Chemist.
1902. Tate, Francis G. H., Kilmersdon, Homecroft Road, Sydenham, S.E., Analyst (H.M. Customs).
- O.M. Tatlock, J., 45, Renfrew Street, Glasgow, Laboratory Furnisher.
- O.M. Tatlock, R. R., Novara, Stirling, N.B., Consulting Chemist.
1902. Tatters, Hugh Lee, 17, Waterloo Road, Runcorn, Cheshire, Analytical Chemist.
1892. Tatton, Reginald A., Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Civil Engineer.
- O.M. Taubman, R., 12, Eton Road, Haverstock Hill, N.W., Analytical Chemist.
1905. Taveau, René de Mortemer, 1218, Mount Royal Avenue, Baltimore, Md., U.S.A., Research Assistant, Johns Hopkins University.
1898. Taverner, W., Ashland, Oregon, U.S.A., Analytical Chemist.
1901. Taylor, Jno. Bernard, Ivy Bauk, Sandown Lane, Wavertree, Liverpool, Works Chemist.
1903. Taylor, Alvin M., c/o General Chemical Co., Hudson Heights, N.J., U.S.A., Chemist.
1902. Taylor, Arthur P., c/o John Taylor and Co., 531, Front Street East, Toronto, Ont., Canada, Soap Manufacturer.
1902. Taylor, Edward R., Penn Yan, N.Y., U.S.A., Manufacturing Chemist.
1902. Taylor, Francis O., c/o Parke, Davis and Co., Detroit, Mich., U.S.A., Analytical Chemist.
1886. Taylor, G. Crosland, Ravenscar, Hellsby, near Warrington, Electrical Engineer.
1894. Taylor, G. Midgley, 27, Great George Street, Westminster, S.W., Analytical Chemist.
1893. Taylor, G. W., Dinting Vale Printworks, Dinting, near Manchester, Printworks Chemist.
- O.M. Taylor, H. E., 702, Alexandra Parade, Dennistoun, Glasgow, Lead Works Manager.
1883. Taylor, Jas., Department of Mines, Sydney, N.S.W., Australia, Government Metallurgist.
1888. Taylor, Jas. Davis, 9, Mincing Lane, London, E.C., Chemical Merchant.
1898. Taylor, Jas. M., 59, Kenmare Road, Sefton Park, Liverpool, Analytical Chemist.
1901. Taylor, John, Crawford Institute, Ennmett Place, Cork, Ireland, Science Master.
1901. Taylor, Jno., c/o Brotherton and Co., Ltd., Tar Works, Litherland, Liverpool, Chemist.
1888. Taylor, J. Scott, North London Colour Works, Kentish Town, N.W., Technical Chemist.
1896. Taylor, Martin, "The Clough," Buckhurst Hill, Essex, Chemical Works Manager.
1901. Taylor, M. J., 77, Front Street East, Toronto, Canada, Soap Manufacturer.
1898. Taylor, Newman, Chinchpoghley Road, Parel, Bombay, India, Resident Engineer.
1901. Taylor, Sidney H., 65, Newbridge Road, Weston, Bath, Works Chemist.
1902. Taylor, Thos., 12, Ancaster Drive, Great Western Road, Glasgow, Chemical Manufacturer.
1902. Taylor, Tom, jun., Journals to Kent House, Sale, Cheshire; communications to Cornbrook Chemical Co., Ltd., Stockport, Colour Manufacturer.
1898. Taylor, Walter, 20, Canning Street, Bury, Lancs., Technical Chemist.
1903. Tazaki, T. M., 15, Kamiyoshicho, Asakusaku, Tokyo, Japan, Technical Chemist.
1887. Teanby, G. W. A., Elvin Lodge, East Dereham, Norfolk, Analytical Chemist.
1899. Teas, Wm. Holmes, Ridegway, Pa., U.S.A., Chemist.
- O.M. Teed, Dr. F. L., Chem. Laby., 9, Mincing Lane, London, E.C., Analytical Chemist.
1904. Teller, George L., The Columbus Laboratories, 103, State Street, Chicago, Ill., U.S.A., Chemist.
- O.M. Tennant, Sir Chas., Bart., 40, Grosvenor Square, W.; Glen, Peebleshire, N.B., and Journals to St. Rollox, Glasgow, Alkali Manufacturer.
1884. Tennant, Jas., Alex. Fergusson and Co., Ltd., 38, McAlpine Street, Glasgow, Lead and Colour Manufacturer.
1896. Tennille, Geo. F., c/o Southern Cotton Oil Co., Savannah, Ga., U.S.A., Chemist.
1888. Terry, Albert, Verulam, Mount Albert Road, Balwyn, near Melbourne, Victoria, Brewer.
1884. Terry, Hubert L., 3, Herbert Street, Moss Side, Manchester, Technical Chemist.
- O.M. Tervet, R., 54, Penshurst Road, South Hackney, E., Oil Works Manager.
1902. Test, Wm., H., 716, Brown Street, Lafayette, Ind., U.S.A., Assistant Professor of Chemistry.
1893. Tetley, C. F., Messrs. Jos. Tetley and Son, The Brewery, Leeds, Brewer.
1897. Tetlow, Wm. E., Ash Cottage, Ashfield, Dunblane, N.B., Chemist.
1903. Thatcher, Ed. J., The Manor House, Chew Magna, near Bristol, Merchant and Manufacturer.
1903. Thayer, Harry M., c/o The Procter and Gamble Co., Ivorydale, Ohio, U.S.A., Chemist.
- O.M. Thomas, Chas., J.P., D.L., Pitch and Pay, Stoke Bishop, near Bristol, Soap Manufacturer.
1894. Thomas, H. Russell, Broad Plain Soap Works, Bristol, Soap Manufacturer.
1902. Thomas, Jas. E., Box 192, Germiston, Transvaal, South Africa, Cyanide Manager.
- O.M. Thomas, J. W., Overdale, Shortlands, Kent, Analytical Chemist.
1902. Thomas, Nehemiah M., Roseville Avenue, Pymble, N.S.W., Australia.



1901. Thomas, Octavius, Gas and Water Offices, Pentre, Glamorganshire, Gas and Water Engineer.
1888. Thomas, S. Percy, 2, Landrock Road, Hornsey, N., Technical Chemist.
1898. Thomas, Wm. Harrison, Jun., Passaic Print Works, Passaic, N.J., U.S.A., Printworks Chemist.
1885. Thompson, Prof. Claude M., 38, Park Place, Cardiff, Professor of Chemistry.
1898. Thompson, Edw. C., 40, Glenlue Road, Westcombe Park, S.E., Manufacturing Chemist.
1893. Thompson, G. Rudd, 69, Dock Street, Newport, Mon., Analytical and Consulting Chemist.
1895. Thompson, Gustave W., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.
1903. Thompson, J. Fairfield, Department of Metallurgy, Columbia University, New York City, U.S.A.
1903. Thompson, Jno. T., Corporation Sewage Works, Knostrop, Leeds, Analyst.
1885. Thompson, W., Sankey Hill, Earlestown, Lancashire, Sugar Refiner.
1884. Thompson, W. G., Colour Manufacturer.
- O.M. Thompson, W. P., Patent Office, 6, Lord Street, Liverpool, Patent Agent.
1896. Thomsen, Monzo L., Maryland Club, 1, East Eager Street, Baltimore, Md., U.S.A., Manufacturing Chemist.
1902. Thomson, Allen B., c/o Spencer Chapman and Messel, Ltd., Silvertown, E., Chemical Engineer.
1884. Thomson, G. Carruthers, 53, Bedford Road, Rock Ferry, Birkenhead, Engineer.
1903. Thomson, G. M., 129, Moray Place West, Dunedin, New Zealand, Analyst.
1891. Thomson, Jas. M., Royal Gunpowder Factory, Waltham Abbey, Essex, Manager (Cordite Branch).
1884. Thomson, Robt. T., 156, Bath Street, Glasgow, Analytical Chemist.
1899. Thomson, Thos., Westlea; and (Journals) c/o Waterproofing Co., Barrhead, near Glasgow, Manufacturer.
- O.M. Thomson, W., Royal Institution Laboratory, Manchester, Analytical and Consulting Chemist.
1890. Thomson, Wm. Thos., Royal Gunpowder Factory, Waltham Abbey, Essex, Explosives Chemist.
1902. Thorburn, Jas., Reid's Villas, Stevenston, Ayrshire, N.B., Analytical Chemist.
- O.M. Thorne, Dr. L. T., 2, Denbigh Gardens, Richmond-on-Thames; and (Journals) Southampton Wharf, Battersea, S.W., Technical Chemist.
- O.M. Thorneycroft, Wallace, East Plean House, Bannockburn, N.B., Technical Chemist.
1901. Thornley, Thomas, Cross Chemical Co., Ltd., Canlon, Falkirk, N.B., Chemical Manufacturer.
1891. Thornton, Chris., 26, Larch Street, Providence, R.I., U.S.A., Printworks Manager.
1891. Thornton, David H., Brookfoot Dyeworks, Brighouse, Yorks., Dyer.
1887. Thornton, H., Redbourn, Ashford, Middlesex, Analytical Chemist.
1899. Thornton, Wm., (Journals) c/o Isaac Brandon and Bros., Panama, Central America; and (subs.) c/o Thos. Thornton, Hermand, West Calder, N.B., Chemist.
1895. Thorp, Dr. Frank H., Mass. Inst. of Technology, Boston, Mass., U.S.A., Assistant Professor of Industrial Chemistry.
- O.M. Thorpe, Dr. T. E., C.B., F.R.S., Government Laboratory, Clement's Inn Passage, Strand, W.C.; and (Journals) 61, Ladbroke Grove, Notting Hill, W., Chief Chemist (Customs and Inland Revenue).
1902. Thurlow, Nathaniel, 4, Union Place, Yonkers, N.Y., U.S.A., Chemist.
1898. Thurnauer, Dr. Gustav, c/o Aurora Metal Co., Aurora, Ill., U.S.A., Chemist.
1904. Thurston, Azor, Grand Rapids, Ohio, U.S.A., Chemist.
1904. Tickle, Thos., Laboratory, 83, Queen Street, Exeter, Analyst.
1903. Tighe, Arthur, 20, Marlborough Place, St. John's Wood, London, N.W., Chemical Student.
1901. Tilden, Philip S., c/o Franklin H. Kallfleisch Co., 35, Burling Slip, New York City, U.S.A., Manufacturing Chemist.
- O.M. Tilden, Prof. W. A., F.R.S., The Oaks, Murray Road, Northwood, Middlesex, Professor of Chemistry.
1900. Tilley, Jas. W., 95, Southwark Street, London, S.E., Research Chemist.
1901. Timmans, W. G., c/o Basford Chemical Co., Nottingham, Chemical Works Manager.
- O.M. Timmis, T. Sutton, Widnes, Chemical Manufacturer.
1894. Tipler, Fred. C., 48, Brooklyn Street, Crewe, Analytical Chemist.
1890. Tobey, C. H., Collingwood, Ontario, Canada, Tannery Chemist.
1894. Toch, Maximilian, 52, 9th Street, Long Island City, N.Y., U.S.A., Chemist.
1893. Tocher, Jas. F., 5, Chapel Street, Peterhead, N.B., Pharmaceutical Chemist.
1886. Todd, A. M., 204, North Rose Street, Kalamazoo, Mich., U.S.A., Manufacturing Chemist.
- O.M. Toms, F. Woodland, States Analyst's Office, St. Heliers, Jersey, Analytical Chemist.
1902. Tone, Frank Jerome, c/o The Carborundum Co., Niagara Falls, N.Y., U.S.A., Manager.
1899. Tone, Jay E., 1427, Woodland Avenue, Des Moines, Iowa, U.S.A.
1896. Tonkin, John, 2603, East Broad Street, Richmond, Va., U.S.A., Manufacturing Chemist.
1902. Torrey, Charles A., Jun., 51, Wachusett Street, Worcester, Mass., U.S.A., Chemist.
- O.M. Towers, J. W., Brantwood, Allerton, near Liverpool, Analytical Chemist.
1903. Townsend, C. Eyre-Coote, 36, Glenlue Road, Blackheath, S.E., Commission Agent.
1892. Townsend, Chas. W., 19, Crawford Street, Port Dundas, Glasgow, Chemical Manufacturer.
1892. Townsend, Oliver C., New Bilton, Rugby, Chemical Manufacturer.
1897. Towse, Walter, 12, Normanton Terrace, Newcastle-on-Tyne, Technical Chemist.
1901. Toyne, Francis D., 95, Goldsmith Street, Nottingham, Chemist.
1899. Trantom, Dr. Wm., Haslemere, Maltman's Road, Lynn, near Warrington, Chemist.
1894. Traphagen, Dr. Frank W., Colorado School of Mines, Golden, Colo., U.S.A., Professor of Metallurgy and Assaying.
1900. Traquair, Jno., Glenfield Starch Works, Paisley, N.B., Analytical Chemist.
1904. Trautwein, Alfred P., Carbondale, Pa., U.S.A., President (Carbondale Chemical Co.).
1893. Travers, Dr. Morris W., F.R.S., University College, Bristol, Prof. of Chemistry.
1889. Trechmann, A. O., Halling Lime and Cement Works, near Rochester, Kent, Cement Manufacturer.
1885. Trechmann, Dr. C. O., Warren Cement Works, Hartlepool, Cement Manufacturer.
1895. Treharne, F. Gwilym, Wrangbrook, Llanishen, near Cardiff, Analytical Chemist.
1885. Trewby, Herbert, 62, St. John Street, London, E.C., Analytical Chemist.
1901. Trigger, Oliver, Chem. Dept., Royal Arsenal, Woolwich, S.E., Analytical Chemist.
1898. Tripp, Dr. E. Howard, The Modern School, Bedford, Science Master.
- O.M. Trobridge, A., c/o Trobridge and Co., Ltd., South Shore Road, Gateshead-on-Tyne, Technical Chemist.
1897. Trotman, Saml. R., King's Walk Chambers, Parliament Street, Nottingham, City Analyst.
1904. Trubek, M., Wood Ridge, Bergen County, N.J., U.S.A., Manufacturing Chemist.
1900. True, Percival E., Bowker Chemical Co., Elizabeth, N.J., U.S.A., Chemical Engineer.
1887. Tsukiyama, S., Nippon Seito Kaisha, Osaka, Japan, Paper Mills Chemist.
1894. Tucker, Alex. E., Norwich Union Chambers, Congreve Street, Birmingham, Metallurgist and Chemist.
1897. Tucker, Samuel A., Columbia University, New York City, U.S.A., Tutor in Industrial Chemistry.

1886. Tuer, Arthur H., Thornhill, near Wigan, Analytical Chemist.
1903. Tufts, C. G., c/o Semet-Solvay Co., Syracuse, N.Y., U.S.A., Chemical Engineer.
1901. Tulloch, Wm. F., 7, West George Street, Glasgow, Merchant.
1904. Tunnell, Raymond W., 425, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Manufacturer.
1899. Turnbull, Dr. Andrew, Manchester and Liverpool District Tanners' Federation, 3, Lord Street, Liverpool, Consulting Chemist.
1888. Turnbull, G. W., 2, Haws Hill, Carnforth, Lancashire, Metallurgical Chemist.
1905. Turnbull, John, 66, Jarvis Street, Toronto, Canada, Manufacturer of Food Products.
1904. Turnbull, R. H., c/o MacAndrews and Forbes Co., Smyrna, Asia Minor, Analytical Chemist.
1884. Turnbull, W. S., 37, West George Street, Glasgow, Chemical Manufacturer.
1902. Turner, Basil, 5, Moore Street, Sydney, N.S.W., Australia, Metallurgist.
1902. Turner, Jos., c/o Read Holliday, and Sons, Ltd., Huddersfield, Chemist.
1897. Turney, Fred. N., Saventham, near Brussels, Belgium, Leather Dresser.
1887. Turney, Sir J., Springfield, Alexandra Park, Nottingham, Tanner.
1903. Tutton, Henry Ralph, 19, St. James' Parade, Bath; and (Journals) c/o Burham Cement Works, Aylesford, Kent, Chemist.
1890. Tweedy, Jas., 306A, Burdett Road, Limehouse, E., Metallurgical Chemist.
1891. Twitchell, E., Wyomung, Ohio, U.S.A., Candle Works Manager.
1897. Twynam, H., c/o Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, Mining Engineer.
- O.M. Twynam, T., Hawthorne House, Slaid Hill, Moor-town, Leeds, Metallurgist.
1904. Tyler, Chas. R., c/o Dr. Francis Wyatt, 402, West 23rd Street, New York City, U.S.A., Analytical Chemist.
- O.M. Typke, P. G. W., Lawn House, New Malden, Surrey, Chemical Manufacturer.
1893. Tyrer, Chas. T., Stirling Chemical Works, Stratford, E., Manufacturing Chemist.
- O.M. Tyrer, T., Stirling Chemical Works, Stratford, E., Chemical Manufacturer.
1899. Tysoe, Jos., South Metropolitan Gas Co., East Greenwich, S.E., M.Inst.C.E., Gas Engineer.

## U

1894. Uhlig, E. C., Fulton Gas Works, Nevins and Degraw Streets, Brooklyn, N.Y., U.S.A., Chemist.
1900. Uhlig, W. C., c/o Hygeia Distilled Water Co., 349, West 12th Street, New York City, U.S.A., Chemist.
1897. Ullman, Jas. A., c/o Sigmund Ullman Co., 146th Street, and Park Avenue, New York City, U.S.A., Printing Ink Manufacturer.
1900. Ulmer, Geo. F., c/o Arbuckle Bros., Sugar Refinery, Foot of Pearl Street, Brooklyn, N.Y., U.S.A., Chemist.
- O.M. Umney, C., (Journals) 81, Lawrie Park Road, Sydenham, and (communications) 50, Southwark Street, London, S.E., Manufacturing Chemist.
1889. Underhill, Thos. J., 73, Pepys Road, New Cross, S.E., Inspector of Stores.
1885. Underwood, G. R., 4, Emerson Street, Peabody, Mass., U.S.A., Glue Works Chemist.
1898. Unglaub, Oscar, Ban Hill House, Bolton Road, Pendleton, Manchester, Soap Manufacturer.
1883. Usmar, J. H., 22, Billiter Street, London, E.C., Chemical Merchant.
1904. Uyeda, Toyokitsu, Takasago, Harima, Japan, Chemist.

## V

1904. Valk, S. J., 158, Franklin Street, New York City, U.S.A., Manufacturer.
1905. Van Arsdale, G. D., c/o Copper Queen Consolidated Mining Co., 99, John Street, New York City, U.S.A., Chemist.
1904. Vandenberg, Dr. F. P., Pelham Manor, Westchester Co., N.Y., U.S.A., Consulting Chemist.
1896. Van der Linde, Harold, 47, Front Street West, and (Journals) 101, Tyndall Avenue, Toronto, Canada, Chemist (India-rubber and Gutta-percha Manufacturing Co.).
1895. Vanderpoel, Dr. Frank, 153, Center Street, Orange, N.J., U.S.A., Chemist.
1904. Van Duzen, Dr. Harlan P., 232, Gt. Portland Street, London, W., Doctor of Medicine.
1903. Van Dyck, Edwin M., Bureau of Engraving and Printing, Washington, D.C., U.S.A., Chemist and Ink Maker.
1897. Van Gelder, Arthur P., c/o Climax Powder Manufacturing Co., Emporium, Pa., U.S.A., Superintendent.
1903. Van Gilder, H. P., 234, Bushkill Street, Easton, Pa., U.S.A., Analytical Chemist.
1891. Van Gundy, Chas. P., Laboratory, B. and O. R. R., Baltimore, Md., U.S.A., Metallurgical Chemist.
1896. Van Ingen, Dudley A., Palmerton, Carbon Co., Pa., U.S.A., Chemist.
1896. Van Laer, Norbert, Truman's Brewery, Burton-on Trent, Brewer and Chemist.
1897. Van Marken, J. C., Repelen bei Moers, Germany, Chemical Engineer.
1902. Vanwinckel, W. H., c/o Lyman Bros. and Co., Ltd., 71, Front Street East, Toronto, Canada, Chemist.
1888. Vargas-Vergara, J. M., Apartado No. 237, Bogota, Colombia, S. America, Metallurgical Chemist.
- O.M. Vasey, T. E., Chemical Engineer.
1894. Veitch, Geo., Chemical Works, Crieff, N.B., Manufacturing Chemist.
1898. Verity, Ben, Magog, Prov. Quebec, Canada, Print Works Chemist.
1897. Verity, Victor, 83, Lexington Street, East Boston, Mass., U.S.A., Chemical Works Foreman.
1904. Vernon, R. H., Cornell University, Ithaca, N.Y., U.S.A., Student.
- O.M. Vickers, Wm., c/o Thos. Vickers and Sons, Miles Platting, Manchester, Chemical Manufacturer.
1895. Vigelius, Carl, 175, Pearl Street, New York City, U.S.A., Shellac Bleacher.
1896. Vincent, Jos. A., Rooms 207-8, 421, Chestnut Street, Philadelphia, Pa., U.S.A., Mechanical Engineer.
1897. Vlies, Leonard E., Fernroyd, Wellington Road, Whalley Range, Manchester.
- O.M. Voelcker, E. W., 22, Tudor Street, London, E.C., Agricultural Chemist.
1887. Voelcker, Dr. J. A., 20, Upper Phillimore Gardens, Kensington, W., Agricultural Chemist.
1901. Vogel, G. C., 583, Cass Street, Milwaukee, Wis., U.S.A., Tanner.
1897. Vogel, Julius L., 91, Blackfriars Road, London, S.E., Engineer.
1899. Vogeler, Gustav, 17, Philpot Lane, London, E.C., Merchant.
1900. Volney, Dr. Carl W., Keyport, N.J., U.S.A., Chemist (Smokeless Powder Co.).
1897. Voorhees, Louis A., Box 55, New Brunswick, N.J., U.S.A., Agricultural Chemist.
1899. Voorhees, Samuel S., c/o Supt. Architect, Treasury, Washington, D.C., U.S.A., Chemist.
1902. Vorisek, Dr. Anton, College of Pharmacy, 115-119, West 68th Street, New York City, U.S.A., Instructor.
1888. Vörster, Fritz, Cöln-Marienburg, Germany, Manufacturing Chemist.
1885. Voss, Hermann, 19, Beckenham Road, Beckenham, Kent, Manure Works Manager.
1899. Voss, Walter A., Eastwood Road, Rayleigh, Essex, Manufacturing Chemist.
1899. Vreeland, Cornelius D., Upper Montclair, N.J., U.S.A., Manufacturing Chemist.



## W

1896. Wachtel, Gregory, 6, Manejny Pereulok, St. Petersburg, Russia, Chemical Engineer.
1904. Wackeureuter, A. G., 134 136, Kinzie Street, Chicago, Ill., U.S.A., Colour Manufacturer.
1895. Waddington, Thos. W., 74, Blackburn Road, Padiham, Lancashire, River Inspector.
1902. Wade, Frank, 44, Beech Farm Road, Southsea, Analytical Chemist.
1890. Wade, Jas. L., 28, West Kensington Gardens, London, W., Chemical Manufacturer.
1889. Wadman, W. E., 102, Lord Avenue, Bayonne, N.J., U.S.A., Manufacturing Chemist.
1897. Wagner, Dr. Theodore B., 1444, Wilson Avenue, Chicago, Ill., U.S.A., Chemist.
1893. Wagner, W. G., 12, North Common Road, Ealing, W., Manufacturing Chemist.
1903. Wainwright, J., 15, Bolton Road, Port Sunlight, near Birkenhead, Soap Works Manager.
1884. Wainwright, Dr. J. H., 159, Front Street, New York City, U.S.A., Analytical Chemist.
1895. Wainwright, Wm., c/o Spooner and Bailey, Manure Works, Eling, near Southampton, Chemist.
1904. Wait, Walter S., 30, Kilby Street, Boston, Mass., U.S.A., Chemist.
1901. Waite, C. Nelson, c/o General Artificial Silk Co., 32, South Broad Street, Philadelphia, Pa., U.S.A., Chemist.
1899. Wakfield, Wm. C., c/o Savile Town Chemical Co., Ltd., Savile Town, Dewsbury, Chemist.
1894. Waldman, Louis J., P.O. Box 162, Albany, N.Y., U.S.A., Aniline Dye Manufacturer.
1895. Waldstein, Dr. Martin E., 107, Murray Street, New York City, U.S.A., Manufacturing Chemist.
1887. Walker, Archibald, 8, Crown Terrace, Glasgow, Distiller.
1897. Walker, H. V., 700, Park Place, Brooklyn, N.Y., U.S.A., Chemist.
1894. Walker, Dr. Jas., University College, Dundee, Professor of Chemistry.
1902. Walker, Jas., Knowle House, Mirfield, Yorks., Woollen Manufacturer.
1897. Walker, Jas. W., Castle Park, Irvine, N.B., Chemical Manufacturer.
1902. Walker, Jno. H., Gourepore Works, Naihati, E.B.S.R., Bengal, India, Chemist.
1904. Walker, John P., c/o B. and M. Smelter, Great Falls, Montana, U.S.A., Metallurgical Chemist.
1884. Walker, S. R., 19, Wolsey Street, Radcliffe, Manchester, Foreman Dyer.
1895. Walker, W. Sloane, c/o Walker, Ltd., Litherland, near Liverpool, Tanner.
1900. Walker, Dr. Wm. H., Massachusetts Inst. of Technology, Boston, Mass., U.S.A., Chemical Expert.
1897. Wallace, Edwin C., P.O. Box 42, Cambridgeport, Mass., U.S.A., Chemist.
1897. Wallace, Robt. A., 58, Abinger Road, Bedford Park, W., Chemical Manufacturer.
1883. Wallace, Robert, 20, Murrayfield Avenue, Edinburgh, Distiller.
- O.M. Waller, Dr. Elwyn, 7, Franklin Place, Morristown, N.J., U.S.A., Professor of Chemistry.
1899. Wallerstein, Dr. Max, 105, East 91st Street, New York City, U.S.A., Chemist.
1886. Walsh, F. T., 195, Nesmith Street, Lowell, Mass., U.S.A., Colour Printer.
1901. Walsh, Lionel O. P., c/o Burt, Boulton and Haywood, Ltd., Prince Regent's Wharf, Silvertown, E., Chemist.
1903. Walsh, Peter H., P.O. Box 469, Magog, Quebec, Canada, Analytical Chemist.
1904. Walther, Wm., Holzapfel's Compositions Co., Ltd., Heworth Shore, Felling-on-Tyne, Chemist and Works Manager.
1902. Walton, Thos. U., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1895. Want, W. Philip, 44, Bishopsgate Street Without, London, E.C. Pharmacist and Editor.
1901. Warburton, Frank, 5, Rosebery Gardens, Muswell Hill, N., Manager.
1901. Warburton, George H., 33, Kilburn Priory, West Hampstead, N.W., Analytical Chemist.
1896. Warburton, Thos., 7, Bambridge Street, Stockport Road, Manchester, Chemist.
1903. Ward, Dudley R., 251, Peckham Rye, London, S.E., Analytical Chemist.
- O.M. Ward, Geo., Messrs. Hirst, Brooke, and Hirst, Ltd., Millgarth Mills, Leeds, Chemical Manufacturer.
1891. Ward, G. J., The Cottage, Bullin Fields, near Nottingham, Civil Engineer.
1884. Ward, Howard Chas., Veadon, Hordle, Lynnington, Hants, Deputy Chairman of Gas Co.
1898. Ward, John, Barnstone Blue Lias Lime Co., Ltd., Barnstone, Notts., Manager.
1899. Ward, Wm. J., Bagillt, North Wales, Chemist.
1892. Warden, Jno. B., Sevier Mine, Kimberley, Utah, U.S.A., Analytical Chemist.
1897. Wardle, Sir Thos., 54, St. Edward Street, Leek, Staffordshire, Silk Dyer.
1902. Waring, W. Geo., Webb City, Mo., U.S.A., Metallurgical Chemist.
1899. Barnes, Arthur R., c/o T. W. Willson, 117, Boyson Road, Cumberwell Gate, S.E., Soapworks Chemist.
1890. Warren, Fiske, c/o S. D. Warren and Co., Cumberland Mills, Me., U.S.A., Paper Manufacturer.
1902. Warren, H. D., The Gutta Percha and Rubber Manufacturing Co., Ltd., 45-49, West Front Street, Toronto, Canada, President.
1890. Warren, Jno. Davis, 7, Essex Road, Acton, W., Manufacturing Chemist.
1901. Warren, Jno. E., Eagle Chemical Works, Barchester Street, Poplar, E., Tar Distiller.
1885. Waterfall, W. B., c/o Avon Manure Co., Bristol; and (Journals) Thirlmere, Clavering Road, Redland, Bristol, Manure Manufacturer.
1890. Waterhouse, Major-General Jas., Oak Lodge, Court Road, Eltham, Kent, Assistant Surveyor-General of India (retired).
1891. Waterhouse, Robt., 7, Lyne Grove, Altrincham, Cheshire, Analytical and Agricultural Chemist.
1902. Watkins, E. J., (communications) 81, Montpelier Road; (Journals) c/o Mellin's Food, Ltd., Stafford Street, Peckham, S.E., Works Chemist.
1900. Watkins, Norman, (communications) Box 767, and (Journals) 1701, Makiki Street, Honolulu, Hawaiian Islands, Chemist.
1898. Watkins, Willard H., c/o Schoellkopf, Hartford and Hanna Co., 36, Purchase Street, Boston, Mass., U.S.A., Chemist.
1894. Watmough, Benj., 1, Ryeburn, Stanley Road; and (Journals) c/o Brotherton and Co. Ltd., Ammonia Works, Wakefield, Chemist.
1894. Watson, Alex. Forbes, St. James's Gate Brewery, Laboratory, Watling Street, Dublin, Chemist.
1884. Watson, Chas., Dawsholm Chemical Works, Maryhill, Glasgow, Manufacturing Chemist.
1894. Watson, Chas. Ernest, 28, Highfield Road, Stretford, Manchester, Chemical Assistant.
1890. Watson, Eric E., (Journals) The Queensland Smelting Co., Aldershot, Maryborough, Queensland, Australia; (subs.) c/o S. Watson, Queen Insurance Buildings, Dale Street, Liverpool, Chemist.
1895. Watson, H. Ard, c/o Tunstall and Co., Ltd., Leeds Bridge, Leeds, Tar Distiller.
1901. Watson, Herbert J., Glenarrm Villas, Cavendish Street, Mansfield, Notts., Chemist.
1903. Watson, H. M., 22, Coleraine Road, Blackheath, S.E., Paint Manufacturer.
1903. Watson, H. W., 111, Brudenell Road, Hyde Park, Leeds, Analytical Chemist.
1894. Watson, Jas., 60, West Park Terrace, South Shields, Alkali Works Manager.
- O.M. Watson, Jno., c/o City and Suburban Gold Mining Co., Box 1026, Johannesburg, Transvaal, South Africa, Technical Chemist.
- O.M. Watson, Jno. C., Schlunessberg, near St. Petersburg, Russia, Manager of Printworks.
1891. Watson, Jno., 56, Cantwell Road, Woolwich Common, S.E., Analytical Chemist.
1904. Watson, Percy, 554, Somerset Avenue, Taunton, Mass., U.S.A., Chemist and Dyer.
- O.M. Watt, A., c/o Macfie and Sons, 34, Moortfields, Liverpool, Sugar Works Chemist.

1901. Watt, Francis L., 10, Northcote Chambers, Reihy Lane, Circular Quay, Sydney, N.S.W., Australia, Student.
1904. Watt, John, 17, Maple Avenue, Toronto, Ont., Canada, Glass Manufacturer.
1900. Watts, Chas. J., 40, City Road, London, E.C., Manufacturer.
1893. Watts, Jno. Isaac, Fairleigh, Hartford, Cheshire, Alkali Works Manager.
1903. Wayland, Wm. A., 12, Albert Road, Brockley, S.E., Manufacturing Chemist.
1900. Webb, Jno. F., 20, Louvaine Road, St. John's Hill, Battersea, S.W., Mining and Electrical Engineer.
1901. Webb, Wm. J., 26, Livingston Avenue, Yonkers, N.Y., U.S.A., Superintendent of Printing Department.
1884. Webster, C. S. Stanford, Malvern House, Redland, Bristol, Consulting and Analytical Chemist.
1901. Webster, Geo. J., Standard Chemical Co., Ltd., Gooderham Building, Toronto, Canada, Secretary.
1902. Webster, Jno., Chemical Laboratory, Guy's Hospital, London, S.E., Analyst.
1904. Wedekind, Rud., Uerdingen am Rhein, Germany, Manufacturer of Alizarin and Bichromates.
1897. Wedge, Utey, Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., U.S.A., Chemist.
1902. Weed, Hy. T., 408, Third Street, Brooklyn, N.Y., U.S.A., Teacher of Chemistry.
1893. Weeks, H. B., 2, Infield Park Road, Barrow-in-Furness, Analytical Chemist.
1895. Weems, Dr. J. B., Iowa Agricultural College, Ames, Iowa, U.S.A., Agricultural Chemist.
1898. Weepce, Lawrence, Pinchin's Wharf, Stratford, E., Colour Works Chemist.
1904. Weightman, Aubrey H., 1915, Walnut Street, Philadelphia, Pa., U.S.A., Chemical Manufacturer.
1904. Weil, Jacob A., c/o The Power Gas Corporation, Ltd., 39, Victoria Street, Westminster, S.W., Chemist.
1902. Weiskopf, Erich, Dynamite Factory, Modderfontein, Transvaal, South Africa, Chemist.
1902. Weiss, Georg A., Chemische Fabrik, Ahlden a/Aller, Hanover, Germany, Chemical Manufacturer.
1893. Welch, J. Cuthbert, Montreal and Boston Cons. Mining and Smelting Co., Boundary Falls, B.C., Canada, Chemist and Metallurgist.
1899. Weldon, Leonard E., 44, Central Avenue, New Basford, Nottingham, Dyer.
1903. Wellecome, Henry S., Snow Hill Buildings, London, E.C., Manufacturing Chemist.
1891. Wells, Jas. Gray, Trent House, Branston, Burton-on-Trent, Brewing Chemist.
1894. Wells, Pierson L., 86, Joralemon Street, Brooklyn, N.Y., U.S.A., Patent Lawyer and Engineer.
1885. Welsh, Jas., Horrocks Lane Dyeworks, Red Bank, Manchester, Printworks Manager.
1890. Welsh, Thos. L., 3, Prince's Gardens, Downhill, Glasgow, Analytical Chemist.
- O.M. Welsh, W., Holt Town, Manchester.
1905. Welt, Dr. Ida, 73, West 83rd Street, New York City, U.S.A., Chemist.
1897. Wense, Dr. W., c/o Herrn H. Schultz, Graalstrasse, Lüneberg, Germany, Manager.
1890. Werner, Emil A., 5, Church Avenue, Rathmines, Dublin, Chemical Demonstrator.
1903. Wesener, Dr. John A., 103, State Street, Chicago, Ill., U.S.A., Consulting Chemist.
1884. Wessel, Carl, (communications) Geheimerer Commerzienrath C. Wessel, Bernburg; and (Journals), Deutsche Solvay-Werke Act.-Ges., Bernburg, Anhalt, Germany, Alkali Manufacturer.
1889. Wesson, D., c/o Southern Cotton Oil Co., 24, Broad Street, New York City, U.S.A., Technical Chemist and Cotton-Oil Expert.
1903. West, Leonard, 203, Uttoxeter New Road, Derby, Manufacturing Chemist.
1900. Westenfelder, B. D., 924, Clinton Street, Cincinnati, Ohio, U.S.A., Chemist.
1885. Westmoreland, J. W., 3, Love Lane, Eastcheap, London, E.C., Metallurgical Chemist.
1898. Weston, David B., Box 503, Sharon, Mass., U.S.A., Chemist.
1894. Weston, Robt. S., 14, Beacon Street, Boston, Mass., U.S.A., Chemist and Bacteriologist.
1904. Weston, Thos. W., c/o Jos. Watson and Sons, Whitehall Soap Works, Leeds, Mechanical Engineer.
1885. Weston, Wm., 17, St. David's Road, Southsea, Analytical Chemist.
1902. Wethered, Wm. P., Redcourt, Carnatic Road, Mossley Hill, Liverpool, Manager.
1890. Wetter, Jasper, 37-39, Essex Street, Strand, London, W.C., Patent Agent.
- O.M. Whalley, L. J. de, 172, Erlanger Road, New Cross, S.E., Sugar Chemist.
1904. Whatmough, Dr. Wm. H., Woodleigh, Cheadle, Cheshire, Chemist.
1904. Wheawill, Cornelius, 11, Westbourne Road, Huddersfield, Chartered Accountant.
1898. Wheeler, Edw. J., 79, Chapel Street, Albany, N.Y., U.S.A., Analytical Chemist.
1903. Wheeler, Ernest, 335, Park Road, Oldham, Lancashire, Metallurgical Chemist.
1895. Wheelwright, Dr. E. W., Greenholme, Westfield Road, Acoek's Green, near Birmingham.
1904. Wherry, H. P., c/o Boston and Montana Smelter, Great Falls, Mont., U.S.A., Chemical Engineer.
1898. Whicelo, Matthew A., 9, Eversfield Road, Eastbourne, Aerated Water Manufacturer.
- O.M. Whiffen, Thos. J., Harefield, Southfields, S.W., Manufacturing Chemist.
- O.M. Whiffen, W. G., Lombard Road, Battersea, London, S.W., Manufacturing Chemist.
1902. Whipple, G. C., St. Paul Building, 220 Broadway, New York City, U.S.A., Chemist.
1893. Whitaker, Alf., Newlaithes Grange, Horsforth, Leeds, Dyer.
1899. Whitaker, Milton C., c/o Welsbaeh Light Co., Gloucester City, N.J., U.S.A., Chemist.
1895. Whitaker, Thos., Newlay Hall, near Leeds, Dyer.
- O.M. Whitaker, Thorpe, (Journals) Bradford Dyers' Association, Ltd., and 35, Pemberton Drive, Bradford, Yorks, Dyer's Chemist.
- O.M. White, A. Dowler, 65, Cedar Gardens, Deodar Road, Putney, London, S.W., Chemical Manufacturer.
1898. White, Alf. H., 1017, Hill Street, Ann Arbor, Mich., U.S.A., Instructor in Chemical Technology.
1893. White, Arthur F., 30, Cornwall Terrace, Manningham, Bradford, Yorks., Manufacturing Druggist.
1902. White, Geo. Arthur, P.O. Box 70, Vandergrift, Pa., U.S.A., Chemist.
1901. White, H. Graham, 24, Bidston Road, Oxton, Birkenhead, Works Chemist.
1889. White, Henry, 245, Western Road, Crookes, Sheffield, Manufacturing Chemist.
1887. White, J. Campbell. See Overtoun, Lord.
1898. White, Jno., County Offices, St. Mary's Gate, Derby, Public Analyst to County of Derby.
- O.M. White, Paul T., Horton Field House, West Drayton, Chemical Manufacturer.
1894. White, W. Gilchrist, Springhill, Port Glasgow, N.B., Calico Printer's Chemist.
1903. Whitehouse, P. L., 10, Victoria Street, West Bromwich, Staffordshire, Oil Chemist.
1885. Whiteley, R. Lloyd, 5, Bagnall Street, West Bromwich, Staffordshire, Chemical Lecturer.
1892. Whiteside, Jno. L., 376, St. Helen's Road, Bolton-le-Moors, Chemical Lecturer.
1885. Whittaker, C. J., West Bank, Lytham, Lancashire, Chemical Engineer.
1904. Whittier, Charles T., 322, Warren Street, Jersey City, N.J., U.S.A., Manager.
1901. Whitton, Jas. T., c/o Nobel's Explosives Co., Ltd., Ardeer, Stevenston, N.B., Chemist.
1884. Whowell, F., Wood End, Bromley Cross, Bolton, Lancs., Bleacher.
1899. Wiarda, Jno. C., 259-273, Green Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1897. Wiborg, E. B., The Ault and Wiborg Co., Cincinnati, Ohio, U.S.A., Manufacturer.
1890. Wickens, B. Foster, 31, Bermondsey Wall, London, S.E., Managing Director (Wickens, Pease and Co., Ltd.).
1905. Widmann, Eugene A., 866, Park Place, Brooklyn, N.Y., U.S.A., Dyestuff Merchant.



1887. Wielandt, Dr. Wm., Kalkkrenthstrasse 1, Berlin, W., Germany, Chemist.
1904. Wieler, Eric E., 4, Palatine Road, Withington, Manchester, Chemical Merchant.
1904. Wiener, William, 621, Nelson Place, Newark, N.J., U.S.A., Analytical and Consulting Chemist.
1904. Wigg, Chas. E., c/o The Hull and Liverpool Red Oxide Co., Peasley Cross, St. Helens, Lancashire.
1883. Wiffin, W. W., Wiffin Street, Birmingham Heath, Birmingham, Nickel Refiner.
1904. Wigglesworth, Edwin, c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
1897. Wigglesworth, Henry, 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
- O.M. Wightman, C. I., Fenchurch Avenue, London, E.C., Chemical Merchant.
1904. Wild, Irving L., 235, College Street, Middletown, Conn., U.S.A., Electrical Engineer.
1899. Wild, Ronald C., The Grange, New Eltham, Kent., Analytical Chemist.
1893. Wilder, F. L., Morro Velho, Villa Nova de Lima, Estado de Minas Geraes, Brazil, Assayer.
1902. Wilder, Salmon W., Jun., c/o Merrimac Chemical Co., North Woburn, Mass., U.S.A., Treasurer.
1899. Wildman, Arthur J., 17, Streatham Avenue, East Ham, E., Chemist.
1902. Wiley, Dr. Harvey W., Bureau of Chemistry, Department of Agriculture, Washington, D.C., U.S.A., Chief.
1903. Wilkie, Jno. M., 12, Chantry Road, West Bridgford, Nottingham, Analytical Chemist.
1885. Wilkin, Sir Walter, K.C.M.G., Appold Street, Finsbury, E.C., Yeast Manufacturer.
1901. Wilkins, Albert D., Bellevue P.O. Station, Allegheny, Pa., U.S.A., Chemist.
1895. Wilkins, Charles, 40, Church Lane, Hornsey, N., Manufacturing Perfumer.
1899. Wilkins, H. A. J., c/o New Jersey Zinc Co., 71, Broadway, New York City, U.S.A., Mining Engineer.
1904. Wilkinson, Prof. J. A., Transvaal Technical Institute, P.O. Box 1176, Johannesburg, Transvaal, Professor of Chemistry.
1886. Wilkinson, J. B., Tong Street, Dudley Hill, Bradford, Yorks., Chemical Manufacturer.
1884. Will, W. Watson, 162, Kennington Park Road, London, S.E., Professor of Organic Chemistry.
1903. Willard, C. T., c/o Singer Manufacturing Co., Elizabethport, N.J., U.S.A., Chemist.
1893. Willcox, Benjamin, 47, Lincoln's Inn Fields, London, W.C., Patent Agent.
1900. Willenz, Dr. Michel, Rue Haringrode 4, Antwerp, Belgium, Leather Trades Chemist.
1903. Williams, Chas. Ed., Thornhayes, Steaford, Seed Crusher.
1895. Williams, David T., 9, Calvert Terrace, Swansea, Chemist.
1903. Williams, Harvey L., P.O. Box 410, Bristol, Tenn., U.S.A., Manufacturer of Barium Salts.
1891. Williams, Henry J., 161, Tremont Street, Boston, Mass., U.S.A., Chemical Engineer.
1904. Williams, Jno. T., Lord's Court Building, 27, William Street, New York City, U.S.A.
1896. Williams, Jno. Taylor, 2, Queen Street, Wellington, Salop, Brewer.
1904. Williams, Naboth, 28, Rolleston Street, Warrington, Technical Chemist.
1902. Williams, Percy, British Uralite Co., Ltd., Higham, near Rochester, Kent, Chemist.
1885. Williams, Rowland, Hale Cote, Albert Park, Lancaster, Analytical Chemist.
1900. Williams, Saml. H., Glastonbury, Conn., U.S.A., Soap Manufacturer.
1903. Williams, S. M., 269, Springdale Avenue, East Orange, N.J., U.S.A., Chemist.
1885. Williams, T. Howell. See Idris, T. H. W.
1884. Williams, Prof. W. Carleton, Broomgrove, Goring-on-Thames, Professor of Chemistry.
1902. Williams, Walter Scott, Arnold Printworks, North Adams, Mass., U.S.A., Chemical Engineer.
1887. Williams, W. Collingwood, 68, Grove Street, Liverpool, Analytical Chemist.
- O.M. Williams, W. J., 5004, Franklin Street, Frankfort, Philadelphia, Pa., U.S.A., Analytical Chemist.
1899. Williamson, G. N., 14, Dey Street, New York City, U.S.A., Manufacturing Chemist.
1894. Williamson, J. Alex., 14, Milton Avenue, Highgate, N., Analytical Chemist.
- O.M. Williamson, Robt., Low Walker, Newcastle-on-Tyne, Technical Chemist.
1903. Wills, J. L., 133, Midwood Street, Brooklyn, N.Y., U.S.A., Technical Chemist.
1895. Willson, Thos. L., St. Catherine's, Ont., Canada, Electrical Engineer.
1891. Wilson, A. Poole, 81, Botanic Road, Glasnevin, Dublin, Ireland, Analytical Chemist.
1890. Wilson, Alf., c/o Messrs. J. and E. Sturge, 18, Wheeley's Lane, Birmingham, Chemist.
1884. Wilson, Anthony W., 20, Westcott Street, Hull, Colour Works Manager.
1888. Wilson, Cecil H., c/o Sheffield Smelting Co., Ltd., Royds Mills Street, Sheffield, Chemist.
- O.M. Wilson, C. J., 14, Old Queen Street, Westminster, S.W.
1888. Wilson, David, Jun., Carbeth, Killearn, by Glasgow.
1885. Wilson, Frank, 7, Bedford Square, London, W.C., Brewer.
1903. Wilson, Geo. C., Mysore Gold Mines, Marikuppam, Mysore State, India, Chemist.
- O.M. Wilson, G. E., The Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.
1902. Wilson, Geo. W., 18, Dinting Vale, Dinting, near Manchester, Works Chemist.
1899. Wilson, Gordon, Benallan, Kirkintilloch, N.B.; and (Journals) Promontorio, Estacion Chimicas, Durango, Mexico, Chemist and Assayer.
1886. Wilson Jno., Tyneside, Hagley Road, Birmingham, Technical Chemist.
1896. Wilson, Jno., The Vines, Oxford Road, Runcorn, Chemical Engineer.
1902. Wilson, Jno. B., Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, Mining Engineer.
- O.M. Wilson, J. H., 6, Fenchurch Buildings, London, E.C., Chemical Manufacturer.
1902. Wilson, Leonard P., Stocksfield, Church Road North, Hanwell, W., Technical Chemist.
- O.M. Wilson, R. H., Eaglescliffe, R.S.O., Co. Durham, Chemical Manufacturer.
1900. Wilson, Walter A., Ardeer, Stevenston, Ayrshire.
1885. Wilson, Dr. W. H., Presidency College, Madras, India, Lecturer on Physics.
1890. Wilson, W. W., The Grange, Carbrook, near Stalybridge, Analytical Chemist.
1884. Wilton, Thos., Winsor House, Beckton, E., Tar Works Manager.
1901. Wing, Herbert H., Monticello, N.Y., U.S.A., Chemical Engineer.
1892. Wing, J. D., 22, William Street, New York City, U.S.A., Merchant.
1893. Wingate, Hamilton M., 90, Queenswood Road, Forest Hill, S.E., Technical Chemist and Metallurgist.
1892. Wingfield, T. R., 5, Bromwich Street, Bolton, Brewer.
- O.M. Wingham, A., Livernead House, Torquay, Metallurgical Chemist.
- O.M. Winsor, P. J., Moor House, Biddulph Moor, Congleton, Cheshire, Soap Works Manager.
- O.M. Winsloe, H., c/o Tennants and Co., Clayton, Manchester, Manufacturing Chemist.
1892. Winstanley, Hy., Bridge House, Cheadle Hulme, Cheshire, Technical Chemist.
1886. Winstone, E. H., Members' Mansions, 36, Victoria Street, London, S.W., Ink Manufacturer.
1892. Wirtz, Dr. Quirin, 28, Great Ormond Street, London, W.C., Consulting Chemist.
1900. Wishart, Harlan L., c/o Repanno Manufacturing Co., Woodbury, N.J., U.S.A., Chemist.
1889. Wishart, Jno., 39, St. Vincent Place, Glasgow, General Manager (Oakbank Oil Co., Ltd.).
1902. Withers, Prof. W. A., State A. and M. College, West Raleigh, N.C., U.S.A., Professor of Chemistry.
- O.M. Witt, Dr. Otto N., Siegmundshof 21, Berlin, N.W., Professor of Chemistry.
1905. Wittmack, Chas. A., 606, West 113th Street, New York City, U.S.A., Chemist.

1904. Wolf, August S., Laboratory, E. L. A. S., 120, Broadway, New York City, U.S.A., Chemist.
1903. Wolf, Jacques, c/o Jacques Wolf and Co., Passaic, N.J., U.S.A., Manufacturing Chemist.
1894. Wolterreck, Dr. H. C., 3, Edinburgh Mansions, Howick Place, London, S.W., Consulting Chemist.
1903. Wolton, Wm. R., c/o Joseph Fison and Co., Ltd., Ipswich, Manager.
1890. Wood, Ebenezer, Stephenson Street, Canning Town, E., Manufacturing Chemist.
1900. Wood, Frank, Hazelhurst, Doncaster Road, Barnsley, Yorks., Assistant Manager (Glass Works).
1901. Wood, Frank S., Chin Chu, Heathcote Street, Newland, Hull, Cement Works Chemist.
1887. Wood, Jos. T., 62, Park Road, Nottingham, Tanner.
1886. Wood, Wm., 20, Rue Général van Merlen, Antwerp, Belgium, Bleacher and Dyer.
- O.M. Woodcock, R. C., American and Continental Sanitas Co., 636-642, West 55th Street, New York City, U.S.A., Technical Chemist.
1902. Woodhead, Chas. E., 40, Westwood Street, Moss Side, Manchester, Chemist.
1884. Woodhead, Jas., Inglewood, Slaithwaite, near Huddersfield, Tar Distiller.
1890. Woodman, Dr. Durand, 127, Pearl Street, New York City, U.S.A., Analytical Chemist.
1900. Woodrow, John, 12, Park Road, Hull, Chemist.
1902. Woodside, T. Frank, c/o Warner Chemical Co., Carteret, N.J., U.S.A., Secretary.
1896. Woodward, Jas., 31, Coventry Road, Ilford, Essex, Government Analyst.
1904. Woolcott, Geo. H., 2, Carolina Terrace, Montenegro, Cork, Ireland, Brewer's Chemist.
1904. Woolcott, Herbert, 44, Zinzan Street, Reading, Brewer's Chemist.
1896. Woolf, Julian, 51, Buckland Crescent, South Hampstead, N.W., Manufacturer.
1889. Woolf, Mortimer, Yeatman and Co., Denmark Street, E., and (Journals) Mayfield, Mortimer Road, St. John's Wood, N.W., Vinegar Brewer.
- O.M. Woolley, G. S., Victoria Bridge, Manchester, Pharmaceutical Chemist.
1901. Worden, Edw. C., c/o Clark Thread Co., Newark, N.J., U.S.A., Analytical Chemist.
- O.M. Worrall, H., Crimsworth, Whalley Range, Manchester, Dyer.
1903. Worstall, Robt. A., c/o Chicago Varnish Co., Chicago, Ill., U.S.A., Chemist.
1895. Worth, F. G., The Acetylene Illuminating Co., 3, Victoria Street, London, S.W., Managing Director.
1900. Worthington, Arthur, Starcliffe Terrace, Great Lever, Bolton, Chemist and Sub-Manager.
1894. Wotherspoon, Peter, 135, Bede Burn Road, Jarrow; and (Journals) c/o Union Cement Co., Ltd., 1, St. Nicholas Buildings, Newcastle-on-Tyne, Chemist.
1896. Wrampelmeier, T. J., E. I. du Pont de Nemours Powder Co., 39, Victoria Street, Westminster, S.W., Chemist and Representative.
- O.M. Wray, O. J. P., Haslemere, Coleraine Road, Blackheath, S.E., Technical Chemist.
1901. Wren, E. Cecil, Glencoe, Eaglescliffe, R.S.O., Co. Durham, Vinegar Brewer.
1895. Wright, Arthur C., c/o Turner, Morrison and Co., 6, Lyons Range, Calcutta, India, Chemist.
1904. Wright, A. M., 62, Harman Street, Addington, Christchurch, N.Z., Chemist (Christchurch Meat Co.).
1904. Wright, Chas. L., Electric Illuminating Co., Cleveland, Ohio, U.S.A., Chemical Engineer.
1901. Wright, Harold E., c/o Sir B. Samuelson and Co., Ltd., Middlesbrough, Chemist.
1885. Wright, Jos., 19, Arboretum Street, Nottingham, Lace Dresser.
- O.M. Wright, L. T., The Mountain Copper Co., Keswick, Cal., U.S.A., Chemist.
1894. Wright, Sidney B., Chemist.
1900. Wright, Walter J., 11, Albion Terrace, Faversham, Kent, Chemist (Cotton Powder Co.).
1890. Wülffing, Dr. Charles, Hönningen a/Rhein, Germany, Technical Chemist.
1904. Wünsche, Fritz, Reichenbachstrasse 25p, Dresden-Alst., Germany, Chemist.
1890. Wyatt, Dr. Francis, 402, West 23rd Street, New York City, U.S.A., Consulting Chemist.
1905. Wyer, Malcolm G., The Library, State University, Iowa City, Iowa, U.S.A., Librarian.
- O.M. Wyld, Jno., The Avenue, Lidgett Park, Romndhay, Leeds, Chemical Works Manager.

## Y

1900. Yamaoka, S., 10, Nishikatomachi, Hongo, Tokyo, Japan, Chief Engineer.
1901. Yardley, Frank, c/o Henry Jutson and Sons, Liverpool Street, Birmingham, Chemical Manufacturer.
1899. Yates, Arthur, Lebong Donok, Bencoelen, Sumatra, Netherlands Indies, Metallurgist.
- O.M. Yates, F., 64, Park Street, Southwark, London, S.E., Chemical Manufacturer.
1897. Yates, Wm. H., 11, Lansdowne Road, Southport, Lancashire, Technical Chemist.
1898. Yetton, Thos., Fen Villa, Queen's Road, Loughton, Essex, Consulting Distiller's Chemist.
1894. Yocum, Dr. Jno. H., 325, Academy Street, Newark, N.J., U.S.A., Chemist.
1886. Yoshida, Dr. H., Imperial University of Kyoto, Kyoto, Japan, Professor of Chemistry.
1900. Yoshitake, E., 18, Tatsukacho, Hongo, Tokyo, Japan, Chemist.
1885. Young, Alfred C., 53A, Algiers Road, Ladywell, S.E.
1901. Young, A. H. Innes, Carlton, Little Sutton, Chester, Student.
1885. Young, Brougham, 2A, Sigdon Road, Dalston, N.E., Analytical Chemist.
1902. Young, Chas. C., c/o Farbenfabriken of Elberfeld Co., Charlotte, N.C., U.S.A., Colourist.
1890. Young, Dr. Geo., Lauraville, Bladda, Port Erin, Isle of Man, Chemist.
1904. Young, James, c/o Flax Pulp, Ltd., Weston Point, Runcorn, Cheshire, Chemist.
1900. Young, J. Bertram, 1639, North 19th Street, Philadelphia, Pa., U.S.A., Chemist.
- O.M. Young, Jno., 2, Montague Terrace, Kelvininside, Glasgow, Technical Chemist.
1886. Young, Jno., (Journals) Claremont House, Beverley Road, Hull, Gas Engineer.
1904. Young, Jno. H., c/o The Cassel Gold Extracting Co., Ltd., Shuna Street, Maryhill, Glasgow, Technical Chemist.
1898. Young, J. W., 4, Portland Terrace, Newcastle-on-Tyne, Inspector under Alkali Acts.
1883. Young, Prof. Sydney, F.R.S., University Chemical Laboratory, Trinity College, Dublin, Professor of Chemistry.
- O.M. Young, W. C., Laboratory, 19-20, Aldgate, London, E.C., Gas Examiner and Consulting Chemist.
1898. Young, W. Gathorne, Analyst's Dept., G.N.R., Doncaster, Yorks., Chief Chemist.
1902. Youtz, Dr. Lewis A., Lawrence University, Appleton, Wis., U.S.A., Professor of Chemistry.

## Z

1890. Zabriskie, C. B., 100, William Street, New York City, U.S.A., Manager (Pacific Coast Borax Co.).
1897. Zacharias, Dr. P. D., Philhellinon Street 22, Athens, Greece, Industrial Chemist.
1897. Zahorski, Dr. Boleslas, Maywood, N.J., U.S.A., Technical Chemist.
1898. Zehetmayr, Ferd. F., 85, Gracechurch Street, London, E.C., Merchant.
1904. Zieme, Carl H., c/o Incandescent and Chemical Co., Youngstown, Ohio, U.S.A., Chemist.
1899. Zilz, Henry, 22, Bush Lane, London, E.C., Agent (Badische Anilin und Soda Fabrik).
1904. Zimmele, H. B., c/o Westinghouse Electric Manufacturing Co., East Pittsburg, Pa., U.S.A., Technical Chemist.
- O.M. Zimmermann, A., 3, Lloyd's Avenue, London, E.C., Chemical Agent.
1904. Zimmermann, H. D., c/o American Ether Co., Richmond, Va., U.S.A., Chemist.
1897. Zinsser, Dr. Fred. G., Hastings-npon-Hudson, N.Y., U.S.A., Manufacturing Chemist.
1895. Zoeller, E. V., Tarboro, N.C., U.S.A., Cottonseed Oil Refiner and Pharmacist.
1899. Znnbeck, Aug., 66, Mark Lane, London, E.C., Chemical Merchant.















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